

Reproductive health impacts of structural gendered racism:
moving from measurement to action

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Abstract

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Intersecting systems of oppression, such as structural racism and sexism, have long been identified as fundamental causes of health inequities by activists and scholars. However, the field of epidemiology has only recently increased attention towards measuring systems of oppression and power in order to inform strategies to advance health equity. Racialized inequities in adverse birth outcomes persist despite decades of health care improvements, indicating the necessity of interrogating structural determinants rather than individual factors. This dissertation integrates unique data sources to advance the study of multilevel measures that capture how inequitable social contexts (re)produce adverse birth outcomes in order to challenge the laws, policies, and practices that uphold these systems.

We examine the reproductive health impacts of structural gendered racism – the totality of interconnectedness between structural racism and sexism – and the role of community care in counteracting these structural harms. First, we develop a novel latent class measure of structural gendered racism at the state level that captures the multidimensionality of these intersecting systems of oppression and how they influence preterm birth inequities across the United States. Second, we explore how policing, as a product of intersecting systems of oppression, acts as a neighborhood-level racialized gendered stressor leading to preterm birth. Third, moving beyond measurement, we look towards community-based doulas as a strategy to provide community care in the context of structural gendered racism. Findings from these

studies reinforce the importance of addressing context-specific structural determinants of health inequities and the need to fund community-led, non-carceral strategies that address the interconnected root causes of these inequities. Taken together, these studies advance the epidemiological conceptualization and measurement of intersecting systems of oppression, amplify calls for the field of epidemiology to critique policing practices as a population health issue, and embrace collective care as a radically hopeful response to systemic oppression.

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Table of Contents

Acknowledgements.....	v
List of Tables	vii
List of Figures	viii
Chapter 1 Introduction.....	1
Chapter 2 Structural gendered racism and preterm birth inequities in the United States	7
Chapter 3 Neighborhood-level policing as a racialized gendered stressor: multilevel analysis of police stops and preterm birth in Seattle, Washington.....	35
Chapter 4 Barriers and facilitators of a community-based doula program: a mixed methods analysis.....	54
Chapter 5 Concluding Thoughts.....	78
Appendices	88
Bibliography	105

List of Tables

Table 2.1. State sociodemographic characteristics of state-level latent classes	31
Table 2.2. Characteristics of study population of all US births, total and by latent classes, 2019.....	32
Table 2.3. Risk ratios and 95% confidence intervals of the association between structural gendered racism latent classes and preterm birth <37 weeks	33
Table 2.4. Ecologic comparison of Black-White inequities in preterm birth by contemporary classes of structural gendered racism and histories of structural racism (Jim Crow and slavery), mean and 95% confidence interval	33
Table 3.1. Individual and neighborhood-level characteristics of births in Seattle, WA, 2017-2019.....	49
Table 3.2. Adjusted risk ratios (RR) for preterm birth associated with neighborhood-level police stops in each exposure window, stratified by birthing person race and ethnicity, Seattle, WA 2017-2019.....	51
Table 4.1. Key components of the four primary Open Arms programs	74
Table 4.2. Characteristics of participants in Open Arms programs, January 1, 2016 – December 31, 2022	75
Table 4.3. Implementation and health outcomes for community-based doula programs, January 1, 2016 – December 31, 2022	76

List of Figures

Figure 1.1. Conceptual Model	6
Figure 2.1. Latent-class median and national distribution of each inequity indicator for US states	29
Figure 2.2. US map of the four latent classes of structural gendered racism	30
Figure 3.1. Adjusted risk or hazard ratio of neighborhood-level stops of Black people among Black births and stops of White people among White births, stratified by exposure window, Seattle 2017-2019.....	53
Figure 4.1. Nested themes for barriers of a community-based doula program.....	77

Chapter 1 Introduction

Intersecting systems of oppression, such as structural racism and sexism, have long been identified as fundamental causes of health inequities by activists and scholars.¹⁻⁴ Indeed, the pioneering work of Black women such as Maria Miller Stewart, Anna Julia Cooper, Sojourner Truth, and Harriet Jacobs from the nineteenth century onwards have connected racism and sexism as co-constituted systems of oppression.⁵ However, the fields of epidemiology and public health have only recently given critical attention to systems of oppression and power. Most of this public health literature focuses on the measurement of structural racism, which is most commonly defined as the “totality of ways racial discrimination is fostered through mutually reinforcing inequitable systems,” such as housing, education, healthcare and employment, that stratify resources and power based on racial hierarchies.^{6,7} Yet, the foundational work of intersectional scholars and activists highlight the imperative of attending to multiple (rather than singular) systems of oppression and grounding this work in community expertise.^{1,2,8} Intersectionality is a theoretical framework and critical social praxis for understanding how multiple social identities (i.e. race, gender, disability) intersecting at the individual level are shaped by interlocking systems of privilege and oppression (i.e. racism, sexism, ableism) at the macro-level.^{2,9,10} **Thus, this dissertation examines the reproductive health impacts of structural gendered racism – the “totality of interconnectedness between structural racism and sexism”¹¹ – and the role of community care in counteracting these harms.**

This dissertation aims to develop multilevel measures that capture how inequitable social contexts harm reproductive health in order to challenge the laws, policies, and practices that uphold these systems. This body of work is informed by reproductive justice, which is a framework, political vision, and movement created by Black women in the 1990s that centers on the human right to bodily autonomy, have children, not have children, and raise children in safe

and sustainable communities.¹² Reproductive justice shifts accountability from individuals to systems. This dissertation operationalizes these systems of oppression that produce adverse reproductive health outcomes with the goal of contributing to these efforts of shifting the focus to systems and away from individual factors that emphasize personal responsibility.¹³

We focus on preterm birth, defined as a gestational duration of less than 37 weeks, as the primary outcome of interest because it presents a direct pathway of the intergenerational harms of structural gendered racism among pregnant people that negatively affects them and their children's short and long-term health outcomes.¹⁴ Preterm birth, a leading cause of perinatal morbidity and mortality, affects 1 in 10 infants born in the United States (US), and Black and Indigenous birthing people have disproportionately high preterm birth rates.¹⁵ These racialized inequities in preterm birth exacerbate infant mortality inequities: preterm-related causes account for over half (55%) of the disparity between the Black and White infant mortality rates.¹⁶ Additionally, pregnancy is a life course period when people are particularly at risk of negative health consequences from stressful exposures, like manifestations of structural racism such as policing.¹⁷ Therefore, this body of work proposes novel measures of structural gendered racism and its' manifestations in relation to preterm birth inequities.

Scholars in epidemiology, sociology, and population health sciences have made important advancements in the measurement of systems of oppression and the institutions they create, such as policing, but critical gaps remain.¹⁸⁻²² First, as previously mentioned, most of this nascent literature has focused on the measurement of structural racism rather than interlocking systems of oppression (with exception Homan et al. 2021¹⁹). Many of these studies focus on adverse birth outcomes and examine spatial indicators of racial inequity (e.g. education and employment inequities between the Black and White population) separately, finding increased risk of infant mortality,^{23,24} preterm birth,^{25,26} small-for-gestational age,²⁷ and severe maternal morbidity^{28,29} and mortality³⁰ for Black birthing people among some, but not all, indicators of structural racism. Many of these measures are unidimensional, which do not

effectively capture the interconnectedness of mutually reinforcing institutions that make up structural racism, and the sole focus on structural racism does not consider how other systems of oppression, like sexism, are co-constituted. Second, only a handful of studies have examined preterm birth inequities in relation to policing, which is conceptualized as an institution borne from intersecting systems of oppression that maintains racial, economic, and political hierarchies and control in the US.³¹⁻³⁶ Within the emerging literature exploring police practices as a racialized gendered stressor,^{37,38} policy-relevant research gaps remain regarding the timing and type of exposure to policing across racialized groups. Finally, program and policy approaches to mitigate the harms of structural gendered racism are urgently needed and must engage directly-impacted communities as experts in developing solutions.³⁹ Research must move beyond describing the problem of structural oppressions to identifying modifiable measures/policies and key levers for intervention.

Therefore, this body of work aims to fill these gaps in the literature through three complementary approaches. First, we develop a novel latent class measure of structural gendered racism at the US state level to attempt to capture the totality of these intersecting systems of oppression and how they influence preterm birth inequities across the US. Second, we explore how policing, as a product of intersecting systems of oppression, acts as a neighborhood-level racialized gendered stressor that can increase risk of preterm birth. Third, moving beyond measurement and documentation of inequity, we consider community-based doulas as key community resources that provide care and support in response to structural gendered racism. Taken together, we examine the reproductive health impacts of structural gendered racism and the role of community care in counteracting these structural harms.

Positionality and Reflexivity

An essential component of the dissertation research process is recognizing positionality and practicing reflexivity. Positionality is an understanding of our identities, power, and privilege

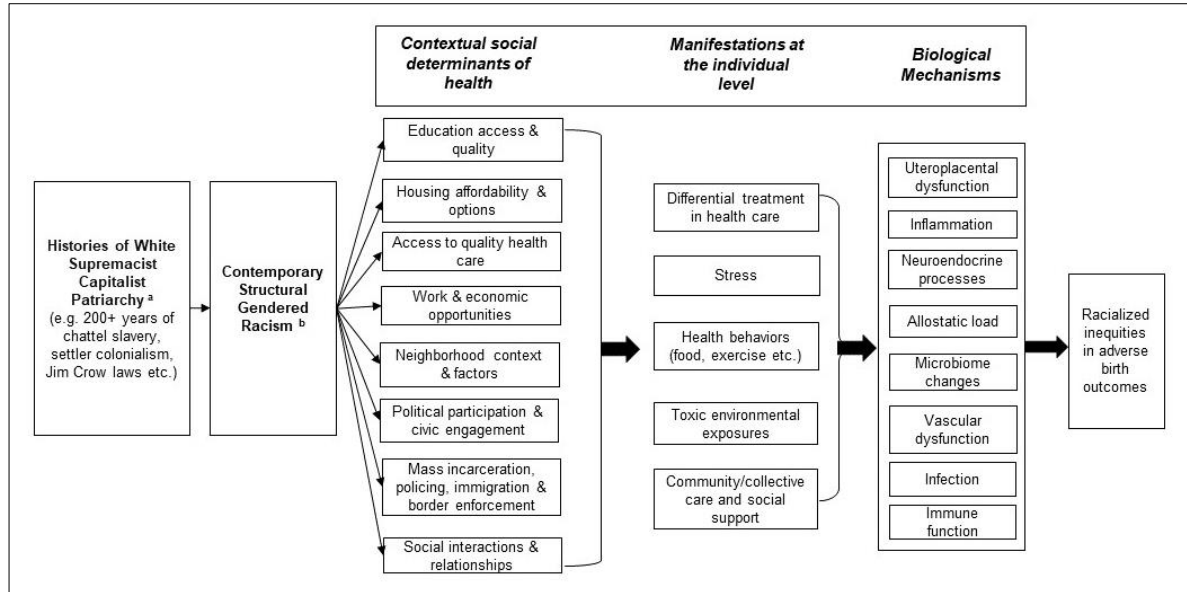
and what we bring to the work.⁴⁰ Reflexivity is a continual process of challenging our beliefs, knowledge, and biases and critically questioning how these influence the research process from beginning to end.⁴¹ I hope to use my positionality statements not as a laundry list of socially-ascribed identities as is typically done, but as a starting point for practicing reflexivity and humility that challenges what I know based on my social, political, and educational identities. Positionality and reflexivity practices that are grounded in community practice and activism can help researchers link these identities to systems of power and help move us towards interrogating, shifting, and redistributing this power back to structurally marginalized communities.⁴⁰ As a White cisgender woman, it is particularly critical I recognize the benefits I receive from white supremacy and continually unlearn the ways in which I have been socialized to uphold white supremacy. As such, this dissertation has been a process of reflexive learning and unlearning: learning new methods, theories, analyses, and histories while unlearning the white racial frame⁴² and white scientific gaze,⁴³ the false idea of science as objective,⁴⁴ and academic/professional norms rooted in white supremacy culture.⁴⁵ In this regard, I acknowledge the scholarship and activism of the many Black, Indigenous, Latina/x and other people of color, primarily women and femmes, cited throughout this dissertation who I am continually and gratefully learning from. Their generous expertise and experiences in reproductive justice, Black feminism, intersectionality, and abolition are foundational to this body of work.^{2,8-10,35,39,46,47}

Conceptual Model and Description of Aims

This dissertation is grounded in the conceptual model shown in Figure 1.1 below. Contemporary structural gendered racism underlies the social determinants of health, such as education, health care, employment, and judicial treatment. These structural harms become “embodied” as individuals biologically integrate these unjust exposures resulting in the biological mechanisms, like stress and inflammation, that lead to racialized inequities in preterm birth.²¹ In Chapter 2, we develop a novel measure of structural gendered racism as a latent construct that

underlies and produces the social determinants of health as seen in Figure 1, ultimately leading to racialized preterm birth inequities. In Chapter 3, we focus on police practices at the neighborhood level as an ecological exposure that acts as a racialized gendered stressor. Routine police practices as a contextual social determinant of health (as seen in the third column in Figure 1.1) have been relatively understudied as a determinant of reproductive health inequities. Finally, in Chapter 4, we center the experiences of community-based doulas who are Black, Indigenous and Latina community health workers that support pregnant people with similar racial, ethnic, and cultural backgrounds. Community-based doula programs intervene at the social determinants of health and manifestations level of the conceptual model, and we explore their roles in providing pregnancy care for racially and economically marginalized families in the context of structural gendered racism.

Figure 1.1. Conceptual Model



- a. bell hooks, 1984: hooks named white supremacist capitalist patriarchy as interlocking and co-constituted systems of oppression. In the context of these studies, we conceptualize white supremacy as the system of conditions and ideologies that underscore the hegemony of whiteness and White political, social, cultural, and economic power;^{48–50} capitalism is a market-based economic system in which means of production are privately owned; and patriarchy is systematic gender inequality in power and resources rooted in systems of oppression designed to reproduce/reinforce the dominance of cisgender men.⁵¹ These are co-constituted systems of oppression with long histories in the US that are the underlying forces shaping contemporary structural gendered racism as operationalized in these studies.
- b. This dissertation focuses on structural gendered racism - the totality of interconnectedness between structural racism and sexism – while recognizing other systems of oppression are deeply intertwined and historically rooted (e.g. heteropatriarchy, ableism, classism etc.) but excluded from these studies. This is a limitation of these analyses.

Chapter 2 Structural gendered racism and preterm birth inequities in the United States

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ABSTRACT

Structural gendered racism – the “totality of interconnectedness between structural racism and sexism” – is conceptualized as a fundamental cause of the persistent preterm birth inequities experienced by Black and Indigenous people in the United States. Our objective was to develop a state-level latent class measure of structural gendered racism and examine its association with preterm birth among all singleton live births in the US in 2019. Using previously-validated inequity indicators between White men and Black women across 9 domains (education, employment, poverty, homeownership, health insurance, segregation, voting, political representation, incarceration), we conducted a latent profile analysis to identify a latent categorical variable with k number of classes that have similar values on the observed continuous input variables. Racialized group-stratified multilevel modified Poisson regression models with robust variance and random effects for state assessed the association between state-level classes and preterm birth. We found four distinct latent classes that were all characterized by higher levels of disadvantage for Black women and advantages for White men, but the magnitude of that difference varied by latent class. We found preterm birth risk among Black birthing people was higher across all state-level latent classes compared to White birthing people, and there was some variation of preterm birth risk across classes among Black but not White birthing people. These findings further emphasize the importance of understanding and interrogating the *whole* system and the need for multifaceted policy solutions.

INTRODUCTION

Despite broad improvements in perinatal health care over the past century in the United States (US), there remain persistent racialized disparities in preterm birth, a leading cause of perinatal morbidity and mortality. Preterm birth affects 1 in 10 infants born in the US and Black, Indigenous, and Native Hawaiian or other Pacific Islander birthing people experience disproportionately high levels (14%, 12%, and 12%, respectively).¹⁵ Preterm birth, which can lead to developmental and health problems among children⁵² as well as poorer mental and physical health for the birthing person,⁵³ is an important contributor to the maternal health crisis in the US.¹³ Most research on perinatal health inequities has focused on individual factors and behaviors that emphasize personal responsibility and reify scientifically-inaccurate biologic essentialism.¹³ Alongside rising rates of pregnancy-related morbidity and mortality and substantial racialized inequities,⁵⁴ there is an imperative need to interrogate the structural determinants of these perinatal health inequities.¹³

Structural racism and sexism have long been identified as fundamental causes of health inequities,⁵⁵ including formative scholarship on racism by WEB Du Bois³ as well as the pioneering work that connected racism and sexism as co-constituted systems of oppression by Maria Miller Stewart, Anna Julia Cooper, Sojourner Truth, Harriet Jacobs and others.⁵ Currently, an emerging field of research seeks to improve the measurement of systems of oppression in relation to health inequities.^{7,18,19,56} Most of this research focuses on the measurement of structural racism, which is most commonly defined⁷ as the “totality of ways racial discrimination is fostered through mutually reinforcing inequitable systems,” such as housing, education, healthcare and legal treatment, that reinforce discriminatory actions and (mal)distribution of resources and power that together affect the risk of adverse health outcomes.⁶ Linking systems of oppression to health, ecosocial theory posits that exposure to structural harms like racism affects health through the embodiment of unjust social and ecological factors that manifest as

biological processes, like stress and inflammation, and lead to preterm birth.⁵⁷ Exposure to harms across the intersecting and mutually-sustaining societal domains that make up systems of oppression in people's neighborhoods, schools, hospitals, and workplaces can increase susceptibility to disease, stress processes, and stress-related behaviors which can in turn lead to adverse birth outcomes.⁵⁸

Existing research on structural racism and adverse birth outcomes

While historical scholarship and theory point to interlocking systems of racial and gendered oppression, previous studies have primarily only investigated structural racism and adverse birth outcomes using single domains of structural racism at the county or state level. Some studies separately examined indicators of racial inequity (e.g. education and employment inequities between the Black and White population) finding increased risk in infant mortality,^{23,24} preterm birth,²⁵ and severe maternal morbidity^{28,29} for Black birthing people among some, but not all, indicators of structural racism. Another formative study reported increased risk of small-for-gestational age births in states with higher levels of co-occurring racial and socioeconomic inequality.²⁷ The index of concentration of extremes, a frequently-used proxy of structural racism that measures racialized economic segregation, has been associated with increased likelihood of adverse pregnancy outcomes in various contexts.^{26,30}

These foundational studies have further elucidated the complex relationship between structural racism and perinatal health inequities, but methodological limitations of these studies could have resulted in the mixed findings. First, investigation of singular dimensions of structural racism or multiple dimensions separately doesn't capture the mutually-reinforcing interconnectedness across dimensions of structural racism.⁵⁹ Additionally, including multiple dimensions in one regression model can produce biased results due to high correlation among dimensions. Further, the way individual-level racialized identity was incorporated in regression models across studies and populations (e.g. as a covariate, effect modifier, or not reported

alongside outcome measures) can lead to inconsistencies, which has important theoretical and methodological implications for the measurement and interpretation of the health effects of structural racism. Lastly, these measures did not account for the co-constituted nature of racism and sexism as the structural level.

Best practices for measuring structural racism include incorporating the historical context and intersectionality, capturing the system as a whole, and emphasizing the multifaceted connections across multiple institutions.^{18,56,59,60} Recent studies aim to capture this multidimensionality of structural racism with indices using indicators of racial inequity that are presented as relative “high” or “low” levels of structural racism.^{19,61} This approach, however, assumes equal weight of indicators⁶² and additive relationships, which do not accurately depict the mutually reinforcing and interlocking domains of structural racism. Further, these continuous measures mask information on the co-occurring patterns of inequities, which can more clearly reveal leverage points for intervening policy. One approach that improves on some of these limitations is latent variable models which assume collinearity among dimensions of structural racism and have the added benefit of aligning conceptually with structural racism as a latent construct which is generally difficult to measure and may not be directly observable.^{18,56,63–65} This approach assumes shared variance among the measurable indicators and that the latent variable represents the underlying cause of the observed associations among indicators. Further, in the context of perinatal health outcomes, scholars should incorporate intersectionality^{2,9,10} as a theoretical framework and analytic tool to understand overlapping systems of oppression, such as racism, sexism and classism.^{18,28,60} Guided by these recommendations and scholarship, this study proposes an intersectional measure of structural gendered racism as a latent variable and tests its relationship with preterm birth.

Preterm birth is an important health outcome to investigate because it presents a direct pathway of the intergenerational harms of structural gendered racism among pregnant people that negatively affect their children’s short and long-term health outcomes.¹⁴ The etiology of

preterm birth is multifactorial and complex, and a recent multidisciplinary scientific workgroup suggests that preterm birth inequities may reflect the combined effects of multiple causes and pathways which points to the necessity of identifying the upstream factors that initiate these harmful pathways - “the cause of the causes.”⁶⁶ They identified racism as the only factor that directly or indirectly explains the racial disparity through multiple different causal pathways,⁶⁶ including stress, infection/inflammation, vascular compromise and environmental toxicants.⁵²

Theoretical foundations of current study

Grounded in intersectionality as a theoretical and analytical framework,^{2,9,10} this study proposes a measure of structural gendered racism that captures the overlapping systems of racial and gender oppression in relation to racialized preterm birth inequities in the US. Gendered racism was originally developed as an analytic frame for understanding how racialized and gendered oppression are co-constituted, inextricably linked, and uniquely affect Black women.⁶⁷ Structural gendered racism was conceptualized by Drs. Pirtle and Wright as the “totality of interconnectedness between structural racism and structural sexism in shaping race and gender inequities, as a root cause of health problems among women of color.”¹¹ While gendered racism at the interpersonal level has been more extensively studied, the few existing studies on *structural* gendered racism have been primarily qualitative or conceptual explorations in relation to sexually transmitted infections,⁶⁸ exposure to child protective services,⁶⁹ COVID-19 inequities,¹¹ and medical mistrust and vaccinations⁷⁰ among Black women. This study is the first quantitative measurement of structural gendered racism to our knowledge.

Recognizing there is no single measure or analytic approach that can perfectly capture the totality of intersecting systems of oppression,⁶² this proposed structural gendered racism measure aims to align theory, historical context, and conceptualization to create a rigorous quantification of this difficult-to-measure construct.⁷¹ Following the formative conceptual and

theoretical scholarship of structural racism as a fundamental cause of health inequities,^{39,55,57–59,72–74} we conceptualized structural gendered racism as a resilient system of interconnected institutions that is ubiquitous, adapts to different contexts and can vary by geography and time, and maintains patriarchy and white supremacy through the subjugation and oppression of Black and other racially minoritized women. White supremacy – defined as the historically-based system of exploitation and oppression of Black, Indigenous and other people of color that sustains White political, social, and economic privilege and domination – enables structural racism to reproduce over time via different mechanisms.^{48–50}

Aligning with previous quantitative measures of structural racism, we utilized the approach that captures inequalities and differential access to flexible social resources in large-scale social and economic institutions (e.g., Black-White ratios of unemployment and poverty rates).¹⁹ These measures reflect the history of the US' consolidation of white supremacy and power based on forced enslavement of Black people, which formed the basis of America's economic, legal, and political systems. Further, the reproductive control of Black women is central to the historical perpetuation of white supremacy, starting with the forced reproduction of women who were enslaved, leading to America's first laws that legalized control over enslaved women's reproduction.⁴⁷ While the colonization and genocide of Indigenous peoples was also central to the foundation of the US, these Black-White inequity measures are grounded in the critical race theory conceptualization of the sociopolitical construction of race and the racial hierarchy as being intimately tied to the system of chattel slavery whereby Whiteness was constructed in opposition to Blackness.^{75,76} This placed Black people at the bottom of the racial hierarchy and White people as the dominant group, solidifying a strong divide between Black and White Americans that created the inequitable political, legal, social, and economic institutions of today. As Dr. Bonilla-Silva posits, this foundational structural inequality likely shapes the life chances of most racially minoritized people in the US.⁴⁹

Therefore, when calculating our measure of structural gendered racism, we draw upon this historical foundation and intersectionality to calculate ratios between Black women and White men rather than between the total Black and White populations as is typically done.^{25,61,63,64,77} This “centering in the margins” focuses on the lived experiences of Black women across these indicators in relation to White men who experience social and health advantages by maintaining the systems of power based on racial and gender structural oppression.³⁹ This measure aims to highlight how power is relational by capturing the “polarities of superior/inferior” between White men and Black women on the interconnected axes of racial and gender oppression.²¹ Additionally, these measures capture structural gendered racism as the practices across social, political, and economic institutions that produce a racialized gendered structure that is responsible for the systematic advantages for the dominant groups (White men) and disadvantages for subordinated groups (Black women).⁷⁸

Importantly, these inequity indicators are *outcomes* of structural gendered racism and the policies and institutional practices that unequally distribute resources and power. We utilize a latent variable model to capture the latent construct of structural gendered racism that is conceptualized both methodologically and theoretically as the underlying cause of the observed associations among the input inequity indicators. While there is no gold standard measure of structural (gendered) racism and this field of study is rapidly growing,^{18,62} we propose a latent class approach in contrast to the more frequently-used additive indices and latent scales to better identify the distinct co-occurring patterns of inequities in the US that are masked in these continuous measures. Further, while this measure is derived and aggregated from data reflecting individual experiences of societal (dis)advantage, we conceptualize this measure as reflecting the actors (including individuals, private and public organizations, and governments) that (re)create these power imbalances and inequities through policies, norms, and racialized rules that are intended to benefit White people.^{49,59,79,80} For the context of this paper, we define power as the interlocking actions and processes of social institutions to maintain oppression

(*power over*) that can also be leveraged for collective benefit and redistributed (*power with, to and within*) to advance health equity.^{1,81,82} Lastly, we posit that the historical creation and contemporary maintenance of these inequitable economic, political, social and legal institutions is grounded in anti-Black racism and sustains white supremacy, which can, in turn, impact all racially minoritized people.⁴⁹

Using linked national administrative data of individual births, we examine whether the risk of preterm birth among racialized groups varies both within and across state-level classes of structural gendered racism in multilevel models. We hypothesized that the risk of preterm birth would be higher for Black birthing people compared to their White counterparts across all latent classes, but that risk within racialized groups would not vary across classes. This is based on previous findings⁸³ and on theory that the classes of structural gendered racism are not better or worse than each other but rather different forms of structural harms across state contexts. States serve as an important unit of analysis for exposure to structural gendered racism in the US because of the substantial variation in past and present state policies that create social norms and distribute access to the determinants of health.^{19,60,84} Additionally, due to the process of devolution since the 1970s that has shifted more legislative power to states away from the federal level, states are conceptualized as racializing institutional actors that play critical roles as legal and administrative entities that shape population health.^{18,19,85,86} Therefore, we measured structural gendered racism at the state level for practical and policy interpretations and implications of the findings.

METHODS

Data and study population

We used restricted-use individual-level national birth certificate data from the National Center for Health Statistics (NCHS) from 2019 that captured all births occurring in the US.⁸⁷ We included live singleton births with a gestational age of 22-44 weeks (n = 3,605,183).

Measures

Structural gendered racism

We adapted the latent-class method proposed by Chantarat et al.^{63,83} to identify classes of structural gendered racism for all 50 states (DC was excluded due to lack of data). States were used as the unit of analysis because of their critical roles as legal and administrative entities that shape population health.^{18,19,85} Rather than the latent class approach, we conducted a latent profile analysis (LPA) which allows for continuous input variables so as not to lose nuanced information of the magnitude of state differences in inequity measures from dichotomization. This LPA method consisted of two steps.

First, we calculated previously-validated indicators that reflect manifestations of structural racial and gendered stratification in resources, opportunity, and risk across 9 domains (Appendix A) for all 50 states. Each indicator was calculated as a ratio between White men and Black women such that values over 1 indicate higher levels of inequities with more advantages for White men and disadvantages for Black women. The indicators include (1) college education, (2) service industry employment, (3) income (e.g. below the federal poverty level), (4) homeownership, (5) health insurance, (6) residential segregation, (7) voting, (8) political representation, and (9) incarceration. We used data from the 2018 American Community Survey (ACS) 5-year estimates to derive indicators (1) to (6), US census voting supplement from 2016 for indicator (7), Center for American Women and Politics and Reflective Democracy for data on state elected officials in 2017 for indicator (8), and Prison Policy Initiative derived from 2010 US Census for indicator (9). For each indicator, we calculated ratios $\frac{P_{WM=1}}{P_{BW=1}}$ where $P_{WM=1}$ is the proportion of White men in the state experiencing the exposure and $P_{BW=1}$ is the proportion of Black women experiencing the exposure (or $\frac{P_{BW=1}}{P_{WM=1}}$ for the service industry employment, poverty, segregation, and incarceration domains).

Second, we conducted LPA to empirically identify the underlying classes of structural gendered racism across the 50 states using the aforementioned indicators. LPA is a model-based, probabilistic clustering approach that identifies a latent categorical variable with k number of classes that have similar values on the observed continuous input variables.⁸⁸ States are assigned to the latent class for which they have the highest estimated posterior probability of membership based on their observed data.⁸⁸ A state's class assignment is thought to explain the state's observed indicators, which methodologically and conceptually aligns with our conceptualization that these indicators are the observed manifestations of structural gendered racism.

We fit a variety of models differing in the number of classes (1-7) and in the parametrization of the variables' variances and covariances which can be freely estimated, estimated to be equal, or (for covariances only) fixed to zero.⁸⁹ The different models with varying number of classes and parameterizations were examined (Appendix B) and compared to one another with regard to statistical criteria, theoretical assumptions, sample size, as well as interpretability and uniqueness of the classes.⁸⁹ Statistical criteria included the Bayesian information criterion (BIC), sample-size adjusted BIC, Aikake information criterion (AIC) (lower values indicate better model fit); log-likelihood (values closer to 0 indicate better fit); entropy (0-1, where 1 is perfect classification/clear delineation of classes); bootstrapped likelihood test (BLRT) (p-value <0.05 indicates good fit); and sample size (all classes should be larger than 10% of the sample).^{63,89} In determining the number of classes, we did not initially look at what states comprised the classes due to likely researcher bias.

We performed two sensitivity analyses excluding political representation and incarceration because these indicators had higher variability and different range of ratios compared to the other indicators. Additionally, we conducted a confirmatory factor analysis (CFA) to examine how these input indicators reflected a latent factor (continuous) scale in comparison to the LPA approach (details in Appendix B).⁹⁰

We reviewed the average and individual probability of states belonging to each class, highlighted the highest inequities within each class, and identified the inequities that differentiated across classes. Given the complexity of structural gendered racism and the risk of naming fallacy,⁹¹ we were unable to identify succinct names that adequately described each class so we maintained the numeric labels from Mplus, similar to what was previously done for latent measures of structural racism.^{63,83} These classes should be interpreted as helpful analytic tools, and not fixed realities, that help us better understand how structural gendered racism operates in different contexts to inform context-specific multisectoral policies. The final state-level classes were then linked to individual-level birth data based on state of residence at the time of birth.

Outcome

The outcome of interest was a binary indicator of preterm birth (<37 weeks gestation), extreme preterm (22-27 weeks), very preterm (28-31 weeks), and moderate/late preterm birth (32-36 weeks) from individual birth records. Gestational age was calculated based on the obstetric estimate.

Covariates

Other variables extracted from birth records included birthing person's age, self-reported race and ethnicity (Non-Hispanic (NH) American Indian/Alaska Native, NH Asian, NH Black, Hispanic/Latina, NH Multiracial, NH White), marital status (married vs. unmarried), place of birth (born in US vs. outside US), education (high school or less vs. college or higher), use of Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), primary payer (public, private or self-pay), mode of birth (cesarean section vs. vaginal), parity (1+ births vs. 0), and infant sex. Except for age, parity, and infant sex, these covariates were not used in the regression model because they are mediators in the relationship between structural gendered

racism and preterm birth which, if included, would dilute the primary association of interest (Appendix C). We conceptualized race (and racialization) as a byproduct of racism and therefore self-reported race and ethnicity was an effect modifier on the relationship between structural gendered racism and preterm birth.

We also calculated a proxy measure for historical structural racism given the influence of the historical context on contemporary racism and racialized health inequities (Appendix C).^{18,92,93} Drawing from Bonilla-Silva's conceptualization of the three periods of the US racial regime,⁹⁴ we measured historical structural racism as the state presence of slavery and/or Jim Crow laws, which perpetuated anti-Black oppression and racialized inequalities across all social, economic, political, and health domains.⁸⁴ A growing body of research demonstrates the far-reaching impacts of slavery and Jim Crow, particularly how these institutions based on race have actually shaped the totality of a state's contemporary political and criminal legal systems.⁹⁵⁻⁹⁸ Therefore, due to these place-based historical influences on contemporary state-level institutions in the exposure measures (e.g. incarceration,⁹⁹ education,¹⁰⁰ and political participation⁹⁵), we controlled for state-level differences in enactment of slavery and Jim Crow⁹² to better quantify the relationship between contemporary structural gendered racism and preterm birth. This is not to suggest that there are no histories of structural racism in states without slavery and Jim Crow laws. We posit that the contemporary racialized inequities in states that did not enact these laws better reflect the contemporary forms of structural gendered racism, such as de facto segregation, that are captured in the exposure measure. This measure counts the presence of each state's historical racial regimes (0 = no slavery or Jim Crow, 1 = slavery or Jim Crow, 2 = slavery and Jim Crow)¹⁰¹ following previous research showing the utility of measures with multiple as opposed to singular indicators of historical racism.⁸⁴

Statistical Analysis

Descriptive statistics of the input inequity indicators, state-level sociodemographic characteristics, and sample population characteristics were calculated with counts and percentages for categorical data and medians and interquartile ranges for continuous data across the state-level latent classes. Because the final model entropy was nearly perfect classification (0.98), average probability of class assignment was high (98-100%), and Mplus is not currently capable of conducting a multilevel 3-step model,^{102,103} we analyzed the latent class assignments as a categorical grouping variable with distal outcomes and covariates. We constructed racialized group-stratified multilevel modified Poisson regression models with robust variance and random effects for state to estimate relative risks and 95% confidence intervals (CI).¹⁰⁴ Class 2 was the reference because it was the largest class. Interpretations of differences across classes should not be interpreted as “high” vs “low” levels of structural gendered racism but as the differences in how structural gendered racism operates in different contexts. All models controlled for age in years (standardized for mean of 0, standard deviation of 1), parity, infant sex, and historical structural racism. While structural gendered racism is rooted in anti-Black racism to uphold white supremacy, all racially minoritized birthing people can be differentially impacted by structural gendered racism. Therefore, we stratified models by all racialized groups (NH American Indian/Alaska Native, NH Asian, NH Black, Hispanic, NH Multiracial, NH White).

Analyses were conducted in R Version 4.1.2, Stata Version 16.1,¹⁰⁵ and MPlus Version 8.9.¹⁰⁶ University of Washington’s Institutional Review Board deemed this study to be non-human subjects research.

RESULTS

Structural gendered racism classes

Higher inequities indicating more advantages for White men and disadvantages for Black women were highly prevalent across all states and most input indicators (Figure 2.1). The four-class model was retained as the best model to fit the data based on the low log-likelihood value, AIC, BIC, and sample size adjusted BIC values, high entropy value, and uniqueness of classes (Appendix B). Additionally, the average latent class probabilities for most likely latent class membership were all close to 100% (all above $> .98$) for all classes. Core clusters of states remained relatively stable through many different model iterations and the best performing model was parameterized with varying variances and covariances fixed to zero.

Figure 2.1 presents the input indicators and Table 2.1 shows state sociodemographic characteristics by class. In Class 1, structural gendered racism was characterized by substantial (i.e. higher-than-national-median) co-occurring inequities in political representation and residential segregation. This class, comprised of 8 states in the Southeast (Figure 2.2), had the highest proportion of NH Black residents, lowest proportion of NH White residents, highest proportion of households with no internet access, lowest median income, and lowest foreign-born populations. In Class 2, structural gendered racism was characterized by substantial inequities in voting and political participation. Class 2, the largest and most geographically dispersed class, comprised 16 states and had the highest percentage of Asian, Latino/a/x, foreign-born residents, limited English-speaking households, and the highest median income. In Class 3, structural gendered racism was distinguished by interconnected inequities in primarily education, employment, poverty, homeownership, and segregation. Class 3 comprised of 11 states primarily in the Midwest and mid-Atlantic with the second highest percentage of NH Black, Latino/a/x, and foreign-born residents and the highest population density. Finally, in Class 4, structural gendered racism was characterized by substantial co-occurring inequities in service employment, poverty, homeownership, voting, health insurance, incarceration, and political representation. Class 4 comprised 15 states primarily in the North and West that had the highest percentage of NH White residents, lowest proportion of Black and Latino/a/x

residents and limited English-speaking households, and the lowest population density. Using CFA, we found one measurement model that had a good fit with the data and generally aligned with these classes. States with higher values on the latent scale (indicating relative “higher” levels of structural gendered racism) were also mostly identified as Class 4 states (details in Appendix B).

In the study population of all US births, the racial composition across classes was similar to the overall population composition (Table 2.2). Class 1 had the highest levels of preterm birth, WIC and Medicaid clients, births among people <20 years, and cesarean sections. Class 2 had the highest proportion of births to people born outside of the US, followed by Class 3. Class 4 had higher levels of older age, education, and private insurance, and the lowest levels of WIC clients and preterm birth.

Structural gendered racism latent classes and preterm birth

Preterm birth (<37 weeks) risk was significantly higher for Black (aRR: 1.31, 95% CI: 1.02, 1.26) and lower for Asian (aRR: 0.89, 95% CI: 0.80, 0.99) birthing people living in Class 3 states compared to Class 2 (Table 2.3), controlling for age, infant sex, parity, and historical structural racism. This was driven primarily by moderate/late preterm births (32-36 weeks) (Appendix D). Black-White inequities in preterm birth were also highest in Class 3 states (Table 2.4). There were no significant differences in preterm birth (<37 weeks) risk across classes among American Indian/Alaska Native, White, Hispanic, and Multiracial birthing people (Table 2.3). However, American Indian/Alaska Native birthing people living in Class 1, 3 and 4 states experienced significantly increased risk of extreme and very preterm birth compared to their counterparts in Class 2 states (Appendix D). Additionally, White birthing people in Class 3 states experienced increased extreme preterm birth risk (<28 weeks) compared to those in Class 2 (aRR: 1.23, 95%CI: 1.02, 1.49).

Sensitivity analyses

The sensitivity analyses removing political representation and incarceration resulted in similar classes with core clusters of states remaining stable. The four-class model also remained the best performing based on statistical criteria.

DISCUSSION

This study proposes and tests a theory-driven, novel measure of structural gendered racism and found four distinct latent classes across 50 US states. All four latent classes were characterized by states that had higher levels of disadvantage for Black women and advantages for White men (except for incarceration), but the magnitude of that difference varied by latent class. We found preterm birth risk among Black birthing people was higher across all state-level latent classes compared to White birthing people, and there was some variation of preterm birth risk across classes among Black but not White birthing people. These classes serve as helpful analytic tools to understand how structural gendered racism is functioning in different states and can inform relevant, context-specific policies to address racialized perinatal inequities.

The distinct latent classes of structural gendered racism illustrate the variation in how intersectional systems of oppression operate to stratify power and resources by gender and race across different contexts. While structural gendered racism is omnipresent across all states with White men holding more power than Black women, we found the most substantial co-occurring inequities across domains in Classes 3 and 4 (primarily Midwestern and Northern states). These patterns parallel the latent scale results and findings from previous studies showing “higher” levels of structural (gendered) racism in these states.^{19,61,65,107} The distinct typologies illustrate how these power imbalances vary and cluster across states, thus providing nuanced information on the complexity and interrelatedness of institutionalized inequities that echo the theory of distinct racialized regimes.^{22,49,94} These patterns across geographic contexts can be masked in continuous latent scale measures, but these scales may be easier to interpret

and compare over time. Importantly, smaller inequities should not be interpreted as an absence or “less” structural gendered racism but rather suggest limitations of these measures. This nascent field of study requires further investigation on the benefits and drawbacks of different measurement approaches with a key focus on the utility and interpretation of these measures to inform policy and strategies for those challenging existing power structures.¹⁷ We discuss further considerations in Appendix B.

The inclusion of historical measures (e.g. Jim Crow and slavery) provides helpful historical context for understanding contemporary typologies of structural gendered racism. All Class 1 states were Jim Crow/Slavery states but had relatively narrower inequities on the contemporary social and economic indicators. Conversely, Class 3 and 4 states had wider inequities between Black women and White men across domains, but less than a quarter were Jim Crow/slavery states. This suggests the need to better understand and account for the historical contexts that shape contemporary manifestations of structural gendered racism, such as the institutionalized practices/policies of racialized exclusion and subordination enacted in Midwestern and Northern states (e.g. Class 3 and 4) in response to the Great Migration.^{65,107,108} This could include using these inequity indicators alongside historical and contemporary laws/policies that influence the distribution of these indicators and potentially better capture how structural gendered racism is a “bundle of processes that operate through social, economic, and political systems.”¹⁰⁹ For example, a recent analysis identified three latent classes of state structural racism-related laws and the class with predominantly harmful laws aligns with this study’s Class 1 (e.g. Southeastern states).¹¹⁰

This study contributes to the emerging scholarship demonstrating how state-level empirical measures of structural oppression can provide meaningful insights into state variation in individual-level health outcomes.^{19,22,84} Higher preterm birth risk among Black birthing people and higher Black-White inequities in Class 3 compared to Class 2 states suggests that the interconnected inequities across education, employment/income, and housing domains in Class

3 states are particularly harmful for preterm birth. Thus, racism-conscious, multisectoral policies addressing these inter-institutional connections are needed in these states.¹¹¹ This particular combination of inequities was also associated with increased risk of extreme preterm birth (<28 weeks) among White people. While previous studies have reported mixed results regarding the health effects of state-level structural racism among White people,^{19,23,77,112} there is a growing body of literature investigating how racism contributes to policies that may harm everyone, including White people.^{113,114} Notably, we found the lowest Black-White preterm birth inequities in Class 4 states which had the most co-occurring inequities and were generally highest on the latent scale. Conversely, Class 1 states, with narrower institutionalized inequities, had the highest preterm birth prevalence overall and the second highest Black-White preterm birth inequities. This suggests this measure is not fully capturing the structural determinants of preterm birth inequities, such as restrictions on abortion and reproductive autonomy which is rooted in White supremacy.¹¹⁵ For example, state-level policies that protect reproductive autonomy are mostly in Class 4 states which have lower rates of racialized preterm birth inequities, whereas Class 1 is primarily composed of states with restrictive laws and higher preterm birth inequities.^{116,117}

We found mixed results of how structural gendered racism predicted preterm birth among Indigenous, Latina, Asian, and multiracial people. While this theory-driven measure aimed to capture the foundational inequitable institutions of the US that are shaped by anti-Black racism and uphold white supremacy, there could be differential policies and other indicators that better explain perinatal health inequities among other racially minoritized groups. For example, anti-immigrant policies and enforcement among Latina birthing people¹¹⁸ and xenophobic travel bans targeted towards people from Muslim-majority countries.¹¹⁹ Additionally, future research should examine more nuanced and specific historical measures of structural racism that better capture policies that target and harm different racialized groups, such as the Chinese Exclusion Act, Japanese internment camps, and histories of forced migration and wealth extraction among

Indigenous communities.⁹³ Lastly, these aggregated estimates among Asian, Latina/e, and multiracial groups do not reflect subgroups and can obscure subgroup differences.¹²⁰ Thus, further data disaggregation is needed.

Strengths and limitations

This study includes several advances to theoretically-grounded measures of structural gendered racism that incorporate intersectionality and multidimensionality. While a foundational study measuring structural intersectionality included separate indices of structural racism, sexism and classism,¹⁹ intersectionality theory posits that these systems of oppression are interlocking and thus cannot be separated.¹⁰ Our measurement approach seeks to align with this theory, recognizing that racism does not operate in the absence of sexism and that these structural forces are mutually constituted to structure power, privilege and lived experiences: racism is gendered and sexism is racialized.¹⁰⁹ The latent class approach aligns conceptually and methodologically with theories that systems of oppression underlie the input inequity indicators. Additionally, the novel inclusion of a historical measure of structural racism aligns with recommended best practices to account for the historical processes that shape contemporary racialized social and health inequities.^{18,92}

This study had several limitations. First, any approach to operationalize structural gendered racism and quantify its population health impacts must simplify the complex ways it operates and therefore underestimates its potential impacts. Relative to continuous indices/latent scales that mask the interconnectedness of inequitable institutions, the LPA approach allows us to interpret these interconnected inequities; however, the interpretation of the LPA approach is more complex and is often a function of one's theoretical understanding of structural gendered racism. Second, the input inequity indicators are dependent on how the US Census and other entities capture race and ethnicity which, as a sociopolitical construct that shifts over time, has known limitations of underestimation and obscurement of racialized

populations via data aggregation.^{60,121} Third, this fixed measure also does not capture an individual's cumulative exposure to structural gendered racism over the life course which may have important consequences for preterm birth. Fourth, due to the pre-birth time lag we implemented for the exposure measure, people giving birth in a state in 2019 may not have resided in that state during pregnancy or before, which could lead to misclassification of the exposure. Fifth, proper class assignment is not guaranteed, the small sample size of 50 states limits the complexity and number of classes, and this state measure does not capture in-state heterogeneity. Finally, we did not include other intersecting systems of oppression, such as heterosexism and classism, that also shape health outcomes.

Research and policy recommendations

Future research should engage directly-impacted community members and organizers within these states to better explicate how structural gendered racism is operating through inequitable institutions in order to challenge the policies and practices that uphold these systems. For example, studies could examine how modifiable policies that are upstream and often influence these frequently-used inequity indicators, such as discriminatory housing markets¹²² and exploitative revenue generation,¹²³ are patterned across these distinct latent classes to better understand and identify strategies that can remediate and eliminate health inequities. This research should explicitly examine *who* benefits from creating and maintaining these inequitable systems in addition to who is most directly and disproportionately harmed.^{21,124} Additionally, studies should explore how state and lower-level jurisdictions (e.g. county or city) converge or diverge in these structural measures to identify localized contexts that might be protective within more discriminatory state contexts (and vice versa). Lastly, future measures should attend to the nuanced intersectional complexities of structural gendered racism, such as the gendered privilege of White women compared to Black women because of how sexism is racialized. Importantly, more research will not dismantle these systems of oppression

perpetuating health inequities; policy, community action, and redistribution of power is needed urgently.

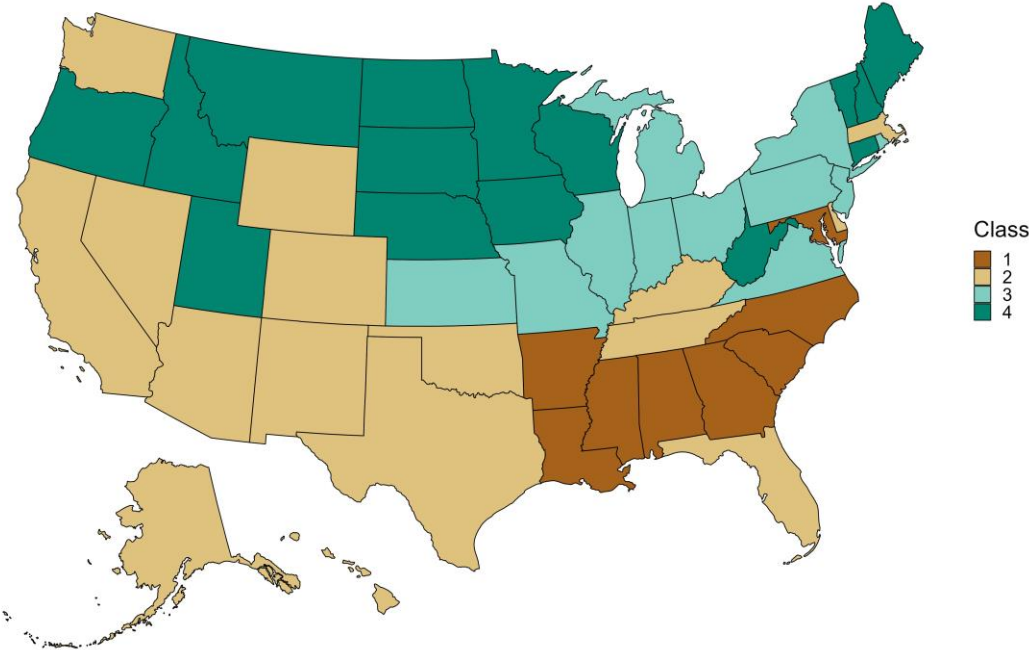
This study highlights the importance of understanding and interrogating the *whole* interconnected system rather than siloed approaches. Multisectoral policies (e.g. policy “bundles”) must jointly address these inequities to have the potential to improve perinatal health inequities, such as protecting voting rights, closing the racial wealth and earnings gap, generating affordable housing, and redressing historical harms through a comprehensive reparations bill.^{86,125–127} Any policy solution must be multifaceted, multisectoral, and interrogate multiple institutions at once.

Figure 2.1. Latent-class median and national distribution of each inequity indicator for US states



Box plot is national distribution and dots represent latent class medians. Ratio over 1 indicates higher levels of inequities with more advantages for White men and disadvantages for Black women. Dotted line = No inequity (ratio = 1).

Figure 2.2. US map of the four latent classes of structural gendered racism



Class 1 = co-occurring substantial inequities in political representation and residential segregation. Class 2 = co-occurring substantial inequities in voting and political representation. Class 3 = co-occurring substantial inequities in education, employment, poverty, homeownership, and segregation. Class 4 = co-occurring substantial inequities in employment, poverty, homeownership, health insurance, voting, incarceration, and political representation.

Table 2.1. State sociodemographic characteristics of state-level latent classes

Characteristics <i>Median (Min, Max)</i>	Class 1	Class 2	Class 3	Class 4
	N=8	N=16	N=11	N=15
% Black	28.4 [15.4, 37.7]	6.57 [0.952, 22.1]	12.4 [5.84, 19.2]	1.91 [0.444, 10.6]
% White	61.1 [51.4, 72.7]	61.9 [22.1, 84.8]	75.2 [55.8, 79.6]	82.2 [67.5, 93.4]
% Asian	1.74 [0.971, 6.29]	3.71 [0.910, 47.8]	3.38 [2.03, 9.41]	2.39 [0.814, 4.79]
% Latino/a/x	6.44 [3.03, 9.81]	12.0 [3.58, 48.5]	9.17 [3.70, 19.9]	5.30 [1.50, 15.7]
% Indigenous	0.492 [0.261, 1.19]	0.871 [0.210, 14.4]	0.273 [0.194, 0.827]	0.907 [0.156, 8.72]
% foreign born	4.81 [2.33, 15.1]	11.6 [3.48, 26.9]	7.11 [4.07, 22.6]	5.17 [1.62, 14.3]
% limited English-speaking households	1.79 [0.808, 3.18]	4.03 [1.17, 9.10]	2.52 [1.13, 8.11]	1.56 [0.360, 5.20]
% households with no internet	21.3 [12.1, 27.0]	14.5 [10.3, 23.4]	16.3 [13.0, 18.2]	15.4 [9.15, 22.9]
Median Income*	\$49800 [\$43600, \$81900]	\$60900 [\$48100, \$78100]	\$59400 [\$53600, \$79400]	\$59200 [\$44900, \$76100]
Population density**	139 [57.9, 636]	113 [1.30, 901]	231 [35.9, 1260]	44.2 [7.40, 745]
Historical Structural Racism N(%)				
No slavery or Jim Crow	0 (0%)	7 (43.8%)	8 (72.7%)	14 (93.3%)
Slavery or Jim Crow	0 (0%)	4 (25.0%)	1 (9.1%)	0 (0%)
Slavery and Jim Crow	8 (100%)	5 (31.3%)	2 (18.2%)	1 (6.7%)

*2018 adjusted US dollars **Population density is a measure of the average population per square mile of land.

Table 2.2. Characteristics of study population of all US births, total and by latent classes, 2019

Characteristics of birthing person	Total	Class 1	Class 2	Class 3	Class 4
	N=3605183	N=534618	N=1577367	N=1087748	N=405450
Age					
<20 years old	169746 (4.71%)	32398 (6.06%)	76878 (4.87%)	45688 (4.20%)	14782 (3.65%)
20-24	684576 (19.0%)	120633 (22.6%)	298068 (18.9%)	194100 (17.8%)	71775 (17.7%)
25-29	1040938 (28.9%)	160096 (29.9%)	445676 (28.3%)	310289 (28.5%)	124877 (30.8%)
30-34	1043533 (28.9%)	139214 (26.0%)	451163 (28.6%)	329306 (30.3%)	123850 (30.5%)
35+	666390 (18.5%)	82277 (15.4%)	305582 (19.4%)	208365 (19.2%)	70166 (17.3%)
Race/ethnicity					
Hispanic/Latina	865556 (24.0%)	69058 (12.9%)	575252 (36.5%)	170271 (15.7%)	50975 (12.6%)
Non-Hispanic AI/AN	27576 (0.76%)	2491 (0.47%)	16988 (1.08%)	1570 (0.14%)	6527 (1.61%)
Non-Hispanic Asian	240309 (6.67%)	19953 (3.73%)	130385 (8.27%)	71386 (6.56%)	18585 (4.58%)
Non-Hispanic Black	517549 (14.4%)	161845 (30.3%)	162652 (10.3%)	165849 (15.2%)	27203 (6.71%)
Non-Hispanic Multiracial	80665 (2.24%)	10861 (2.03%)	38600 (2.45%)	21472 (1.97%)	9732 (2.40%)
Non-Hispanic White	1840270 (51.0%)	268740 (50.3%)	630766 (40.0%)	651189 (59.9%)	289575 (71.4%)
Missing	33258 (0.92%)	1670 (0.31%)	22724 (1.44%)	6011 (0.55%)	2853 (0.70%)
Place of birth outside US	821843 (22.8%)	85788 (16.0%)	441795 (28.0%)	233793 (21.5%)	60467 (14.9%)
Parity (1+ births)	2207227 (61.3%)	327277 (61.3%)	959729 (60.9%)	664744 (61.2%)	255477 (63.1%)
Currently married	1891467 (59.6%)	287440 (53.8%)	675422 (58.8%)	659468 (60.6%)	269137 (66.4%)
Education: High school or less	1371898 (38.1%)	223183 (41.7%)	615049 (39.0%)	402612 (37.0%)	131054 (32.3%)
WIC client	1208305 (33.5%)	209339 (39.2%)	564503 (35.8%)	328642 (30.2%)	105821 (26.1%)
Primary insurance					
Medicaid	1509304 (41.9%)	255347 (47.8%)	693841 (44.0%)	419881 (38.6%)	140235 (34.6%)
Private Insurance	1787172 (49.6%)	230234 (43.1%)	731312 (46.4%)	590152 (54.3%)	235474 (58.1%)
Self-Pay	157980 (4.38%)	24775 (4.63%)	77427 (4.91%)	40940 (3.76%)	14838 (3.66%)
Other	126611 (3.51%)	23424 (4.38%)	63072 (4.00%)	28961 (2.66%)	11154 (2.75%)
Missing	24116 (0.67%)	838 (0.16%)	11715 (0.74%)	7814 (0.72%)	3749 (0.92%)
Mode of birth					
C-Section	1089913 (30.2%)	171240 (32.0%)	483744 (30.7%)	327120 (30.1%)	107809 (26.6%)
Vaginal	2513841 (69.7%)	363206 (67.9%)	1092985 (69.3%)	760153 (69.9%)	297497 (73.4%)
Missing	1429 (0.04%)	172 (0.03%)	638 (0.04%)	475 (0.04%)	144 (0.04%)
Preterm Birth (<37 weeks)	373064 (10.3%)	66923 (12.5%)	162107 (10.3%)	107294 (9.86%)	36740 (9.06%)
Male Infant sex	1845015 (51.2%)	273504 (51.2%)	807926 (51.2%)	556116 (51.1%)	207469 (51.2%)

WIC = Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 2.3. Risk ratios and 95% confidence intervals of the association between structural gendered racism latent classes and preterm birth <37 weeks

	American Indian/Alaska Native (non-Hispanic)	Asian (non-Hispanic)	Black (non-Hispanic)	Hispanic/Latina	Multiracial (non-Hispanic)	White (non-Hispanic)
Structural gendered racism latent class						
Class 2 (ref)						
Class 1	1.221 (0.918 - 1.623)	0.992 (0.850 - 1.158)	1.079 (0.960 - 1.213)	1.014 (0.948 - 1.085)	1.056 (0.938 - 1.190)	1.046 (0.929 - 1.178)
Class 3	0.863 (0.639 - 1.165)	0.890** (0.797 - 0.993)	1.131** (1.015 - 1.261)	1.021 (0.963 - 1.084)	1.089 (0.979 - 1.211)	1.055 (0.958 - 1.163)
Class 4	1.207 (0.967 - 1.507)	0.937 (0.808 - 1.087)	0.995 (0.839 - 1.178)	0.995 (0.934 - 1.060)	1.088 (0.957 - 1.237)	1.093 (0.994 - 1.202)

All models controlled for age, parity, male sex, and historical structural racism. * $p < .05$ ** $p < .01$ *** $p < .001$

Table 2.4. Ecologic comparison of Black-White inequities in preterm birth by contemporary classes of structural gendered racism and histories of structural racism (Jim Crow and slavery), mean and 95% confidence interval

Black:White Inequity in Preterm Birth (95% CI)*	Overall (N=50)	Jim Crow/Slavery states (N=21)	Non-Jim Crow/Slavery states (N=29)
Class 1	1.52 (1.49, 1.55)	1.52 (1.49, 1.55)	-
Class 2	1.49 (1.40, 1.57)	1.49 (1.39, 1.60)	1.48 (1.33, 1.63)
Class 3	1.61 (1.54, 1.68)	1.62 (1.59, 1.65)	1.61 (1.51, 1.71)
Class 4	1.30 (1.08, 1.51)	1.45 (-)	1.28 (1.06, 1.51)

*No estimates for Class 1 and non-Jim Crow/Slavery states because there are no Class 1 states without a history of Jim Crow or Slavery. No confidence intervals for the preterm birth inequity estimate for the Class 4 and Jim Crow/Slavery states because there is only one state (West Virginia) in this category.

Chapter 3 Neighborhood-level policing as a racialized gendered stressor: multilevel analysis of police stops and preterm birth in Seattle, Washington

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ABSTRACT

Background: Most studies capturing the health effects of police violence focus on directly-impacted individuals, but a burgeoning field of study is capturing the indirect, community-level health effects of policing. Few empirical studies have examined neighborhood-level policing, a contextual and racialized gendered stressor, in relation to preterm birth risk among Black and other racially minoritized people.

Methods: We spatially linked individual birth records (2017-2019) in Seattle, Washington (n=25,909) with geocoded data on police stops for three exposure windows: year before pregnancy, first and second trimester. We fit race-stratified multilevel modified Poisson regression models predicting preterm birth (<37 gestational weeks) across tertiles of neighborhood stop rates controlling for individual and neighborhood-level covariates. For second trimester exposure window, birth was operationalized as a time-to-event outcome using multilevel Cox proportional hazard models.

Results: Neighborhood stop rates of Black residents was higher compared to White residents, and Black and Asian pregnant people were exposed to the highest median neighborhood-level stop rates. Black birthing people living in neighborhoods with more frequent police stops had increased risk of preterm birth across all exposure windows including year before pregnancy (aRR:1.38, 95%CI:1.02, 1.85), first trimester (aRR:1.74, 95%CI:1.17, 2.57) and second trimester (aHR:1.66, 95%CI:1.14, 2.42). We found null or inverse associations among Asian, Hispanic, and White people.

Conclusion: Our study adds to the growing evidence documenting associations of higher risk of preterm birth with neighborhood police stops among Black birthing people. These findings suggest that routine police practices are one aspect of structural racism contributing to racialized perinatal health inequities.

What is already known on this topic: Police violence is increasingly recognized as a community-level stressor that harms community health and produces health inequities, but few empirical studies have examined the perinatal health impacts of the more frequent and everyday low-level police stops that characterize the predominant law enforcement strategy in the United States.

What this study adds: Black birthing people living in neighborhoods with more frequent police stops occurring before and during pregnancy experienced increased preterm birth risk.

How this study might affect research, practice, or policy: The persistent racialized inequities in perinatal health demand that public health research and practice address the ways that multiple forms of structural racism, including routine racialized police practices, contribute to the perinatal health crisis in the United States.

INTRODUCTION

A growing body of research suggests that policing, a manifestation of structural racism, can (re)produce racialized health inequities.^{31–33,128} In addition to well-documented health consequences of directly experiencing police violence, research focuses on police violence as an ecological/vicarious exposure that has “spillover” health impacts within communities.^{32,128} Black individuals residing in areas with greater fatal police violence have higher risks of preterm birth,¹²⁹ poor mental health,¹³⁰ hypertension and diabetes,¹³¹ sexually transmitted infections,¹³² and declines in emergency department visits.¹³³ However, less is known about the health consequences across racialized groups of the frequent and quotidian low-level police stops that characterize the predominant law enforcement strategy in the United States (US). Order maintenance policing is characterized by persistent patrolling and surveillance to manage minor offenses and disorder, often leading to officers stopping/searching individuals deemed suspicious.¹³⁴ Police surveillance and frisking can be intrusive and involve force and intimidation.¹³⁵ This practice is widespread and disproportionately concentrated in communities of color, particularly majority Black neighborhoods, even after accounting for population-specific crime rates.^{33,136–138}

Evidence suggests that living in a neighborhood with heightened community surveillance produces fear and hypervigilance of police contact and unfair treatment.^{139–141} Regardless of personal encounters with police, individuals can experience stress from living in neighborhoods with frequent police stops, which is linked to depression, anxiety, and reduced health care utilization.^{139–144} Given the higher rates of police interactions that end in brutality and death for Black, Latino/x, and Indigenous people,^{32,145,146} these effects are heightened for people in those racialized groups. Thus, addressing policing – including surveillance, criminalization, and arrests – is a critical public health issue.³¹

There is also a gendered dynamic of neighborhood policing as a racialized stressor.¹⁴⁷ Systems of oppression, like structural racism and sexism, intersect to shape inequitable

exposure to police and subsequent health consequences.^{32,147} Black mothers in particular report anticipatory stress about their family being harmed by police violence,^{143,148–150} resulting in depression and anxiety.^{151,152} Higher neighborhood-level police contact and violence are associated with increased adverse birth outcomes and maternal depressive symptoms among Black women.^{37,38,153,154} While these studies have looked at the associations between neighborhood policing and preterm birth, policy-relevant research gaps remain regarding the timing and type of exposure across racialized groups. Specifically, identifying sensitive periods in pregnancy for specific kinds of police surveillance (e.g. total stops, stops involving frisks, etc.) would bolster mechanistic evidence of causality and amplify calls from residents and social movements for an end to inequitable police surveillance and criminalization..³²

When conceptualizing neighborhood policing as a racialized gendered stressor, preterm birth is a fitting outcome to examine because it presents an important pathway of the direct intergenerational harms of stressful community-level exposures.¹⁴ Preterm birth is a leading cause of perinatal morbidity and mortality and racialized inequities in preterm birth are persistent.⁵² Pregnancy is a gendered process and a sensitive life course period,¹⁵⁵ but little is known about the health impacts of ecological stressors like policing during different exposure windows before and during pregnancy.

This study aims to examine whether individuals living in neighborhoods with more frequent police stops were at increased risk of preterm birth in Seattle, Washington. We conceptualize policing as a tool of white supremacy, an enduring system of exploitation and oppression of Black, Indigenous and other people of color that sustains White political and economic domination.^{48,49} Policing in the US is historically rooted in slavery, anti-Black racism, and continued maintenance of racialized economic hierarchies.^{98,156} In Seattle, police have played key roles in outlawing Indigenous people during the city's colonial founding,¹⁵⁷ forced removal of Chinese immigrants, Japanese internment,¹⁵⁸ enforcement of residential segregation and the War on Drugs that targeted Black residents,^{159,160} and collaboration with federal

immigration enforcement targeting Latino communities.¹⁶¹ Today, the Seattle Police Department (SPD) stops Black and Indigenous people at 5 and 9 times the rate of White people, respectively.¹⁶² Given these localized histories, we aim to examine the health consequences of this disproportionate police exposure among women of color. We hypothesize that living in more frequently surveilled neighborhoods is associated with increased preterm birth, particularly among Black pregnant people, due to elevated stress about themselves or family members being unnecessarily criminalized.^{33,131,139}

METHODS

Data and study population

We conducted a multilevel study with publicly available data from SPD, restricted-use birth certificate data (2017-2019) from the Washington state Department of Health (WDOH), and data from the American Community Survey (ACS). We included all live singleton births with gestational ages 22-44 weeks (n=25,909). Neighborhoods were defined by zip-code (n=29) since this is the smallest geographic level provided in vital statistics and we included all zip-codes within SPD's jurisdiction.

Exposure measures

We operationalized neighborhood policing using geocoded data from SPD that captures the time, date, and type of stop (e.g., initiated by police or 911 call); use of frisk (e.g. physical pat-down of outer clothing); officer-perceived race of subject; and blurred geographic coordinates (which maintains confidentiality by blurring coordinates within 50 meters of stop) from 2015-2019. Stops with missing geographic coordinates (4%) were excluded. We examined (1) overall stops, (2) police-initiated stops, defined as stops based on officer discretion rather than citizen request, and (3) stops that involved a frisk. The police-initiated and frisk-involved stops capture invasive surveillance and involuntary police contact common to aggressive

policing. In a secondary analysis, we examined the association between preterm birth and racially concordant stops, where the birthing person and the person stopped in their neighborhood were of the same race, among Black and White birthing people.

We calculated temporal-and-geographic specific policing rates for each birth for three exposure windows: year before pregnancy, first trimester, and second trimester. We estimated date of conception by subtracting gestational age (weeks) from the fifteenth day of the birth month because exact day of birth was not provided, as has been done previously.¹⁶³ For each birth, we then calculated the end and start dates of the specific trimesters (1st trimester:1-13 weeks, 2nd trimester:14-27 weeks) and the year before pregnancy. Within each exposure window, we spatially merged the number of each type of stop that occurred during that time period in their neighborhood. To account for increased stops due to a larger neighborhood population, we calculated per-capita stop rates per time period in each zip-code using annual zip-code-population denominator data from ACS 5-year estimates. We assumed annual population numbers remained stable throughout the year. To account for exposure windows that spanned different years, we calculated time-weighted denominators (e.g. if the pre-pregnancy year was from September 2016 to September 2017, we calculated weighted population number as 3/12 months * 2016 population + 9/12 months * 2017 population). We categorized all stop rates into tertiles based on each rate's overall distribution to reduce bias from influential outliers and to avoid assumptions of linearity.

Outcome

The outcome of interest was a binary indicator of preterm birth (<37 gestational weeks). Gestational age was determined based on the physician's clinical estimate at time of delivery, as recommended by WDOH.

Other covariates

Individual-level variables from the birth records include age (years), birth parent self-reported race and ethnicity (non-Hispanic (NH) American Indian/Alaskan Native, NH Asian, NH Black, Hispanic/Latina/e, NH Multiracial, and NH White), education (high school or less), marital status (currently married vs. not), infant sex, and whether Medicaid was the primary payer of the birth. To address differential neighborhood-level drivers of preterm birth and policing, we calculated the index of concentration at the extremes (ICE) which assesses spatial concentrations of racial and economic privilege and disadvantage within a given area.¹⁶⁴ We calculated ICE for each neighborhood i as $(A_i - P_i) / T_i$ where A_i represents the number of NH White and affluent people (80th income percentile), P_i the number of Black and low-income people (20th income percentile), and T_i is the total population in neighborhood i . This measure is scaled -1 to 1 indicating racial/economic deprivation and privilege, respectively, which we then categorized into quintiles. We used Seattle-specific income thresholds rather than the US average to better account for city-specific differentials in income and cost of living.¹⁶⁵ We chose this comprehensive indicator because it avoids the common multi-collinearity issues associated with using separate measures of advantage/deprivation (e.g. poverty, % Black residents etc.). We also included per capita rates of violent crime (homicide and aggravated assault) in each zip-code over the study period from SPD. Violent crime was conceptualized as a confounder because it is associated with preterm birth, precedes police stops, and is likely not on the causal pathway from police stops to preterm birth.

Analysis

We first conducted a descriptive analysis of individual and neighborhood-level characteristics and rates of police stops across preterm and term births. For the pre-pregnancy and first trimester exposure windows, we fit multilevel modified Poisson models with random intercepts for zip-code to account for spatial clustering by neighborhood and robust standard errors to

estimate risk ratios (RR) and 95% confidence intervals (CI) for preterm birth in relation to our measures of neighborhood-level policing rates. For the second trimester exposure window, we used a time-to-event framework because of varying potential lengths of exposure and immortal time bias.¹²⁹ We conducted multilevel Cox proportional hazards regression models with gestational week as the temporal unit and standard errors adjusted to account for clustering by zip-code to estimate hazard ratios (HR) and CI. Survival time was defined as the duration from first day of the second trimester to date of birth. Models were adjusted for age, marital status, education, nativity, Medicaid status, previous preterm birth, infant sex, season of birth (December-February; March-May; June-August; September-November), and neighborhood-level ICE and violent crime. We stratified models by birthing person's race and ethnicity that accounted for at least 10% of the sample to ensure adequate sample sizes for analyses.

Analyses were conducted in R Version 4.3.0 and Stata Version 16.1.¹⁰⁵ University of Washington's Institutional Review Board deemed this study non-human subjects research.

RESULTS

There were 25,909 births (average of 893 births per zip-code) in Seattle from 2017-2019, of which 1,544 (6%) were preterm (Table 3.1). The prevalence of preterm birth was higher for all racially minoritized people compared to White people (5%), the highest of which was among Indigenous (9%), Latina/e (8%), Black (6%), and Asian (6%) individuals (Appendix E). Those who had a preterm birth were more likely to have a high school education or less, use Medicaid, and have a prior preterm birth compared to those with term births.

Black residents were stopped at higher rates than White residents (median rate of 328 compared to 62 per 10,000 in year before pregnancy) (Table 3.1). Black and Asian pregnant people were exposed to the highest median rates of police stops in their neighborhoods across all exposure periods.

We found no significant associations among total births but did find increased risk of preterm birth among Black birthing people residing in neighborhoods with higher levels of overall police stops after accounting for individual risk factors and neighborhood-level racialized economic segregation and violent crime (Table 3.2). In the year before pregnancy, Black birthing people living in neighborhoods with medium-level overall police stops had a 38% increased risk of preterm birth (aRR:1.38, 95%CI:1.02, 1.85) compared to their counterparts in neighborhoods with the lowest stop rates. This association was stronger when the exposure was to the highest-level of stops in the first (aRR:1.74, 95%CI:1.17, 2.57) and second trimester (aHR:1.66, 95%CI:1.14, 2.42).

When examining police-initiated and frisk-involved stops, we observed similar patterns of elevated risk only among Black birthing people in the second trimester. The hazard of preterm birth was higher among Black birthing people living in neighborhoods with the highest police-initiated stop rates (aHR:1.54, 95%CI:1.01, 2.36) and frisk-involved stop rates (aHR:1.55, 95%CI:1.01, 2.4) compared to the lowest.

Conversely, we found that increasing exposure to neighborhood-level policing was associated with decreased preterm birth risk among Latina/e people. Latina/e birthing people living in neighborhoods with higher overall police stop rates had reduced risk of preterm birth compared to those living in neighborhoods with the lowest stop rates during the first (aRR, medium:0.78, 95%CI:0.64, 0.96; high:0.64, 95%CI:0.49, 0.84) and second trimester (aHR, high:0.60, 95%CI:0.44, 0.82), adjusting for covariates. This held true for police-initiated stops in the year before pregnancy and second trimester. We found no evidence of differential preterm birth risk across gradients of neighborhood-level police stop rates among White and Asian birthing people.

Our secondary analysis examined racial concordance between the birthing person's race and the stop rates of people of the same race. The highest neighborhood stop rates of Black people was associated with increased preterm birth risk among Black birthing people in

the first trimester (aRR:1.72, 95%CI:1.22, 2.44) compared to the lowest tertile (Figure 3.1). We found positive associations with increased stop rates of Black people in the other exposure windows, but all CIs included the null. We found no significant associations between neighborhood-level stops of White people and preterm birth among White birthing people.

DISCUSSION

Our study sought to examine the association between neighborhood policing and preterm birth across critical periods before and during pregnancy across racialized groups in Seattle. We found consistent increased preterm birth risk among Black birthing people living in neighborhoods with greater police stops, but mixed results among other racialized groups. This aligns with other studies in Minneapolis and New Orleans that found increased preterm birth risk among Black birthing people living in neighborhoods with more frequent policing.^{37,38} The null association among White people and positive association across preconception and pregnancy exposure windows among Black people further bolsters the evidence that neighborhood policing can be conceptualized as a contextual stressor with differential racialized and gendered impacts. These findings add to the growing evidence of the indirect, intergenerational adverse health impacts of routine police practices.^{32,33}

We found mixed results of how neighborhood-level police stops predicted preterm birth among other racially minoritized groups. Preterm birth inequities between Latina/e and White people were higher in Seattle compared to nationally. However, higher neighborhood-level police stops were associated with lower preterm birth risk among Latina/e people. This finding does not align with the limited research suggesting that exposure to local police and its ties with immigration enforcement are associated with delayed/inadequate prenatal care and higher risk of adverse health outcomes like low birthweight among Latina/e people.^{118,166–168} This could be due to exposure misclassification because our measure doesn't capture immigration enforcement and because zip-codes with higher Latina/e populations overlapped with a

neighboring town's police jurisdiction for which we did not have data, resulting in underestimation of the association for Latina/e people. Interdisciplinary research using more comprehensive data is needed to better elucidate the interconnected roles of local law enforcement, federal immigration, and state anti-immigration policies as contextual stressors with direct and indirect health impacts among Latina/e communities (and potentially other communities with immigrants/refugees).¹⁶⁷ We also found Asian birthing people experienced the highest median exposure to neighborhood police stops across all exposure windows compared to other racialized groups, but had null associations with preterm birth. This could be due to issues with aggregation that mask the diverse experiences of various Asian communities with policing in Seattle.¹²⁰ Future research should disaggregate by ethnicity and nativity to better disentangle subgroup-specific relationships between policing and preterm birth.¹⁶⁹ Given these data limitations, we urge cautious interpretation of the findings for Latina/e and Asian people.

Implications

These findings contribute to the growing recognition of policing as a structural barrier to health equity.³¹ First, public health research and practice should expand efforts to disrupt routine racialized police practices given it has widespread adverse community health impacts as seen in this study and others.^{139,140,142} Public health research has examined fatal police violence,³² but more studies that investigate these routine police practices can contribute to conceptualizing these police killings not as an aberration but as a result of the violence of these everyday police practices in criminalized communities.¹⁷⁰ Second, these findings bolster the long-term calls of community members, advocates, and broader social movements to limit the presence of policing and police surveillance and instead invest in community-led programs that address the root causes of harm and health outcomes, such as housing, healthcare, education, and employment.¹⁷¹

Strengths and Limitations

This study leverages a unique policing dataset to advance the nascent literature on community-level health effects of policing by calculating temporal-and-spatial-specific exposure measures for three critical periods of susceptibility. However, there are important limitations. First, Seattle has lower preterm birth prevalence (6% vs. 10% national average) so generalizability outside Seattle is limited. Second, reliance on administrative data likely underestimated exposures as SPD data does not capture all relevant police-community interactions (e.g. county sheriff, federal immigration enforcement), only those identified/recorded by SPD.¹³⁹ Zip-code might not be a good proxy for neighborhoods and residential zip-code doesn't capture non-residential exposures to policing. We also assumed residential zip-code at birth was the same before and during pregnancy which may not be the case, particularly for those who are economically marginalized and experiencing housing instability. Additionally, because police violence is associated with pregnancy loss,¹⁶³ there is potential for exposure-induced selection in which fewer than expected pregnancies that resulted in live births were preterm because the fetuses most likely to experience these outcomes were lost prior to birth. This would likely underestimate the association between police stops and preterm birth. Lastly, data limitations precluded us from conducting regression analyses among Indigenous and multiracial birthing people and given the disparate policing among Indigenous communities in particular, future research should better incorporate these racialized groups.

Conclusion

This study expands evidence of the reproductive health impacts of policing across multiple racialized groups with precise temporal ordering. Results indicate that Black birthing people experience increased preterm birth risk in neighborhoods with more frequent police stops, suggesting that the core functions of policing act as a racialized gendered stressor with broad negative health impacts. The mixed results among other racially minoritized people

require further investigation with more robust data that better captures community carceral surveillance, including immigration enforcement. The persistent racialized inequities in perinatal health demand that public health research and practice address the ways that structural racism, including racialized police practices, contribute to the perinatal health crisis in the US.

Table 3.1. Individual and neighborhood-level characteristics of births in Seattle, WA, 2017-2019

	Total (N=25,909)	Preterm Birth (N=1,544)	Term Birth (N=24,365)
<i>Individual</i>	N(%) or Median(IQR)		
Race and ethnicity			
NH American Indian/Alaska Native	93 (0.4%)	8 (0.5%)	85 (0.3%)
NH Asian	4679 (18.1%)	292 (18.9%)	4387 (18.0%)
NH Black	2778 (10.7%)	176 (11.4%)	2602 (10.7%)
Hispanic/Latina/e	3831 (14.8%)	288 (18.7%)	3543 (14.5%)
NH Multiracial	1069 (4.1%)	75 (4.9%)	994 (4.1%)
NH White	13325 (51.4%)	693 (44.9%)	12632 (51.8%)
Missing	134 (0.5%)	12 (0.8%)	122 (0.5%)
Born outside of US	9395 (36.3%)	550 (35.6%)	8845 (36.3%)
Age	32.5 (5.05)	32.7 (5.59)	32.5 (5.01)
HS Education or less	4498 (17.4%)	365 (23.6%)	4133 (17.0%)
Medicaid	6596 (25.5%)	496 (32.1%)	6100 (25.0%)
Prior preterm birth	467 (1.8%)	107 (6.9%)	360 (1.5%)
Male infant sex	13071 (50.4%)	868 (56.2%)	12203 (50.1%)
<i>Neighborhood</i>			
ICE race income*			
Quintile 1 (least privileged)	7026 (27.1%)	487 (31.5%)	6539 (26.8%)
Quintile 2	4884 (18.9%)	310 (20.1%)	4574 (18.8%)
Quintile 3	4285 (16.5%)	238 (15.4%)	4047 (16.6%)
Quintile 4	5607 (21.6%)	301 (19.5%)	5306 (21.8%)
Quintile 5 (most privileged)	4107 (15.9%)	208 (13.5%)	3899 (16.0%)
Violent crime rate per 1,000 residents	2.14 [0.93, 2.98]	2.24 [0.82, 3.16]	2.14 [0.93, 2.98]
Pre-pregnancy police stops per 10,000 residents			
Total stops	78.1 [26.51, 105.7]	81.16 [22.73, 107.4]	77.98 [26.67, 105.68]
Proactive stops	31.13 [9.28, 43.79]	32.22 [7.7, 44.16]	31.07 [9.35, 43.71]
Frisk	14.44 [5.53, 25]	15.76 [5.99, 26.41]	14.34 [5.52, 24.93]
Stops of Black people	328.57 [179.51, 850.34]	305.04 [154.87, 720.57]	329.5 [180.59, 855.01]

Stops of White people	61.68 [21.66, 93.37]	65 [20.82, 95.73]	61.46 [21.68, 93.23]
First trimester police stops per 10,000 residents			
Total stops	18.81 [5.92, 26.94]	19.41 [5.21, 27.25]	18.75 [5.94, 26.88]
Proactive stops	7.14 [2.2, 11.19]	7.4 [1.96, 11.64]	7.13 [2.2, 11.15]
Frisk	3.43 [1.31, 6.55]	3.7 [1.3, 6.71]	3.42 [1.31, 6.52]
Stops of Black people	76.24 [34.78, 186.05]	70.05 [19.17, 156.9]	76.45 [35.12, 186.95]
Stops of White people	14.9 [4.53, 23.3]	15.43 [4.16, 24.38]	14.9 [4.57, 23.25]
Second trimester police stops per 10,000 residents			
Total stops	18.66 [5.95, 26.66]	19.08 [5.52, 26.72]	18.61 [5.98, 26.66]
Proactive stops	7.12 [2.2, 11.27]	7.33 [1.85, 11.47]	7.12 [2.2, 11.25]
Frisk	3.42 [1.36, 6.57]	3.51 [1.36, 6.97]	3.42 [1.36, 6.55]
Stops of Black people	74.98 [32.4, 183.31]	68.81 [19.63, 161.87]	75.57 [33.14, 184.35]
Stops of White people	14.43 [4.47, 22.92]	14.62 [4.32, 23.57]	14.43 [4.48, 22.91]

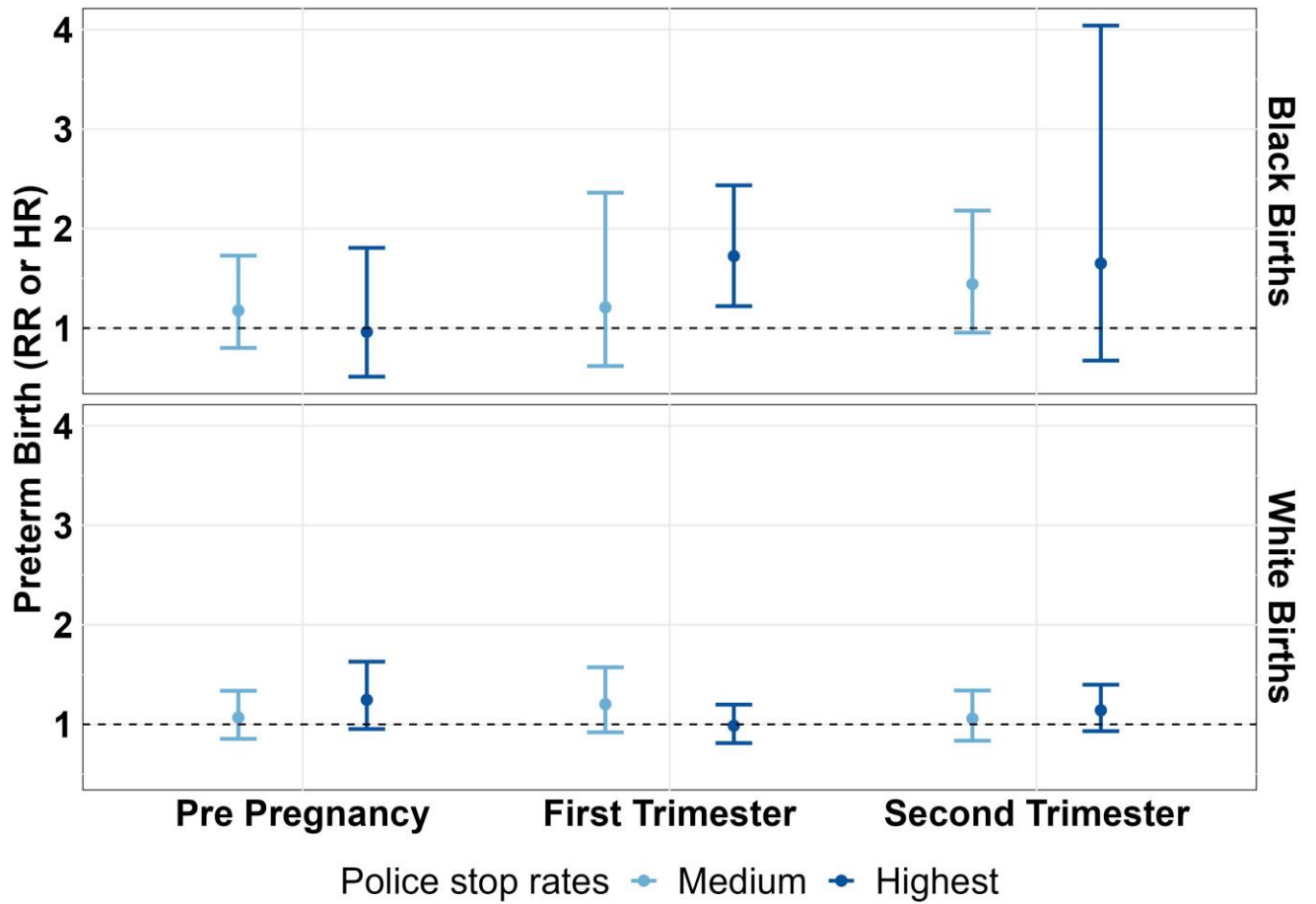
*NH = Non-Hispanic. * Calculated based on distribution of all neighborhoods in Seattle to better reflect the racialized economic segregation in all of Seattle rather than based on the neighborhoods that birthing people live in.*

Table 3.2. Adjusted risk ratios (RR) for preterm birth associated with neighborhood-level police stops in each exposure window, stratified by birthing person race and ethnicity, Seattle, WA 2017-2019

Neighborhood police stop rate (per 10,000)	All births, aRR (95% CI)	Asian births, aRR (95% CI)	Black births, aRR (95% CI)	Latina/e births, aRR (95% CI)	White births, aRR (95% CI)
<i>Pre-pregnancy</i>					
Overall stops					
Low [0, 46.9)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [46.9, 98.8)	1.02 (0.92, 1.14)	1.06 (0.87, 1.3)	1.38 (1.02, 1.85)	0.84 (0.66, 1.07)	1.05 (0.86, 1.28)
High [98.8, 911.3]	1.04 (0.87, 1.24)	0.9 (0.69, 1.17)	1.41 (0.85, 2.33)	0.79 (0.57, 1.1)	1.17 (0.87, 1.59)
Police-initiated stops					
Low [0, 16.5)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [16.5, 38.6)	1.06 (0.95, 1.17)	1.1 (0.87, 1.37)	1.24 (0.88, 1.73)	0.75 (0.61, 0.92)	1.14 (0.96, 1.35)
High [38.6, 474.2]	1.05 (0.9, 1.24)	0.88 (0.64, 1.21)	1.36 (0.91, 2.04)	0.85 (0.65, 1.12)	1.23 (0.96, 1.57)
Frisk-involved stops					
Low [0, 8.2)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [8.2, 20.7)	1 (0.87, 1.14)	0.81 (0.62, 1.06)	1.14 (0.76, 1.72)	0.87 (0.66, 1.14)	1.14 (0.91, 1.43)
High [20.7, 150.3]	1.1 (0.98, 1.23)	1.05 (0.82, 1.35)	1.11 (0.67, 1.86)	0.95 (0.65, 1.39)	1.15 (0.93, 1.41)
<i>First trimester</i>					
Overall stops					
Low [0, 10.2)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [10.2, 24.3)	0.92 (0.81, 1.06)	0.91 (0.7, 1.17)	1.16 (0.82, 1.66)	0.78 (0.64, 0.96)	0.96 (0.74, 1.25)
High [24.3, 200.1]	1.02 (0.87, 1.2)	0.85 (0.59, 1.21)	1.74 (1.17, 2.57)	0.64 (0.49, 0.84)	1.19 (0.86, 1.65)
Police-initiated stops					
Low [0, 3.7)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [3.7, 9.7)	0.95 (0.85, 1.05)	0.96 (0.75, 1.22)	1.18 (0.83, 1.67)	0.89 (0.73, 1.08)	0.94 (0.79, 1.11)
High [9.7, 107.9]	1.04 (0.89, 1.23)	0.94 (0.64, 1.37)	1.46 (0.99, 2.13)	0.78 (0.59, 1.02)	1.16 (0.89, 1.52)
Frisk-involved stops					
Low [0, 1.9)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [1.9, 5.3)	1 (0.88, 1.14)	0.87 (0.72, 1.04)	1.06 (0.67, 1.68)	0.93 (0.74, 1.17)	1.04 (0.83, 1.31)
High [5.3, 45.5]	1.03 (0.89, 1.18)	0.93 (0.67, 1.3)	1.33 (0.9, 1.98)	0.81 (0.59, 1.12)	1.18 (0.91, 1.51)

<i>Second trimester</i>	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)	HR (95% CI)
Overall stops					
Low [0, 10.1)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [10.1, 24.2)	0.97 (0.82, 1.14)	0.95 (0.74, 1.23)	1.26 (0.89, 1.78)	0.82 (0.65, 1.02)	1.02 (0.79, 1.31)
High [24.2, 189.4]	1.01 (0.89, 1.13)	0.82 (0.62, 1.08)	1.66 (1.14, 2.42)	0.6 (0.44, 0.82)	1.19 (0.97, 1.47)
Police-initiated stops					
Low [0, 3.6)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [3.6, 9.7)	0.93 (0.81, 1.06)	0.91 (0.73, 1.14)	1.13 (0.82, 1.56)	0.8 (0.65, 0.97)	0.98 (0.78, 1.22)
High [9.7, 105.2]	0.94 (0.81, 1.1)	0.95 (0.69, 1.31)	1.54 (1.01, 2.36)	0.58 (0.43, 0.79)	1.01 (0.78, 1.29)
Frisk-involved stops					
Low [0, 1.9)	Ref.	Ref.	Ref.	Ref.	Ref.
Medium [1.9, 5.3)	1.04 (0.89, 1.21)	1.08 (0.87, 1.35)	1.25 (0.82, 1.91)	0.99 (0.69, 1.43)	1.05 (0.81, 1.36)
High [5.3, 44.1]	1.03 (0.88, 1.2)	0.83 (0.63, 1.09)	1.55 (1.01, 2.4)	0.87 (0.62, 1.22)	1.13 (0.88, 1.45)

Figure 3.1. Adjusted risk or hazard ratio of neighborhood-level stops of Black people among Black births and stops of White people among White births, stratified by exposure window, Seattle 2017-2019



Note: Risk Ratio (RR) for pre-pregnancy and first trimester, Hazard Ratio (HR) for second trimester.

Chapter 4 Barriers and facilitators of a community-based doula program: a mixed methods analysis

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ABSTRACT

Community-based doulas, who provide nonclinical perinatal support and are from the same communities of the families they serve, are increasingly recognized as a strategy to ameliorate racialized perinatal health inequities. However, little is known about successful implementation and sustainability of community-based doula programs. Using an explanatory sequential mixed methods design, we aim to examine the implementation and health outcomes of a community-based doula program serving low-income families and the barriers and facilitators that influence these outcomes. We analyzed programmatic data, including time spent with families and health outcomes, among all families enrolled in the program from January 2016-December 2022. Four in-depth listening sessions with the program's direct service providers were conducted and analyzed using thematic analysis. Among the over 2,000 families served, the majority of whom identified as Black, Latina/e/x, Indigenous, and other people of color, there were 14,672 total home visits that totaled 17,774 hours. Over \$87,000 in direct funds and 7,000 tangible items were dispersed to families. Preterm birth ranged from 4-9% across programs and the vast majority (>94%) were lactating at birth. Direct service providers identified holistic, culturally-matched services and "doula-ing the doula" (organizational infrastructure to support doula's work) as facilitators. Barriers included the intersecting systems of oppression that underlie the primary challenges faced by direct service providers, including lack of community resources and power asymmetries within birth settings, that can lead to provider burnout. These findings document the positive impact of community-based doula programs and bolster the calls for increased compensation and structural supports for doulas.

INTRODUCTION

The alarming racialized inequities in perinatal health outcomes are persistent and structural racism is recognized as a fundamental cause of these inequities.^{13,55} Structural racism is the “totality of ways in which societies foster racial discrimination through mutually reinforcing inequitable systems,”⁶ like housing, health care, and employment, and has been empirically linked with inequitable adverse birth outcomes.^{25,27,83} Black and Indigenous birthing people are 2 to 3 times more likely to die from a pregnancy-related cause and experience higher rates of preterm birth and infant mortality than White birthing people.^{15,172,173} The vast majority of research and interventions addressing these inequities have focused on individual risk factors and behaviors with little change in outcomes,¹³ but growing attention is being paid to structural and social determinants of these inequities.

An increasingly popular strategy to address racialized perinatal health inequities are doulas, who are trained professionals who provide nonclinical support to pregnant people before, during, and after birth. Doulas are recognized as an evidence-based intervention that improve maternal health, patient satisfaction, and health care experiences.^{174–179} However, the majority of doula care implementation and research focuses on private care models where families pay out of pocket. This is out of reach for many, especially economically and racially marginalized people. Community-based doula programs explicitly aim to disrupt the social determinants of these health inequities and support birthing people at elevated risk of adverse health outcomes due to structural racism, generally at no or low cost.¹⁸⁰ Community-based doulas are from the same community as the families they serve and provide continuous, one-on-one emotional and informational support during the perinatal and postpartum periods. This goes beyond standard doula care to include a wider array of culturally responsive support services tailored to the specific needs of the communities they serve.

A growing field of research and practice explores how doulas can mitigate the intersecting systems of oppression (e.g. sexism, racism, classism, xenophobia) that coalesce

during pregnancy, childbirth, and postpartum and can lead to adverse birth outcomes.^{181–183} Previous studies have highlighted how community-based doulas who share similar racial, ethnic, religious, or cultural backgrounds as the families they serve can help disrupt these harms by building trust, providing information and supporting autonomy, facilitating culturally-grounded birthing practices, and addressing discrimination in the hospital.^{181,184,185} However, research also shows the mistreatment of doulas in hospitals and the additional support they provide beyond birth that can lead to burnout.^{183,184,186–188} Additionally, most of this research focuses on doula's role primarily during hospitalized births, but less is known about community-based doula programs throughout pregnancy and into early childhood and parenting. With community-based doulas becoming a popular strategy to improve perinatal health inequities through policies such as Medicaid reimbursement,¹⁸⁹ it is imperative to better understand the factors affecting successful implementation and sustainability of community-based doula programs.

To fill this gap, our study aims to examine the implementation and health outcomes of a community-based doula program and the barriers and facilitators that influence these outcomes. Using both quantitative and qualitative methods, we aim to capitalize on the advantages of each method to obtain a more in-depth understanding of community-based doula programs as well as the experiences of direct service providers who work within these programs. We used intersectionality as the guiding theoretical framework for this study to recognize the overlapping systems of oppression such as racism, sexism, classism, and xenophobia at the macro social-structural level that (re)produce adverse health outcomes for families living at these intersections.^{1,2,9} Intersectionality provides a useful framework for understanding the structural context in which community-based doula programs operate in and help navigate birthing families through.

METHODS

An academic-community research team co-conceptualized and conducted this mixed-methods study of a community-based doula program in Washington state. We used an explanatory sequential mixed methods design¹⁹⁰ (quan->QUAL) in which we used quantitative methods to describe the program's implementation and health outcomes followed by qualitative methods that explore the barriers and facilitators to achieving those outcomes. This study design leveraged the existing and continually collected programmatic data of the community-based doula program which was then followed with qualitative data to explain and contextualize the quantitative findings. Study procedures and analyses were reviewed and approved by the University of Washington Institutional Review Board. Details on the study team are in Appendix F.

Study setting

Open Arms Perinatal Services is a nonprofit community-based organization that provides free, culturally responsive, and comprehensive pregnancy, birth, lactation, and early parenting services to families living within 200% of the federal poverty level in Washington state. Open Arms predominately employs and serves Black, Indigenous, Latina/e/x, and other people of color and offers culturally-matched doula care, childbirth education, lactation and new parent support, referrals and help navigating community resources (e.g. food banks, housing support, and domestic violence support services), and tangible items such as diapers and other baby items.

Quantitative methods and analysis

The study population for the quantitative analysis included all individuals enrolled with Open Arms between January 1, 2016-December 31, 2022. Data on demographics (age, race and ethnicity, primary language, place of birth, and county of residence) were recorded by intake coordinators. Data on referrals, time spent with families, and health outcomes were

recorded by direct service providers during each family visit into a central database. Data quality checks were performed to ensure accuracy and data were extracted from the database for analysis.

Individuals were categorized by the four programs in which they received services (programs described in Table 4.1). The first program was Family Support Services, which all Open Arms families have access to for tangible goods and help navigating community resources. Upon intake, families choose one doula service to enroll in – either the Birth Doula Services or the Community-Based Outreach Doula Program (Outreach Doula) – based on their personal interest and program availability. Birth Doula Services involves 3 prenatal visits, 3 postpartum visits, and continual labor and delivery support, whereas the Outreach Doula program is more intensive and long-term with bi-weekly visits from the second trimester until the child's second birthday. Families in Birth Doula Services are able to choose to extend their services by enrolling in the Lactation Support Program in addition to or after they complete the Birth Doula Services program. Families in the Outreach Doula Program are not eligible for individual home visiting through the Lactation Support Program as services would be duplicative. Direct service providers in Family Support Services, Outreach Doula, and Lactation Support Programs are full time employees of Open Arms whereas Birth Doulas are contracted employees.

We categorized outcomes into two groups. First, implementation outcomes included data on the delivery of key components of each program and included counts of the number of home visits, time spent with families during home visits and labor/delivery, referrals, and tangible goods and direct funds given to families. Second, health outcomes included pregnancy and birth outcomes including cesarean section, preterm birth (< 37 weeks gestation), low birthweight (<2500 g), neonatal intensive care unit (NICU) admission, and lactation at birth. Descriptive statistics of sociodemographic characteristics of families were calculated across the Open Arms programs. We calculated the total and average per family for all implementation

outcomes and counts and percentages for health outcomes. Analyses were conducted in Stata Version 16.0. Following these analyses, the first integration step in this explanatory sequential study involved connecting the results from this initial quantitative phase to help plan the questions for the follow-up qualitative data collection phase.¹⁹⁰

Qualitative methods and analysis

After analyzing the quantitative data, we conducted four in-depth listening sessions with direct service providers in each of the four Open Arms programs (described above) in April-June 2023. All direct service providers were invited to participate via email and there were a total of 25 participants (ranging from 4-8 per session). Listening sessions were held either in-person on-site or on Zoom for 60-90 minutes and participants received a \$50/hour incentive. Guided by the quantitative findings, we developed a semi-structured question guide that asked about facilitators and barriers to their work and the families' outcomes, as well as resources and policies that could further support and sustain community-based doula programs. We tailored interview guides to each program's scope of work. Data saturation was considered reached after these four sessions were conducted. We obtained oral informed consent from all interviewees to audio record the discussions. Listening sessions were audio recorded and transcribed verbatim using Otter.ai transcription software. Manual notes taken by the facilitator (ZVB) and notetaker (TR) were used to augment the transcripts. Deidentified transcripts were imported into Dedoose software.¹⁹¹

We used a thematic analysis approach to identify, analyze, and report themes within data.¹⁹² Two coders (ZVB and TR) conducted independent, inductive line-by-line coding of the transcripts to generate initial codes. We used memos to define codes and highlight areas of potential differing interpretation and resolved coding disagreements through discussion. We developed the codebook in an iterative process of reviewing, refining, and finalizing codes through team consensus. After finalizing the codebook, the two coders independently coded all

transcripts. The codes were then grouped into broader categories to generate themes to capture the broader conceptual findings and patterns in the data. Rather than calculate intercoder reliability,¹⁹² we ensured reliability through multiple consensus meetings, iterative refinement of the codebook, and checking for thematic saturation. Analyses were conducted in Dedoose.¹⁹¹ Following the qualitative analysis, the last integration step was documenting the ways in which the qualitative results helped explain and extend upon the quantitative results.¹⁹⁰

RESULTS

Quantitative

Open Arms served over 2,000 families across the four programs between January 1, 2016 and December 31, 2022, the majority of whom identified as Black, Latina/e/x, Indigenous, Multiracial, or Asian (ranging from 77-99% across programs) (Table 4.2). The majority of birthing people served identified as Black and Latina/e/x and around half, on average, were born outside of the United States. Around one in five birthing people spoke Spanish as their primary language across the programs, and one-quarter in the Outreach Doula program spoke Somali as their primary language compared to smaller proportions in the other programs. While families lived across ten Washington counties, most lived in King, Pierce, and Snohomish counties.

Among the 1,567 families served by Birth Doula Services, there were 1,488 home visits that totaled 7,748 total hours, with an average of 6 hours per family, and over 12,000 service hours during labor and delivery, with an average of 11 hours per family (Table 4.3). Among the 203 families served by the Outreach Doula program, there were 13,184 home visits that totaled 11,026 total hours, with an average of 61 hours per family, and over 2,000 hours during labor and delivery, with an average of 14 hours per family. Across both groups, over \$87,000 in direct funds and 7,000 tangible items were dispersed to families. The proportion of adverse birth outcomes, such as preterm birth and low birthweight, tended to be lower among families in the Birth Doula program. Though, for both groups, the vast majority (>94%) were lactating at birth.

Qualitative

We identified six interconnected themes that emerged across the four groups to describe the facilitators and barriers to community-based doula programs.

Facilitator: Holistic, culturally matched services

Participants across all groups described the uniqueness and effectiveness of the Open Arms model of holistic services and culturally matched support in which community-based service providers are trusted members of the communities they serve and matched with families based on culture, ethnicity, and preferred language. This cultural congruence between the provider and birthing person helped to build trust which contributed to positive pregnancy and birth experiences. One participant described it as being someone:

“who either is from and shares that community affinity, or has an understanding of the communities that we serve. And so that builds a level of trust and a way that families are able to connect, knowing that the provider they're connected with here at Open Arms has experience, potentially the same lived experience or similar....[We are] able to hold some of the complexities that come up for families who have been oppressed or marginalized and are experiencing various levels of harm or fears as they're navigating through systems, that there's someone who understands and can hold them more holistically” (Family Support Services provider)

Another key aspect of the program discussed by participants was the holistic services that met the varying needs of families, many of whom had acute needs beyond birth including housing, food, mental health care, childcare, and immigration and legal needs. Compared to other community resources, these are no-barrier resources (e.g. free and no ID required to access resources). Community-based service providers spoke at length about the many “hats” they wore to meet these diverse needs of birthing families.

“Especially in a community-based situation where we're driving around, getting diapers, getting formula, getting car seats, looking for housing for clients... I just do it because I'm like, they need this. So, I'm going to do it.” (Birth Doula Services provider)

Together, the holistic and culturally matched services were crucial aspects that facilitated strong relationships and trust with birthing families. These relationships enabled community-based service providers to offer informed and proactive support to meet the holistic needs of racially and economically marginalized birthing families. One participant explained it as “meeting people where they are” and, in turn, “they will see you for who you really are. And that'll help you have a better relationship with your client... you're part of their village... you go from doula to mom, or auntie or you know, whomever they need” (Birth Doula Services provider). This relational and holistic approach to pregnancy-related care resulted in families being able to “thrive when they have the wraparound services that meet their health needs, the baby's needs and their basic necessities” (Family Support Services provider).

Facilitator: “Doulas need to be doula’ed”

Another key facilitator that was discussed across groups was that community-based service providers needed support themselves in order to sustain providing these holistic, culturally matched services. “The doula needs to be doula’ed” in order to build the relationships and trust that led to successful pregnancy and birth experiences (Birth Doula Services provider). One participant described it as a positive feedback loop where support for community-based providers led to bolstered support of families: “if we're supported then there's more in our cup to be able to fill the cups of our clients” (Birth Doula Services provider).

This facilitator was present at the organizational level and among peers, mentors, community, and families. At the organizational level, participants described flexible workplace policies (e.g., “offline” days with no meetings), formalized mentorship to help providers develop their skills and navigate challenges, on-call midwife available for support/questions, continued

professional development, and training/educational opportunities (both internal and external) as key factors in how they were most supported to sustain their work. Community-based providers also derived support and resources through mentorship from both their peers and trained mentors. One participant described it as: “we doula one another and continue to create unity and [a] village amongst one another” (Birth Doula Services provider). Fellow direct service providers serve as important sources to decompress, seek advice, process challenging situations, and celebrate successes. Additionally, given the unpredictable and time sensitive nature of birth work, doulas also felt supported by being able to call on other doulas to cover a birth for them. This sense of community of support within Open Arms was discussed across all groups, described as “being held through the work that we do with the families and with each other” (Family Support Services provider). Lastly, participants described how a home support system and family that understands the demands of the job helped to make this work easier.

Barriers

Four interconnected themes described challenges of the community-based program including 1) intersecting systems of oppression harm community-based providers and the families they serve, 2) lack of resources due to policy and institutional constraints, 3) navigating power asymmetries within birth settings, and 4) burnout of community-based providers. Guided by the socio-ecological model,¹⁹³ we conceptualized these themes as embedded and connected but operating at distinct levels from societal (theme 1) to individual (theme 4) (Figure 4.1).

Societal-level barrier: Intersecting systems of oppression harm community-based providers and the families they serve

Participants identified how intersecting systems of oppression, like structural racism, sexism, settler colonialism, and xenophobia, shaped the pregnancy and birth experiences of the families they worked with. Participants explicitly named the barriers experienced by the families they serve — such as language inaccessibility, mistreatment, and lack of affordable housing, food, and health care — as systemic.

“I think the systemic part is really key in this...the bigger picture like systemic racism and also systemic like, barrier and oppression on the communities that we are working with and that we are part of too.” (Lactation Support Program provider)

These intersecting systems of oppression shaped how families were treated in the birth setting based on the intersectional identities they held or were perceived to hold.

“If it's a queer family, that will... kind of shift things, if it's a family that looks a little more Eurocentric-aligning, or just happens to kind of present that way, that might shift things. If it's a biracial family, if it's like a black, femme bodied person giving birth, and their partner is white, that also can shift things and make it look different. Or if they are an immigrant family, that also can look really different... And then for a family that might not look like they have all the resources in the world, right? Like, that also looks really different, or a family that uses like, African American Vernacular, right? Like, they assume that they don't know anything, or they don't ask them questions...And so that makes it really frustrating when I'm like, there isn't even consistency among how the hospital shows up.” (Outreach Doula Program provider)

This differential treatment was directly linked to histories of structural oppression, including the extensive historical trauma in the Indigenous community that leads to “unnecessary interventions...a lot of biased opinions and stereotypes and things like that” (Outreach Doula Program provider). Participants also described that holding the same structurally marginalized identities as the families they serve provided some benefit due to similar lived experiences, but that it was predominately challenging both living in and helping families navigate these systems of oppression.

“[You've got] your own life going on, your own family members, you know, that are in the same community facing these same barriers that you're trying to help along with your

clients. And you're facing these barriers at the same time..." (Outreach Doula Program provider)

Community-level barrier: Lack of resources due to policy and institutional constraints

Participants described how these overarching systems of oppression, like racism and xenophobia, manifests in their work in the form of lack of resources for the families they serve.

"Our people have already gone through enough...but really its policies, its racism, hierarchy. We're dealing with housing crises. Right now we're dealing with a lack of food benefits. A lack of mental health [care]. All of our resources are like tapped or have like months of waiting lists... We are dealing with chronic white supremacy issues here" (Outreach Doula Program provider)

Open Arms coordinates referrals with external organizations that provide rental assistance, food, intimate partner violence services, and mental health care. However, these resources were often limited, completely lacking, or language inaccessible due to policy and organizational constraints. For example, participants described external organizations running out of resources, lack of sufficient relationships/linkages with external organizations to refer families to, lack of low or no barrier resource options, and geographic barriers (e.g. county border lines that restrict what county resources are available to families). Additionally, participants discussed the absence or limitations of policies that provide pregnancy and parenting support, such as not working enough hours to qualify for paid family leave or inadequate policies for postpartum and lactation support.

Lack of language accessible services, both within and outside the birth setting, was discussed as a large barrier across groups. Participants shared anecdotes of interpretation services that were not always reliable, timely or accurate. For example, birthing families who used hospital interpreters would experience incomplete and sometimes misleading translations,

lack of proper consent for all labor interventions, reduced privacy, and not be given enough time for labor decisions compared to English speakers. The lack of quality interpretation services, both within the hospital and in the community at large, “leaves [immigrants and non-English speakers] behind in so many ways” (Lactation Support Program provider).

Interpersonal-level barrier: Navigating power asymmetries in birth settings

The intersecting systems of oppression also shaped the power asymmetries present in birth settings between medical staff, doulas, and birthing families. Medical staff, including nurses and doctors, generally maintain decision-making power and authority within birth settings, which can sometimes lead to conflict with doulas if these decisions don’t align with families’ preferences. For Black, Indigenous, Latina/e/x and other doulas of color, these barriers to centering their families’ wishes are exacerbated when navigating the interacting power differentials of race and credentials in the birth setting. Indeed, doulas described approaching each birth as akin to “preparing to go in for a war at their birth” and not being sure of what might happen.

“Because sometimes if you're going to the hospital, you gotta go in there with the full armor of God, because you never know. You never know what you're up against sometimes” (Birth Doula Services provider)

Part of this unpredictability was due to differing and unclear hospital policies regarding birth practices, such as delayed cord clamping, use of cameras in delivery room, or deciding to switch clinicians. Several participants agreed with the sentiment that hospital policies could be weaponized by hospital staff and that “some of the policies [are] not a policy at all. It’s the nurse’s policy” (Birth Doula Services provider). These unpredictable hospital policies, often viewed as subjective or unwarranted by doulas, would lead to conflict between doulas and medical staff. Lastly, doulas noted a lack of knowledge or respect from hospital staff, particularly doctors and nurses, about doulas and what their role was. One participant described it as:

“Nurses are like gatekeepers, sometimes they don't want you in there. The providers, due to lack of knowledge of our expertise, they don't understand the purpose for us even being in the room” (Birth Doula Services provider)

Participants also shared their strategies for navigating these power asymmetries including being clear with medical staff that they work for the birthing person and not the hospital, requesting documentation of hospital policies, and building relationships with clinicians over time so they can have open conversations to work through conflicts.

Individual-level barrier: Burnout of community-based providers

The lack of community resources and power asymmetries within birth settings, all stemming from intersecting systems of oppression, led to burnout of community-based providers. Participants spoke at length about the difficulties they experienced supporting families by taking on their challenges and helping them navigate systemic barriers. The demanding nature of community-based care and building relationships with families can lead to compassion fatigue, stress, and burnout.

“I think that can lead to burnout...that we're kind of overextending ourselves, because for us, our clients are more like family. It's not always a transactional situation where it's like you've paid me so now I'm going to do this. This is when you're an empath, and you're a healer, you understand things for people that are needing it. And if you can figure it out, then you usually do.” (Birth Doula Services provider)

Community-based providers “show up in places that people don't even think about... the corners that kind of get left in the dark” (Outreach Doula Program provider). Because of this, they must address the substantial challenges experienced by birthing families, which directly affects the well-being of community-based providers as well. As one participant explained:

“It’s just really hard to witness...to support people in accessing these things.

Systemically you notice all these barriers, and so it does have a huge impact and effect on our supporting folks.” (Lactation Support Program provider)

This work often had emotional, mental, and physical impacts on community-based provider’s own health and well-being. As one participant described:

“I need strength because you know, this is weighing on me, this is just as taxing on my body, my mental health as well. I’m trying to take it all, you know, I want this to be very serene for you. So, I’m grabbing your stress” (Birth Doula Services provider)

Notably, there was a synergy between the burnout that community-based providers experienced when holistically meeting the needs of the families they serve and the facilitator of “doulas need to be doula’ed.” The organizational infrastructure of mentorship, training, and flexible workplace policies (e.g. “doula-ing the doula”) were introduced to counteract the barriers and burnout experienced by community-based providers. This was described as an iterative process that required both the organization and community-based providers to be flexible in responding to emergent needs of both providers and the families they serve.

Mixed-Methods Integration

The facilitators that emerged from the qualitative data provided key insights and nuances that helped explain the striking quantitative findings of high levels of home visits, hours with families, and positive birth outcomes (e.g. vaginal and term births). Specifically, participants’ qualitative descriptions of the holistic services reflected the extensive number of hours spent with families and the tangible items, direct funds, and referrals given to families. However, the qualitative data revealed these implementation outcomes were likely *underestimates* because much of community-based provider’s work entailed labor outside of home visit or labor/delivery hours (e.g. cooking meals, finding car seats, answering texts and calls at night etc.). The

qualitative findings helped link the implementation outcomes that holistically met families' needs during pregnancy as a key factor that contributed to higher rates of term, vaginal, and healthy weight births. Additionally, some divergence emerged between the qualitative findings of supporting family autonomy and agency in defining their own positive birth outcomes compared to the standard quantitative measures of "positive" outcomes. For example, while exclusive lactation is generally seen as the gold standard positive outcome, participants urged that instead a patient-centered outcome that reflects the patient's informed choice to use formula, donated human milk, and/or direct bodyfeeding was a better representation of "positive" perinatal outcomes.

DISCUSSION

This study explored the barriers and facilitators of implementing a community-based doula program and underscored the dual importance of providing holistic services for racially and economically marginalized families alongside structural supports for the community-based providers doing this demanding work. Our mixed-methods findings documented the substantial number of hours spent with birthing families and amount of direct funds and tangible items provided, which were further contextualized with the qualitative findings of the many roles that community-based providers play to meet the needs of birthing families. Intersecting systems of oppression, such as structural racism and sexism, underlie the primary challenges faced by the community-based doula program, including lack of community resources and power asymmetries within birth settings, that lead to provider burnout. These findings affirm other research that suggests an undue burden is placed on doulas and other community-based providers to improve enduring racialized inequities while they are simultaneously experiencing and supporting families in the context of discrimination and inequitable institutions.^{184,187,188} These findings add to the growing body of work documenting the positive impact of community-

based doula programs and bolster the widespread calls for increased compensation and structural supports for doulas.^{181,183,188}

While these health outcomes are not directly comparable to overall county or state specific measures because this study population is only families living within 200% of the federal poverty level, there are some comparisons worth noting. The cesarean rate among Open Arms birthing people (24-26%) is slightly lower in both programs compared to the Washington state average (29%).¹⁹⁴ The preterm birth prevalence among families in the Birth Doula program was much lower (4%) compared to the state average (9%). Given that the Outreach Doula program just serves Black, Somali, Indigenous and Latina/e/x families, the program's 9% average is on par or lower than the state averages for these same racialized groups (13% Indigenous, 11% Black and 9% Latina).¹⁹⁴ Alongside the qualitative findings of doulas building trusting relationships with families, these quantitative findings bolster previous research that doulas play a crucial role that has the potential to disrupt systemic patterns of frequent medical interventions, high cesarean rates, and trauma from negative birth experiences.^{181,187}

This study also documents how the four interconnected programs of Open Arms aim to address the interconnected root causes of health inequities by responding to the totality of ways in which structural racism operates through mutually reinforcing inequitable systems like housing, health care, and employment.⁶ Community-based service providers described how the unique integration of lactation support, community-based doula care, holistic services and resource acquisition for housing, food, baby items, and other necessities can work synergistically to blunt the intergenerational impact of structural racism on health and well-being. Indeed, these mixed-methods findings show how this comprehensive community-based approach can help achieve positive outcomes for families. Similar studies also describe housing, food and mental health services as the largest needs of the families that community-

based doulas serve,¹⁹⁵ suggesting that resource acquisition is an essential part of these programs and requires increased funding to sustain. Notably, the geographic barriers to resource acquisition is tied to other aspects of structural racism like gentrification that pushes families out of cities/counties with more publicly-funded resources.¹⁹⁶ Thus, community-based doula programs have potential to disrupt these systemic harms but structural and policy approaches are needed to address inequitable access to resources, such as affordable housing, livable wages, paid parental leave, and comprehensive postpartum care.

Community-based service providers dedicate a vast amount of time to reliably support birthing families, shining a light on the financial undervaluing of birth worker services. This study helps illuminate the invisibilized labor that is required to build the infrastructure for these robust referral systems and the underlying work of structurally supporting community-based doula programs beyond prenatal and birth hours. This comprehensiveness is partly reflected in the average of 17-75 total hours spent per family with ranges up to 200 hours, but the qualitative findings reveal how these are underestimates. It is important to note that these estimates do not fully capture the effort dedicated to building a robust infrastructure that supports doulas adequately, including timely payments for services, expertly matching doulas with families, resource acquisition for families, and evidence-based reflective mentorship and relationship-based practices.¹⁹⁷ This is critical and relevant information for setting appropriate compensation and insurance reimbursement for doulas.¹⁹⁸ Additionally, these findings have implications for funders of community-based doula programs. There is a need for monetary and structural support for community-based service providers, who witness and try to disrupt the racism and obstetrical violence their families experience, which can lead to burnout. Funders should also recognize the extensive labor, which is often made invisible, that goes into building community linkages, “doula-ing the doula”, and infrastructure required to result in this reliable, consistent, and trustworthy support for birthing families.

Limitations

This study had several limitations. First, the recorded home visit hours did not include time spent on administrative duties, travel, resource acquisition, and other aspects of supporting families that doulas routinely provide. Second, these findings only reflect the experiences of community-based direct service providers, not the individuals and families enrolled at Open Arms. Third, the listening sessions were conducted with fellow coworkers and sometimes supervisors, thus participants may not have felt comfortable sharing their experiences in this setting due to potential power differentials and/or lack of anonymity. Fourth, the missing birth outcome data for the Birth Doula Services program is likely non-random and we could be underestimating the prevalence of adverse birth outcomes in this program. Lastly, generalizability of these findings to other community-based doula programs in different social contexts may be limited.

Conclusions

Community-based programs that are culturally-and-relationship-centered, like Open Arms, provide an example of how systems-focused programs can mitigate the effects of structural racism on health inequities. Holistic services are essential to meet the acute needs of marginalized birthing families, and there is a simultaneous need for increased funding and structural supports for the programs and individuals providing this care.

Table 4.1. Key components of the four primary Open Arms programs

Component	Description
1) Family Support Services	Provides supportive resource navigation, hosts peer support parenting groups, organizes community events for families, and builds referral relationships with community organizations that provide services for families from pregnancy to age five. The Family Support Services team connects family with tangible goods such as diapers and other baby necessities and connect families directly to a variety of community programs and services including resources related to basic needs, food, childcare, parent groups, health insurance enrollment and navigation, housing and rental assistance, mental health, domestic violence, advocacy, legal aid and more. Services are provided in English and Spanish. Virtual interpretation support is available when required to support additional languages.
2) Birth Doula Services	Provides culturally-and-linguistically-matched person-centered services focused on prenatal health, birth preparation, lactation, and postpartum support. The program offers three prenatal visits, continuous support during labor and delivery, three postnatal visits and three case management calls, and connects families to community resources and baby supplies. Services have been provided in 67 languages, primarily Amharic, English, Somali, Spanish, Tigrinya, Toisanese, and Vietnamese.
3) Community-Based Outreach Doula Program	Provides comprehensive, culturally-matched support prenatally, during birth, and into early parenting. They provide at least bi-weekly visits from the second trimester of pregnancy until the child's second birthday. This program currently serves the Indigenous, Latina/e/x, African American/Black, and Somali communities.
4) Lactation Support Program	Provides Black/African American and Spanish-speaking families with a community-matched Lactation Support Peer Counselor (LSPC). The LSPC supports families prenatally and up to a year postpartum in working towards their self-identified feeding goals. The Lactation Support Program offers home visits, prenatal lactation classes, monthly lactation topic classes (i.e. mastitis, pumping, milk sharing, etc.), group in-person parent support gatherings, and virtual drop-in lactation lounges. Services are provided in Spanish and English.

Table 4.2. Characteristics of participants in Open Arms programs, January 1, 2016 – December 31, 2022

Characteristics	Birth Doula Services	Community-Based Outreach Doula Program	Lactation Support Program	Family Support Services
	N (%)	N (%)	N (%)	N (%)
Age				
<20	109 (7)	21 (10)	4 (5)	15 (8)
21-29	748 (49)	109 (54)	48 (57)	88 (49)
30-39	606 (40)	63 (31)	28 (33)	68 (38)
40+	64 (4)	8 (4)	4 (5)	7 (4)
Race and Ethnicity*				
American Indian/Alaska Native	32 (2)	12 (6)	8 (9)	3 (1)
Asian	132 (8)	0 (0)	0 (0)	2 (1)
Black	561 (36)	133 (66)	44 (50)	97 (43)
Latina/e/x	411 (26)	46 (23)	26 (30)	54 (24)
White	268 (17)	0 (0)	0 (0)	14 (6)
Multiracial/Other	146 (9)	11 (5)	8 (9)	17 (8)
Declined to provide	17 (1)	1 (0)	2 (2)	38 (17)
Primary language				
English	925 (59)	98 (48)	68 (77)	120 (53)
Spanish	310 (20)	44 (22)	18 (20)	45 (20)
Somali	69 (4)	57 (28)	0 (0)	3 (1)
Amharic	50 (3)	0 (0)	1 (1)	12 (5)
Other	213 (14)	4 (2)	1 (1)	45 (20)
Place of birth				
Born in US	726 (49)	82 (47)	86 (52)	45 (63)
Born outside US	754 (51)	93 (53)	78 (48)	26 (37)
County of Residence				
Island County	11 (1)	0 (0)	0 (0)	0 (0)
King County	1256 (81)	175 (91)	82 (95)	162 (87)
Kitsap County	3 (0)	0 (0)	0 (0)	0 (0)
Lewis County	1 (0)	0 (0)	0 (0)	0 (0)
Mason County	1 (0)	0 (0)	0 (0)	0 (0)
Pierce County	98 (6)	13 (7)	3 (3)	12 (6)
Skagit County	3 (0)	0 (0)	0 (0)	0 (0)
Snohomish County	165 (11)	5 (3)	0 (0)	12 (6)
Thurston County	16 (1)	0 (0)	1 (1)	1 (1)
Whatcom County	1 (0)	0 (0)	0 (0)	0 (0)
Total	1567	203	88	225

*Data collected included self-reported race and ethnicity categories that follow federal Office of Management and Budget (OMB) categorizations.

Note: If someone was enrolled in multiple programs, they are represented in each program they were enrolled in (e.g. individuals can be in multiple columns)

Table 4.3. Implementation and health outcomes for community-based doula programs, January 1, 2016 – December 31, 2022

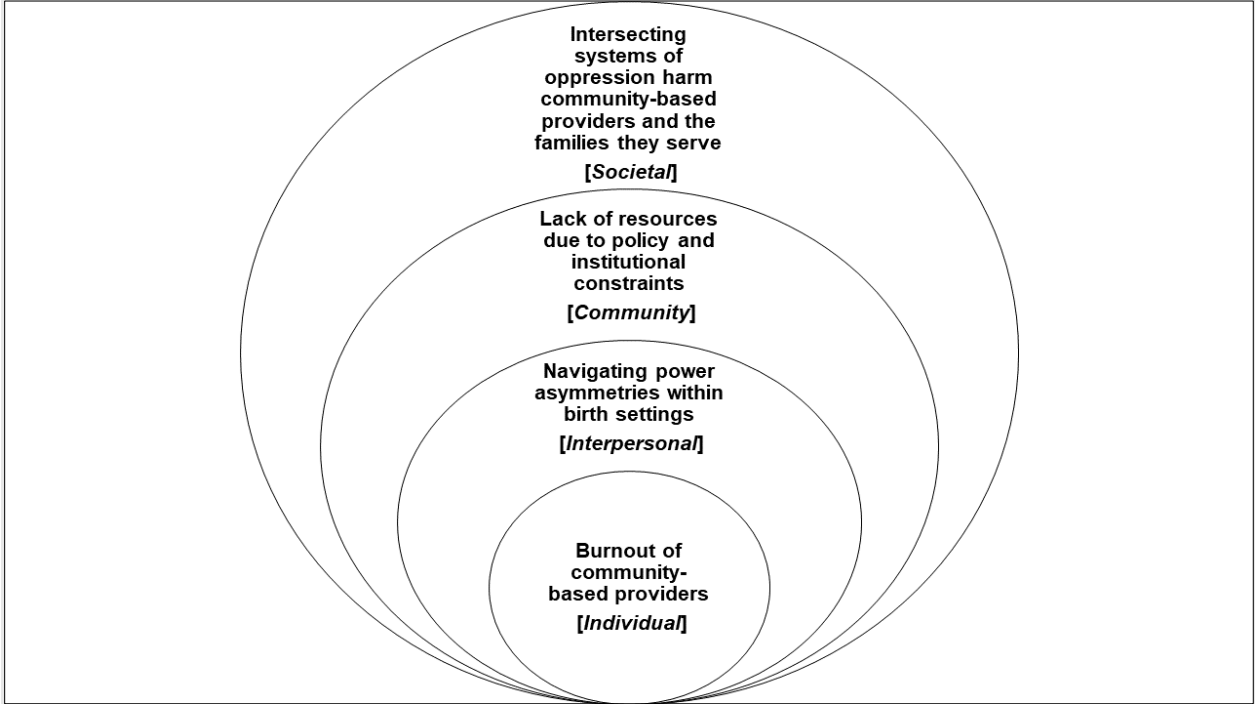
	Birth Doula Services		Community-based Outreach Doula Program	
	N = 1,567		N = 203	
Implementation outcomes	Total	Average per family (range)	Total	Average per family (range)
No. of home visits	1,488	1 (0,11)	13,184	65 (0,302)
No. of home visit hours	7,748	6 (0, 58)	11,026	61 (2, 244)
No. of labor & delivery hours	12,869	11 (0, 80)	2415	14 (0, 75)
No. of referrals	2,432	2 (0,38)	3240	16 (0, 94)
No. of tangible goods dispersal	1336	5 (0, 36)	5919	29 (0, 229)
Direct funds (\$) ^a	\$55,406	-	\$31,659	-
Health outcomes	N (%)		N (%)	
Cesarean rate ^b	290 (26.3)		41 (23.8)	
Preterm birth ^b	43 (4.1)		16 (9.3)	
Low birthweight ^b	52 (4.5)		21 (12.2)	
NICU admission ^b	64 (5.5)		23 (13)	
Lactation at Birth	1108 (94)		172 (98)	

a. Direct funds started in 2020 at the onset of the COVID-19 pandemic. Individual data not available, only totals.

b. Among singleton births only: 3 multiples in and 21 multiples in BDS removed for these calculations.

28 OD families missing health outcome data. 388 (25%) Birth Doula Services families missing health outcomes data (444 (28%) for cesarean)

Figure 4.1. Nested themes for barriers of a community-based doula program



Chapter 5 Concluding Thoughts

Overview

This body of work contributes to a burgeoning literature that measures intersecting systems of oppression, and its manifestations, in order to identify strategies to advance health equity. Together, these studies suggest important implications for social epidemiologic research and social justice-grounded public health praxis. First, the intersecting systems of oppression of racism and sexism are inextricably linked, omnipresent, and operate via distinct typologies of co-occurring inequities that vary and cluster geographically. Second, routine police practices are one manifestation of structural racism that (re)produces health inequities and thus demands increased critique within the field of public health. Third, community care in the form of doulas plays an important role in supporting racially and economically marginalized families in the context of intersecting systems of oppression, but these programs need more resources and funding to do their work effectively. **Taken together, these studies reinforce the importance of addressing context-specific structural determinants of health inequities and the need to fund community-led, non-carceral strategies that address the interconnected root causes of these inequities.**

The combined implications of these three studies reveal policy and program solutions that are context-specific, grounded in the experience and expertise of directly-impacted communities, and address the interconnectedness of inequitable systems rather than siloed approaches. For example, the distinct co-occurring patterns of inequities in housing, employment, and education in Chapter 2 illustrate how structural gendered racism is deeply embedded and can vary by historical and geographic context. It also reveals how structural gendered racism is not fixed and intractable, but rather dynamic with potential for change that can be leveraged by those working to challenge existing power structures.¹⁷ In conjunction with the Chapter 3 findings of neighborhood-level health effects of police surveillance, these findings

reveal the importance of context-specific public health approaches that address multilevel inequitable social contexts. Community-based doula programs, as seen in Chapter 4, are already addressing these multilevel social contexts and the unique survival needs (e.g. housing, food) these contexts produce. These three studies together illustrate that while programs like community-based doulas can play an important role in mitigating structural harms from intersecting systems of oppression, this is not sufficient in addressing the root causes of health inequities. Indeed, as Dila Perera at Open Arms Perinatal Services says “doulas are not a vaccine” to the maternal health crisis in the US. Structural policy changes are needed, such as expanding affordable and accessible housing, livable wages, and health care access.

Below, I first describe my processes of self-reflexivity through the dissertation process and reflect on ways to improve this practice moving forward. Then, I discuss and reflect on the cross-cutting themes and public health implications that emerged from this body of work.

I. Practicing reflexivity

As mentioned in Chapter 1, reflexivity is a continuous practice through which researchers acknowledge, critique, and evaluate how our subjectivities and contexts influence the research process.^{41,199,200} In this concluding chapter, I will briefly describe my attempts at self-reflexivity throughout the research process. I reflect on how my assumptions, biases, and presence affected the research with specific attention paid to interrogating hierarchies and power imbalances *within* this body of work. Many thanks to committee members, particularly Dr. Mienah Sharif, for encouraging these practices.

In the conceptualization, design, and data collection phases of research, (self) reflexivity is a necessary process for collaboratively developing research questions and study processes. For example, in my initial conversations with colleagues at Open Arms, it was important I clearly stated my positionality as a White cisgender woman, a doula, and a doctoral student who is affiliated with a well-resourced university. This included recognizing my identity as both insider

and outsider related to doula research participants. As a doula, I have previous experience navigating birth settings with doctors and nurses who question the roles of doulas, but as a White woman I have not experienced the compounding racism that doulas of color experience in birth settings. Additionally, as a White researcher working with predominately racially minoritized collaborators and participants, I named these racialized power hierarchies up front and appraised how this might impact data collection. It was important to also recognize the power imbalance and related dynamics across the research team with my university affiliation (and related resources) working alongside a community-based organization. I named these contexts during initial conversations with partners/collaborators as well as my intention to shift institutional funding to this (and other) community-based organization(s). We also made sure to name these power dynamics during the listening sessions. The facilitator (Zeruiah) and I found it was helpful to explicitly mention our affiliation with the University of Washington, specifically related to the wealth and resource hoarding of the university (that we benefit from as students) as well as the past harms that researchers at the university have caused among these communities.

Another example of active reflexivity where I evaluated my biases and subsequently changed my approach was during the qualitative data collection process. The research team and I created question guides asking community-based direct service providers about the “positive outcomes” of the families they serve. Across all listening sessions, participants responded to that question with a question: What and who defines a positive outcome? After each session, during the memo-ing process, I reflected on my biases of what I consider a “positive” outcome that is deeply influenced by the public health literature and the strong biomedical influence. What we in public health consider a “positive outcome,” like exclusive breastfeeding, does not necessarily reflect individual’s desires or needs. Something similar also came up during our member checking event of validating our findings. For this event, I created data visualizations of preterm birth and cesarean sections rates in the program. This reflected a

deficits-based view rather than focusing on positive, strengths-based approaches. I framed these outcomes in the “negative” direction which did not align with how community-based direct service providers saw their work or wanted their work to be portrayed. In these instances, I had to reflect and challenge my biases of how researchers like me define “positive outcomes” and how I typically focus on the biomedical, deficits approach in reporting outcomes in my research. I am thankful for this reflexive experience to critique my biases and broader research norms and be able to reframe and adapt how I think about and report research findings that better aligns with community partners.

Lastly, I was also able to reflect on my biases and assumptions on what I value as “knowledge” during the analysis and interpretation phases of research. One way my assumptions and biases affected my research and implored me to better interrogate power imbalances *within* research was how I privileged peer-reviewed literature in my interpretation of study findings. Particularly for some of the mixed findings from these studies, such as policing among Latina and Asian communities, I initially relied only on the (very limited) peer reviewed literature across disciplines including criminology, sociology, and public health. The dearth of peer-reviewed studies on the relationship between policing and preterm birth among Latina and Asian communities led me to limit my interpretation of these findings. This was my bias in action towards valuing peer-reviewed literature over the gray literature or lived experiences of friends, colleagues, and fellow organizers. Moving forward, I intend to more frequently “check” myself on this researcher bias I hold and ensure the “evidence” that informs the entire research process from conceptualization to interpretation goes beyond scientific literature to valuing (and uplifting) other forms of knowledge production.³⁹

Moving forward, I have identified places where I can improve and build upon these practices of humility and reflexivity. While I included the proposed reflexivity prompts from Jaimeson et al.⁴¹ in my analysis plans as a way to form concrete practices throughout the research process, I am still seeking ways to ensure I hold myself accountable to continual

reflexive practices. I will have a new form of power after obtaining a PhD, and I intend to be mindful of and attentive to how power shows up in the research process and within research teams. Relatedly, I hope to structure reflexivity prompts that ensure these practices are collaboratively done across the research team. Overall, these reflexive practices, while not perfectly consistent, have sharpened my accountability towards community partners and those challenging power structures.

II. Cross-cutting themes and public health implications from this body of work

a. Interrogate social conditions, and underlying power structures, rather than pathologizing individuals.

Alongside my other work on abortion criminalization¹¹⁵ and incorporating abolition geography into public health research and action,^{124,201} this dissertation adds to a growing shift in focus away from individual choices/behaviors and towards the *conditions* in which people become pregnant and either continue or terminate their pregnancies. This theme was illuminated across dissertation chapters: from state level contexts of structural gendered racism to neighborhood-level policing to the holistic services of community-based doula programs addressing the barriers borne from oppressive systems. While the increased attention on social determinants of health in epidemiology is important, it still misses the underlying sociopolitical and commercial forces that shape the distribution of protective and harmful social determinants. Further, going back to the building blocks of epidemiologic causal inference, conducting research on oppression like this is *necessary but insufficient* to advance health equity. Thus, it is vital that social epidemiologists look further upstream to examine how power operates, who holds power, and how we can build power for social change.⁸²

Power has been widely theorized outside of public health.²⁰² In the context of health equity and justice, power can be conceptualized as the interlocking actions and processes of

social institutions to maintain oppression (*power over*) that can also be leveraged for collective benefit and redistributed (*power with, to and within*).^{1,81,82,203} Moving forward, I hope to align my public health research and practice with community organizers, social movements, and those within public health who have long been working towards shifting the balance of power, redistributing resources, and collective solidarity.⁸² In my nascent explorations, I see hopeful examples in my experiences with abortion funds that build power and fund abortions to support people in realizing their bodily autonomy; in organizing with fellow students to bring more comprehensive reproductive health care, including emergency contraception and abortion, to our campuses; in union organizing for better pay, safer workplaces, and benefits; and in local community organizing with Solidarity Budget and other efforts to shift the city's carceral funding to community-led approaches to meet people's basic needs.¹⁷¹

One approach to this could be working alongside community-based organizations and community members to define, measure, and unveil these underlying power structures. We often say "what gets measured gets changed", but the field's measurements are generally based on researcher's ideas of social inequalities that have been used historically in sociology, public health and related academic disciplines. These measures generally emphasize the spatial distribution of racialized individuals that reflect *outcomes* of structural oppressions like racism rather than the underlying sociopolitical forces that shape where people live.¹⁹⁶ Instead, community members and organizers could identify the most pressing sociopolitical issues in their local contexts that need to be changed, which researchers can then measure in order to help challenge these policies/practices. Moving forward, I hope to contribute to this work using participatory action research methods that build power across community organizations and researchers to identify and repair the harms produced by these underlying power structures.²⁰⁴

b. Criminalization and routine police practices play a key role in maintaining intersecting systems of oppression and perpetuating health inequities.

These studies, alongside my research on abortion criminalization, have helped unveil the adaptive processes of criminalization and the institution of policing as central to the functioning of intersecting systems of oppression that produce health inequities. The origins of policing and criminalization are tied to the control of slavery and the working class, and throughout history the police have primarily functioned to maintain racial, political, and economic hierarchies.^{34,98} Put another way, those in power maintain these hierarchies via the institution of policing and criminalization. *What* is deemed a crime and *who* is deemed a criminal is socially and politically constructed. We see multiple contemporary examples of the continual making of “crime”: over half of US states now criminalize obtaining, providing, or helping people get abortions,²⁰⁵ the Seattle City Council recently decided to make using drugs in public illegal, adding a new crime to the city’s criminal code that reverts to the failed and harmful “War on Drugs,”²⁰⁶ and Georgia is poised to pass a bill that criminalizes charitable bail funds.²⁰⁷ These criminalization processes enforced by the police have widespread and disastrous population health and health equity consequences.^{208,209}

Our findings in Chapter 3, alongside other studies,^{37,38,139,140,142} reveal the harmful individual and community health impacts of routine policing and criminalization that deserve further critique from the field of public health. My research illustrates how the spatial distribution of routine police practices aligns with histories and contemporary processes of structural racism.¹²⁴ In Seattle, police stops are significantly more intensive in neighborhoods that were both formerly redlined and currently gentrified compared to structurally advantaged neighborhoods.¹²⁴ These findings help illustrate what movement organizers have long said: routine police practices are a central process of maintaining structural racism and other related systems of oppression.¹⁷⁰ Additionally, findings from Chapter 2 emphasize the necessity of paying attention to the interconnectedness of policing with other inequitable institutions, such as

the role of police and punishment in schools, surveillance in hospitals, and the effects of carceral system-involvement on employment prospects and voting rights. While there has been a growing and essential study of fatal and nonfatal police violence in public health,³² I hope this dissertation contributes to the increasing interrogation of the embeddedness and “normalcy” of routine police practices in our neighborhoods, schools, and hospitals that have broad public health impacts.²¹⁰

c. Advancing health equity requires uplifting expertise outside of epidemiology, public health, and academia.

This dissertation was deeply influenced by the work of historians, sociologists, legal scholars, geographers and, most importantly, organizers and writers within racial and social justice movements. I have learned that a multidisciplinary approach to these complex structural issues is a necessity because other disciplines bring in important theoretical and historical groundings that are often lacking in epidemiology. Additionally, the wisdom and expertise of individuals with lived experiences of aggressive policing, incarceration, structural racism, and adverse pregnancy experiences are also crucial. This expertise of individuals and organizations outside of academia must play a leading role in developing strategies to advance health equity. Those of us in academia must be accountable in uplifting this knowledge and shifting institutional academic privilege and resources to community-led approaches to collective care and liberation.

d. Collective care, while not a substitute for structural change, is a radically hopeful response to intersecting systems of oppression.

Collective care is a grassroots practice that centers the wellbeing of community members, meets people’s needs, and creates new ways of caring for each other while simultaneously resisting oppressive systems.²¹¹ This is distinct from charity, non-profits, and government social welfare that often take a top-down approach. Chapter 4 provided an example

of collective care with community-based doulas who, as trusted members of their communities, holistically support economically marginalized families when our existing systems fail them. Through my research for Chapter 3, I found examples of collective care through bail funds that support criminalized communities who experience disproportionate exposure to harmful routine police practices. At the onset of the COVID-19 pandemic, we saw an expansion of mutual aid to support our neighbors and create community safety and wellness.²¹² There are also several historical examples of collective care. The Black Panther Party opened free health clinics across the country,²¹³ implemented free breakfast programs,²¹⁴ and started a national sickle cell anemia screening program.²¹⁵ Similarly, the Young Lords, a Puerto Rican activist organization, offered door-to-door education and health screenings in New York and demanded better health care through direct action.²¹⁶ These examples illustrate how collective care is about dismantling systems of oppression that dehumanize and building alternative ones.

Collective care is a key tenet of prison industrial complex (PIC) abolition, which is a political vision and practical organizing tool of “disrupting overlapping systems of prisons, policing, and surveillance that (re)create harm while building life-affirming institutions and lasting alternatives to punishment.”²¹⁷ Indeed, there are many overlaps between abolitionist values and public health goals of prevention as I’ve written about previously.²⁰¹ Instead, though, criminalization and policing are deeply embedded within health care and public health research, practice and training.^{201,210} To truly advance health equity and justice, epidemiologists and public health practitioners must divest from the PIC and invest in community-led approaches that address root causes of harm and meet people’s needs. With a cautious eye towards co-optation, appropriation, and erasure that often happens in academia, I believe there is great potential for public health practitioners to support and mobilize alongside community efforts of collective care and resisting systems of oppression.

Conclusion

This dissertation has proposed novel theory-driven measures and methods for interrogating structural determinants of health, presented innovative spatial linkages of large and interdisciplinary datasets, and uplifted the expertise of community-based direct service providers in developing solutions to advance health equity. Grounded in interdisciplinary scholarship and theoretical frameworks, these studies advance the epidemiological conceptualization and measurement of intersecting systems of oppression, amplify calls for the field of epidemiology to critique policing practices as a population health issue, and embrace collective care as a radically hopeful response to systemic oppression.

Appendices

Appendix A: Indicators of Structural Gendered Racism, Operationalization, and Data Sources

Domain	Operationalization	Data Source
Education	Ratio of the proportion of White men (WM) to Black women (BW) aged 25 years and over who have a bachelor's degree.	ACS
Employment	Ratio of the proportion of BW:WM who are employed in the service industry among civilians in the labor force aged 16-64 years.	ACS
Income	Ratio of the proportion of BW:WM who are below the federal poverty level	ACS
Wealth	Ratio of the proportion of WM:BW who own their home	ACS
Health Care	Ratio of the proportion of WM:BW who had any health insurance	ACS
Residential Segregation*	Ratio of the proportion of BW:WM who live in a highly segregated neighborhood (census tract). Segregation was measured using the Black isolation index, which measures the probability that the average individual racialized as Black will meet individuals of the same racialized group in their neighborhood. The isolation index is calculated as: $\sum_{i=1}^N \frac{x_i x_i}{X t_i}$ where x_i = number of residents racialized as Black in neighborhood i , t_i = the total population of neighborhood i , X = number of residents racialized as Black in the entire county, N = total number of neighborhoods in the county. ²¹⁸	ACS
Political	<i>Voting</i> : Ratio of the proportion of age-eligible WM:BW who voted in the 2016 presidential election** <i>Representation</i> : Ratio of 1) the proportion of state legislators who are WM divided by the proportion of the state population of WM to 2) the proportion of state legislators who are BW divided by the proportion of the state population of BW. For states with zero BW in the state legislature (n=9), the calculated value is infinity so we imputed the highest calculated ratio (10.2) for these states as a conservative approach.	U.S. Census Center for American Women and Politics and Reflective Democracy
Judicial	Ratio of BW:WM incarceration rates	Prison Policy Initiative

ACS=American Community Survey. BW = Black women. WM = White men.

* It is recommended to use the isolation index for capturing the local variation of concentration of poverty (e.g., insufficient services and amenities)²¹⁹ which we theorize is due to racist disinvestment from both public and private actors. While most previous studies measuring structural racism use the index of dissimilarity, for the purpose of this study, the isolation index is preferred because it is a more conceptually sound aggregate measure of neighborhood disinvestment that speaks more directly to the proposed theoretical links between neighborhood disinvestment/segregation and preterm birth.²²⁰ Census tracts were defined as highly segregated if the tract's index value was higher than the median index value for that state. We then calculated the proportion of Black women and White men living in highly segregated tracts out of the total state population of Black women and White men, respectively. This measure aligns with the other inequity measures in that it quantifies the proportion of individuals in a state who are exposed to/experience higher levels of segregation (similar to poverty, incarceration etc.). **Montana had no voting data for Black women so we imputed the proportion of Black men voting in the state.

Appendix B: Latent profile analysis and confirmatory factor analysis measurement models, model fit statistics, and comparison of latent measures

This appendix provides further details and model fit statistics of the latent profile analysis (LPA) and confirmatory factor analysis (CFA). The nascent literature measuring systems of oppression as latent constructs has primarily used exploratory or confirmatory factor analyses^{22,64,65} and latent class analyses.^{63,83} With this field of study in its infancy, we propose a LPA approach to capture the “systems of exposure” across the US.¹⁷ We conducted the LPA with MPlus¹⁰⁶ via the R packages tidyLPA²²¹ and MPlusAutomation.²²² We conducted the CFA with the R package lavaan.

While the primary focus of this study was to develop a latent *class* measure, we also conducted a CFA to examine if and how these indicators of structural gendered racism reflected a latent construct in the form of a latent factor *scale*. While it is beyond the scope of this analysis to conduct an in-depth investigation comparing the benefits and drawbacks of these measurement approaches, we intend for this initial comparison to spur future research in this area that further scrutinizes these frequently-used indicators and latent measurement approaches. Below, we 1) provide details on model specifications and model fit statistics for both measurement approaches, 2) compare the CFA and LPA approaches and results, 3) discuss implications for future measurement research, and 4) discuss considerations for measurement of input indicators.

B.1. Model specifications and model fit statistics for LPA and CFA measurement approaches

Latent profile analysis

We fit a variety of models differing in the number of classes (1-7) and in the parametrization of the variables’ variances and covariances which can be freely estimated,

estimated to be equal, or (for covariances only) fixed to zero.⁸⁹ Different models with varying number of classes and parameterizations were examined (Appendix Table B.1) and compared to one another with regard to statistical criteria, theoretical assumptions, sample size, as well as interpretability and uniqueness of the classes.⁸⁹ Statistical criteria included the Bayesian information criterion (BIC), sample-size adjusted BIC, and Aikake information criterion (AIC) where lower values indicate better model fit; log-likelihood where values closer to 0 indicate better fit; entropy which ranges from 0-1, where 1 is perfect classification/clear delineation of classes; bootstrapped likelihood test (BLRT) where p-value <0.05 indicates good fit; and sample size (data not presented but we ensured that all classes should be larger than 10% of the sample).^{63,89} We retained the four-class model that was parameterized with varying variances and covariances fixed to zero as the final model for this study.

Appendix Table B.1. Model fit statistics of latent profile analyses

Model Number ^a	Number of Classes	Log-likelihood	Aikake information criterion	Bayesian information criterion (BIC)	Sample size adjusted BIC	Entropy	Bootstrapped likelihood test (BLRT) p value
1	1	-235.38	506.76	541.17	484.68	1	
1	2	-190.87	437.74	491.27	403.39	0.974	0
1	3	-155.31	386.63	459.28	340.01	0.974	0
1*	4	-123.16	342.32	434.10	283.44	0.987	0
1	5	-104.95	325.90	436.79	254.74	0.924	0
1*	6	-73.43	282.85	412.87	199.43	0.953	0
1*	7	-65.92	287.85	436.99	192.16	0.93	0.6667
2	1	-235.38	506.76	541.17	484.68	1	
2	2	-107.53	289.06	359.81	243.67	0.951	0
2	3	-70.65	253.30	360.38	184.60	0.977	0
2	4	-34.75	219.51	362.91	127.50	0.979	0
2*	5	-7.60	203.21	382.94	87.89	0.988	0.0217
2*	6	11.91	202.19	418.25	63.56	0.991	0
2*	7	22.24	219.52	471.91	57.59	0.989	0
3*	1	-150.22	408.44	511.69	342.19	1	
3*	2	-113.63	355.25	477.62	276.74	1	0
3*	3	-95.22	338.44	479.93	247.66	1	0
3*	4	-84.25	336.50	497.11	233.45	0.998	0.1395
3*	5	-69.32	326.64	506.37	211.32	0.986	0.3333
3*	6	-70.02	348.05	546.90	220.46	0.979	1
3*	7	-53.78	335.56	553.53	195.70	1	

a. Model 1: Equal variances, and covariances fixed to 0. Model 2: Varying variances and covariances fixed to 0. Model 3: Equal variances and equal covariances.

*These models had warnings that the best log likelihood was not replicated and that the solution may not be trustworthy due to local maxima. We reran Model 2 Class 5 and Model 2 Class 6 with increased number of random starts as recommended but the model did not converge and there was the same warning message. Therefore, despite performing well on the statistical criteria, the Class 5 and 6 models were too complex and did not fit the data.

Confirmatory Factor Analysis

Based on our theoretical foundations, we specified the number of factors and relationships between factors and indicators as well as specified the patterns of error correlations based on observed bivariate relationships (Appendix Table B.2).⁹⁰ This CFA model assumes reflective measurement where the unobservable latent factor (structural gendered racism) causes the indicators, accounts for the correlations among those observed indicators,

and assumes that all associations are linear.²²³ We used the unit variance identification constraint which fixes the variance of a latent factor to 1 to standardize it, which is suited for a single sample analysis such as ours.⁹⁰

We examined several specifications for latent measurement models of structural gendered racism. Following other approaches,^{22,90} we used the following five commonly-used criteria to determine model fit: chi-squared test with a null hypothesis that the sample and model-implied variance-covariance matrixes do not differ (e.g. rejecting the null means the model does not fit the data well); Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) where values over 0.90 indicate good fit (conservatively >0.95); Root Mean Square Error of Approximation (RMSEA) where values < 0.05 indicate good fit; and Bayesian Information Criteria (BIC) where lower values indicates better fit.

Model 1 included the nine input inequity indicators loading on a single latent variable with no correlated errors (e.g. assumes measurement error is random and that the observed relationship between any two indicators results completely from the shared influence of the latent variable).^{90,223} It did not have a good fit (chi-squared is statistically significant, CFI and TLI < 0.7, RMSEA = .174) (Appendix Table B.3). Subsequent models allowed for correlated errors among indicators to address common sources of variation that are independent of the effect of structural gendered racism on the input inequity indicators. We selected correlated errors based on bivariate associations and correlations (Appendix B.2). Model 2 permitted error terms between health insurance-homeownership and poverty-employment to be correlated due to their observed relationships of highest correlation among all input indicators (both > 0.7). Model 2 also did not have a good fit (chi-squared is statistically significant, CFI and TLI < 0.7, RMSEA = .185). Model 3 allowed more error terms to be correlated (additionally between healthcare-employment, poverty-homeownership), but the model was still a poor fit (chi-squared is statistically significant, CFI and TLI < 0.8, RMSEA = .154). Model 4 allowed even more error terms to be correlated (additionally between healthcare-poverty, homeownership-employment)

which performed slightly better but was still a poor fit (chi-squared is statistically significant, CFI =.904, TLI=0.836, RMSEA = .114). Finally, Model 5 – the preferred model - included additional correlated errors (additionally between healthcare-voting, poverty-education, employment-voting, political participation-education) and had a much better fit (chi-squared p = 0.369, lowest BIC, CFI= 0.99, TLI=0.979, RMSEA=0.039). Additional models with more correlated errors did not converge. We also tested whether the input inequity indicators reflected multiple latent constructs, but the two-factor did not fit well (Model 6), similar to other studies.²²

Therefore, the best fitting Model 5 was used to compare to the final latent class measure of structural gendered racism derived from our LPA. Appendix Figure B.1 is a diagram of the measurement model. The estimates of the standardized loading show the latent measure has relationships in the expected directions for all indicators except education and segregation. These negative standardized factor loadings suggest a negative linear association between the latent variable and these observed indicators. While we kept all nine indicators to align with the primary LPA analysis for the purposes of comparison, future research may revisit the inclusion of these indicators and how they are measured (e.g. how segregation is calculated, isolation versus dissimilarity index, and how education is measured (see further measurement considerations in section B.4.)).

Appendix Table B.2. Correlation matrix of indicator variables used in latent measures

	Educ	Emp	Pov	Home	Vote	Health	Incar	Pol	Seg
Educ	1								
Emp	0.13	1							
Pov	0.52	0.71	1						
Home	-0.05	0.67	0.41	1					
Vote	-0.05	0.37	0.24	0.27	1				
Health	0.06	0.6	0.39	0.72	0.33	1			
Incar	-0.11	0.17	0.08	0.28	0.21	0.25	1		
Pol	-0.3	-0.06	-0.15	0.26	-0.08	0.15	-0.03	1	
Seg	-0.03	-0.17	-0.15	-0.26	-0.22	-0.08	-0.28	-0.01	1

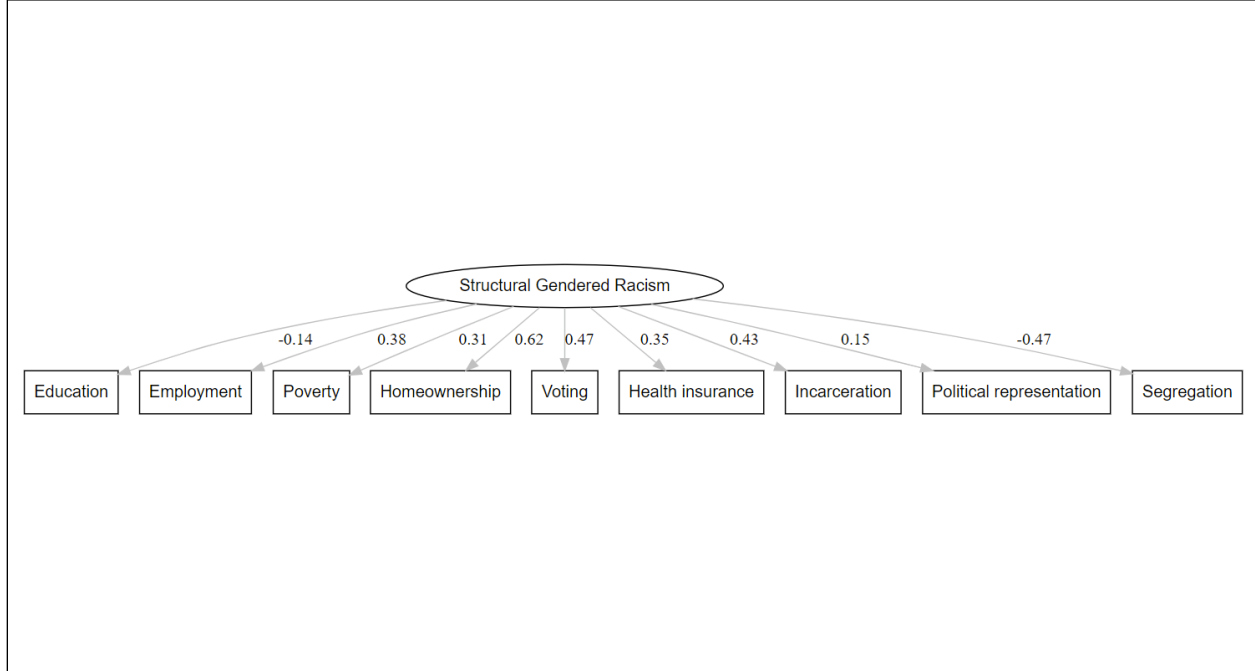
Educ=education. Emp=Employment in service industry. Pov=poverty. Home=Homeownership. Vote=Voting. Health=Healthcare. Incar=Incarceration. Pol=Political participation. Seg=Segregation.

Appendix Table B.3. Model fit statistics for confirmatory factor analysis

Model number	Description	Chi-squared	df	p-value	BIC	RMSEA	CFI	TLI
Model 1	One factor, no correlated errors	68.13	27	0	438.867	0.174	0.695	0.593
Model 2	One factor, correlated errors between a) healthcare & homeownership, b) poverty & employment	67.82	25	0	446.498	0.185	0.681	0.541
Model 3	One factor, correlated errors between a) healthcare & homeownership, b) healthcare & employment, c) poverty & employment, d) poverty & homeownership	50.395	23	0.001	436.897	0.154	0.796	0.681
Model 4	One factor, correlated errors among a) healthcare, homeownership, employment, and poverty	33.838	21	0.038	428.164	0.111	0.904	0.836
Model 5	One factor, correlated errors among a) healthcare, homeownership, employment, and poverty, b) healthcare & voting, c) poverty & education, d) employment & voting, e) political participation & education	18.324	17	0.369	428.298	0.039	0.99	0.979
Model 6	Two factors, correlated errors (Factor 1: employment, poverty, homeownership, healthcare with correlated errors between a) healthcare & homeownership, b) poverty & employment, c) home & employment, c) healthcare & employment. Factor 2: education, voting, incarceration, political participation, and segregation with correlated errors between political participation & education)	44.213	21	0.002	438.539	0.149	0.827	0.704

Df = degrees of freedom. CFI = Comparative Fit Index. TLI = Tucker Lewis Index. RMSEA = Root Mean Square Error of Approximation. BIC = Bayesian Information Criteria.

Appendix Figure B.1. Structural gendered racism latent scale with standardized factor loadings



B.2. Comparison of CFA and LPA results and approaches

Appendix Table B.4 and Appendix Table B.5 show the comparison between the latent score from the CFA and the four final classes from the LPA. Generally, these two latent measures correspond. States with the highest average and median of the latent factor score estimates (indicating “higher” levels of structural gendered racism) were in Class 4, which had the more substantial co-occurring inequities. For a crude comparison, we created quartiles of the latent scale to compare with the four-class solution from the LPA. These somewhat aligned, with most overlap occurring in Class 4 and quartile 4 (Appendix Table B.5).

B.3. Implications for future measurement

Overall, we saw good model fits in both the LPA and CFA approaches suggesting the observed indicators of structural gendered racism reflected a latent construct. There are at least two key differences in assumptions and characteristics of these two methods that have important implications for interpretation. First, the CFA assumes that the latent construct (in this

case, structural gendered racism) is continuous whereas the LPA assumes distinct typologies/classes. Second, the CFA assumes all associations are linear.⁹⁰ Thus, the CFA latent scale approach requires an interpretation of a relative higher versus lower levels of structural gendered racism with a linear structure. Assumptions and interpretation of linearity are easier to understand, but it risks flattening the adaptive, flexible, and malleable nature of structural (gendered) racism. Additionally, it is possible that the inter-institutional connections resemble more of a multiplicative or interactive effect, rather than additive/linear, which aligns with intersectionality theory and systems science.^{56,59,224} Conversely, the LPA approach provides information on distinct patterns of how these inequities co-occur and what the predominant inequitable institutions are within clusters of states. This operationalization and conceptualization aligns with formative theoretical and conceptual work describing “systems of exposure” and “contemporary racialized regimes” that have distinct patterns across time and place.^{17,49,74,94} However, the LPA approach still requires arbitrary quantitative cut-offs to describe relatively higher inequities (e.g. above the national median) and the interpretation is complex. Importantly, any of these measurement approaches must clearly lay out the limitations of the input inequity indicators (see more below) and recognize these are not fixed realities but dependent on researcher decisions, data sources and indicator selection (e.g. ratio measure vs. absolute measures vs. other approaches).

Future studies should more comprehensively compare these different analytical approaches with a specific focus towards the interpretation of these latent measures that can inform strategies for dismantling intersecting systems of oppression. Approachable and interpretable measures have the potential to provide useful information about these dynamic and mutable systems that can be leveraged by community organizers, policymakers and others working to challenge existing power structures.¹⁷

B.4. Considerations for measurement of input indicators

The latent classes and magnitude of differences across inequity indicators provide useful information for advancing the measurement of structural gendered racism. As mentioned before, the inclusion of these frequently-used indicators reflects what is predominately used in the literature, but both of these measurement approaches (CFA and LPA) are sensitive to what indicators are chosen and how they are measured. Poverty, homeownership, voting, and political representation had the largest differences in inequities by class, which could be due to variability in state-specific policies.^{86,225} The minimal inequities for health insurance and education across all states and classes could be because these indicators (e.g. bachelor degrees and any insurance coverage) may not accurately capture structural gendered racism in these domains. In addition, this could be a result of federal policies that impact these domains in all states, such as the Affordable Care Act²²⁶ or Pell grants. Other measures, such as student loan burden or barriers to comprehensive reproductive health care, may better capture inequities in these domains that reflect structural gendered racism.

The differential patterns in incarceration reflect real differences in incarceration by gender and could also be due to poor validity of the measure. The most recent and representative data for racial and gender breakdowns of incarcerated populations at the state level is from the 2010 Census via Prison Policy Initiative. Limitations of these data include reliance on administrative data that may not be based on self-reported race and ethnicity, place of incarceration is treated as place of residence, and these data are a decade old.²²⁷ While there are more recent sources, such as the Annual National Prisoner Statistics, these underestimate the total incarcerated population by only including those incarcerated in state and federal prisons. Further, the racial-gendered differences in incarceration likely does not fully capture the extent to which the carceral system negatively impacts the health of Black women and their families. Ample evidence shows the overrepresentation of Black women in the criminal legal system, the

deleterious health impacts of having partners and family incarcerated,^{228,229} and how this burden is disproportionately held by Black women.²³⁰

Appendix Table B.4. Descriptive summary statistics of the latent factor scale across the LPA four class solution

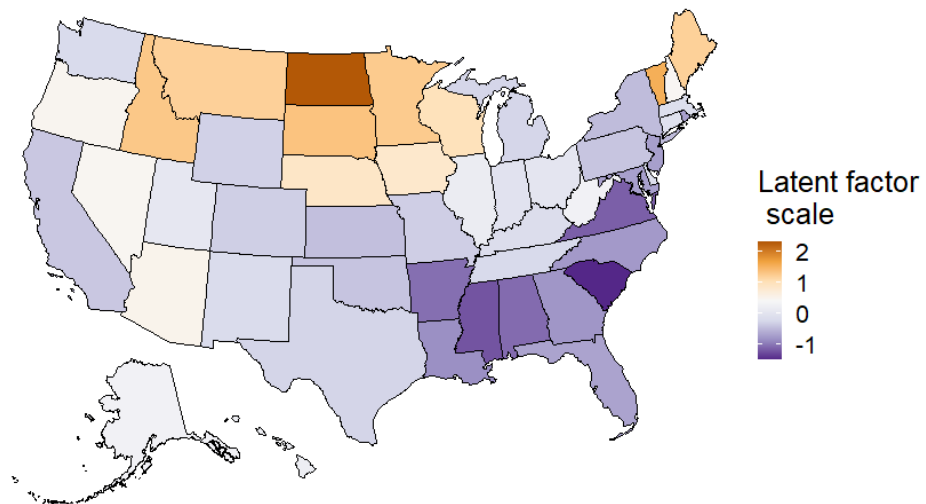
	Class 1 (N=8)	Class 2 (N=16)	Class 3 (N=11)	Class 4 (N=15)
Factor scale				
Mean (SD)	-0.993 (0.271)	-0.116 (0.327)	-0.394 (0.375)	0.942 (0.626)
Median [Min, Max]	-0.946 [-1.50, 0.708]	-0.187 [-0.681, 0.529]	-0.398 [-1.15, 0.162]	1.00 [-0.0736, 2.32]

Note: See table B.5. below for the distribution of the full factor scale: range = -1.5 to 2.3, interquartile range = -0.467 to 0.463.

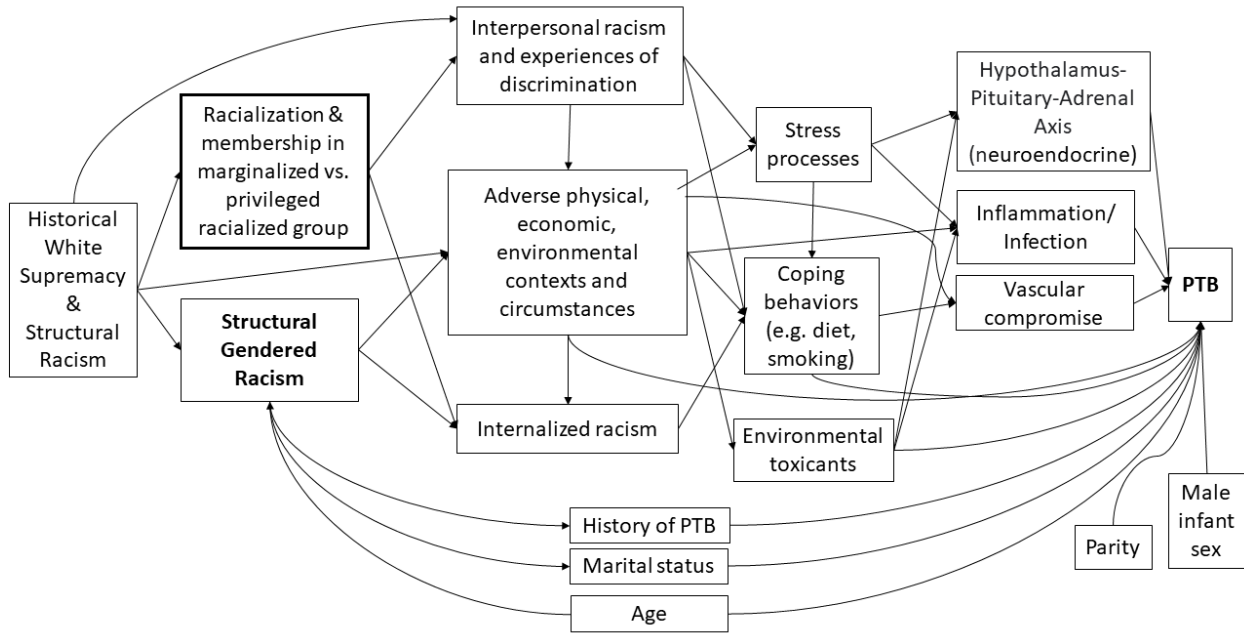
Appendix Table B.5. Number of states overlapping between the 4 LPA Classes and Quartiles of the latent scale

	Class 1	Class 2	Class 3	Class 4
Quartile 1 [-1.496, -0.4676)	8	1	4	0
Quartile 2 [-0.4676, -0.1626)	0	8	4	0
Quartile 3 [-0.1626, 0.4629)	0	5	3	4
Quartile 4 [0.4629, 2.316]	0	2	0	11

Appendix Figure B.2. Spatial distribution of state-level structural gendered racism latent scale



Appendix C: Directed Acyclic Graph



Appendix D: Descriptive statistics and regression analyses

Appendix Table D.1. Median of input inequity indicators by latent class and for all US states

	Total	Class 1	Class 2	Class 3	Class 4
	N=50	N=8	N=16	N=11	N=15
Education (WM:BW)	1.46 [1.31;1.62]	1.40 [1.32;1.44]	1.37 [1.26;1.59]	1.59 [1.53;1.64]	1.44 [1.22;1.76]
Service industry employment (BW:WM)	2.39 [2.12;2.66]	2.23 [2.00;2.40]	2.12 [1.84;2.39]	2.41 [2.27;2.52]	2.76 [2.54;3.11]
Poverty (BW:WM)	2.87 [2.62;3.45]	2.73 [2.61;2.95]	2.68 [2.37;2.84]	2.98 [2.82;3.39]	3.55 [3.09;4.20]
Homeownership (WM:BW)	1.85 [1.60;2.04]	1.54 [1.46;1.58]	1.72 [1.58;1.89]	1.90 [1.80;1.93]	2.40 [1.86;2.74]
Voting (WM:BW)	1.01 [0.93;1.27]	0.92 [0.89;0.94]	1.05 [0.88;1.16]	0.98 [0.94;1.02]	1.61 [1.12;2.60]
Health insurance coverage (WM:BW)	1.00 [0.98;1.01]	0.99 [0.99;1.00]	0.98 [0.96;1.00]	1.00 [1.00;1.01]	1.02 [1.00;1.06]
Incarceration (BW:WM)	0.45 [0.30;0.58]	0.24 [0.24;0.26]	0.41 [0.34;0.52]	0.38 [0.34;0.52]	0.72 [0.58;1.04]
Political representation (WM: BW)	3.30 [2.02;5.82]	3.95 [3.01;5.08]	4.46 [3.30;10.4]	2.58 [2.06;3.13]	3.41 [1.24;7.45]
Residential segregation (BW:WM)	1.26 [1.18;1.38]	1.69 [1.54;1.98]	1.21 [1.15;1.32]	1.27 [1.21;1.45]	1.23 [1.18;1.28]

Highlighted in gray if higher than national median. Interquartile range in brackets. BW = Black women, WM = White men.

Appendix Table D.2. Regression results for extreme, very, and moderate/late preterm birth

	American Indian/Alaska Native (Non-Hispanic)			Asian (Non-Hispanic)			Black (Non-Hispanic)		
	Extremely preterm	Very preterm	Moderate/ Late preterm	Extremely preterm	Very preterm	Moderate/ Late preterm	Extremely preterm	Very preterm	Moderate/ Late preterm
Structural gendered racism latent classes									
Class 2 (reference)									
Class 1	1.013 (0.486 - 2.110)	1.518** (1.101 - 2.094)	1.191 (0.886 - 1.601)	1.031 (0.788 - 1.351)	0.976 (0.783 - 1.217)	0.990 (0.842 - 1.164)	1.089 (0.924 - 1.283)	1.096 (0.957 - 1.254)	1.075 (0.952 - 1.213)
Class 3	1.833** (1.081 - 3.106)	1.327 (0.891 - 1.976)	0.788 (0.556 - 1.118)	0.918 (0.660 - 1.275)	0.925 (0.725 - 1.180)	0.890** (0.800 - 0.989)	1.149 (0.982 - 1.344)	1.124 (0.977 - 1.293)	1.116** (1.004 - 1.239)
Class 4	1.476 (0.880 - 2.475)	1.356** (1.024 - 1.796)	1.203 (0.951 - 1.521)	1.262 (0.852 - 1.868)	1.087 (0.765 - 1.546)	0.925 (0.798 - 1.072)	0.997 (0.796 - 1.249)	0.965 (0.777 - 1.199)	1.013 (0.854 - 1.202)

	Hispanic/Latina			Multiracial (Non-Hispanic)			White (Non-Hispanic)		
	Extremely preterm	Very preterm	Moderate/ Late preterm	Extremely preterm	Very preterm	Moderate/ Late preterm	Extremely preterm	Very preterm	Moderate/ Late preterm
Structural gendered racism latent classes									
Class 2 (reference)									
Class 1	1.024 (0.879 - 1.194)	1.007 (0.863 - 1.175)	1.013 (0.940 - 1.091)	1.009 (0.704 - 1.446)	1.199 (0.890 - 1.615)	1.043 (0.912 - 1.191)	1.028 (0.892 - 1.186)	0.990 (0.852 - 1.151)	1.045 (0.930 - 1.175)
Class 3	1.120 (0.981 - 1.278)	1.043 (0.957 - 1.136)	1.013 (0.954 - 1.077)	1.197 (0.850 - 1.687)	1.131 (0.867 - 1.476)	1.079 (0.970 - 1.201)	1.233** (1.020 - 1.491)	1.066 (0.914 - 1.242)	1.042 (0.950 - 1.144)
Class 4	1.072 (0.828 - 1.388)	0.940 (0.824 - 1.072)	1.003 (0.938 - 1.072)	0.922 (0.527 - 1.614)	1.113 (0.828 - 1.496)	1.092 (0.964 - 1.236)	1.083 (0.893 - 1.314)	1.071 (0.903 - 1.269)	1.092 (0.999 - 1.193)

*** p<0.01, ** p<0.05, * p<0.1

Extremely preterm: <28 weeks. Very preterm: 28-31 weeks. Moderate/late preterm = 32-36 weeks.

Appendix E: Distribution of exposure to neighborhood-level stops by racialized groups and by exposure window

	American Indian/Alaska Native	Asian	Black	Hispanic/Latina	White
	(N=93)	(N=4679)	(N=2778)	(N=3831)	(N=13325)
Preterm birth, N (%)	8 (8.6%)	292 (6.2%)	176 (6.3%)	288 (7.5%)	693 (5.2%)
Pre-pregnancy police stops per 10,000 residents, Median [IQR]					
Total stops	73.04 [6.15, 104.71]	83.67 [23.08, 111.98]	82.5 [3.14, 109.44]	74.82 [4.67, 104.71]	76.24 [38.43, 103.58]
Proactive stops	30.19 [3.02, 43.67]	32.53 [7.48, 46.58]	32.72 [0.86, 46.74]	30.04 [2.29, 43.18]	30.49 [12.87, 42.65]
Frisk	12.82 [2.64, 25.62]	16.7 [5.53, 29.03]	17.4 [0.37, 34.16]	13.2 [1.45, 26.46]	13.64 [6.49, 22.49]
Stops of Black people	249.01 [30.24, 622]	327.39 [164.94, 878.04]	205.05 [5.18, 328.29]	247.27 [10.74, 426.51]	400.67 [229.67, 1132.22]
Stops of White people	57.65 [8.83, 93.8]	68.8 [20.77, 99.88]	67.73 [2.92, 99.73]	58.89 [5.86, 95.62]	59.57 [27.74, 90.27]
First trimester police stops per 10,000 residents, Median [IQR]					
Total stops	17.44 [1.46, 29.84]	20.05 [5.5, 28.28]	19.64 [0.58, 26.91]	17.71 [1.45, 26.96]	18.36 [8.31, 26.45]
Proactive stops	6.52 [1.07, 11.48]	7.64 [1.96, 12.07]	7.16 [0.31, 11.56]	6.6 [0.39, 11.15]	7.1 [2.91, 10.83]
Frisk	2.77 [0.4, 7.32]	3.72 [1.31, 7.38]	3.96 [0, 8.15]	3.29 [0.36, 6.84]	3.33 [1.51, 5.81]
Stops of Black people	63.07 [5.94, 139.2]	76.09 [24.57, 202.31]	46.08 [0, 78.73]	57.14 [0, 109.29]	94.22 [50.91, 252.19]
Stops of White people	14.95 [1.64, 26.54]	16.59 [4.14, 25.38]	16.05 [0.71, 25.14]	14.48 [1.46, 23.76]	14.43 [6.33, 22.07]
Second trimester police stops per 10,000 residents, Median [IQR]					
Total stops	18.27 [1.97, 25.6]	19.87 [5.51, 28.22]	19.72 [0.5, 26.54]	17.55 [1.45, 26.16]	18.25 [8.14, 26.27]
Proactive stops	6.82 [0.39, 10.58]	7.52 [1.92, 11.99]	7.11 [0.31, 11.15]	6.65 [0.48, 11]	7.12 [2.85, 11]
Frisk	2.99 [0.73, 6.1]	3.77 [1.37, 7.51]	4.11 [0, 8.13]	3 [0.36, 6.85]	3.32 [1.55, 5.89]
Stops of Black people	57.44 [3.12, 145.08]	72.86 [20.96, 187.99]	46 [0, 75.76]	54.79 [0, 107.38]	93.23 [50.46, 240.85]
Stops of White people	13.76 [2.24, 23.69]	15.87 [4.33, 25.32]	15.49 [0.42, 24]	13.63 [1.43, 23.34]	14.23 [6.26, 21.92]

Note: Distribution for total population is in Table 1.

Appendix F: Description of Study Team

Our research team included two students (TR and ZB), staff members and technical support of the community-based doula program (KWB, DP, JT), and a faculty member (MZS). TR is a queer White woman, trained doula, and graduate student in social and reproductive epidemiology at the time of the study. ZVB is a Black, queer, hard-of-hearing woman and graduate student in social epidemiology. KWB is a White mother of three, Master's in Social Work, trained doula, and Lead Administrator at Open Arms. DP is a first-generation Sri Lankan American mother of one, has a Masters in Social Work and Master of Public Health, and former doula. CT is a first-generation Mexican American mother of one, Licensed Clinical Social Worker, Director of Programs at Open Arms, trainer and consultant of reflective practices and infant mental health. JT is a queer, White, community-based researcher and data capacity builder, Director of Programs with a Master's in Public Sociology.

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