THEME AREA 5: Sociobiology of Racial Disparities in Preterm Birth

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Racial Disparities in Preterm Birth

![Graph showing racial disparities in preterm birth rates from 1990 to 2008.](image)

NOTE: Rates are the percentage of live births at less than 37 weeks of gestation.

Chronic Hypertension of Pregnancy

What have we learned?

• As many as 50% of preterm births in the US are unexplained.
• Racial disparities are persistent, profound and are not explained by economic or educational disparity.
• Any effort to reduce the incidence of preterm birth must address racial disparity.
• Racism is typically considered in isolation from other causes of preterm birth.
Gaps in Knowledge

• How can the relation of racism to preterm birth be measured?
  – Exposure to racism, discrimination and stress
  – Perception of racism, discrimination and stress
  – Physiologic effects of racism, discrimination and stress
    • What modulates these effects?
      – Individually
      – In communities

• Do we know what & when to measure?
Gaps in Knowledge

• How and when do racial discrimination and stress influence the physiology of normal and preterm parturition?
• If stress during pregnancy is important to pregnancy outcome, why doesn’t stress reduction in pregnancy improve outcomes?
• What differentiates African American women who do and do not deliver preterm?
Regional Epidemiology

- Incidence of preterm birth in Cincinnati varies by neighborhood and is concordant with racial and economic disparities. Distinct attributable risk profiles characterize specific high prevalence neighborhoods.

Geospatial Analysis of Preterm Birth in Hamilton County


![Map of Hamilton County showing preterm birth rates](image)
Franklin and Cuyahoga Counties

Proportion of Premature Births (<37 wks) to All Births, Singeltons only

Franklin County

Legend
- 0% - 11%
- 11.01% - 14.5%
- 14.51% - 100%

Cuyahoga County

Legend
- 0% - 11%
- 11.01% - 14.5%
- 14.51% - 100%

Hall, Liu, and Greenberg, unpublished 2011
Preterm Birth Maps with Racial Disparity

Hamilton County/Cincinnati
Cuyahoga County/Cleveland
Franklin County/Columbus
Perspectives

• Racial disparities are obvious
• Stress consistently tracks with preterm birth
• Support during pregnancy directed toward large populations has not been shown to be effective
• Do we have the right population?
• Can measurement of stress and resilience during pregnancy help us understand racial disparity?
• High recurrence rates
• Highest incidence communities: 25% preterm birth rate
• Most African American births are > 37 weeks!
Theory

• The Racial Disparity of US Preterm Birth results from the net impact of negative stressors moderated by individual resilience characteristics

• Stress/resilience is mediated through a susceptible genetic/epigenetic phenotype to generate preterm birth
Aim 1

• Cohort Assembly
  – Use criteria relevant to public policy and known epidemiology
    • Geography
    • Income
    • Seeking pregnancy testing and subsequent PNC
  – African-American and European-American
  – Biosample collection
  – Resource for all MOD centers
LONGITUDINAL PREGNANCY COHORT

Eligibility Criteria
- Singleton pregnancy
- African-American or White
- Low income
- High-Incidence Geography

Service Population-Deliveries

<table>
<thead>
<tr>
<th>Cincinnati</th>
<th>Columbus</th>
<th>Cleveland</th>
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<tbody>
<tr>
<td>9,500</td>
<td>7,500</td>
<td>7,000</td>
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</table>

E1
Up to 20 weeks

T2
25 +/- 1week

T3
32 +/- 1week

Delivery

- Bio-sample collection
- Stress/resilience instrument
- Stress biomarkers
- Medical History

- Life course measurement
- Bio-sample collection
- Stress/resilience instrument
- Stress biomarkers
- Medical History

- Bio-sample collection
- Stress/resilience instrument
- Stress biomarkers
- Medical History

- Outcome
- Placenta
- Medical History

Aim 1

• Quantitative measurement of stress and resilience by race
  – Chronic stress: race, environment, unemployment, poverty
  – Acute stress: physical abuse, loss of job, change in employment status, death or injury of immediate family member or close friend
  – Resilience: Psychosocial measures

• Test the utility of telomere length as a novel biomarker capable of integrating stress and resilience
Aim 2

• Psychosocial stress, modified by resilience is mediated through genetic variants that predict the risk of preterm birth

• Experimental questions:
  • Can cumulative stress derived from psychosocial, community, environmental, behavioral, and biomedical perspectives be quantified and adjusted for individual resilience metrics to predict preterm birth?
  • Are women of low resilience at increased risk for preterm birth accounting for differences in stress? Does this vary by race?
  • Do low resilience women report a different number of adverse pregnancy events than high resilience women?
  • Does low resilience predict increased risk for medical complications during pregnancy?
  • How does genetic susceptibility moderate stress and resilience to affect the outcome of preterm birth?

• Prototypic genetic markers: CRHR1 and FKBP5
Susceptible genetic variants

Preterm Birth
Aim 3

• The maternal physiologic stress response phenotype moderates the duration of gestation and therefore may contribute to, or diminish the risk of preterm birth.
  – 180 postpartum women recruited from original cohort
  – Preterm/term
  – African-American/European-American
  – High/Low psychosocial resilience
Racial Disparity

Negative “Hits” (Aims 1 and 2)

- Stressors (chronic, acute)
- Health behaviors
  - Smoking
  - Substance abuse
  - Nutrition
  - Exercise
- Chronic biomedical
  - Diabetes
  - Previous preterm
- Acute biomedical
  - UTI
  - Preeclampsia

Resilience (Aims 1 and 2)

- Psychosocial
- Positive emotions
  - Active coping
  - Meaning
  - Cognitive flexibility
  - Social support (network)
- Physiologic (Aim 3)
  - Trier (TSST)
  - Impedance cardiography
Aim 1: Race

Aim 2: Psychosocial Stress

Aim 2: Psychosocial Resilience

Aim 3: Telomere Length

Aim 2: Physiologic Stress/resilience

Aim 3: Duration of pregnancy

Biosample collection
Theme 5
Interactions

Sociobiology of Racial Disparities in Preterm Birth

Themes 1 Evolution & 2 Genetics
- comparative analysis of fetal growth, maternal habitus, stress across species
- longitudinal cohorts, biophysical measures, human samples to test effects of gene variants

Theme 3 Developmental Biology
- analyze relationship of fetal growth/maturation with decidual senescence
- explore role of stress and nutrient deficiency in sensitized mouse model

Theme 4 Progesterone receptor
- comparative analysis of short cervix and stress/resilience
- longitudinal cohort to inform future interventional studies
Theme 5 Innovation and Deliverables

• An opportunity to reduce racial disparity
  – Link psychological stress with physiologic responses
  – Define individual susceptibility on the basis of their unique responses: “one size does not fit all”
  – Stratify risk to target appropriate interventions
  – Provide carefully phenotyped cohort to inform future genetic, epigentic, microbiome, and environmental studies across March of Dimes Prematurity Research Centers