Intergenerational Transmission of Toxic Stress: Exploring the Role of the Infant Gut Microbiome
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INTRODUCTION
• Toxic stress = persistent elevation of the hypothalamic-pituitary-adrenal axis in response to chronic childhood stressors (e.g. maltreatment)¹
• Toxic stress increases risk for chronic disease, but underlying biobehavioral mechanisms are not well understood
• The gut microbiome regulates communication between gastrointestinal & central nervous systems (e.g. “gut-brain axis”)²
• Animal studies indicate gut microbiota are sensitive to early life stress, but this is not well studied in humans³
• Improved understanding of the relationship between stress & infant gut microbiome may uncover novel intervention targets for toxic stress prevention

OBJECTIVES
Purpose: To explore the relationship between maternal stress, infant stress, and the infant gut microbiome among mother-infant dyads.

Specific Aims:
1. Characterize the composition and structure of the gut microbiome of infants (age 2-6 months)
2. Examine associations between infant gut microbiome composition and indicators of infant stress
3. Examine associations between infant gut microbiome composition and indicators of maternal stress

METHODS
This study is an innovative collaboration between the Yale School of Nursing & the Yale Microbial Sciences Institute & is funded by a Yale “All Points West” Pilot Grant

Sample: 40 maternal-infant dyads (infant age 2-6 months)

Exclusions: Infants eating solid foods, with a history of preterm birth (<37 weeks), or with gastrointestinal disorder

Procedures: Data collected remotely due to COVID-19 pandemic. Mothers completed online questionnaires and self-collected saliva and stool samples.

Variables & Measures:
Indicators of Maternal Stress:
• Adverse Childhood Experiences (ACE questionnaire)
• Mental health (e.g. PTSD checklist, depression scale)
• Sleep disturbance (Pittsburgh Sleep Quality Index)
• Parenting stress (Parenting Stress Index)
• Inflammation (salivary cytokines)
• COVID-19 pandemic (Covid Responses to Stress Scale)

Indicators of Infant Stress:
• Sleep (Brief Infant Sleep Questionnaire)
• Inflammation (salivary cytokines)

Infant Gut Microbiome: Community composition of stool based on 16S (V4) rRNA gene sequence analysis

Maternal & Infant Characteristics:
• Infant birth and health history
• Mother & infant diet history
• Demographic characteristics

Planned analyses: Multivariate regression, adjusting for maternal and infant characteristics (e.g. diet, medications)

RESULTS
Data collection ongoing; 38 dyads currently enrolled

Preliminary Descriptive Findings:
• Mean maternal age: 32.2 years
• Mothers’ self-reported race/ethnicity:
  - 69% Non-Hispanic White
  - 18% Hispanic/Latina
  - 5.2% Asian
  - 5.2% Native American/Pacific Islander
  - 2.6% Non-Hispanic Black/African American
• 32% receiving state/federal aid (e.g. WIC, SNAP)
• 92% married or living with partner
• Infant sex: 55% female, 45% male
• 58% infants breastfed, 21% formula fed, 21% both

Next Steps & Study Timeline:
• Data collection completion: expected April 2021
• Lab & statistical analyses: Spring/Summer 2021
• Dissemination of findings: Fall 2021

REFERENCES