Using Biomarkers to Understand Stress among Parents at Risk for Child Maltreatment Perpetration: Baseline Results from a Pilot Study

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IBC Protocol B1218
Presentation Overview

- Introduction/ Background
- Research Challenges
- Purpose of Study
- Study Overview
- Preliminary Findings
- Limitations/Conclusions
- Next Steps
Child Maltreatment

- Child maltreatment (CM) is significant public health problem in the US\(^1\)
  - 88.6% of all perpetrators were parents
    - Parents at greatest risk experience acute & chronic stressors
      - Low socioeconomic status, low household income, substance abuse, depression, trauma history, high parental stress\(^2\)-\(^5\)
  - Parental stress is particularly important risk factor
    - Can lead to poor parent-child interactions and heightened parent-child conflict\(^6\)-\(^11\)
Mitigating CM risk among High-Risk Populations

- Behavioral parent training programs are recognized recommendation for CM prevention\(^\text{12}\)
- Based on social learning principles and include components such as didactic instruction, modeling, and differential reinforcement\(^\text{13}\)
- Attempt to teach parents effective child management skills\(^\text{14}\)

- The SafeCare® model
  - Studies show positive reductions in self-reported parental stress
  - *Parent-Child Interaction Module (PCI)\(^\text{15}\)*
Research Challenges

- Current use and acceptance of perceived stress measures limits ability to identify sub-populations at risk for poor intervention outcomes.

- No known studies have explored effects of behavioral parent-training programs on physiological biomarkers of stress among at-risk parents.

- Such markers of parental stress may elucidate how such programs can have an impact on broad-based parental outcomes among parents with varying stress levels.
Biological Measures of Stress-Cortisol

- Primary hormone of neuroendocrine models exacerbating debilitating effects of acute and chronic stress on several physiological outcomes

- Limited research at caregiver level
  - Study among employed women high levels of excreted cortisol significantly associated with number of children residing at home
  - No known cortisol studies on behavioral parenting interventions among at-risk populations

- Studies in literature with focus on child-level outcomes
Biological Measures of Stress-Dihydroepiandosterone (DHEA)

- Most abundant circulating steroid hormone in humans with known associations with psychosocial stress

- Studies on posttraumatic stress disorder (PTSD) among war veterans\(^{18}\)
  - Higher levels of symptomology or PTSD diagnosis associated with increased DHEA levels
  - Shown to be modifiable with psychological treatment\(^{19}\)

- No known studies of DHEA in parenting literature
Why Biomarkers?

- **New, objective benchmark for stress**
  - Saliva & hair: non-invasive methods to estimate serum levels of hormones

- Need **to understand relationship between perceived parental stress and physiological correlates of stress** with physiological implications

- Research needed **to elucidate the impact of evidence-based practices, known to reduce parental stress, on known physiological correlates**
Study Goals

To conduct a multidisciplinary, exploratory study using steroid hormone and genetic biomarkers to understand physiological stress among a high-risk parent population

(1) Recruit 18 mothers at risk of CM who will receive SafeCare® PCI

(2) Conduct repetitive, within subject assessments including measures of parent stress and behavior (self-report, observational), and physiological markers for cortisol, DHEA

- Compare biomarkers to perceived, self-reported levels of stress
Additional Study Aim:

(3) Assess feasibility and participants’ willingness to provide physiological measures in this research project

- Qualitative semi-structured interviews conducted at baseline
- Feasibility of providing samples:
  - Saliva using salivette and passive drool
  - Hair
  - (Cheek swab)
Research Question

- Mothers who report higher levels of self-reported stress and mental health problems at baseline will have *impaired steroid hormone levels (i.e., cortisol, DHEA)*
  - Correlations between self-reported stress, mental health, and physiological measures collected at baseline and post-intervention

*Impaired: deviation from standard levels of steroid hormones

- Cortisol normal range: 0.053-0.359 ug/ml
- DHEA normal range: 15.9-303.8 pg/mL
Study Overview

- Recruited 18 high-risk mothers from GSU community partner Hughes Spalding Children’s Hospital of Atlanta

Inclusion criteria
- ≥ 18 years of age
- Biological and custodial caregivers of target child
- At least 1 child between 0-5 years of age

Exclusion Criteria
- Self-report of medical/ psychological conditions, and/or consistent use of steroid medications likely to interfere with bio-meaures
Study Design

- Quasi-Experimental Design: Pretest/Posttest

18 Participants:

Pre-intervention
- Consent
- Self-report measures
- Qualitative interview
- Biomarkers of stress

SafeCare® PCI module

Post-intervention
- Self-report measures
- Biomarkers of stress
# Study Assessments

Table 1. Assessment Schedule

<table>
<thead>
<tr>
<th>Baseline/ Pre-intervention</th>
<th>Intervention</th>
<th>Post-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong></td>
<td><strong>Weeks 2-7</strong></td>
<td><strong>Week 8</strong></td>
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<tr>
<td>Consent</td>
<td>SafeCare® Intervention</td>
<td>Survey</td>
</tr>
<tr>
<td>▪ Survey</td>
<td></td>
<td>▪ Survey</td>
</tr>
<tr>
<td>▪ Qualitative Interview</td>
<td></td>
<td>▪ Biomarker Samples:</td>
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<tr>
<td>▪ Biomarker Samples:</td>
<td></td>
<td>▪ Cortisol</td>
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<tr>
<td>□ Cortisol</td>
<td></td>
<td>□ DHEA</td>
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<tr>
<td>□ DHEA</td>
<td></td>
<td>□ (telomere length)</td>
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<td>□ (telomere length)</td>
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Intervention Procedures

- Parent-Child Interaction (PCI) Module of SafeCare®
  - 6 home-visiting sessions with a SafeCare® home visitor (6 weeks)
  
  Providers teach parents to structure activities with their children, while reducing problematic behavior and reinforcing positive behavior.

- Home visitors assess parenting skills pre- and post- PCI for mastery.
Self-Report Measures

- **Demographics Information Form** - to collect basic demographic information on all participants

- **Parenting Stress Inventory (PSI-SF)**\(^{30}\) - to examine parent stress

- **Brief Symptom Inventory (BSI)**\(^ {31}\) - to evaluate depression and other psychopathology

- **Posttraumatic Diagnostic Scale (PDS)**\(^ {32}\) - to examine trauma history
Biomarker Measures

- **Cortisol** - Saliva, Hair
  - Saliva measured using Salivette
  - Acute and Chronic Stress
  - Saliva time dependent*

- **DHEA** - Saliva
  - Using passive drool
  - Time independent

- Cortisol, DHEA- extracted from saliva; enzymeimmunoassay (EIA) performed after to measure hormone levels
Acute vs. Chronic Stress- Cortisol

- **Acute Stress (saliva):** Salivary samples collected consistently at same time (12-3:30pm) when cortisol levels appear stable.

- **Chronic Stress (hair):** Hair samples of 2-3cm may provide a 2-3 month estimation to chronic stress exposure.

[Diagram of Normal Diurnal Cortisol (Salivary)](http://www.salimetrics.com/assets/documents/1-3002.pdf)
Baseline Characteristics

- n=18, African American, Age 18-40 yrs, M=27 yrs
- 50% single, 33% with partner
- 50% high school degree or less
- 81% not working
- 60% with income < $20,000
- 44% with 1 biological child
- 78% with more than 2 children living in household
- 69% reported >1 stressor in the month prior to the study
<table>
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<tr>
<th>Measure</th>
<th>All Participants</th>
<th>Completers</th>
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<tbody>
<tr>
<td></td>
<td>Baseline (n=18)</td>
<td>Baseline (n=10)</td>
</tr>
<tr>
<td></td>
<td>M(SD)</td>
<td>M(SD)</td>
</tr>
<tr>
<td><strong>Trauma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trauma Exposure</td>
<td>1.7; 77%: 1 ≥ traumatic event</td>
<td>1.7; 70% 1 ≥ traumatic event</td>
</tr>
<tr>
<td>PTS symptomology</td>
<td>22.56 (11.7)</td>
<td>22.0 (12.6)</td>
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<tr>
<td><strong>Mental Health</strong></td>
<td></td>
<td></td>
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<tr>
<td>Depressive Symptomology</td>
<td>.80 (.85)</td>
<td>.67 (.88)</td>
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<tr>
<td>Anxiety Symptomology</td>
<td>.50 (.63)</td>
<td>.32 (.52)</td>
</tr>
<tr>
<td>Global Distress</td>
<td>.93 (.65)</td>
<td>.83 (.67)</td>
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<tr>
<td><strong>Stress</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parental Stress Score</td>
<td>78.0 (26.35)</td>
<td>75 (25.2)</td>
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<tr>
<td><strong>Physiological Measures</strong></td>
<td></td>
<td></td>
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<tr>
<td>Cortisol (salivary)</td>
<td>0.053-0.359ug/ml</td>
<td>.011-.39 ug/dl</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.011-.19 ug/dl</td>
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<tr>
<td>DHEA (drool)</td>
<td>15.9-303.8pg/ml</td>
<td>63.69-506.90 pg/ml</td>
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Cortisol vs. Self Reported Stress-Preliminary Findings: Baseline

Mothers who report higher levels of self-reported stress and mental health problems will have impaired steroid hormone levels (i.e., cortisol, DHEA).

Cortisol Levels vs. Self-Reported Parental Stress (PSI) at Baseline

- Cortisol ug/dL
- PSI sum
DHEA Levels vs. Self Reported Stress Stress

**Preliminary Findings: Baseline**

*Mothers who report higher levels of self-reported stress and mental health problems will have impaired steroid hormone levels (i.e., cortisol, DHEA)*
Participant Quotes from Qualitative Interviews at Baseline

Drool Sample: “Ew”; “It was kind of weird but it was okay. Well the spitting in the tube was kind of weird, I felt like I was like I a felon or something”; “I felt that was a little weird”;

Cotton Tube (under tongue): “That was easy. I’d do that one again. It was actually comfortable”; “Yeah that was, it was okay”

Cheek Swab: “That was the best”; “Oh it was okay- it didn’t feel like nothing”; “It was fun *laughs*”

Hair sample: “Yeah you just pulled a little piece out from back here”; “That felt okay...”; “That was nothing, it was okay, I’m fine with that”

All participants stated they would engage in this research and would recommend friends to participate

“Yes, because it’s easy and you learn a lot about stressing with your child...it’s easy”

“Yes, I think the only thing that would gross them out is the same thing that grossed me out that saliva [drool] part”
Limitations

- Retention of participants (smaller n)
- Self-report of medications/foods
- No comparison group
- Convenient, homogenous sample
- Unanticipated events during the study (e.g., pregnancy, death within family)
Implications/Conclusions

- Novel Benchmark for parental stress, possibly mental health symptomology
  - Biomarkers of stress may correlate with self-reported stress among at-risk parents
- Feasibility - high acceptability among participants; simple methodology
- Timing considerations (cortisol diurnal patterns)
  - Inclusion of child populations
    - Measuring saliva from infants and young populations
- Monitoring medications and food intake
Next Steps

- Telomere length, hair (chronic cortisol) analyses
- New biomarkers: DNA methylation, alpha amylase
- In-depth qualitative analyses
- Follow-up assessment data analyses and correlations
- Examine PDS in relation to biomarkers? Map individual trajectories?
- Pre-/Post-intervention comparison- Repeated measures ANOVA
Thank You!

- **Primary Investigators:**
  - Laura Carruth, PhD
  - Shannon Self-Brown, PhD

- **Home Visitors:**
  - Akilah Thomas, Courtney Jones, Lacell Joseph, Leslie Sewall, Lisa Dickman-Jackson, Roddey Jones

- **Graduate Research Assistants:**
  - Charles Robinson, Colleen McCarty
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