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Dysregulated Fear Responses in Adults and Children from a Traumatized Inner City Population

Tanja Jovanovic, PhD

Dept of Psychiatry & Behavioral Sciences,
Emory University
Atlanta, GA
Grady Trauma Project: Risk and Resiliency

www.gradytraumaproject.com

PIs: Kerry Ressler, MD, PhD and Bekh Bradley, PhD
# Severe Inner-city Trauma

<table>
<thead>
<tr>
<th>TRAUMATIC EVENTS INVENTORY</th>
<th>Percent of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Disaster</td>
<td>20.69</td>
</tr>
<tr>
<td>Serious Accident or Injury</td>
<td>55.77</td>
</tr>
<tr>
<td>Sudden Life-Threatening Illness</td>
<td>38.60</td>
</tr>
<tr>
<td>Military Combat</td>
<td>9.26</td>
</tr>
<tr>
<td>Close Friend or Family Member Murdered</td>
<td>3.57</td>
</tr>
<tr>
<td>Close Friend or Family Member Committed Suicide</td>
<td>8.77</td>
</tr>
<tr>
<td>Attacked with Weapon</td>
<td>35.09</td>
</tr>
<tr>
<td>Attacked Without Weapon</td>
<td>34.55</td>
</tr>
<tr>
<td>Violence Between Parents or Caregivers</td>
<td>35.19</td>
</tr>
<tr>
<td>Beaten as a Child</td>
<td>35.71</td>
</tr>
<tr>
<td>Sexual Contact Before Age 13</td>
<td>21.43</td>
</tr>
<tr>
<td>Forced Sexual Contact Between 14 and 17</td>
<td>9.09</td>
</tr>
<tr>
<td>Forced Sexual Contact After Age 17</td>
<td>9.80</td>
</tr>
</tbody>
</table>
Exposure to multiple types of trauma is the rule rather than the exception.

Trauma Exposures Often Include Childhood Abuse and Other Types of Family Violence.

<table>
<thead>
<tr>
<th>None</th>
<th>One Type</th>
<th>2 or 3 Types</th>
<th>4 or More Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.6%</td>
<td>13.9%</td>
<td>35.4%</td>
<td>37.1%</td>
</tr>
</tbody>
</table>

- **% Childhood Physical Abuse:**
  - Male: 19
  - Female: 19

- **% Childhood Emotional Abuse:**
  - Male: 24
  - Female: 28

- **% Witnessing Violence between Caregivers:**
  - Male: 27
  - Female: 30

- **% Sexual Abuse before 13:**
  - Male: 13
  - Female: 25

- **% Sexual Abuse 14-17:**
  - Male: 4
  - Female: 17
PTSD—The Disorder

- Onset determined by traumatic event, but low rates of illness relative to trauma exposure: gene X environment risk factors
- Heterogeneous: three major symptom clusters
  - Re-experiencing (intrusive) symptoms
  - Avoidance symptoms
  - Hyper-arousal symptoms
- High rates of comorbidity with depression, other anxiety disorders, substance abuse
GENES
ENVIRONMENT
TRAUMA

NEUROBIOLOGICAL BIOMARKERS

PTSD
Biomarker:

ACOUSTIC STARTLE RESPONSE
Simple Discrimination: A+/B-

Acquisition: 3 blocks of 4 trials

CS+ danger signal

CS- safety signal

6 seconds

108 dB startle

0.5 s

air

6 seconds

108 dB startle
Cognitive discrimination between CS+ and CS-
Cognitive discrimination between CS+ and CS-
Startle discrimination between CS+ and CS-
Startle discrimination between CS+ and CS−
Correlation between startle to CS+ and CS- and PTSD symptoms

<table>
<thead>
<tr>
<th></th>
<th>TEI</th>
<th>CTQ</th>
<th>BDI</th>
<th>PSS Intrusive</th>
<th>PSS Avoidance</th>
<th>PSS Hyperarousal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CS+ DANGER</strong></td>
<td>Pearson r</td>
<td>.07</td>
<td>.04</td>
<td>.18</td>
<td>.27*</td>
<td>.03</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.57</td>
<td>.74</td>
<td>.15</td>
<td>.03</td>
<td>.84</td>
</tr>
<tr>
<td><strong>CS- SAFETY</strong></td>
<td>Pearson r</td>
<td>.14</td>
<td>.08</td>
<td>.19</td>
<td>.18</td>
<td>.09</td>
</tr>
<tr>
<td></td>
<td>p</td>
<td>.26</td>
<td>.58</td>
<td>.13</td>
<td>.15</td>
<td>.45</td>
</tr>
</tbody>
</table>

B) Outcome: Hyper-Arousal PTSD Symptoms

<table>
<thead>
<tr>
<th>Predictors:</th>
<th>R²</th>
<th>R² Change</th>
<th>F Change</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age, Sex, and Race</td>
<td>0.003</td>
<td>0.003</td>
<td>0.11</td>
<td>ns</td>
</tr>
<tr>
<td>2. Childhood and Adult Trauma</td>
<td>0.134</td>
<td>0.131</td>
<td>7.56</td>
<td><strong>0.001</strong>*</td>
</tr>
<tr>
<td>3. Startle to Safety Cue</td>
<td>0.191</td>
<td>0.057</td>
<td>7.00</td>
<td><strong>0.009</strong></td>
</tr>
<tr>
<td>4. SCR to Safety Cue</td>
<td>0.194</td>
<td>0.003</td>
<td>0.32</td>
<td>ns</td>
</tr>
</tbody>
</table>

Glover et al (2011) *Depression & Anxiety*
Fear inhibition is impaired in PTSD

• PTSD is associated with impaired fear inhibition using 3 fear-potentiated startle paradigms

• Impaired fear inhibition is a biomarker of PTSD in different trauma populations
Longer-term effects:

NEUROBIOLOGY OF FEAR AND ANXIETY IN THE NEXT GENERATION
Child trauma exposure at Grady:

- Witnessed assault: 80%
- Witnessed stabbing: 15%
- Witnessed gunshot: 10%
- Witnessed arrest: 100%
- Witnessed drug trafficking: 30%
- Child assaulted: 20%
- Child threatened with weapon: 10%
- Confronted with murder: 30%
PTSD Symptoms in Children

- Bad Dreams and Fears
- Externalizing or “acting out” behaviors including impulsivity, irritability/anger and inattentiveness.
- Re-enact traumas (e.g., aggression, sexualized behaviors, need to control others). Such behaviors may emerge in an automatic manner in response to reminders of their traumatic experiences.
Generalization of Danger
Nightmares
Re-enacting
Play or drawing of trauma
Kid Startle Team:

GTP Researchers:

Ami Smith, PhD
Dorthie Cross, MA
Will Holland
Jannifer Winkler
Sarah Spann
Jennifer Davis
Alicia Nelson
Bekh Bradley, PhD

Collaborators:

Erin Tone, PhD
Chaundrissa Smith, PhD
MaryAnn Jacobs, MD
Fear conditioning in children
Preliminary data: fear-potentiated startle in children
AGE < 10

AGE = 10-12

\[ p = 0.04 \]
Startle in Children of Abused Mothers
**Dark-Enhanced Startle**

- Startle magnitude greater in dark than light
- Nonspecific anxiety marker
- Greater in “high-risk” adolescents (risk defined by parental anxiety or depression)

---

**Diagram**

- **ACCLIMATION**
- **HABITUATION**
- **LIGHT**
- **DARK**
- **LIGHT**
- **DARK**

2 min 
2 min 
2 min 
2 min
Dark-enhanced startle is associated with anxiety in children

$r=0.55$, $p<0.03$
Children of abused mothers startle more in the dark

Children of mothers with high levels of abuse have higher dark-enhanced startle than children of mothers with low levels of childhood physical abuse.

Increased dark-enhanced startle is not due to maternal mental illness or child’s own trauma

<table>
<thead>
<tr>
<th>Dark-Enhanced Startle</th>
<th>R²</th>
<th>R² Change</th>
<th>F Change</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Child's Age and Sex</td>
<td>0.06</td>
<td>0.06</td>
<td>0.71</td>
<td>0.50</td>
</tr>
<tr>
<td>2. Child's Trauma</td>
<td>0.09</td>
<td>0.03</td>
<td>0.75</td>
<td>0.40</td>
</tr>
<tr>
<td>3. Maternal PTSD</td>
<td>0.13</td>
<td>0.04</td>
<td>0.90</td>
<td>0.35</td>
</tr>
<tr>
<td>4. Maternal Depression</td>
<td>0.13</td>
<td>0.00</td>
<td>0.10</td>
<td>0.76</td>
</tr>
<tr>
<td>5. Maternal Childhood Physical Abuse</td>
<td>0.42</td>
<td>0.28</td>
<td>9.24</td>
<td>0.007</td>
</tr>
</tbody>
</table>
Conclusions

- Physiological markers such as the startle response provide potential biomarkers of PTSD risk in adults and children.
- Trauma has long-term neurobiological consequences for the victim as well as the victim’s children: multigenerational effects.
Acknowledgements:

Grady Trauma Project: Kerry J. Ressler, M.D., Ph.D. Bekh Bradley, PhD Tanja Jovanovic, PhD Ebony Glover, PhD Negar Fani, PhD Allen Graham Angelo Brown Justine Phifer James Poole Asante Kamkwalala Jennifer Winkler Sarah Spann Andrew Pallos

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Psychology & psychotherapy
Related Journals

- Addiction Research & Therapy
- Neurological Disorders
- Psychological Abnormalities in Children
Psychology & psychotherapy Related Conferences

- 4th International Conference and Exhibition on Addiction Research & Therapy
- International Conference on Adolescent Medicine and Child Psychology
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