Social and Emotional Influences on Physiological Stress in Infants, Children and Adolescents

Emma K. Adam

Program on Human Development and Social Policy
School of Education and Social Policy
Northwestern University
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Biobehavioral Systems Model (modified from Gottleib, 2000)

Environment (Physical, Social, Cultural)

Individual Emotion, Cognition, Behavior, Health

Neural and Physiological Activity

Genetic activity
General Research Question

How do the social worlds of parents and children “get under the skin” to influence their current emotional and physical health?
Stress!!
Two Major Stress Systems

- **Sympathetic-adrenal-medullary system (SAM)**:
  - Fast acting but shorter lived response to stressor
  - Responds to psychological and physical **challenge**
  - Measured by heart rate, blood pressure, epinephrine (adrenalin) and norepinephrine from blood or urine

- **Hypothalamic-pituitary-adrenal axis (HPA)**:
  - Slower acting but longer lasting response, reinforces and modulates initial SAM response
  - Responds to psychological and physical **threat**
  - Measured with **cortisol** from blood, urine or saliva
HPA/Cortisol Facts

- **Cortisol Responds to Stressors (Reactivity)**
  - Signals from brain (hypothalamus and pituitary) cause release of cortisol from adrenal cortex
  - Peak levels reach saliva 20 minutes later
  - Turned off by negative feedback of cortisol to brain (hippocampus, hypothalamus and pituitary)

- **Has a Strong Diurnal Rhythm (Basal Activity)**
  - Cortisol has a typical daily pattern: highest in morning just after awakening, declines to near zero in evening
  - Alterations of basal cortisol rhythm has been associated with a variety of physical and mental health disorders
  - 60-70% of variation in cortisol levels due to time of day
Why Cortisol?

1. Unobtrusively and reliably measured in saliva
2. Sensitive to social and emotional environments and modified by cognitive interpretation; responds to perceived balance of threat and support
3. Short term: adaptive changes intended to help respond to immediate threat, but directs body resources away from non-threat related foci (growth, learning, healing..)
4. Long term: chronic exposure to high levels thought to cause wear and tear on body and brain and contribute to development of mental and physical health disorders

-> Therefore important to know what factors modulate HPA activity and cortisol levels in day to day life
Hypotheses

- **Close personal (esp. family) relationships** are likely to be key, serve as powerful:
  - Buffers of the cortisol stress response
  - Elicitors of the cortisol stress response

- **Broader social contexts** impinge on the individual partially through their impact on physiological stress processes:
  - Postnatally
  - Prenatally
Close Personal (especially Family) Relationships as Modulators of Stress Hormones in Infants, Children, and Adolescents
Infants
Cortisol Increases to Common Events in the Neonatal Nursery

Gunnar et al.

Exams: DS=discharge exam  BR=Brazelton  HS=Heelstick
Circumcision: lido= with lidocaine  no lido=no lidocaine  novice=1st time
Dampening of Cortisol Response to Doctor’s Exams including Shots over 1st Yr

Gunnar et al.
Cortisol Reactivity Increases with Age for Infants of Low Responsive Caregivers

Gunnar et al.

Cortisol Responses in Standard Units

Age In Months: Physical Exam with Inoculations
Young Children
Secure Attachment Relationship as Buffer of Cortisol Response to Threatening Events

Nachmias et al.
Family Relationships as Stressors

- However...caregivers are not always buffers of stress, they can also be powerful stress elicitors.

  - Parent conflict and poor marital quality stressful for children because combines:
    - Exposure to anger and conflict
    - Unavailability of caregiver(s) and fear of loss
Parent Relationship Quality, Parenting Quality and Child Cortisol

Significant effects on child average cortisol levels:

• Marital Quality

• Parenting Quality

• Interaction of Marital and Parenting Quality

Pendry and Adam, 2004
Can we see similar processes at work with adolescents?
What factors do predict cortisol reactivity in adolescents?

- Poor marital quality
  - Higher cortisol

- Parenting quality
  - n.s.

- Interaction
  - n.s.

N=31 Adolescents

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Adolescent Daily Experiences and Stress Study

- What factors in the daily lives of adolescents influence their stress hormone activity?

- Experience Sampling Method (ESM)
  - Randomly beeped diary reports
  - 7 times a day for 2 days
  - Diary report of location, activities, thoughts, moods

- Salivary Cortisol
  - Saliva 20 min. after each ESM report
  - Also at wakeup and bedtime
Associations between Adolescent Emotions and Cortisol Levels, Controlling Time of Day

Higher levels of cortisol at moments they are experiencing negative emotions such as worry, stress or frustration

WITHIN-PERSON effects: effect of change in mood on change in cortisol, controlling time of day

Also higher cortisol at moments they are ALONE

\( N = 52 \) Adolescents

\[
\begin{array}{c|c|c|c|c|c}
\text{Positive} & \text{Angry} & \text{Worried} & \text{Social} & \text{Productive} \\
\hline
\text{% Change in Cortisol Level per SD change in Emotion} & \\
\end{array}
\]
Being Alone and Cortisol

- Also had significantly greater cortisol at moments they are alone than moments they are with other people during the day.

- This effect declines significantly with age.
Multiple Sources of Strain Predict Adolescent Cortisol Levels

In another study of 76 adolescents at high risk for psychopathology, I found that average cortisol levels were strongly predicted by:

- Negative Mood
- Family Strain
- Romantic Strain

*All of the above!

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Social Influences on HPA Axis Across Development

Current HPA Axis Functioning (As Indexed by Cortisol Activity)

- Wakeup Level
- Bedtime Level
- Average Level
- Diurnal Slope
- Amplitude of Reactivity to Stressors
- Amplitude of Response to Awakening
- Efficiency of Negative Feedback and Stress Recovery
- Variability Within and Across Days

Historical Influences
- Prenatal and Early Postnatal Organizational Influences
- Childhood History of Stress, Support, and Trauma
- Physical, Mental Health, and Lifestyle History

Current Influences
- Recent/Immediate Emotional and Cognitive State
- Current Functioning of Related Physiological and Neurological Systems
- Current Psychopathology
- Current Physical Health and Lifestyle Factors
- Recent/Immediate Environmental Stresses and Supports

Moderating Factors
- Temperament/Personality, Gender, and Genetic Variations
- Physical, Mental Health, and Lifestyle History
- Childhood History of Stress, Support, and Trauma
- Prenatal and Early Postnatal Organizational Influences

Social Influences = Red Boxes

Moderating Factors = Green Boxes
SES-Health Gradient

SES = socioeconomic status (income, education, occupation)

SES-Health Gradient = an increase in health outcomes with every increase in SES

- True for mortality, morbidity, disease risk markers
- True for wide range of diseases
- Holds across ENTIRE gradient, including difference between rich and very rich, not just poor-not
Possible Environmental Mechanisms

- Poor health care access or quality
- Bad genes, bad health behaviors
- Exposure to pathogens/environmental toxins
- Higher emotional and physiological stress
  - Loneliness
  - Humiliation
  - Anger/hostility
  - Discrimination
  - Anxiety
  - Conflict
  - Unpredictability
  - Low perceived control
  - Helplessness/hopelessness

• Strain in Relationships
• Negative Emotion
• Stress