

Stress Physiology in Young Children: Individual, Family & Contextual Factors



Sarah Watamura, Ph.D.

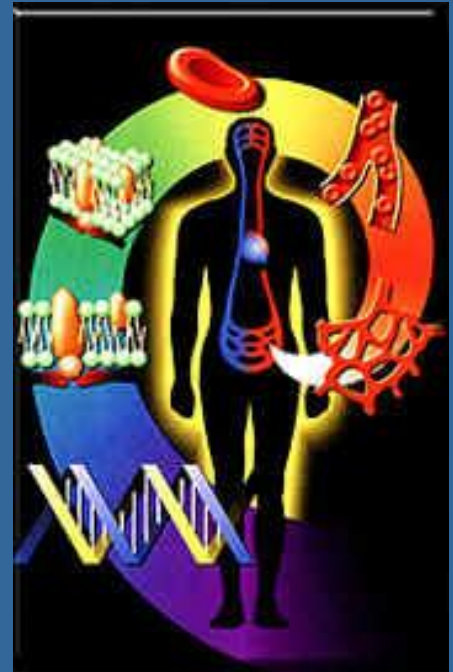
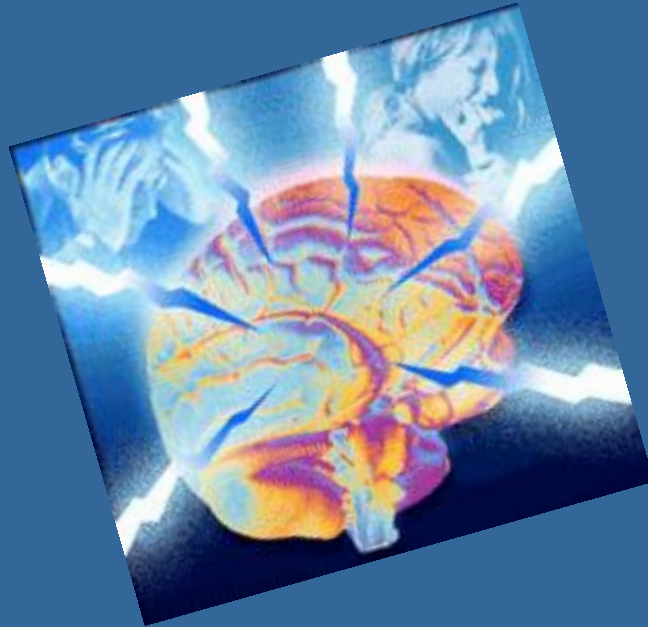
ABC Strive to Thrive
Building Systems that Care for Birth to Fives

Long Beach, CA ~ February 3, 2011

Outline

- ▶ Overview of the Two Main Physiologic Stress Systems
 - ▶ Conceptualizing Stress
 - ▶ Why Physiological Stress Systems are Critical
 - ▶ Long-term Effects of Chronic Stress
 - ▶ Stress During Development: Unique Effects?
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- ▶ The Case of Attenuation
 - ▶ Stress Physiology among Hispanic Immigrants
 - ▶ Caregivers as Buffers

Physiologic Stress



Physiologic Stress Response

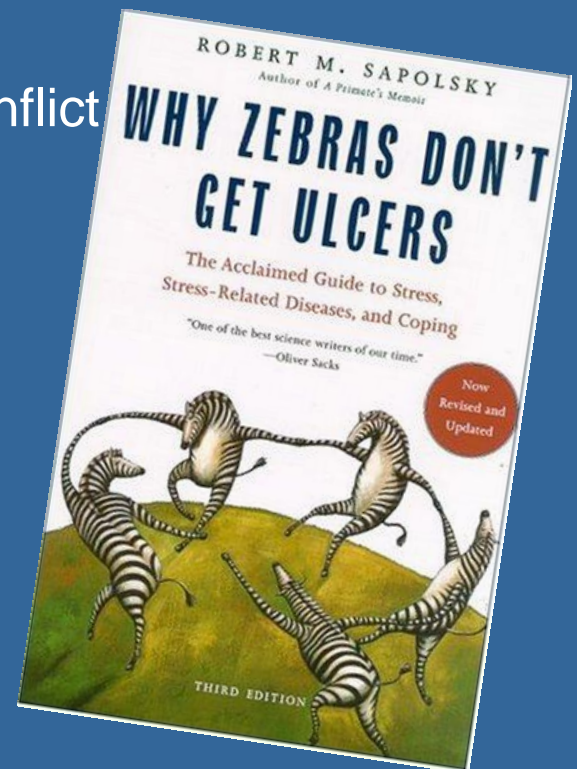
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Physiologic Stress Response

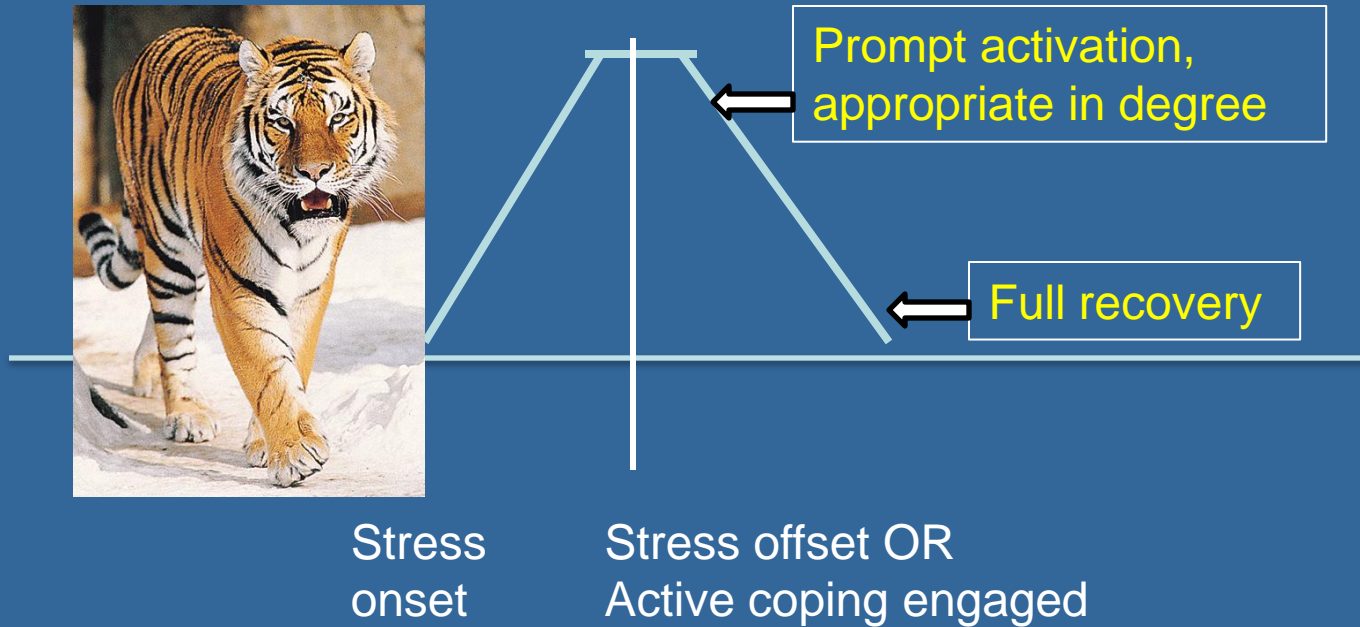
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 - imagining a conflict with a boss or coworker
 - preparing to perform in public

Physiologic Stress Response

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- ▶ At least for humans, the tiger can be just thinking about having to do something threatening
 - imagining an anticipated or experienced conflict
 - preparing to perform in public
 - Preparing to enter a new environment



Ideal Stress Response



Function of the Stress Response

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 - Handling a threat is metabolically very costly, whether the response is to fight or to flee
- ▶ **Our stress systems divert energy from long-term processes to the immediate threat**

▶ **Away from**

- digestion
- reproduction
- growth
- repair
- long-term immune processes (making antibodies for a secondary infection)

▶ **Toward**

- respiration
- glucose to burn
- increased heart rate to move energy to muscles
- short-term immune processes (trafficking white blood cells to the site of infection)

Two Stress-Response Systems

- ▶ Likely activated at the same time, the primary and secondary response help to manage threat

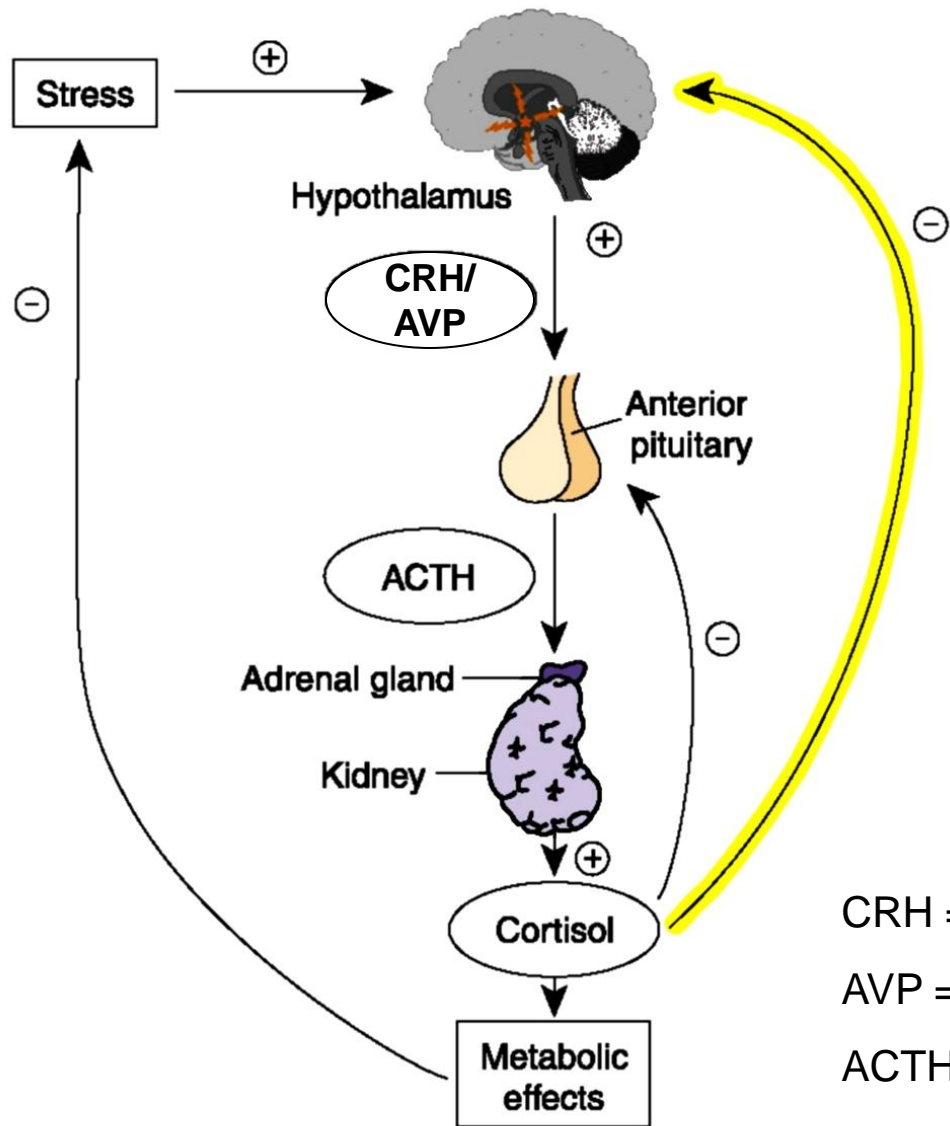
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- ▶ First response: NE/SAM
 - Sympathetic nervous system
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- ▶ **First response: NE/SAM**
 - Sympathetic nervous system
 - Parasympathetic nervous system
 - Burns through stored glucose to increase respiration, dilate pupils, increase heart rate etc.
- ▶ **Second response: HPA**
 - Hypothalamic-pituitary-adrenal (HPA) axis
 - Supports the first response by replenishing glucose stores and further suppressing long-term growth and restorative processes

HPA-Axis Response



CRH = corticotropin-releasing hormone

AVP = arginine vasopressin

ACTH = adrenocorticotrophic hormone

HPA-axis → Cortisol

- ▶ **Highly Conserved System**
 - HPA-axis shared with salmon
 - at least 400 million years old

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▶ Cortisol

- A potent steroid hormone that can cross the blood-brain barrier and the membranes of cells to exert wide-ranging effects
- Hydrocortisone cream, cortisone shots and steroid inhalants have clinical uses because they inhibit inflammation caused by the immune system

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▶ Functions of Cortisol

- Mediates many bodily changes in response to stress & challenge
- Cortisol also has many other functions in the body
 - e.g. Facilitates metabolism

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- The body’s response to demands
- Mediated by hormonal changes
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▶ Stress is Bad

- This theoretical position mirrors the way we continue to talk and think about stress
- It requires constant effort to remember that stress itself and the stress response are not inherently bad

Stress as Allostasis & Allostatic Load

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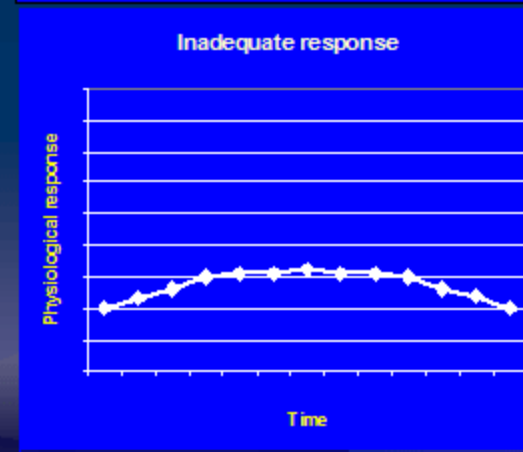
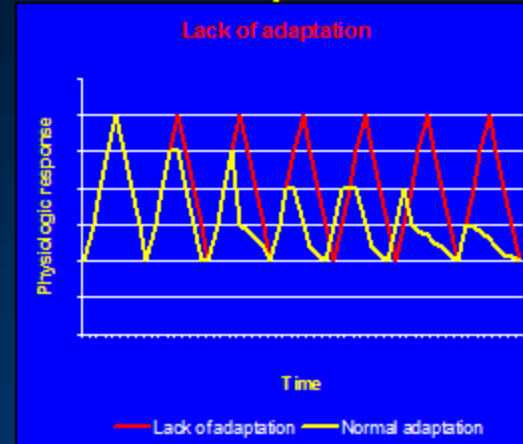
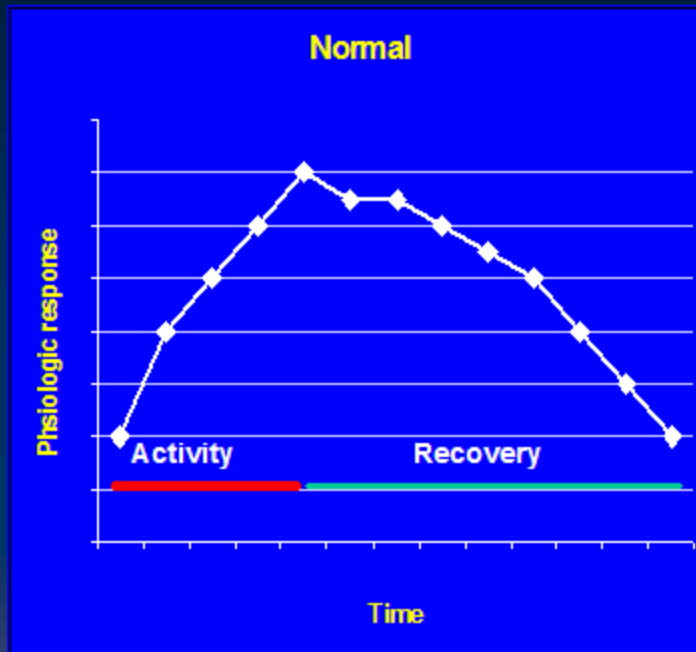
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- ▶ Allostatic Load
 - Wear and tear on stress systems over the life time
 - Occurs when the systems are activated chronically

Allostasis

physiological and behavioural response

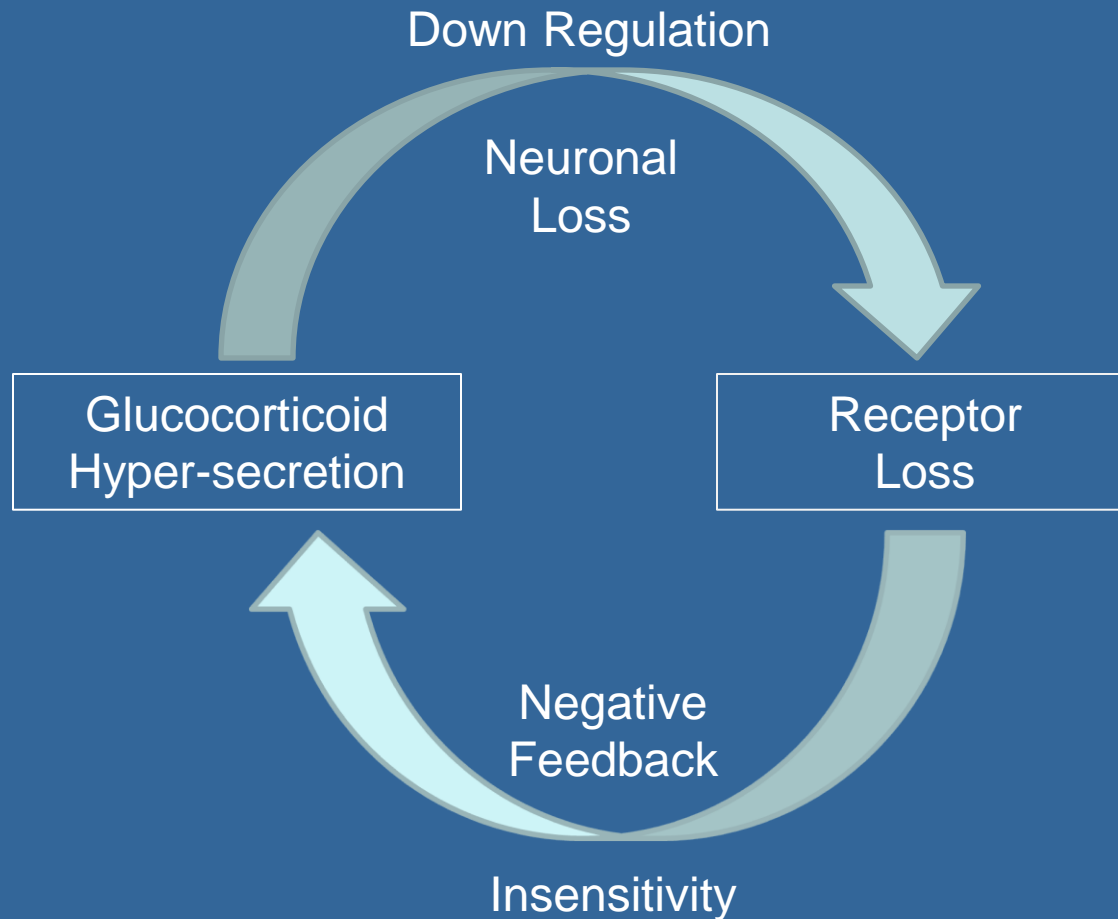


Behavioural

Rumination -> magnification -> learned helplessness

McEwen 1998, New Eng J Med, 338, 3, 171-179

Glucocorticoid Cascade Hypothesis



Robert M. Sapolsky, Lewis C. Krey, Bruce S. McEwen, The Neuroendocrinology of Stress and Aging: The Glucocorticoid Cascade Hypothesis. *Endocr. Rev.* **7**, 284-301 (1986).

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But, Two Examples of the Critical Role of Physiologic Stress

- ▶ Transition to life outside the womb
- ▶ Adrenal insufficiency (Addison's disease)

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- ▶ Preterm infants are often given synthetic glucocorticoids to aid with maturation

Adrenal Insufficiency: Why we Know we Need Cortisol

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- ▶ Individuals with adrenal insufficiency who need surgery or who are nearing childbirth will be given additional injections of hydrocortisone

Normal State Transitions & Metabolism



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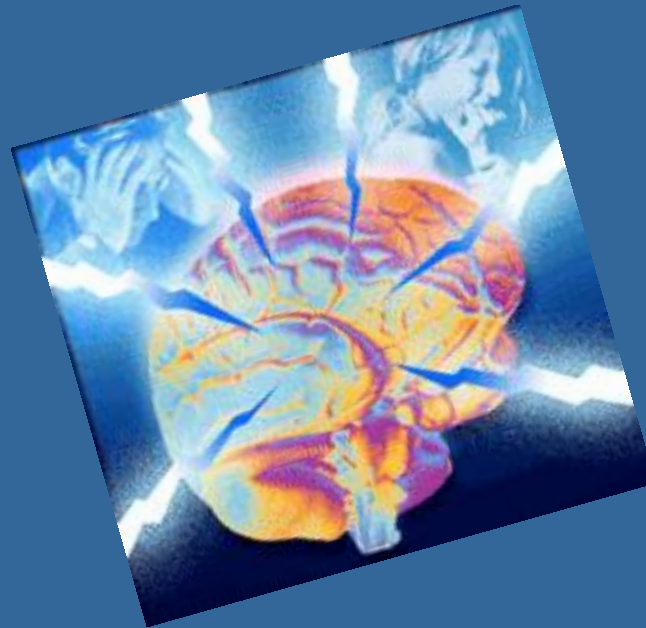
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 - This is not due simply to poorer health care access as it persists in countries with universal health care
 - It is also not due simply to lifestyle differences
 - Perceived low-status is in some cases most important
 - Stress-related illness is worse for people at the same income level who live in communities with higher disparities as compared with those who live in communities where their income status is more typical

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- increases the risk for obesity, decreases immune function and can impair growth
- can impair cognitive functioning, including memory and attention
- increases risk for mental health problems including depression and anxiety

Long-term Effects of Chronic Stress

- ▶ Effects of stress depend on many factors
 - the type of stressor
 - the duration of the stress (acute vs. chronic)
 - the unpredictability or uncontrollability of the stress
 - the social environment of the stressed individual including caregiving in children and social support in adults
 - genetic risk factors

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Stress & Challenge During Early Development



How might psychobiologic responses differ during development?

- ▶ Stress systems maturing
- ▶ Behavioral responses limited
- ▶ Dependence on caregivers

Physiologic Stress In Human Children

▶ Difficult to study

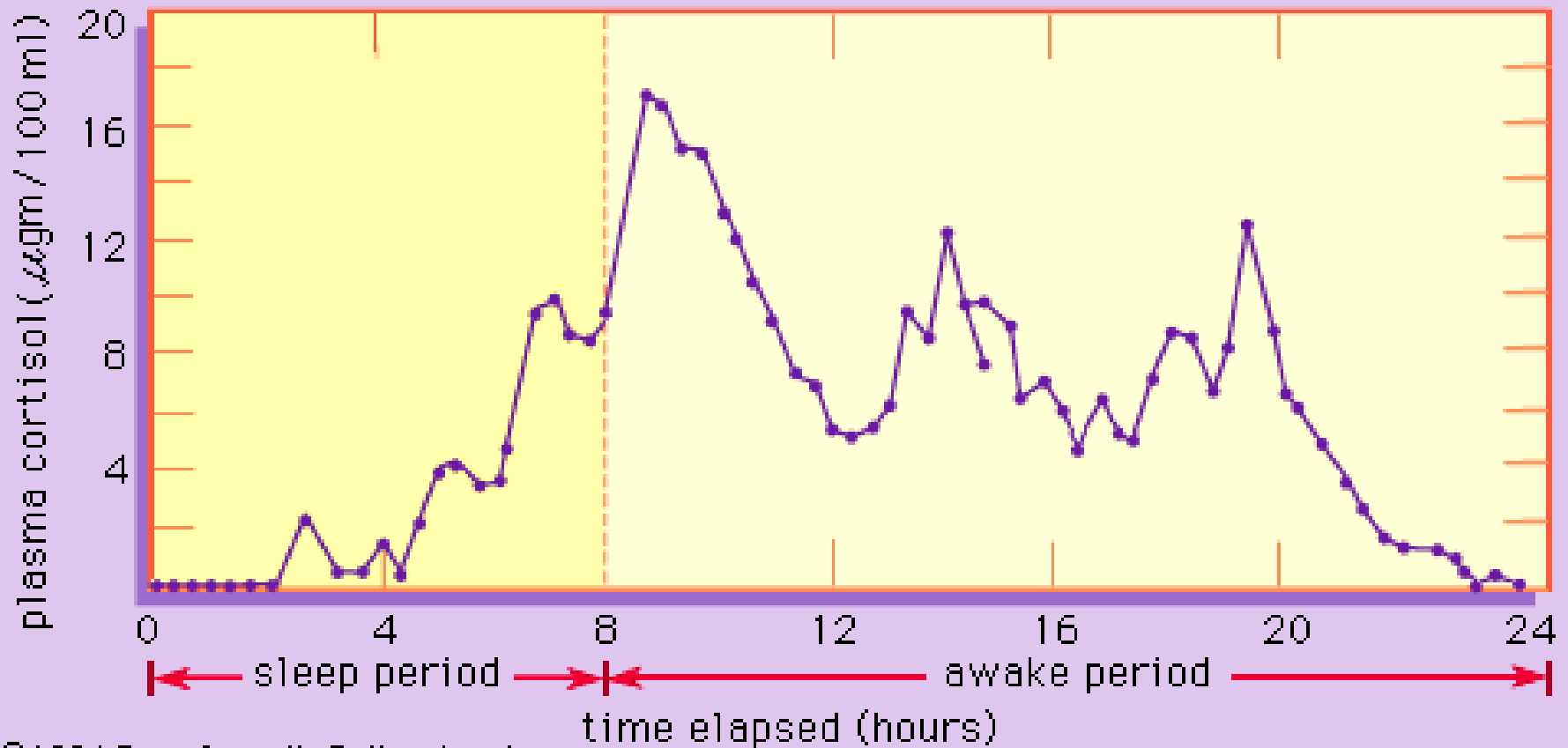
- For a variety of reasons, it is very difficult to study the effects of early experience in young children

▶ Sources of evidence

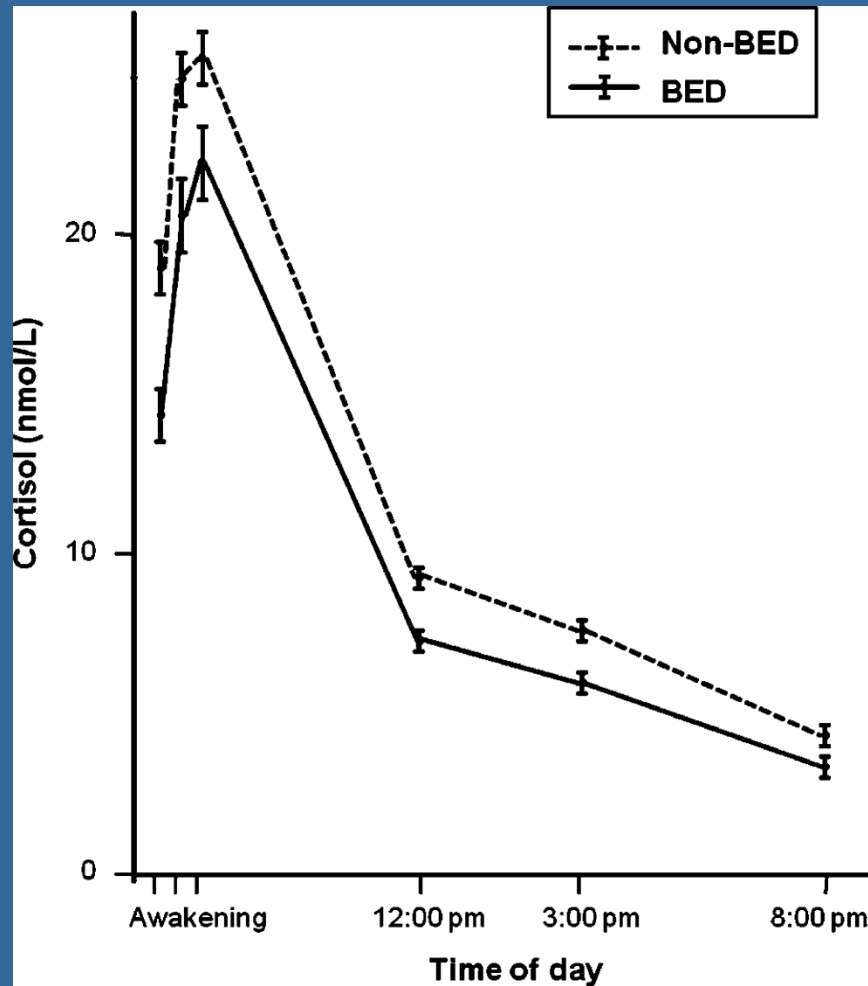
- Studies with children raised in orphanages
- Studies with children who experienced documented abuse & neglect
- Inorganic failure to thrive

Ideal Basal Rhythm

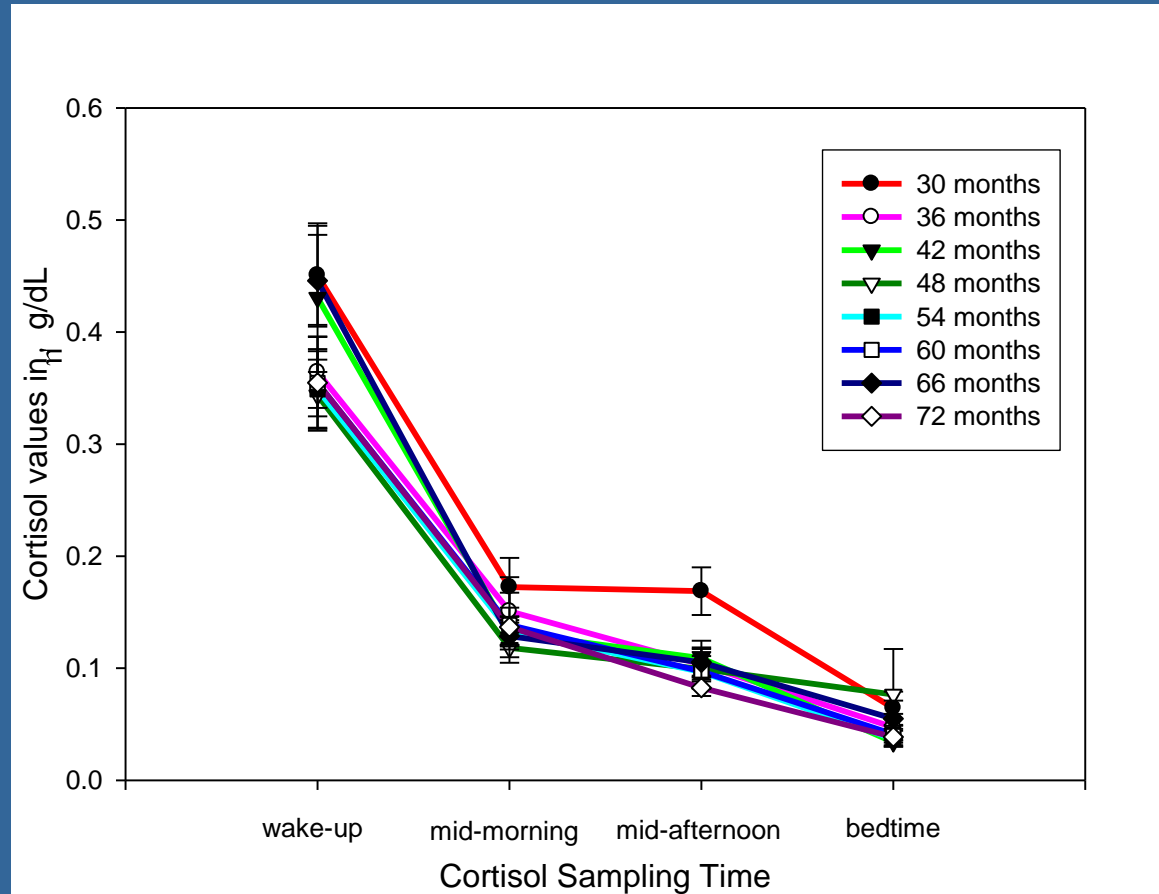
(Usually called the “Normal” or “Typical” Rhythm)



“Normal” or “Typical Basal Rhythm



Cortisol Patterning at Home in 2.5 to 6 Year-Olds



Watamura, S. E., Badanes, L. S., Wolff, B., Lebourgeois, M. K., & Kirkham, N. Z. (in prep).

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Current Study Overview

▶ Families

- Approximately 300 families
- Experiencing a range of stressors
- Served in intervention preschool sites

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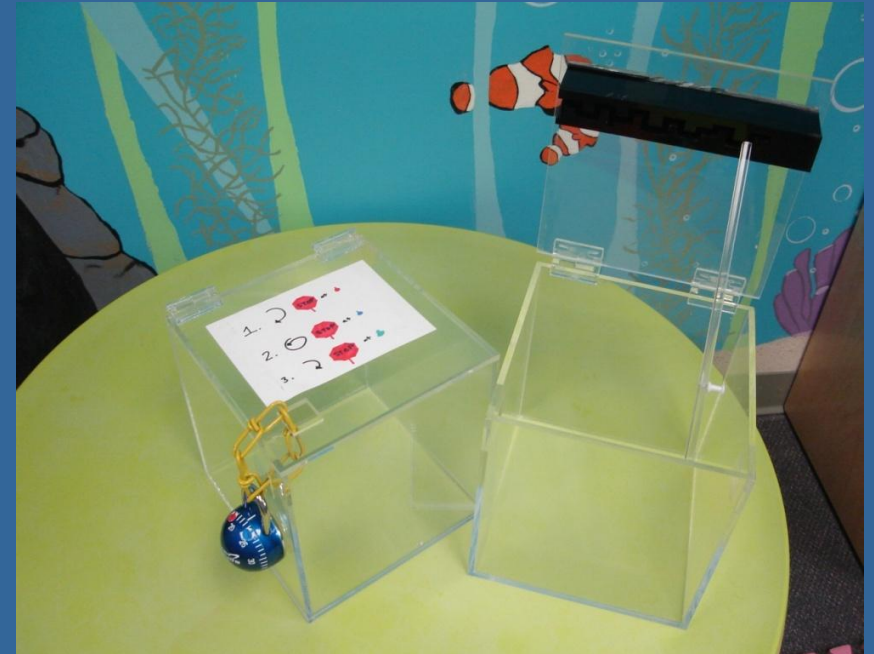
▶ Families

- Approximately 300 families
- Experiencing a range of stressors
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▶ Measures

- Cortisol assessed mid-morning and mid-afternoon at home and at child care
- Cortisol also assessed across a mild stress paradigm
- Child care quality assessed
- Families asked about their stresses and buffers

Materials for Mild Stress Paradigm



Attenuation

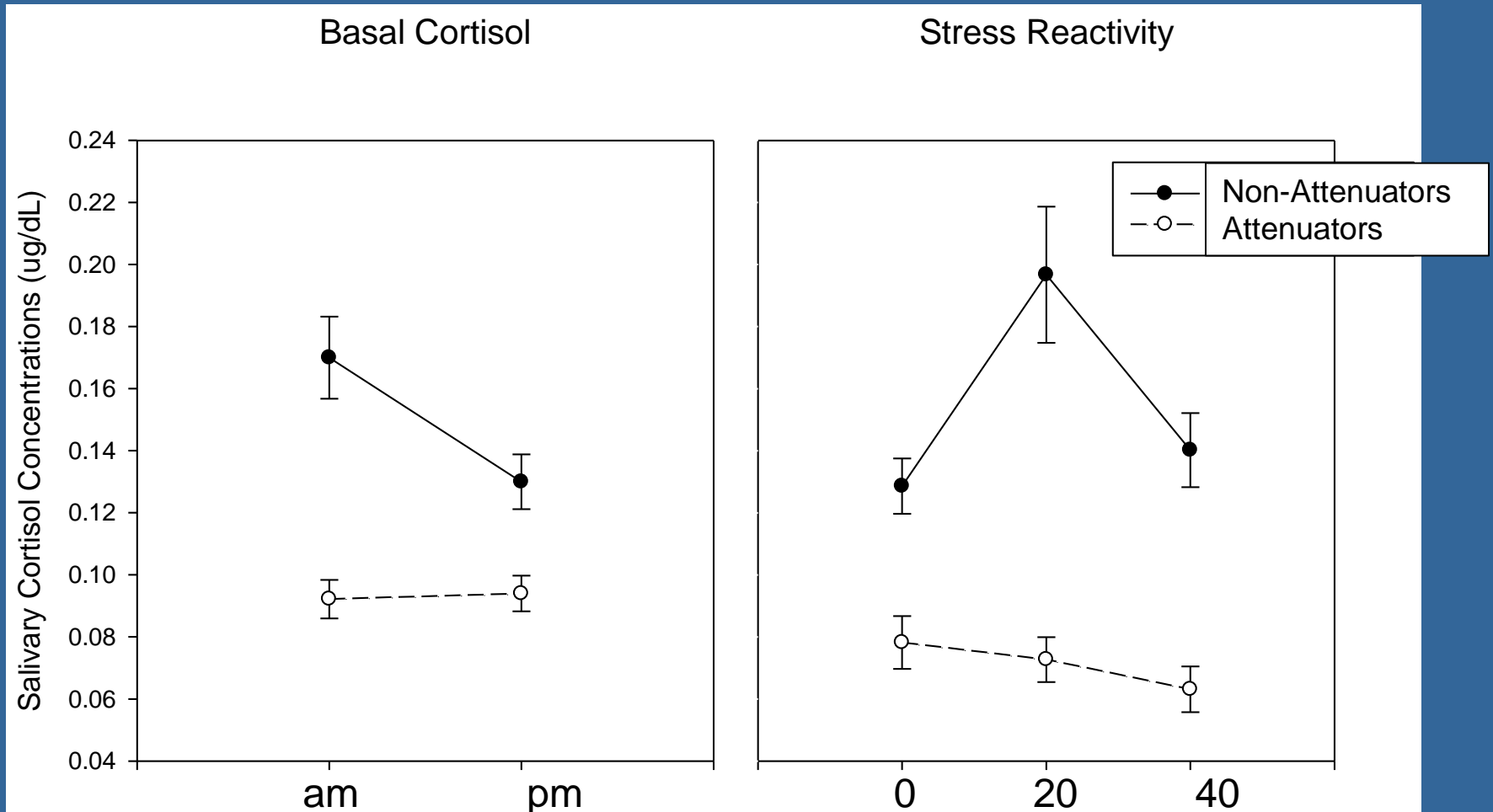
- ▶ Children with more internalizing symptoms (as rated by mothers, teachers, or both) have lower cortisol at all time points

Biological Psychiatry, 2010, Volume 68, pps. 484-490
Development & Psychopathology, in press

Predicting Early Internalizing Symptoms

| | | B | S.E. | Wald | Sig | Exp(B) |
|---------------------|---------------------|-------|------|------|-------|--------|
| Demographics | | | | | | |
| | Age | .60 | .51 | 1.39 | .24 | 1.83 |
| | Sex | 1.21 | .84 | 2.08 | .15 | 3.36 |
| | Race | 1.81 | 1.19 | 2.32 | .13 | 6.08 |
| | Mexican | .31 | 1.30 | .06 | .81 | 1.37 |
| | Hispanic | .43 | 1.28 | .11 | .73 | 1.54 |
| Family Risk | | | | | | |
| | Maternal Depression | 2.23 | .97 | 5.20 | .02* | 9.18 |
| | Financial Risk | 2.60 | 1.08 | 5.75 | .02* | 13.43 |
| | Stress | -1.28 | .99 | 1.68 | .20 | .28 |
| Cortisol | | | | | | |
| | Attenuated | 4.02 | 1.44 | 7.76 | .01** | 55.57 |

Attenuators vs. Non-Attenuators



Where does this early attenuation come from?

- ▶ Already the result of early stress?

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- ▶ Pre-existing risk?
 - prenatal
 - genetic

What might this early attenuation mean?

- ▶ Temporary adaptation to repeated inescapable stress?
 - Some costs, some benefits

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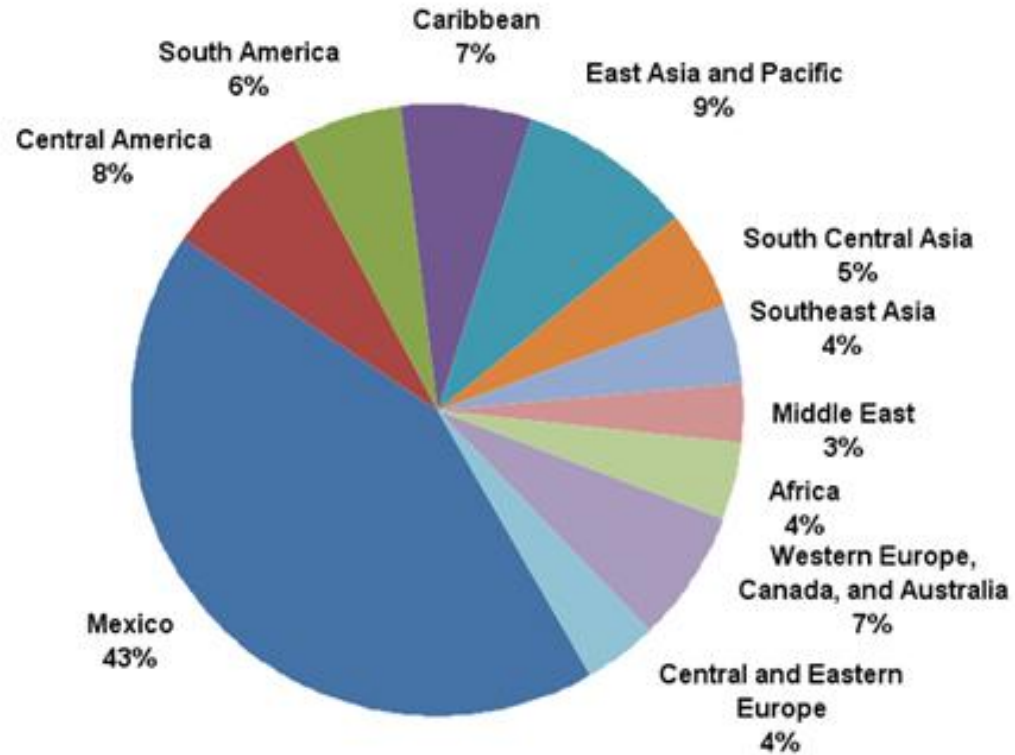
- ▶ Temporary adaptation to repeated inescapable stress?
 - Some costs, some benefits
- ▶ Association with internalizing symptoms makes sense
- ▶ Note earlier pubertal timing in girls experiencing high family stress

Ellis, B. J., Garber, J. (2003). Psychosocial antecedents of variation in girls' pubertal timing: Maternal depression, stepfather presence, and marital and family stress. *Child Development*, 71(2), 485-501.

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Children of Immigrants



8.7 Million Children of Immigrants

Hispanic Health Paradox: Recent Hispanic Immigrants healthier

- ▶ Than other SES matched minority groups

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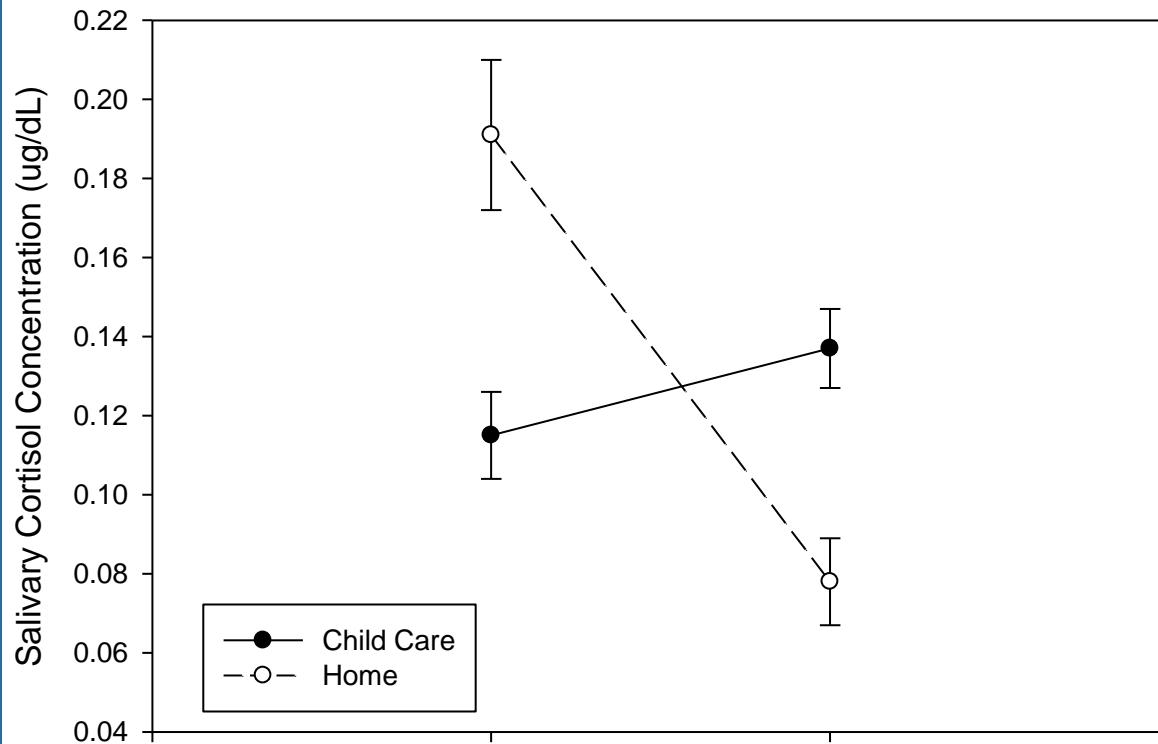
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 - Salmon bias
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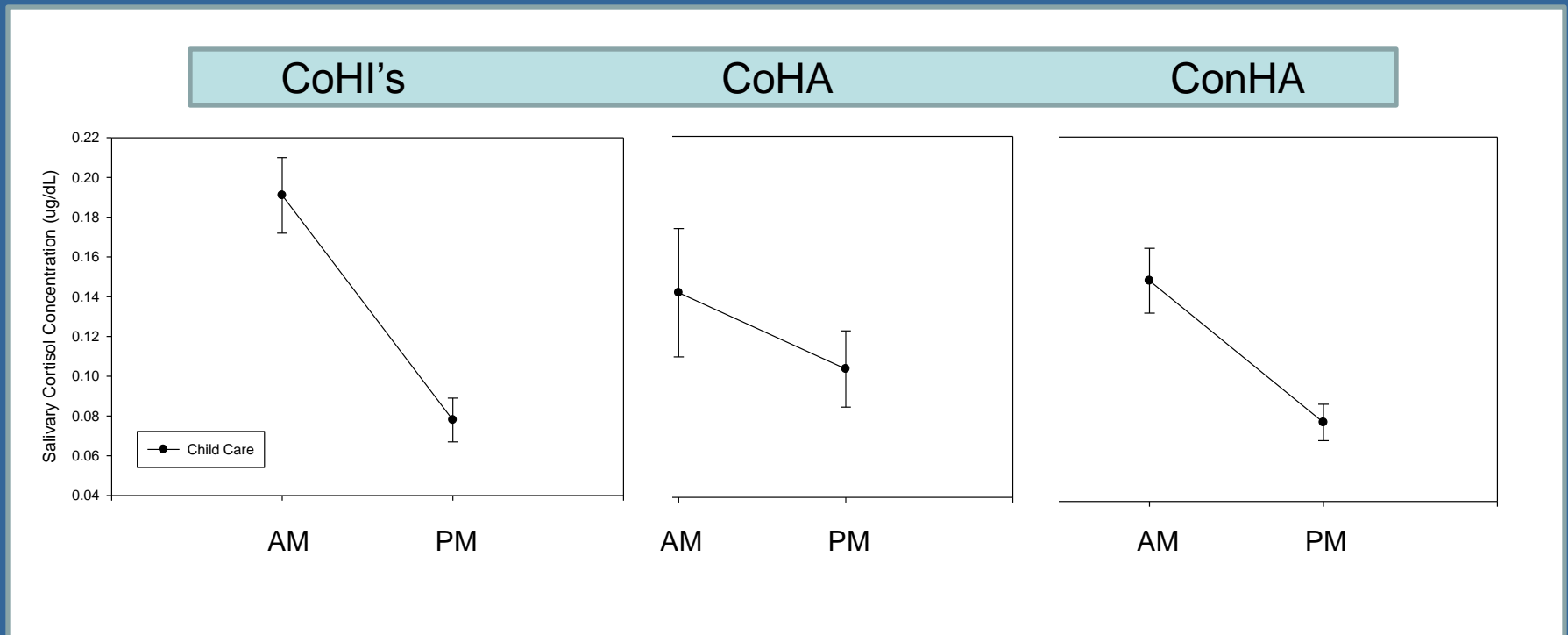
- ▶ Than other SES matched minority groups
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- ▶ Psychosocial explanations
 - Better health behaviors
 - Nutrition
 - Substance use
 - Better coping strategies
 - Religion
 - Family networks

Larger Home-School Gap among Children of Hispanic Immigrants

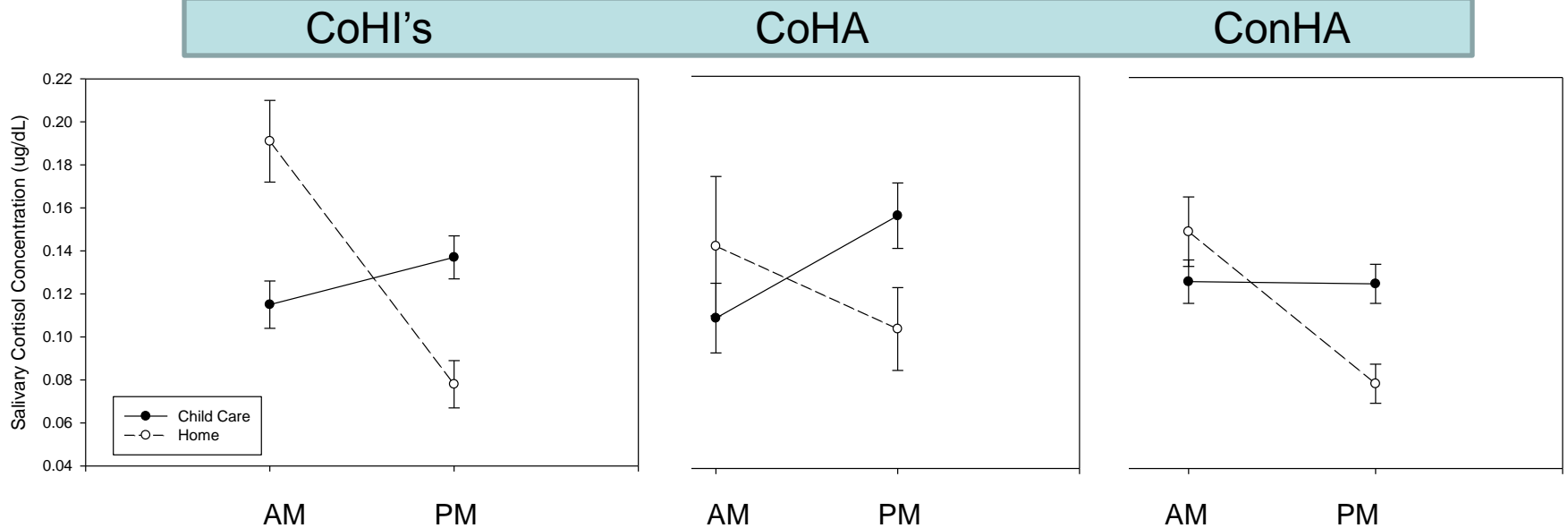
Cortisol Slopes Across the Day - COHI



Children of Hispanic Immigrants exhibited the steepest (and healthiest) slope at home

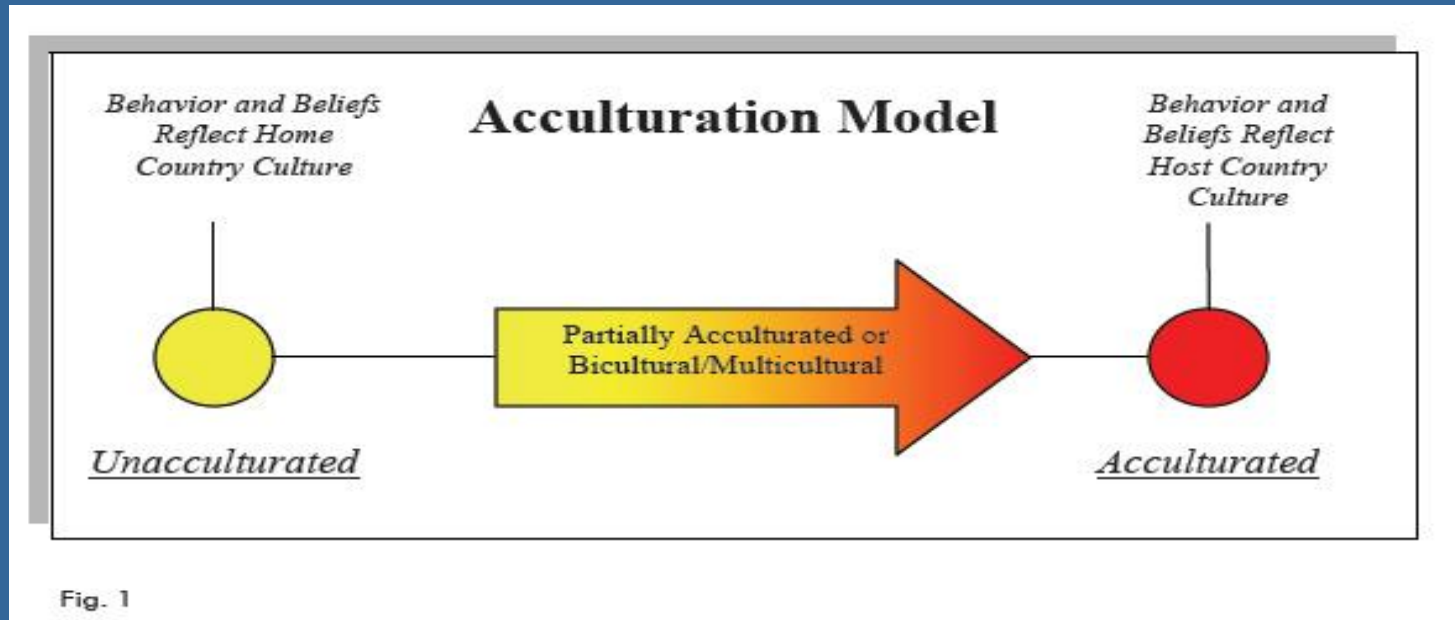


Children of Hispanic Americans exhibited the most stress reactivity to child care

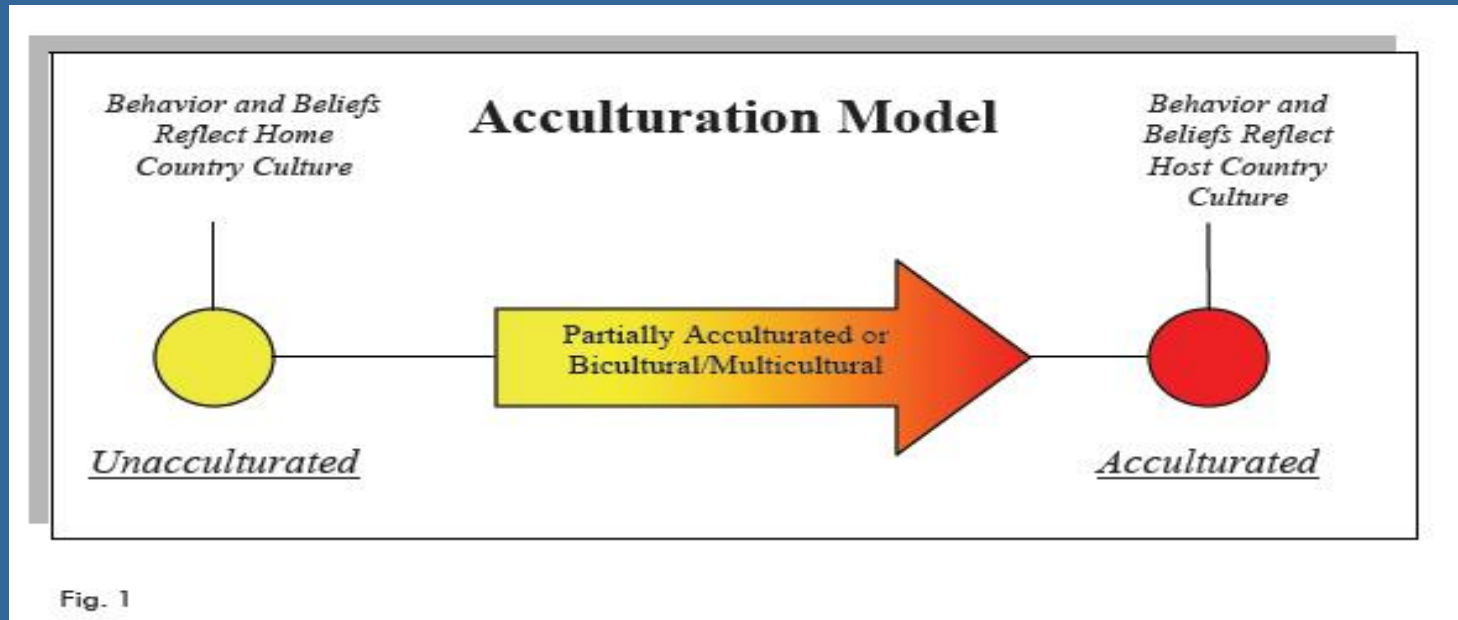


Acculturation

- ▶ Assessed by asking language preference



Greater Acculturation (Preference for English)



- ▶ Greater acculturation predicted rising cortisol across the day both at child care and at home

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Caregivers as Buffers: Intervention Approaches



Attachment Buffering

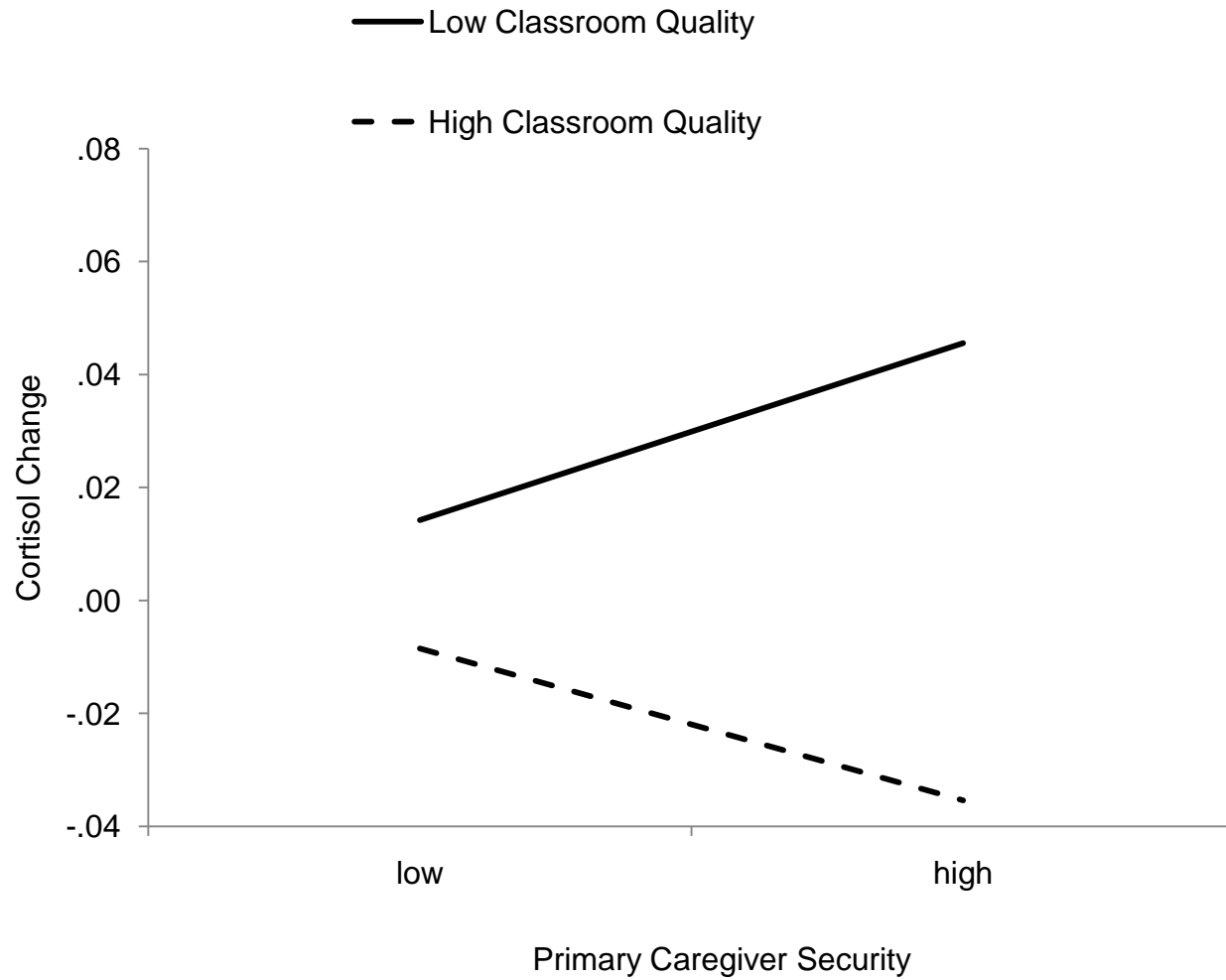
- ▶ Children with more secure attachment to their lead teacher were more likely to show falling cortisol across the child care day



Attachment to Parents

- ▶ Attachment to parents interacted with classroom quality (ECERS-R)
- ▶ Less secure children
 - cortisol did not differ at child care as a function of quality
- ▶ More secure children
 - they showed rising cortisol across the day in lower quality classrooms but falling cortisol in higher quality classrooms

Attachment to Parents and Classroom Quality



Implications for Practice

- ▶ Experience influences physiology
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- ▶ **The central role of culture**
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- ▶ **The central role of culture**
 - The special case of recent immigrants
- ▶ **Relationships and quality interventions affect physiology**