

# The Developmental Correlates of Early Deprivation: Studies of Orphanage-Adopted Children

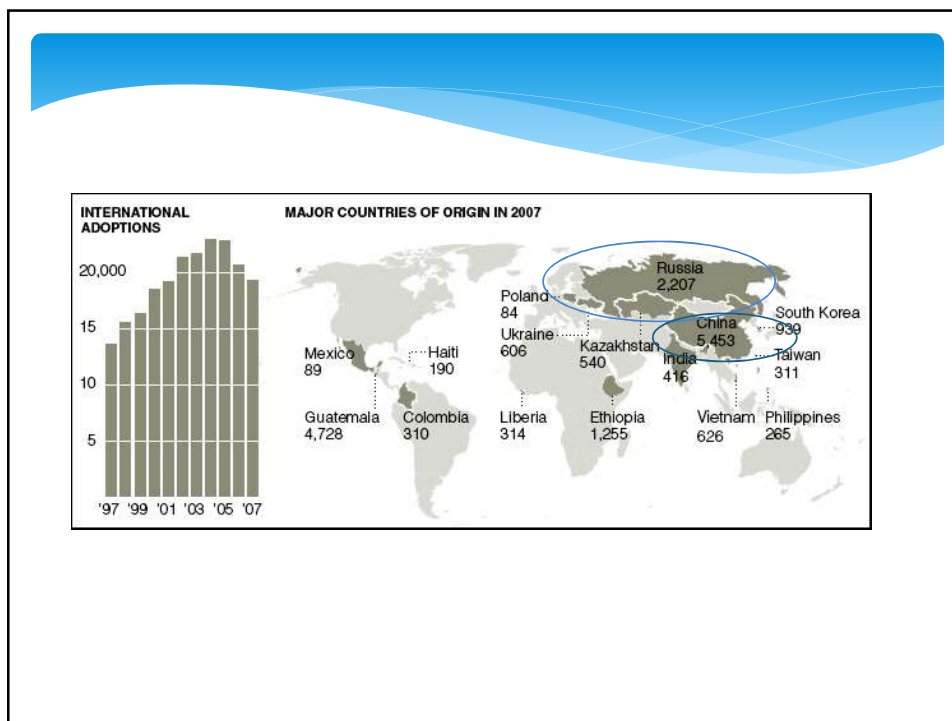
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Institute of Child Development  
University of Minnesota  
USA



## Romanian Orphanages




- \* English and Romanian Adoption Study: Michael Rutter
- \* Bucharest Early Intervention Project: Chuck Nelson, Nathan Fox and Charlie Zeanah



## Mn International Adoption Project

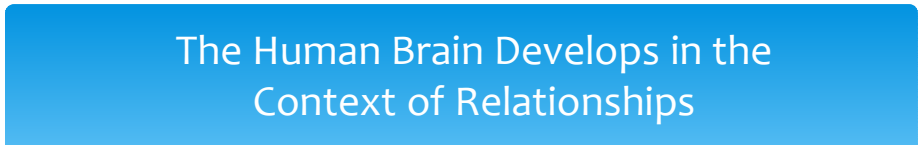


- \* Initial survey to families of all children adopted internationally from 1990-1998 (>4,000).
- \* Registry of families interested in research (>6000)
- \* Targeted studies probing the neurobiological and endocrine basis for altered developmental trajectories.



Neurodevelopment  
Requires Stimulation

Human Infant is Unable to Provide  
Itself Adequate Stimulation  
for Neurodevelopment



The Human Brain Develops in the  
Context of Relationships

## What if we lack these relationships?



## Adoption Marks End of Deprivation

## WHY STUDY PI CHILDREN

- Post-Institutionalized Children

- Children Experiencing Neglect

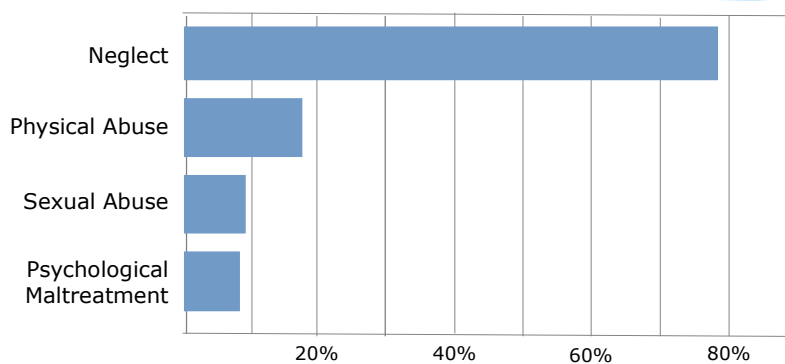
Animal Models: Deprivation

Period of Deprivation  
Circumscribed

Adoptive Parents Motivated to  
Support Research

Drawback:  
Pre-Adoption Care and Prenatal  
Care Frequently Unknown or  
Unreliably Known

## Neglect is the Most Prevalent Form of Child Maltreatment



Source: U.S. Department of Health and Human Services (2010b).

## Orphanage to Adoption An (Un) Natural Experiment

- \* No random assignment to institutional care
- \* Adoption is not experimentally controlled
- \* Adoption Bias towards healthier and more attractive and towards girls
- \* Adoption comparison group

## Remainder of Talk

- \* Neurocognitive development
  - \* Executive Functions
  - \* Structural Brain Development
- \* Development of Stress/Defense System

## General Cognitive Functioning

- \* Marked delays in cognitive development that increase with duration of institutional care; due to decreased stimulation (Tizard)
- \* DQ Often too low to measure in institution and by 1-2 years post adoption IQ is in normal range
- \* Duration of exposure to institutions associated with greater delay and long time to catch-up

## Executive Functions (Air Traffic Control System of the Mind)

- \* **Depend on three types of brain function:**
  - \* **Working memory**
  - \* **Cognitive Flexibility**
  - \* **Inhibitory Control**
- \* Begin developing in Infancy and show improvements to mid-late 20's.
- \* Depends on complex, distributed circuits that mature with maturation/development of prefrontal brain regions

## Early Life Stress is Associated with Impaired Executive Functions

- \* Assessed 12 months post-adoption
- \* Children are 2.5 to 4 years olds
- \* Battery of laboratory measures

Spin the Pots: Working memory

Delay of Gratification

DCCS: Rule shifting

Hostinar, Stellern, Schaefer, Carlson & Gunnar (2012, *PNAS*)

## Early Life Stress is Associated with Impaired Executive Functions

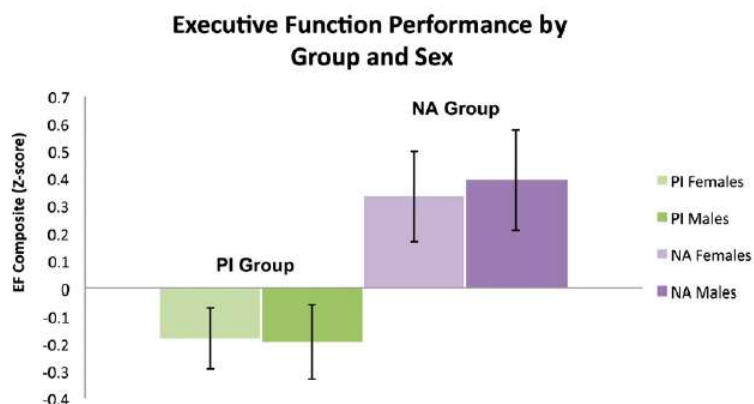


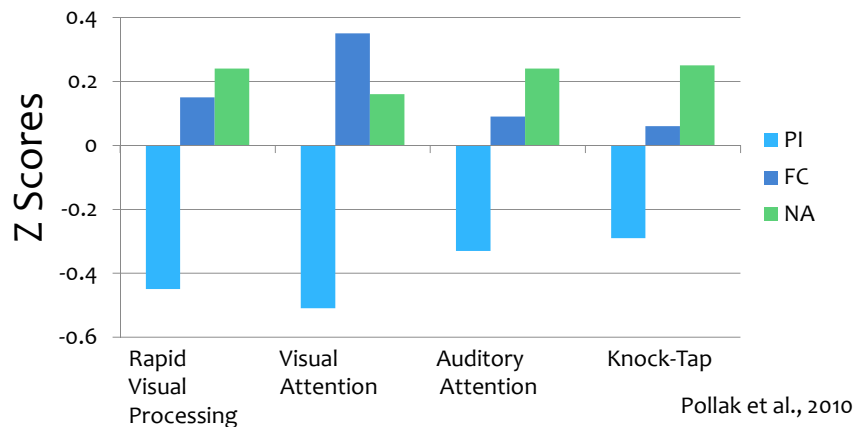
Fig. 1. Estimated means for EF performance by group and sex after controlling for IQ. Error bars represent SEMs. Hostinar et al. (2012, *PNAS*)

$$F(1,79) = 25.4, p < .001, \eta^2 = 0.24$$



## CANTAB and NEPSY Attention Inhibitory Control: 8-9 Year Olds

Duration of Institutional Care  
With summary Attention Score  $r = -.36$

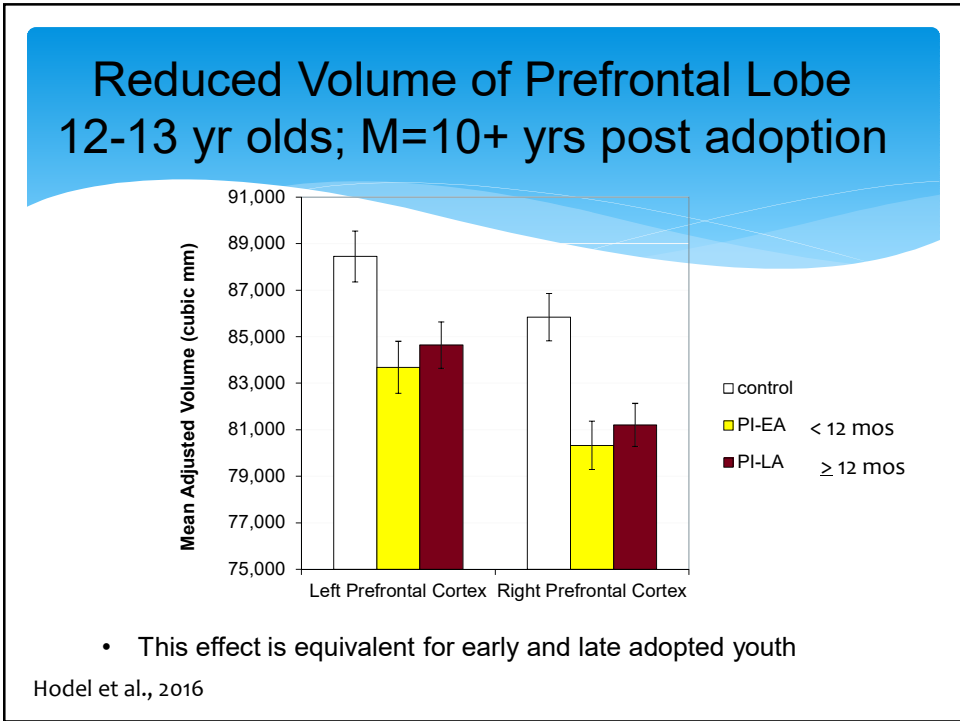
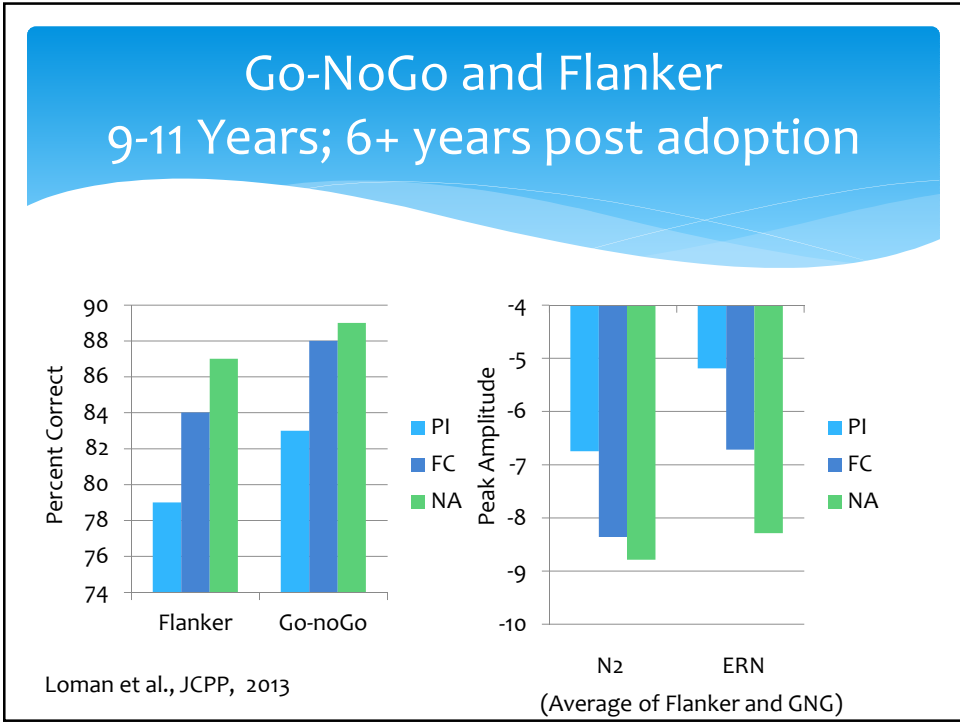


## Probing Neural Structure and Function Associated with EF deficits

\* Brain Electrical Activity using EEG/ERPs

\* Neuroimaging using MRI and fMRI

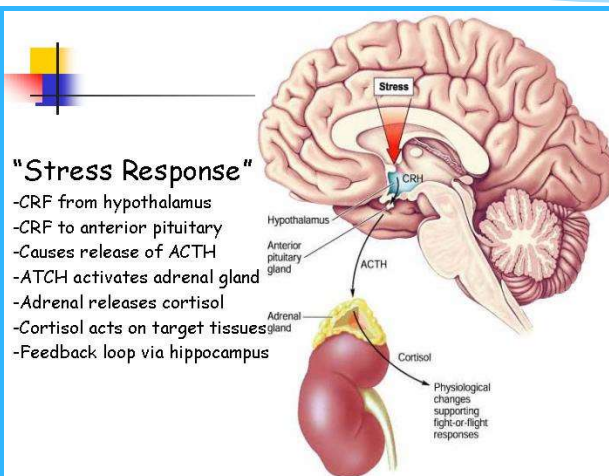
Kathleen (Katie) Thomas, Professor, ICD

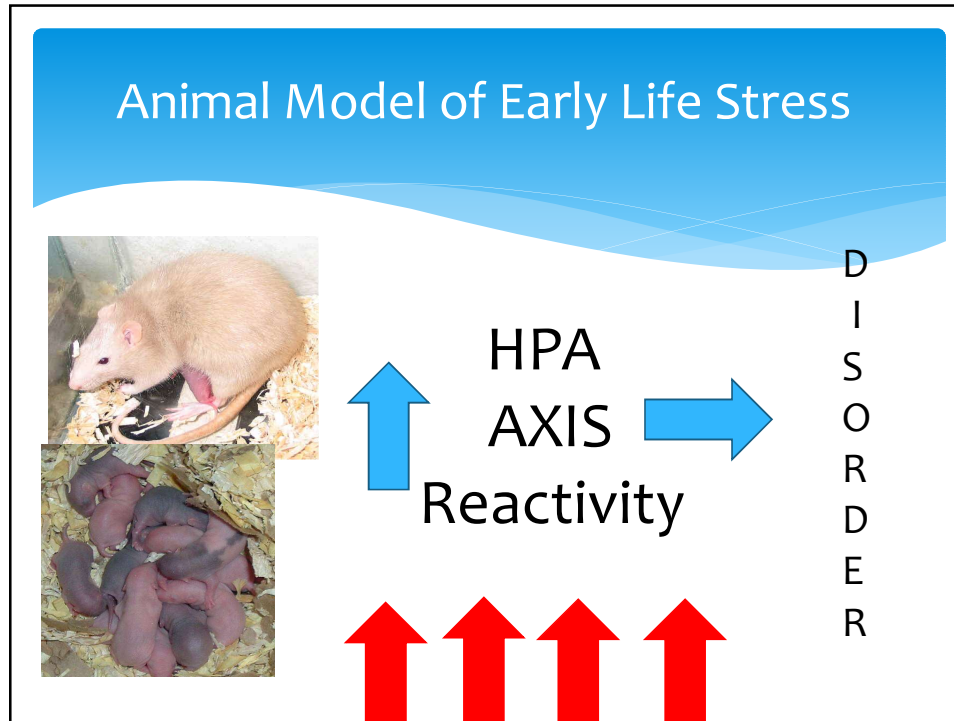


## Interim Conclusions

- \* Consistent Pattern of EF deficits that do not recover with recovery of IQ
- \* EF plays a major role in self-regulation, in math capabilities, and in the “soft” elements of academic success
- \* Signature of poor EF in children adopted from orphanages looks very like those of children with ADHD who have not experienced deprivation

## Anatomy and Physiology of HPA Axis





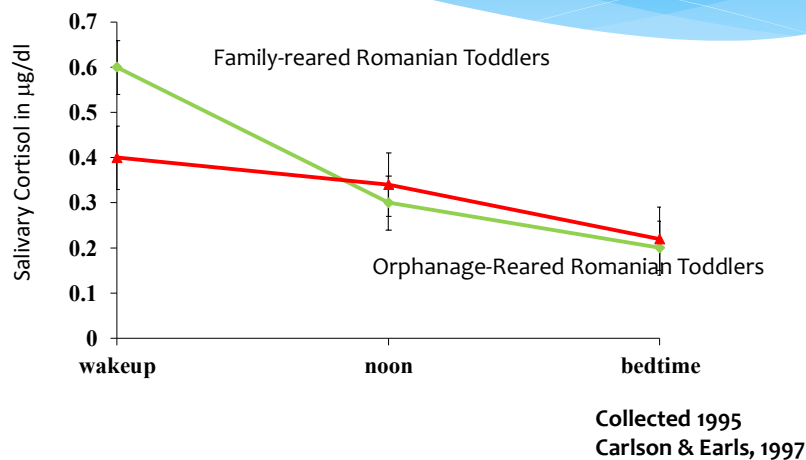
## Models of Deprivation/Neglect and the Stress/Defense System

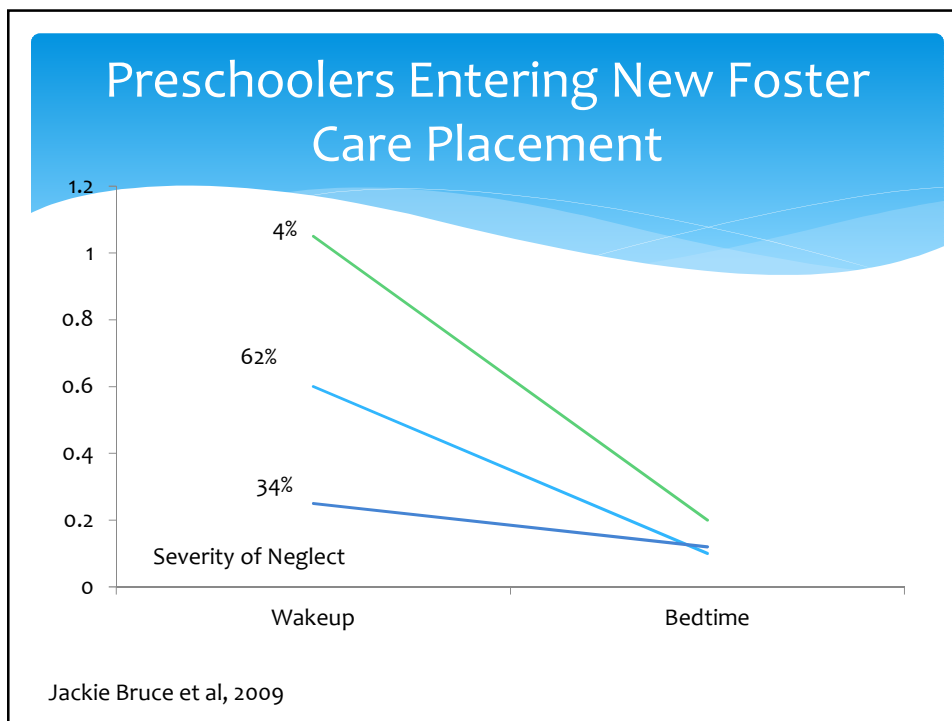
- \* Animal studies used deprivation or reductions in expected stimulation
- \* Children reared in orphanages are the human equivalent in many respects of the animal studies
- \* This allows us to use the animal studies to guide the questions we ask about institutional care effects on children and allows us to ask the animal researchers to look for effects they had not previously reported (translation and reverse translation from animal to human studies).

## Iasi Romania 1995

- \* My first experience collecting measures of stress hormone activity on children in institutional care came from work in Iasi Romania
- \* We went in expecting that the orphanage children (age 2 years) would have highly elevated cortisol levels, but we were wrong. Their levels across the day were either significantly lower (morning) or not significantly higher (noon and late afternoon) than family reared 2 years olds in Romania.
- \* We later found that neglected children entering a new foster placement also were more likely to have low morning and a flat daytime cortisol rhythm.
- \* This led us to write a paper in 2001 alerting the field to the possibility that hypocortisolism was the expected pattern in human following early deprivation.

## Toddlers in Romanian Orphanage Lack Normal Diurnal Cortisol Rhythm





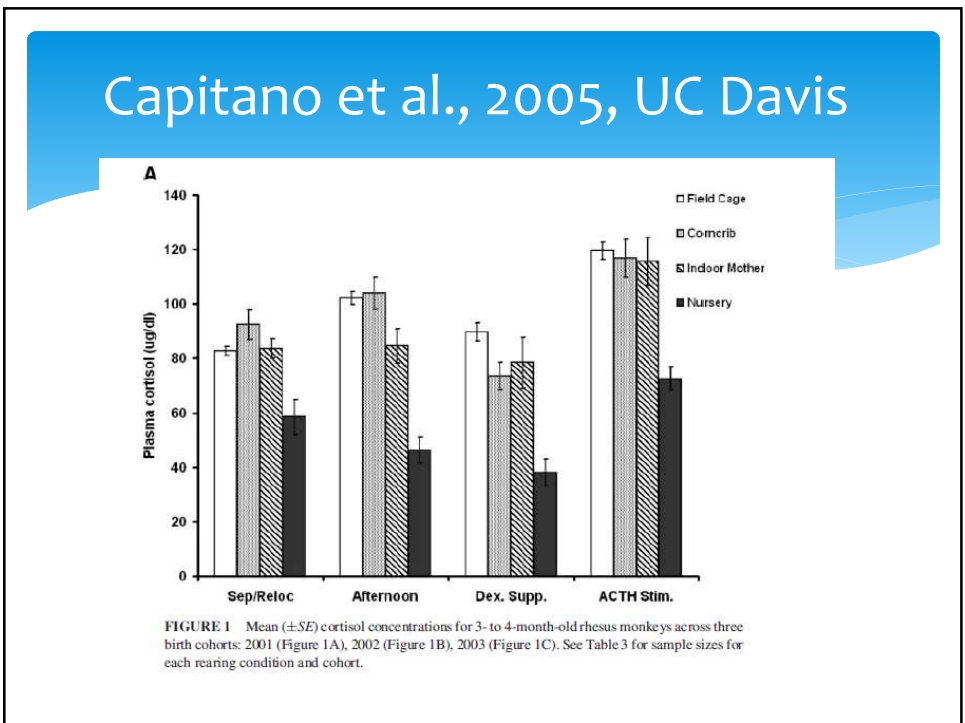
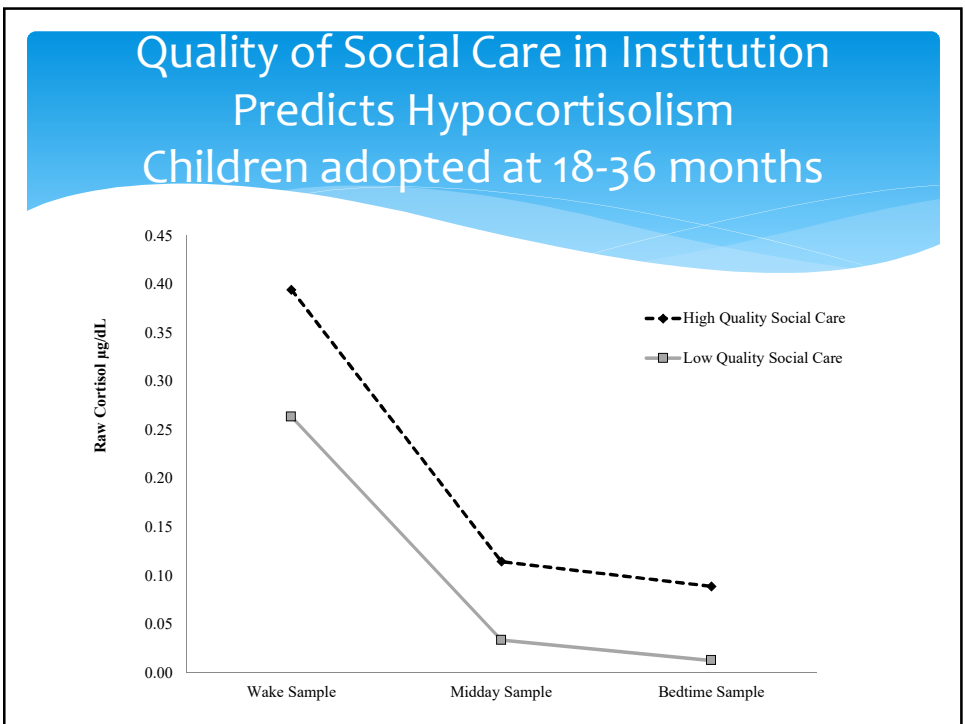
*Development and Psychopathology*, 13 (2001), 515–538  
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 Printed in the United States of America

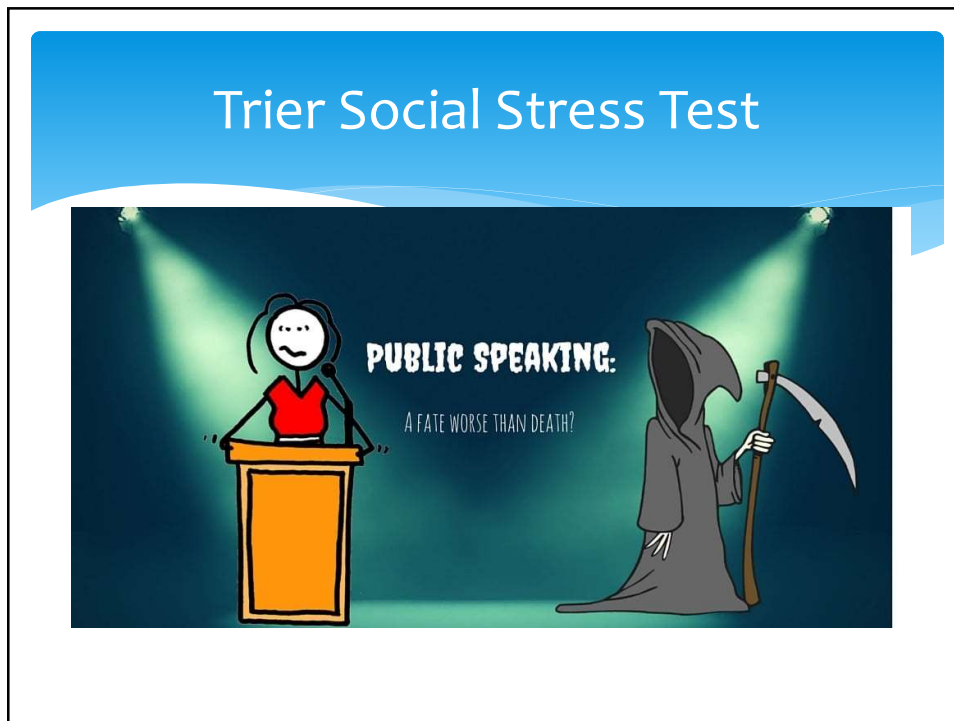
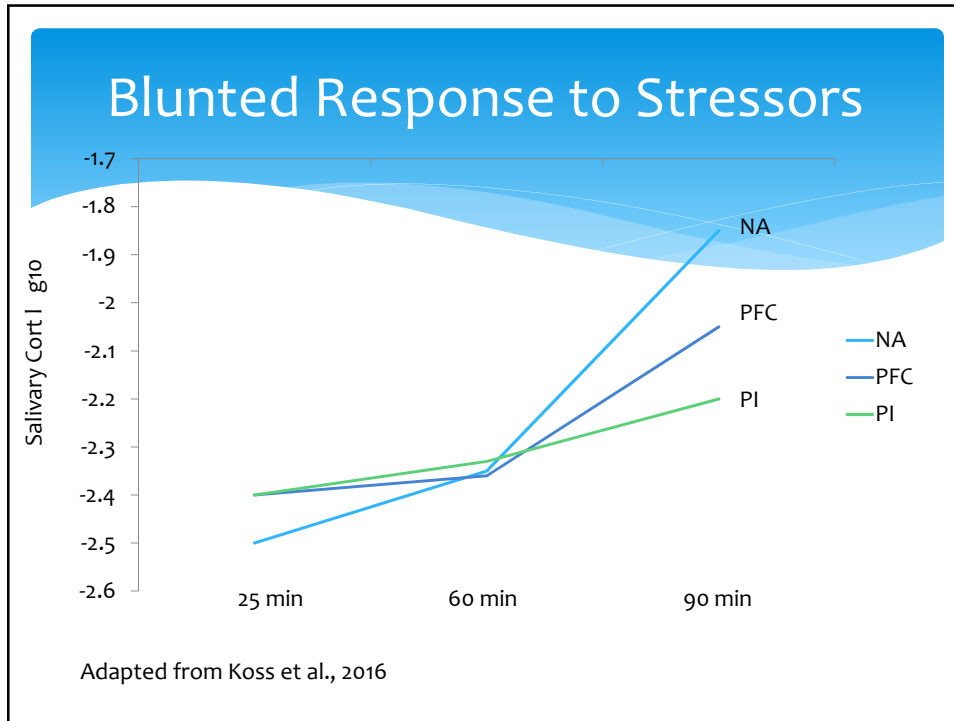
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## Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development

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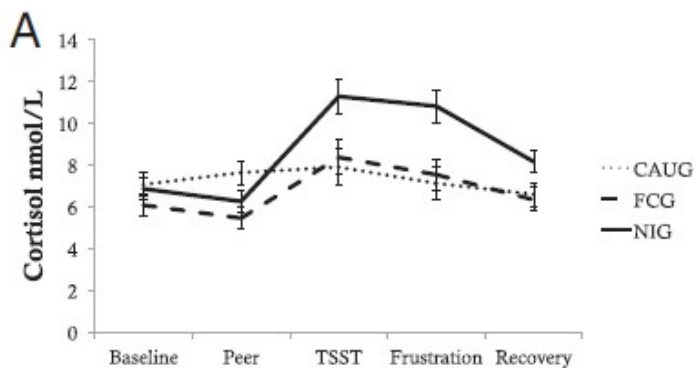
MEGAN R. GUNNAR<sup>a</sup> AND DELIA M. VAZQUEZ<sup>b</sup>  
<sup>a</sup>University of Minnesota; and <sup>b</sup>University of Michigan





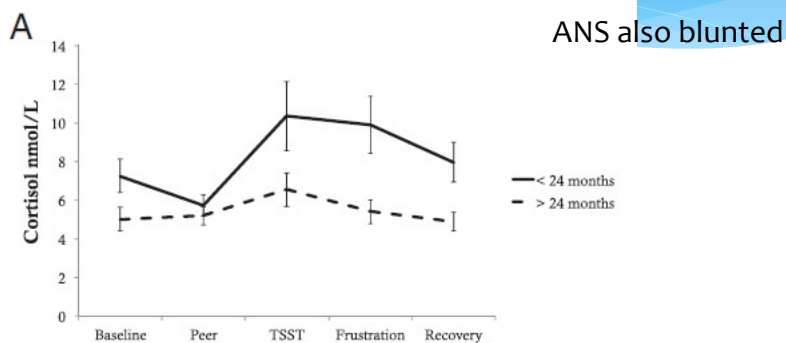


## Bucharest Early Intervention Project (Nelson, Fox, Zeanah)



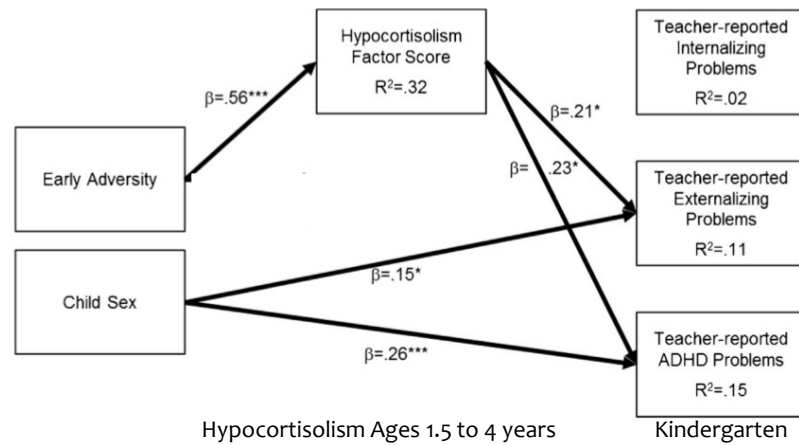
McLaughlin et al., 2015

## BEIP: Early vs Late Removal From Deprivation



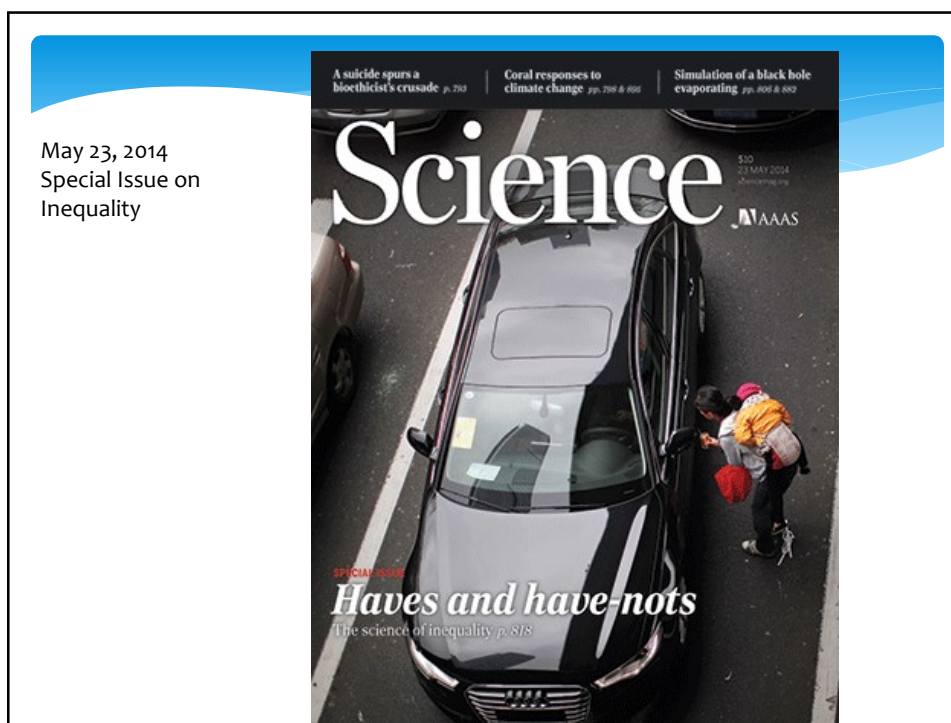
McLaughlin et al., 2015

## Hypocortisolism Mediates Attention and Externalizing Problems



## Interim Summary

- \* Animal studies in rodents led the field to anticipate the early neglect/deprivation would lead to hyper activity of the stress neuraxis.
- \* In humans and in monkeys this is not the case. Instead, early neglect/deprivation induces a pattern of hypofunctioning.
- \* Hypofunctioning of stress responsive systems is predictive of problems in executive functions and sometimes associated conduct problems.
- \* Now, in the last few moments of the talk, for the economists, I will place our findings in the context of theories about the psychology of poverty.



**SPECIAL SECTION** THE SCIENCE OF INEQUALITY

**REVIEW**

## On the psychology of poverty

Johannes Haushofer<sup>1,2,3,4,\*</sup> and Ernst Fehr<sup>3,\*</sup>

Poverty remains one of the most pressing problems facing the world; the mechanisms through which poverty arises and perpetuates itself, however, are not well understood. Here, we examine the evidence for the hypothesis that poverty may have particular psychological consequences that can lead to economic behaviors that make it difficult to escape poverty. The evidence indicates that poverty causes stress and negative affective states which in turn may lead to short-sighted and risk-averse decision-making, possibly by limiting attention and favoring habitual behaviors at the expense of goal-directed ones. Together, these relationships may constitute a feedback loop that contributes to the perpetuation of poverty. We conclude by pointing toward specific gaps in our knowledge and outlining poverty alleviation programs that this mechanism suggests.

## Stress Effects on Risk Aversion and Delay Discounting

- \* Hanshofer & Fehr reviewed studies showing that pharmacologically elevating cortisol and/or manipulations that increase negative emotions
  - \* Increased Risk Aversion
  - \* Decreased Delay Discounting

## Early Life Stress Hypothesis

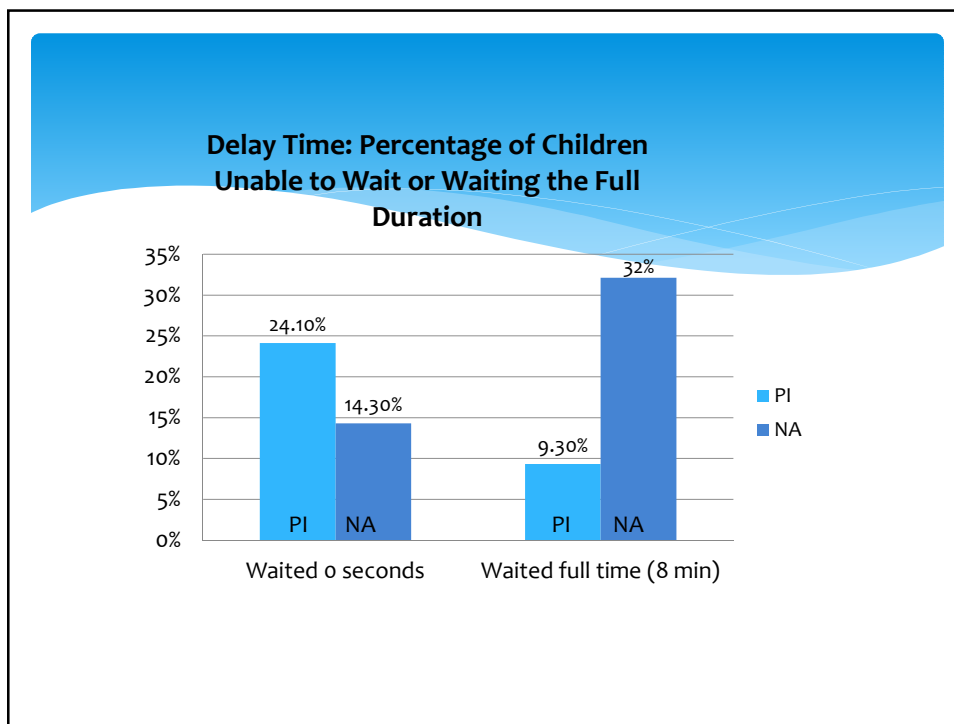
- \* Harsh conditions early in life produce negative emotions and stress that, in turn, shape neural systems to be biased towards risk aversion and immediate gratification.
- \* This may be a form of predictive adaptation that would increase survival in ongoing harsh environments but may limit productivity in benign/resource rich environments.

## Psychology of Poverty


- \* Bias towards immediate gratification over long term gain.
- \* More risk averse, less willing to risk what they have for uncertain gain.

## Delay of Gratification

A close look at out Delay of Gratification Findings




## Why Wait? Only if you trust the experimenter.



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**Cognition**

journal homepage: [www.elsevier.com/locate/COGNIT](http://www.elsevier.com/locate/COGNIT)



**Brief article**

### Rational snacking: Young children's decision-making on the marshmallow task is moderated by beliefs about environmental reliability

Celeste Kidd<sup>a,\*</sup>, Holly Palmeri<sup>a</sup>, Richard N. Aslin<sup>a,b</sup>

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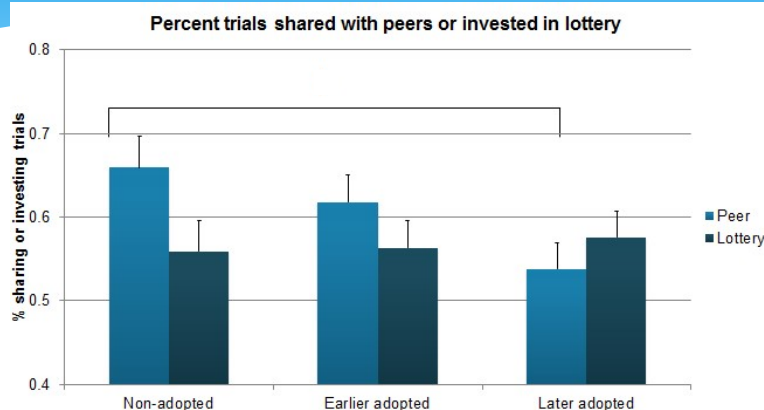
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<p><b>ARTICLE INFO</b></p> <p><i>Article history:</i>          Received 3 March 2012          Revised 27 June 2012          Accepted 15 August 2012          Available online 9 October 2012</p> <p><i>Keywords:</i>          Child learning          Decision-making          Rational analysis          Delay of gratification          Marshmallow task</p>	<p><b>ABSTRACT</b></p> <p>Children are notoriously bad at delaying gratification to achieve later, greater rewards (e.g., Flager, 1970)—and some are worse at waiting than others. Individual differences in the ability-to-wait have been attributed to self-control, in part because of evidence that long-delayers are more successful in later life (e.g., Shoda, Mischel, &amp; Peake, 1990). Here we provide evidence that, in addition to self-control, children's wait-times are modulated by an implicit, rational decision-making process that considers environmental reliability. We tested children (<math>M = 4.6</math>, <math>N = 28</math>) using a classic paradigm—the marshmallow task (Mischel, 1974)—in an environment demonstrated to be either unreliable or reliable. Children in the reliable condition waited significantly longer than those in the unreliable condition (<math>p &lt; 0.0005</math>), suggesting that children's wait-times reflected reasoned beliefs about whether waiting would ultimately pay off. Thus, wait-times on sustained delay-of-gratification tasks (e.g., the marshmallow task) may not only reflect differences in self-control abilities, but also beliefs about the stability of the world.</p> <p style="text-align: right;">© 2012 Elsevier B.V. All rights reserved.</p>
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## Trust and Decision Making in Post-Institutionalized Children: Clio Pitula et al, Dev Sci, 2016

- \* Youth ages 12-14 years
- \* Adopted from orphanages between 2 mos and 5 years of age (early= <12 mos; late=> 12 mos)
- \* Non-adopted comparison families of same SES as adoptive families
- \* 30 in each condition: NA, Early and Late Adopted
- \* Variation of the Trust Game developed by Berg, 1995
  - \* Don't trust= no gain and no loss
  - \* Trust and Trust not reciprocated=loss
  - \* Trust and Trust reciprocated=big gain

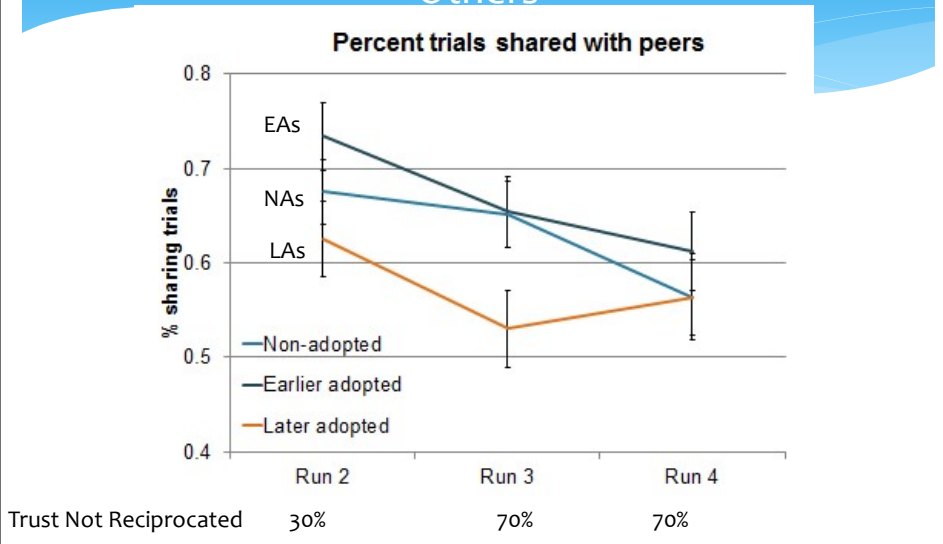
## Without Feedback, PI youth trust others less



Graph 1. Percent of sharing and investing responses during Run 1. Standard error bars are shown.

Clio Pitula et al, in preparation

## Deprivation Conditions for One Year or More in Infancy Associated with Rapid Loss of Trust in Others



## Risk Aversion

\* Balloon Analogue Risk Task-Youth Version:



BART-Y; Lejuez et al., 2007



## Early Deprivation Associated with Later Risk Aversion

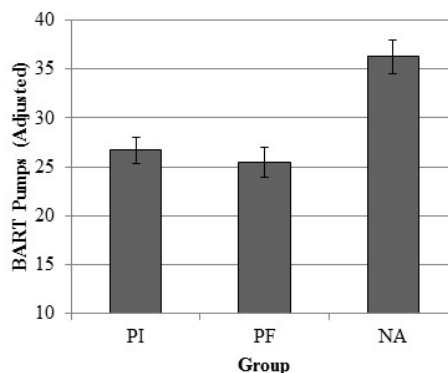
\* Participants were young adolescents (M=12.9 yrs)

\* Mean adoption age < 15 mos.

\* PI, n=54

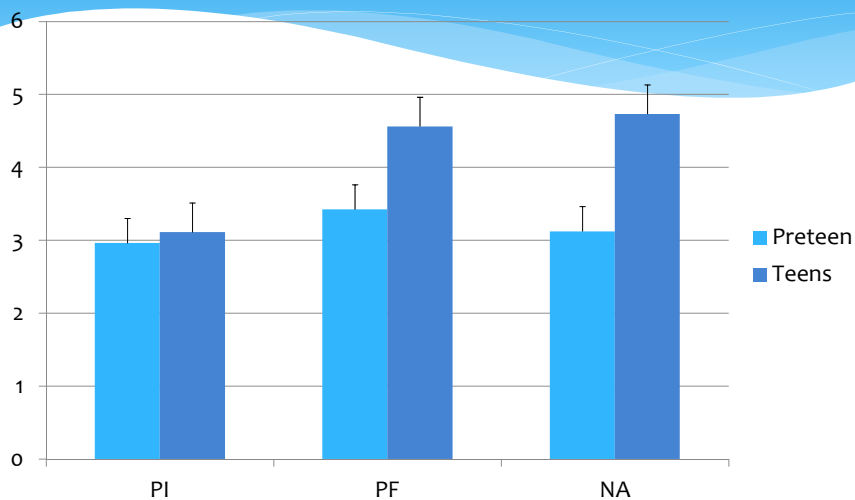
\* FC, n=44

\* NA, N=48



Loman et al., 2014

## Social Sensation (Risk) Seeking Increases with Puberty, but not for PIs



Loman et al., 2014

## Psychology of Poverty Conclusions

- \* So far, results suggest support for the hypothesis that conditions early in life are associated with setting biases affecting preferences for immediate vs delayed rewards, less trust in others, and less willingness to take risks.
- \* If conditions have been harsh/low resourced early in life, conditions post infancy may not readily “reset” these biases.
- \* Biases may continue to influence decision making into adolescence and perhaps into adulthood.
- \* If moving a child into a highly resourced and supportive family doesn’t “reset” these biases, what will?
- \* We may need targeted interventions focused on the systems specifically altered by adaptation to harsh conditions early in life.

## STAFF, STUDENTS, & COLLABORATORS

### ○ Mn International Adoption Project

- D. Johnson, H. Grotevant, W. Hellerstadt, R. Lee

### ○ Early Experience, Stress and Neurodevelopment Center

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