PGC Worldwide Lab Call Details

DATE: Friday, June 13th, 2014
PRESENTER: Israel Liberzon, Department of Psychiatry, Psychology and Neuroscience, University of Michigan
TITLE: “Childhood Poverty and Emotional Regulation”
START: We will begin promptly on the hour.
1000 EDT - US East Coast
0700 PDT - US West Coast
1500 BST - UK
1600 CEST - Central Europe
0000 AEST – Australia (Friday, March 14th into Saturday, March 15th, 2014)
DURATION: 1 hour

TELEPHONE:
- US Toll free: 1 866 515.2912
- International direct: +1 617 399.5126
- Toll-free number? See http://www.btconferencing.com/globalaccess/?bid=75_public
- Operators will be on standby to assist with technical issues. “*0” will get you assistance.
- This conference line can handle up to 300 participants.

PASSCODE: 275 694 38 then #

Lines are Muted **NOW**

Lines have been automatically muted by operators as it is possible for just one person to ruin the call for everyone due to background noise, electronic feedback, crying children, wind, typing, etc.

Operators announce callers one at a time during question and answer sessions.

Dial *1 if you would like to ask a question of the presenter. Presenter will respond to calls as time allows.

Dial *0 if you need operator assistance at any time during the duration of the call.

UPCOMING PGC Worldwide Lab

DATE: **Friday, September 12th, 2014**
PRESENTER: TBD
TITLE: To Be Announced
START: We will begin promptly on the hour.
1000 EDT - US East Coast
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PASSCODE: 275 694 38 then #

Childhood Poverty and Emotional Regulation

Israel Liberzon MD

University of Michigan Department of Psychiatry, Psychology and Neuroscience

Ann Arbor Veteran Affairs Health Systems

Collaborators

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Sean Ma PhD
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Shaun Ho PhD
Tony King PhD
Arash Javanbakht MD
Pilyoung Kim PhD
Luan Phan MD

Funding

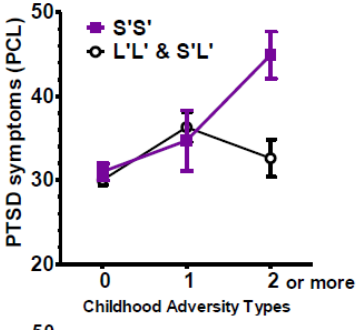
NIH RC2 “Grand Opportunity” grant to IL, GE and JS

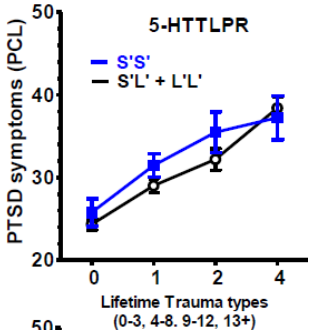
Disclosures - basically none relevant.

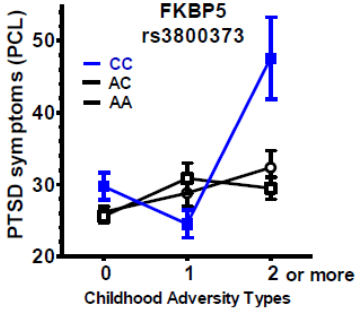
Consulted in 2012 – Embera Pharm. And Corcept Inc.
No Pharma holding > $10K, No current pharma grants,
Not on any speaker’s bureau.
Interest in DMI Inc.

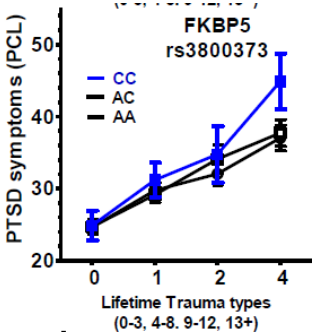
Why Childhood Poverty in the context of examining genetic architecture?

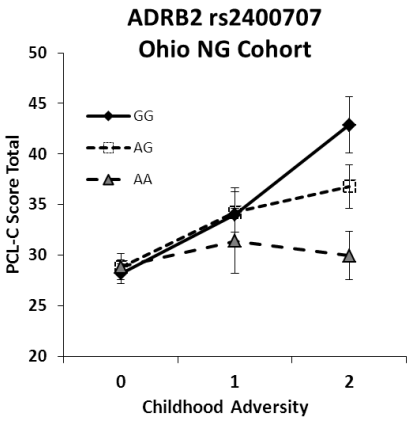
a) The effects of Childhood Trauma – GXE interactions

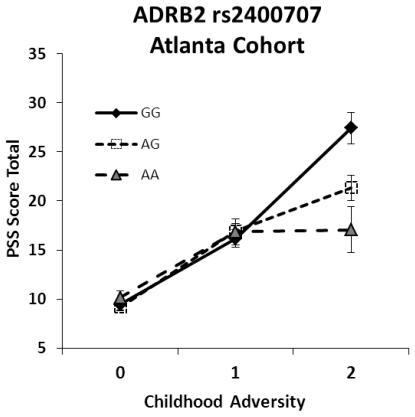












Why Childhood Poverty in the context of examining genetic architecture?

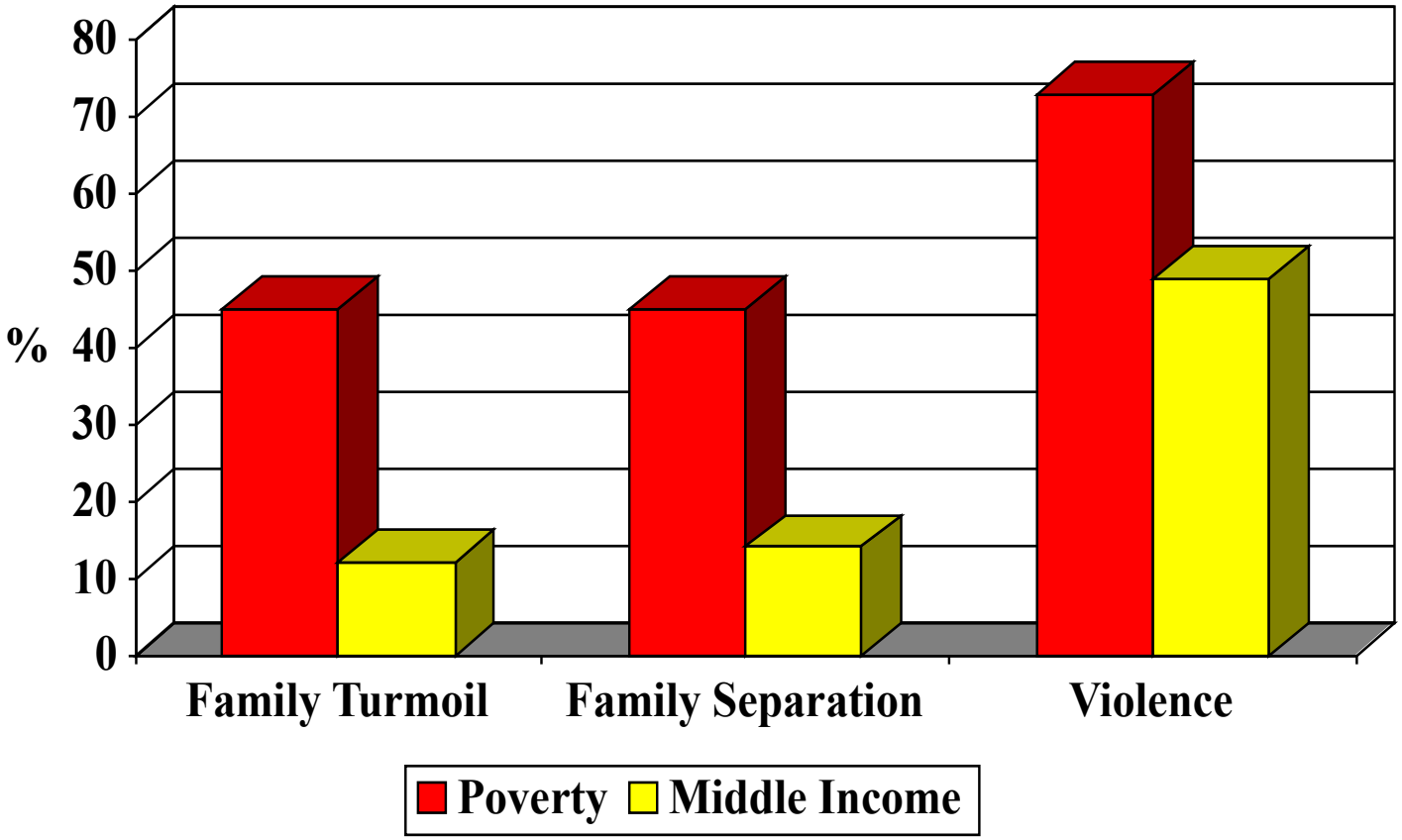
B) Childhood Poverty, Trauma and Aggression

2-4 year olds exposure to aggressive peers

Setting	High SES	Low SES
Neighborhood	.9	1.4
Preschool	.8	1.2
Friends	.6	1.2

0= no exposure
1= exposure monthly or less
2= once a week or more

Poverty, Adversity & Violence



Could Genetics explain all the Poverty effects?

Twin studies indicate a substantially greater environmental vs. genetic contribution in relation to poverty

Caspi, et al. *Psychol Sci*. 2000.

Shifts in family income within one generation cause dramatic changes in children's health and achievement

Adler, et al. *Proc Natl Acad Sci U S A* (2012).

When low SES children are adopted, they show dramatic gains in intelligence as well as improvements in physical health

Osler et al. *Int J Epidemiol* (2006).

Random assignment of varying levels of exposure to income demonstrate income effects, that can not be accounted for by genetics alone

Ludwig *et al. N Engl J Med* 2011, Ludwig *et al. Science* 2012

EXAMPLE

Development and Psychopathology **23** (2011), 439–452

doi:10.1017/S0954579411000162

SPECIAL SECTION ARTICLE

Association between childhood maltreatment and adult emotional dysregulation in a low-income, urban, African American sample: Moderation by oxytocin receptor gene

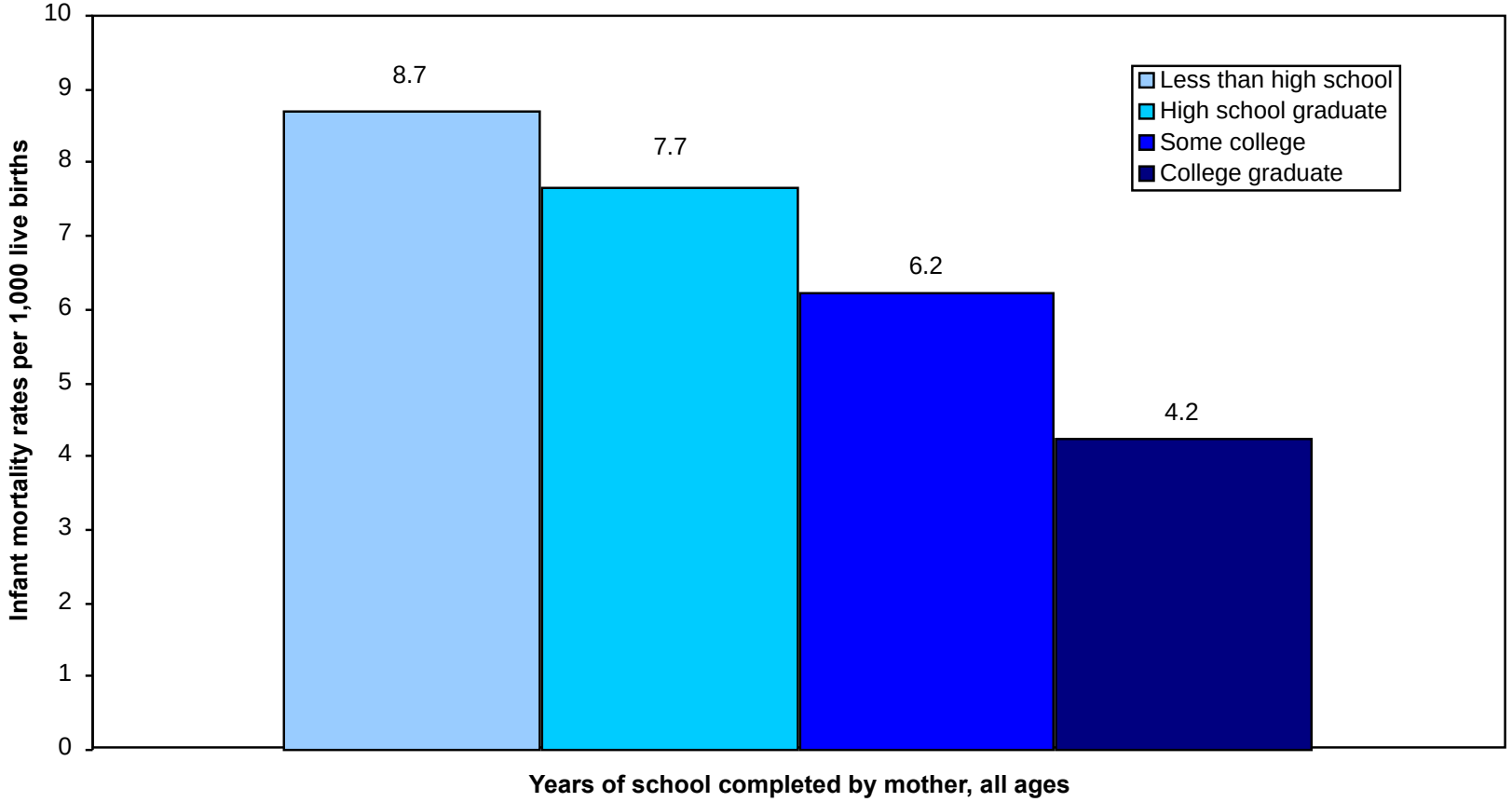
BEKH BRADLEY,[a,b] DREW WESTEN,[b] KRISTINA B. MERCER,[c] ELISABETH B. BINDER,[b] TANJA JOVANOVIC,[b] DANIEL CRAIN,[b] ALIZA WINGO,[a,b] AND CHRISTINE HEIM[b]
[a]*Atlanta VA Medical Center;* [b]*Emory University; and* [c]*Howard Hughes Medical Institute*

Childhood Poverty

- 14 million children living below the poverty line of $22,050 for a family of four
- From 2000 to 2008, the number of children living in poverty rose by 21% ().

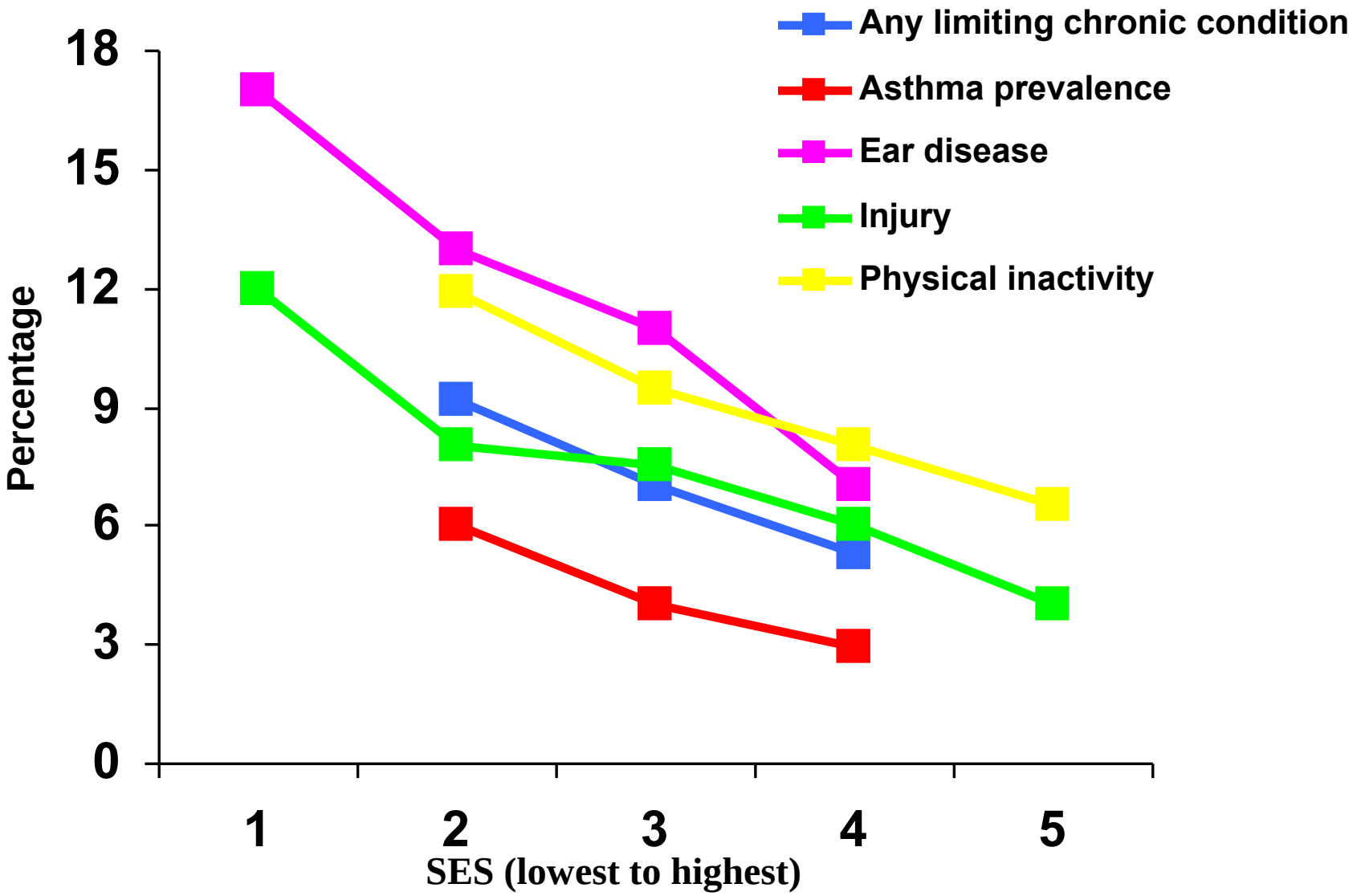
Grieder, 2009; Murry et al., 2011

Figure 1. Compared with babies born to mothers with 16 or more years of schooling, babies born to mothers with fewer than 12 years of schooling are more than twice as likely to die before reaching their first birthdays.

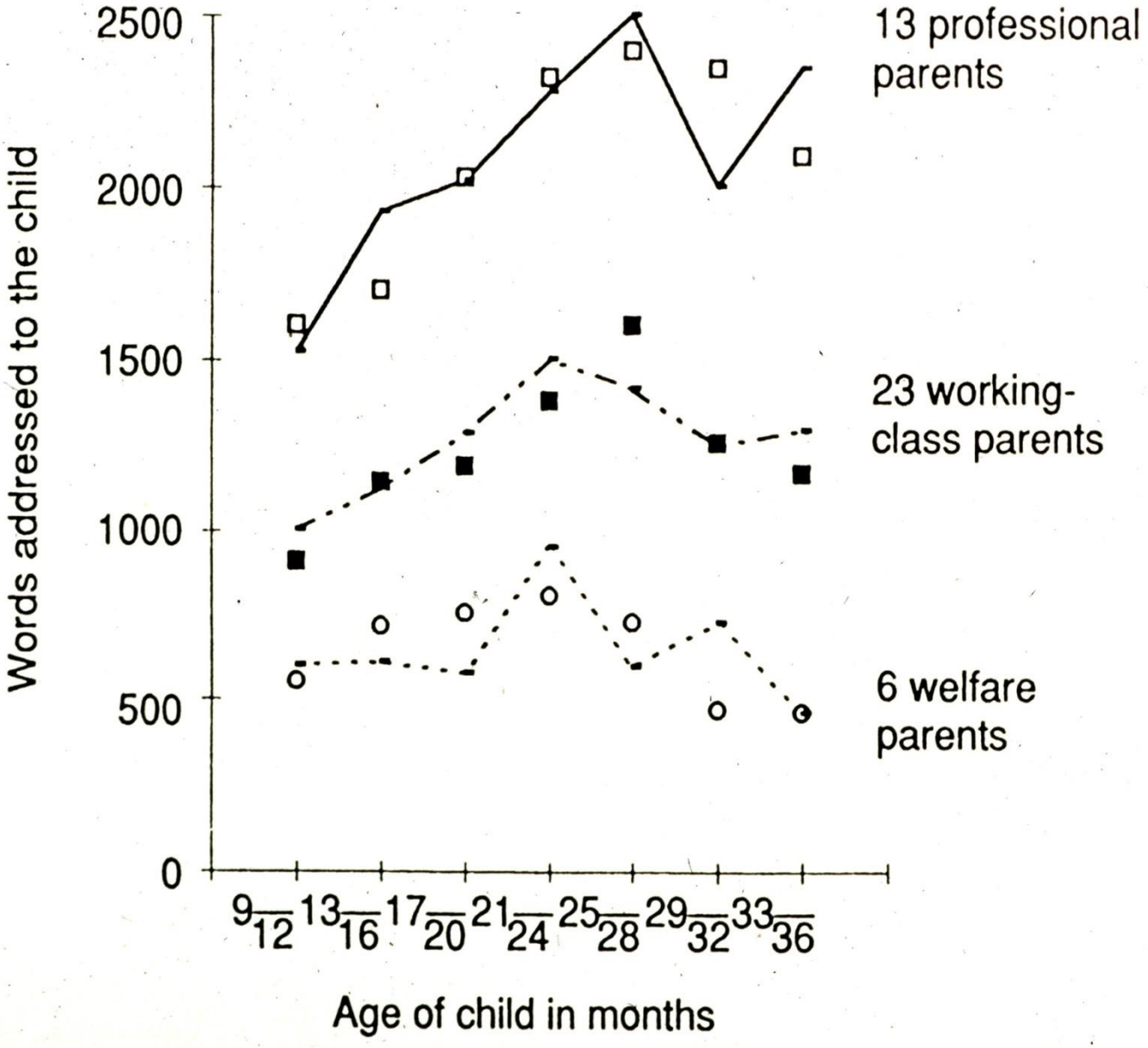


Source: Mathews TJ, MacDorman MF. Infant mortality statistics from the 2003 period linked birth/infant death data set. National vital statistics reports; vol 54 no 16. Hyattsville, MD: National Center for Health Statistics. 2006.

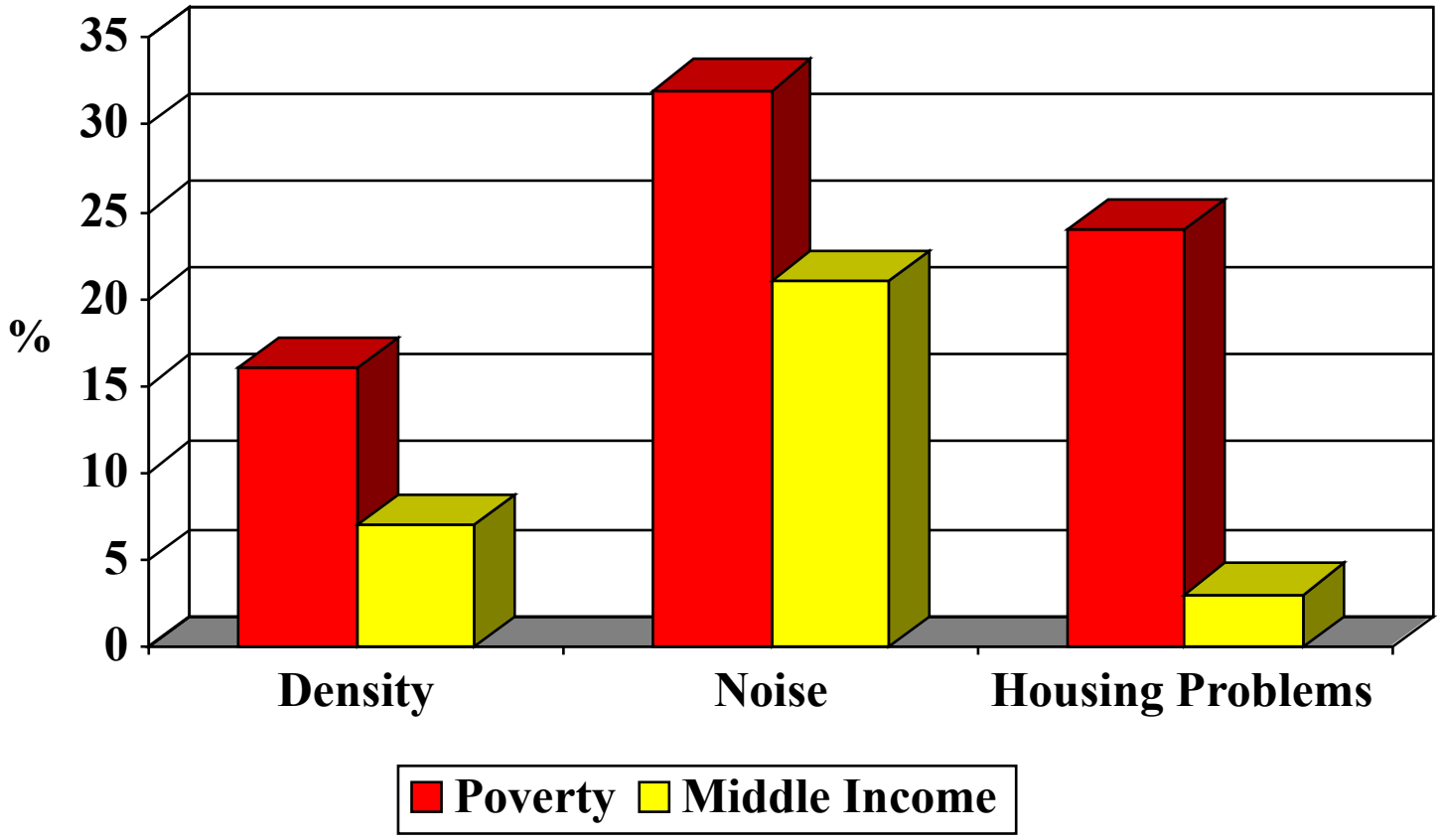
Prevalence of Health Problems in Children



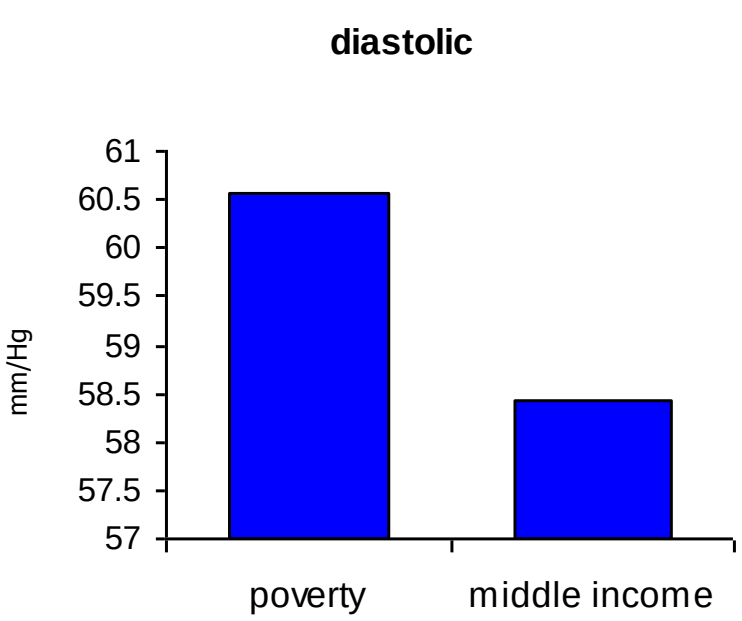
Psych Bull. 2002;128:295-329

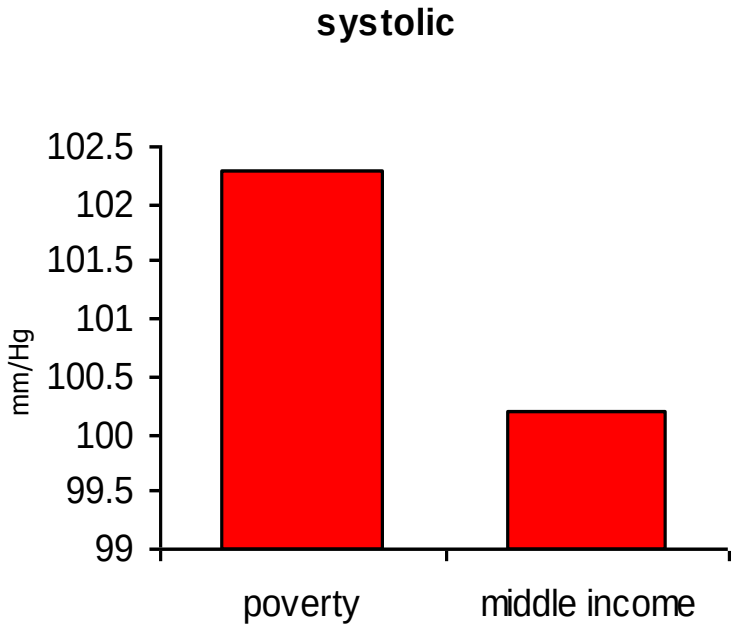

2500
2000
1500
1000
500
0
Words addressed to the child
13 professional parents
23 working-class parents
6 welfare parents
9/12 13/16 17/20 21/24 25/28 29/32 33/36
Age of child in months

Socio-economic Adversity & Stressor Exposure



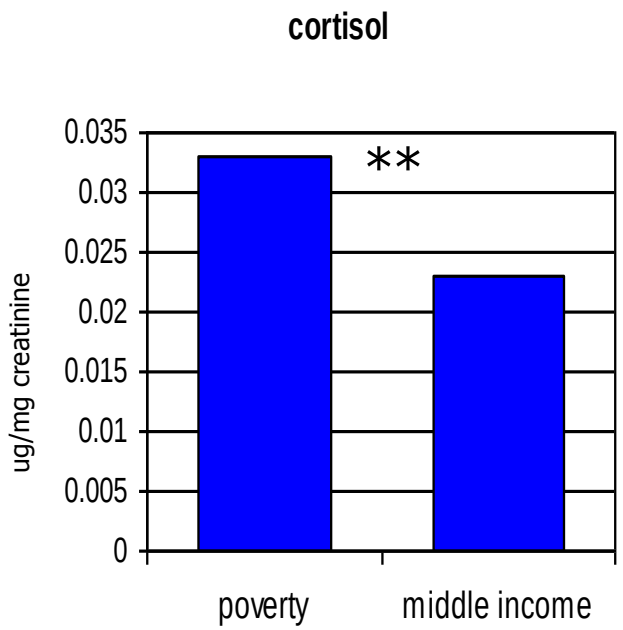
Childhood Poverty & Resting Blood Pressure

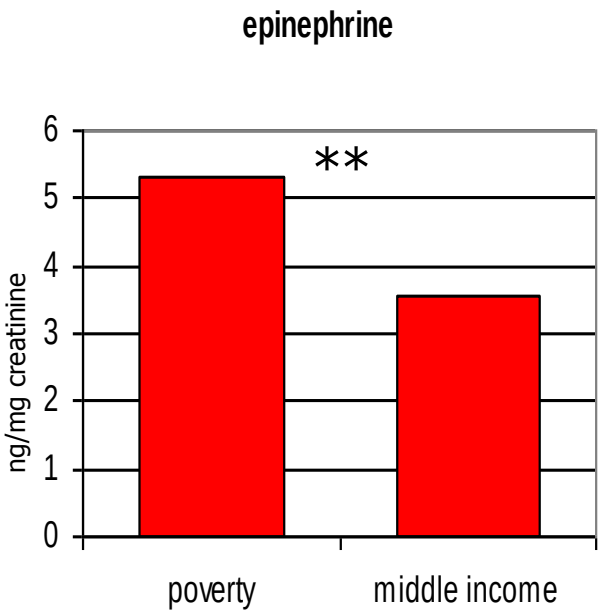


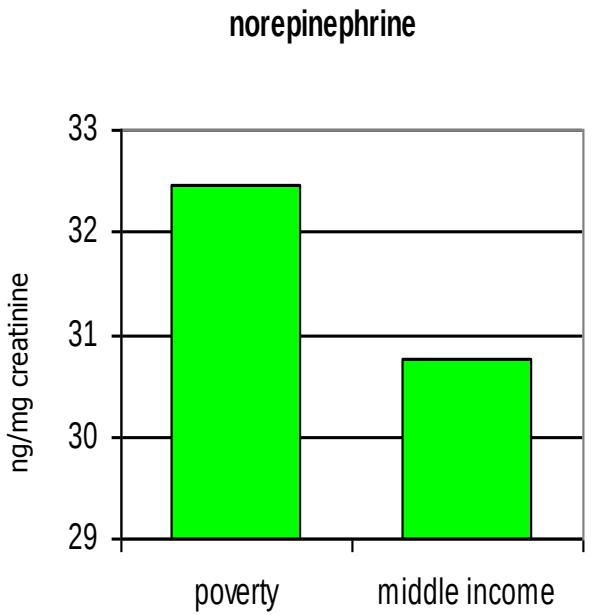


Childhood Poverty & "Stress" Hormones

Overnight hormone levels in rural dwelling 8 to 10 yr. olds:



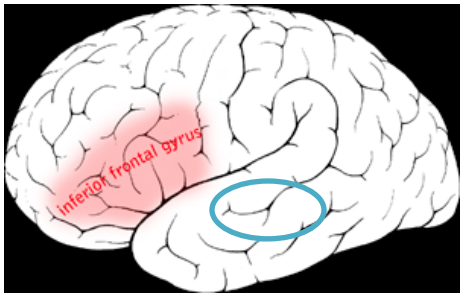




** $p < .01$

Evans & English, 2002

Language System



- Lower scores on vocabulary test
- Less hemispheric specialization in the left inferior frontal gyrus
- Correlation between left fusiform gyrus activity and phonological awareness in low SES children. Not found in high SES children.

Kishiyama et al., 2008; Raizada et al., 2008; Noble et al., 2007

Emotional Processing Regions

ACC, caudate nuclei, amygdala, insula, mPFC, Hpc

- Smaller ACC and caudate nuclei
  - Adults with early life stressors including poverty
- Greater amygdala activity
  - College students with parents of lower education, income, occupational prestige
- Reduced gray matter volume in the pACC
  - Adults with lower subjective social status
- Smaller hippocampal and amygdala volumes.
  - The effects of poverty on hippocampal volume were mediated by stressful life events

Cohen et al., 2006; Gianaros et al, 2007, Gianaros et al., 2008 Luby et al 2013

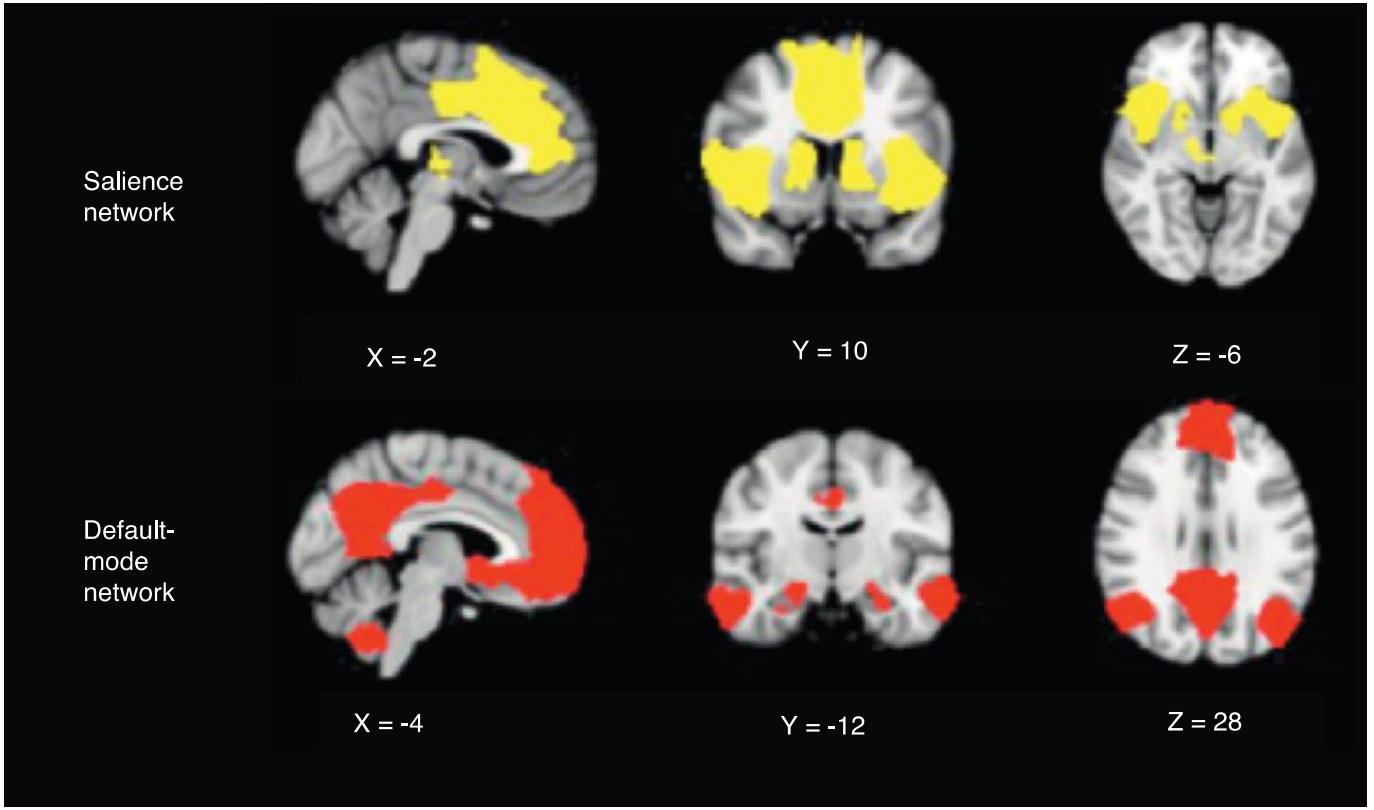
Emotional reactivity and regulation studies

- Resting state connectivity – Intrinsic large scale networks
- EFAT – emotional response to facial expression
- SEAT – emotional regulation by attention and cognitive appraisal mechanisms
- ERT – effortful/volitional emotional regulation by cognitive re-appraisal

Participants

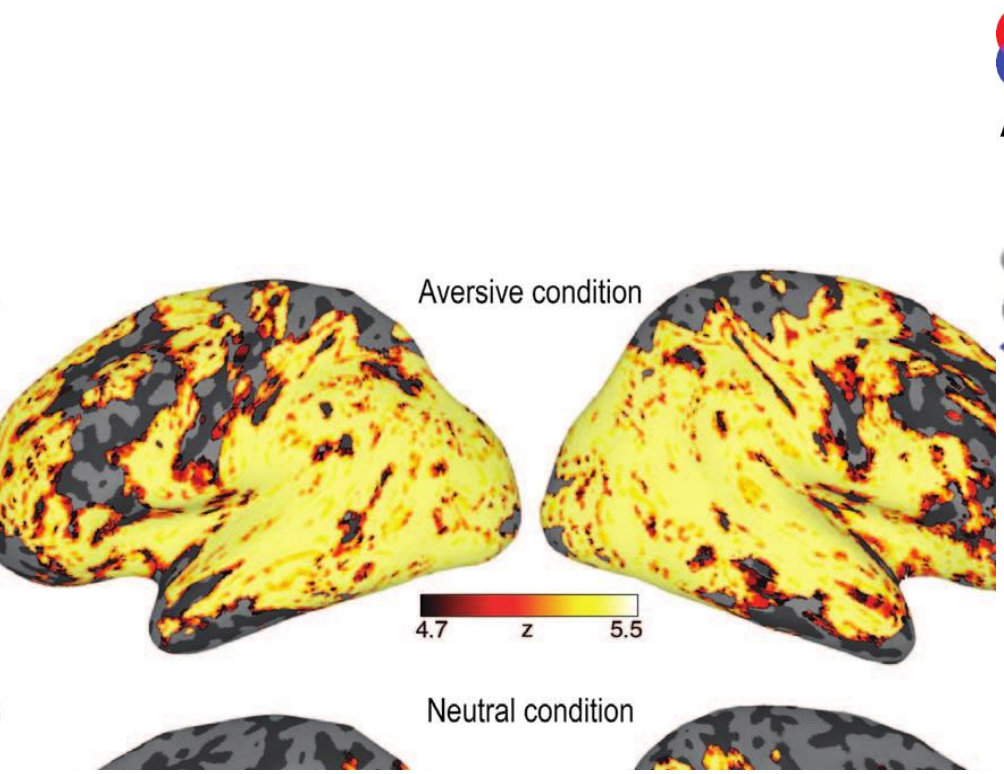
- 54 subjects with low and middle SES participated in the study.
- The experiment was of a counter-balanced, within-subject design.
- Two days of experiments were scheduled, and subjects engaged TSST before task on one of two days.
- Of 54 subjects, 51 subjects completed the SEAT and SEAT TSST.
- Finally, data of 23 subjects with low SES (15men and 10women aged 24.2±1.2y) and 26 subjects with mid SES (13 men and 13 women, aged 23.2±1.2y) were analyzed.

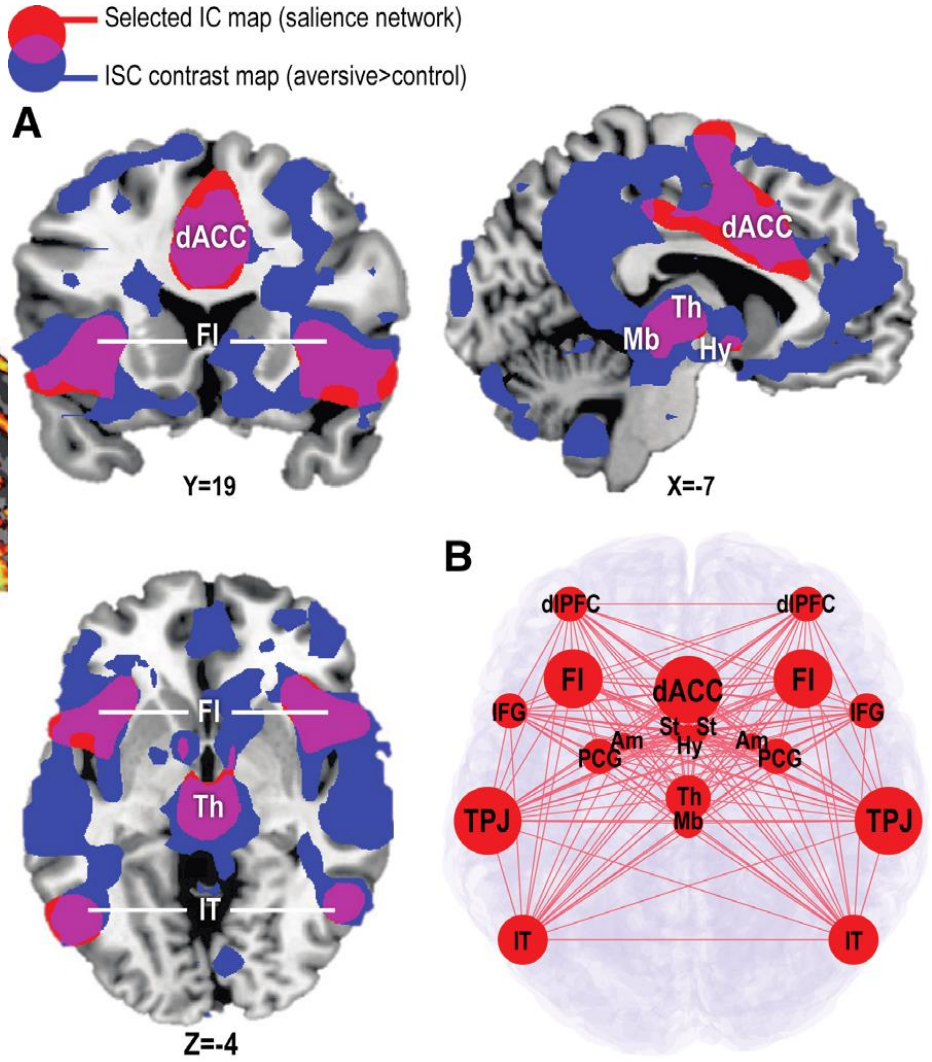
Salience Network and Default Network



Menon 2011 TICS

Acute stress increases SN connectivity

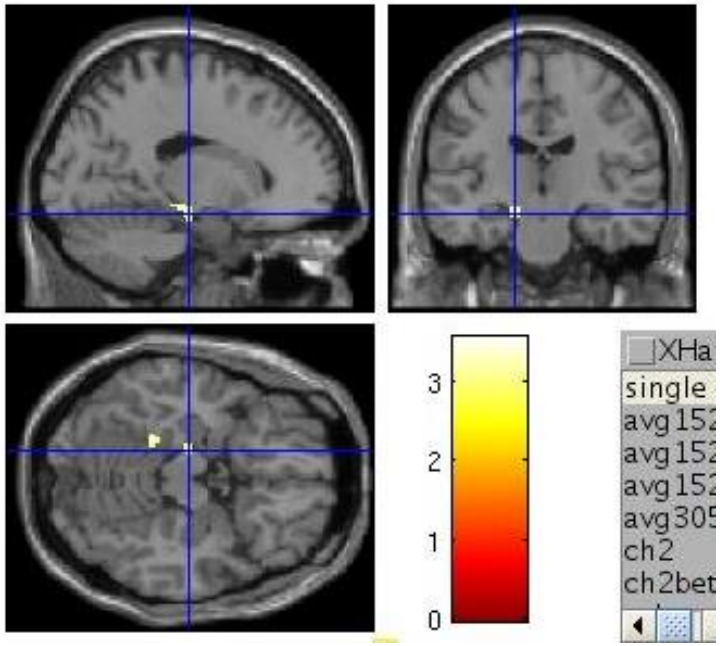




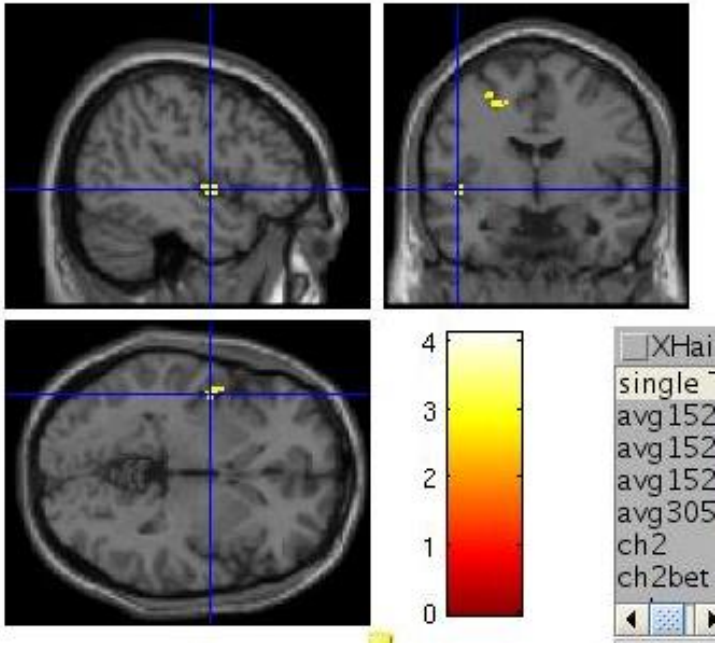
Hermans 2011 Science

Poverty effects on DMN and SN connectivity

PCC – Hpc connectivity
DMN
(Mid SES > Low SES)



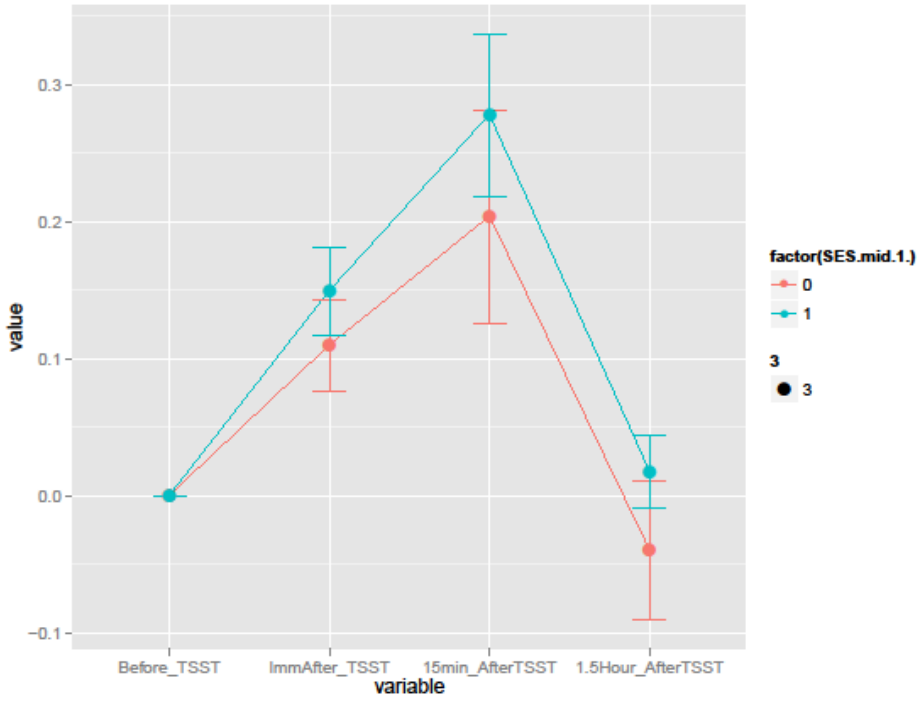
ACC – Insula connectivity
SN
(Low SES > Mid SES)



Childhood Poverty and Stress Reactivity Are Associated with Aberrant Functional Connectivity in Default Mode Network

Sripada et. al. Neuropsychpharmacology April 2014

TSST effects on Cortisol change levels (normalized)



Pre-TSST cortisol levels were greater in the Childhood Poverty group than (t=3.14, p=0.003).

Across groups, lower connectivity within PCC (reduced within-DMN coupling) was associated with higher pre-TSST cortisol (r=−0.299, p=0.049).

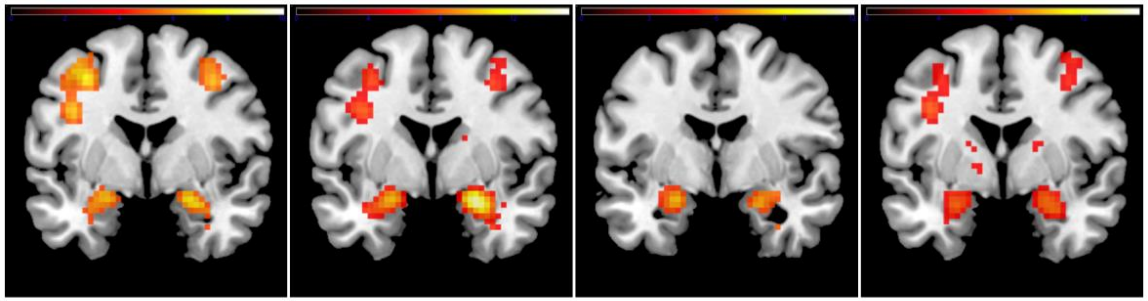
Summary

- Childhood poverty associated with
  - reduced within-DMN connectivity
  - increased within-SN connectivity
- These, in turn, were associated with higher cortisol levels in anticipation and response to social stress, respectively.
- Reduced within PCC connectivity associated with:
  - Greater CORT in anticipation of TSST (r=-.339, p=.024)
- Increased dACC to insula connectivity associated with:
  - Greater CORT immediately (r=.388, p=.008) and after 15 minutes after TSST (r=.366, p=.015)
  - Greater score on perceived stress scale (r=.314, p=.032)
- The results suggest a possible brain basis for exaggerated threat sensitivity, especially under stress in individuals with impoverished backgrounds

Emotional Faces Assessment Test

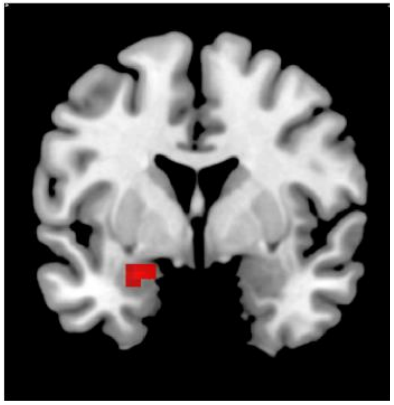
Fearful Faces

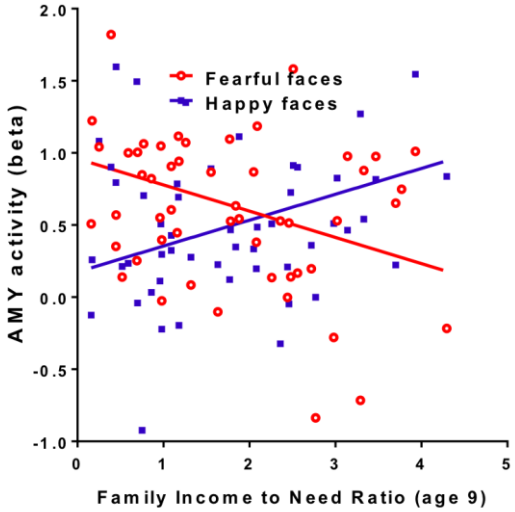
Happy Faces

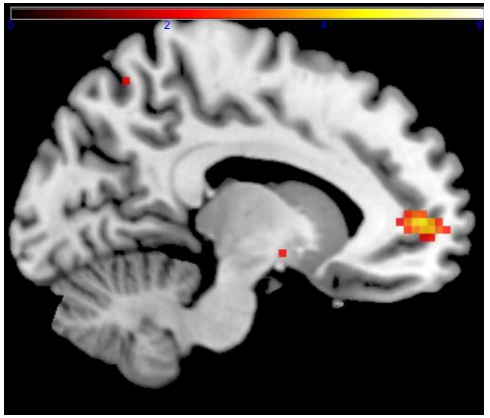


Angry-Shapes | Fearful-Shapes | Happy-Shapes | Neutral-Shapes

EFAT results





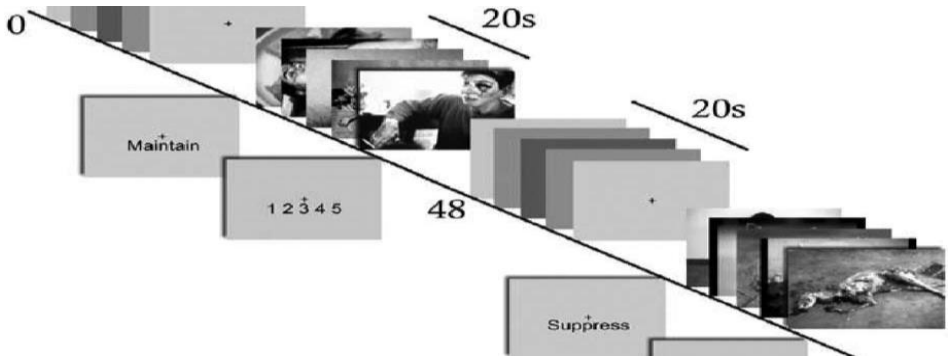


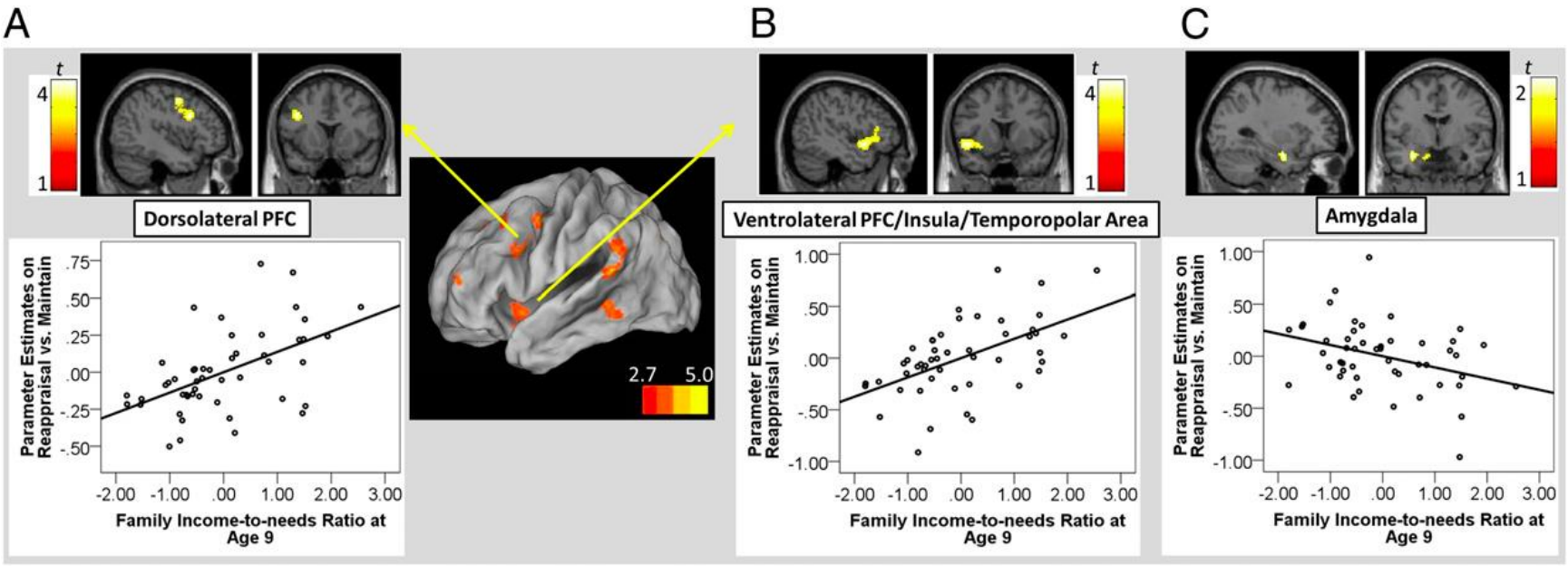
Childhood low SES predicted greater amygdala reactivity to fearful faces while a higher childhood SES amygdala reactivity to happy faces.

Amygdala reactivity to fearful faces vs happy faces followed a childhood SES gradient in regression analysis suggesting “negative bias” in subjects with lower SES

Increased connectivity between left amygdala and mPFC in higher SES subjects, suggestive of a more effective emotion regulation

Emotional Regulation Task - ERT





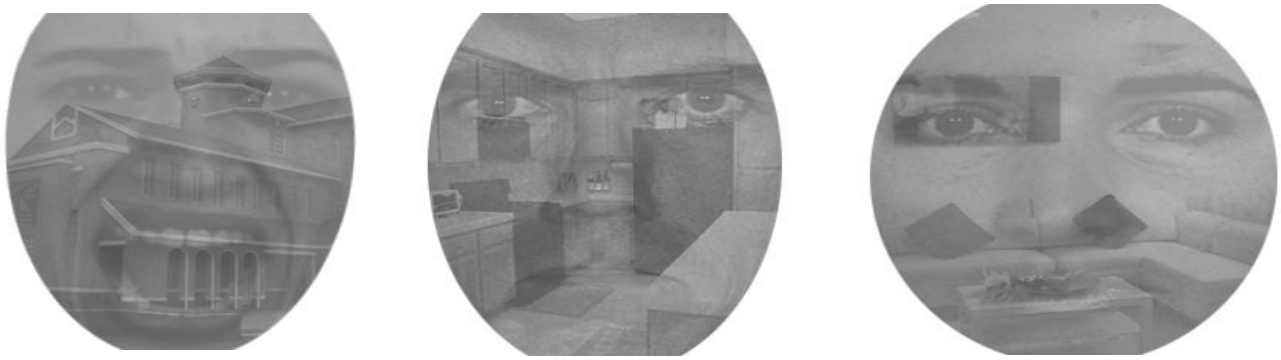
Effects of childhood poverty and chronic stress on emotion regulatory brain function in adulthood Kim et al *Proc. Nat. Acad. Sc.* October 2013

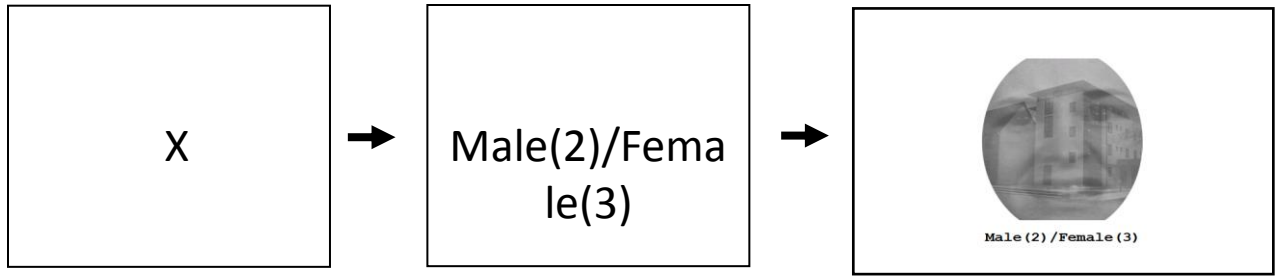
Main Findings

- During emotion regulation with cognitive reappraisal, lower family income at age 9 was associated with reduced activity in the adult DLPFC and VLPFC but increased amygdala activity.
- When the individual's stress history was incorporated into our model, exposure to chronic stressors throughout childhood (i.e., ages 9 – 17) mediated the links between family income at age 9 and reduced adult DLPFC and VLPFC activity.
- Furthermore, the mediating role of chronic stressor exposure in childhood may help account for the link between childhood poverty and adult neural functions, which may contribute to physiological and psychological stress regulation difficulties.

Shifted-Attention Emotional Appraisal Task (SEAT)

- Superimposed pictures: Face on Building
  - **Face Type**: Angry, Fearful, and Neutral of 20 individuals
  - Building: Indoor or Outdoor, 10 pictures each





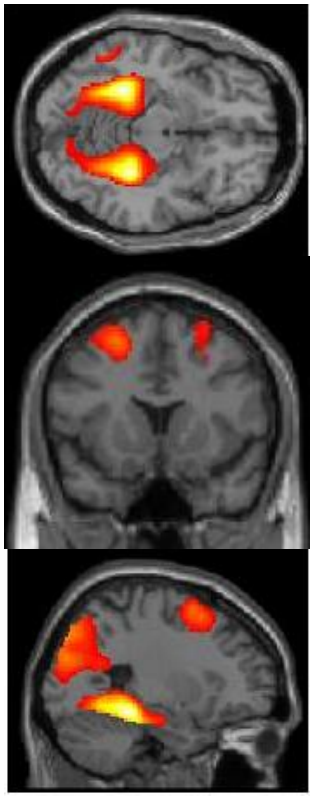
3-8 seconds

750ms + 250ms blank screen

1.5 seconds

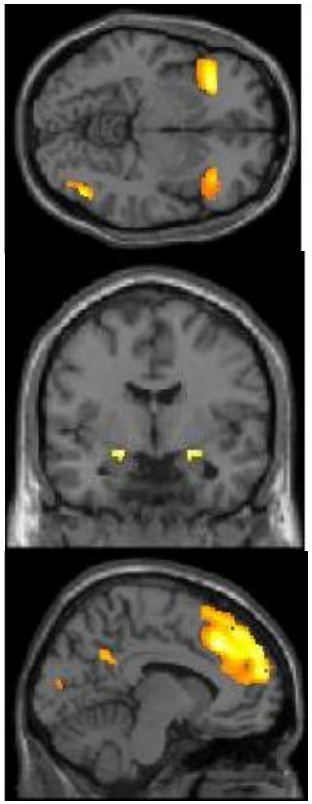
Fig 1.

Indoor or Outdoor?



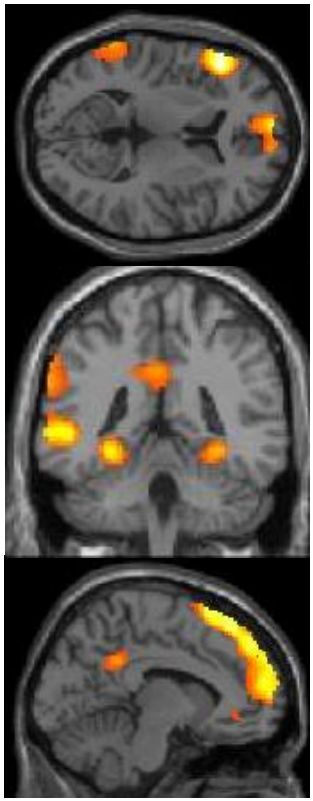
Shifting attention to places

Male or Female?



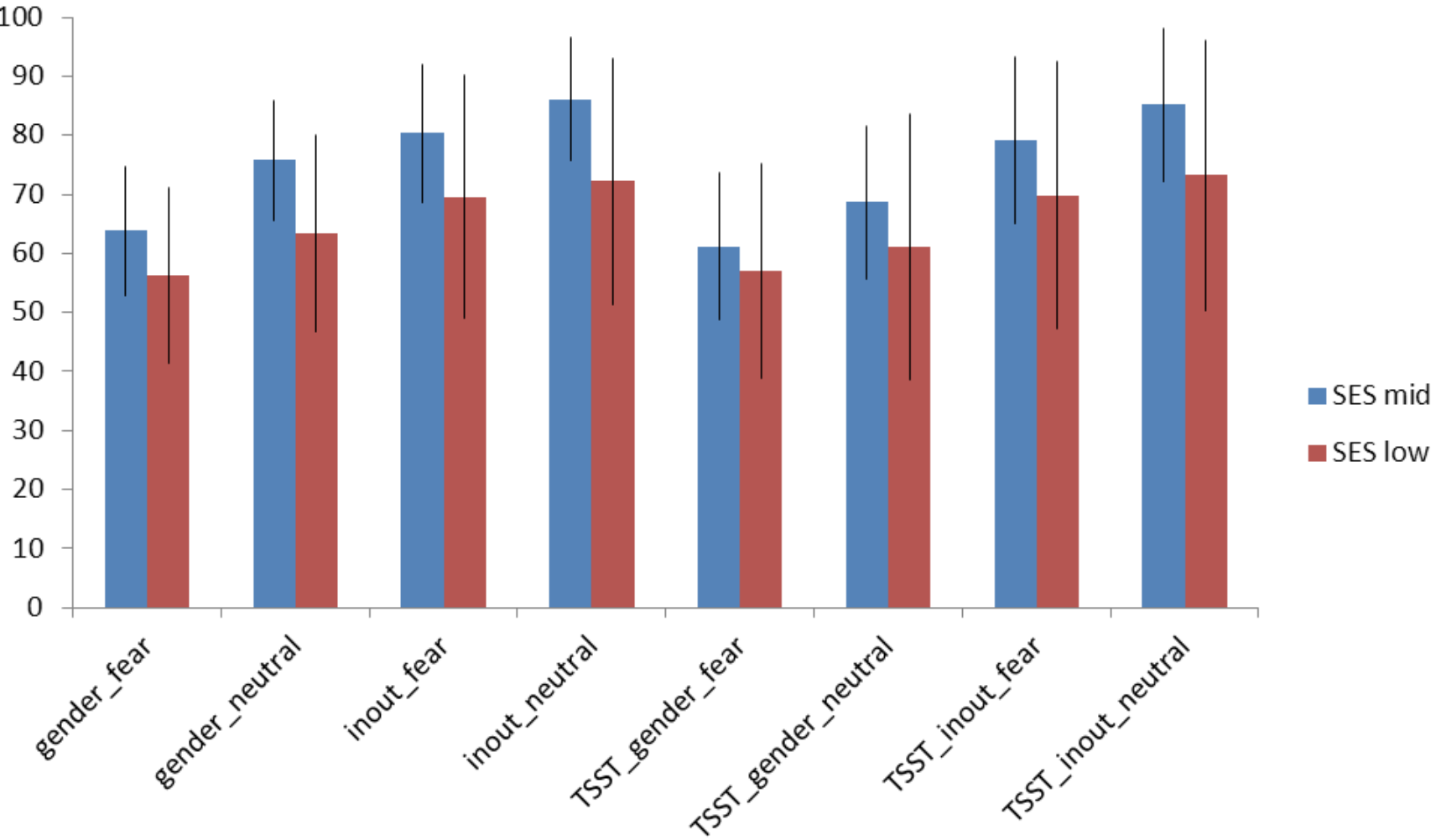
Implicit emotion processing

Like or Dislike?

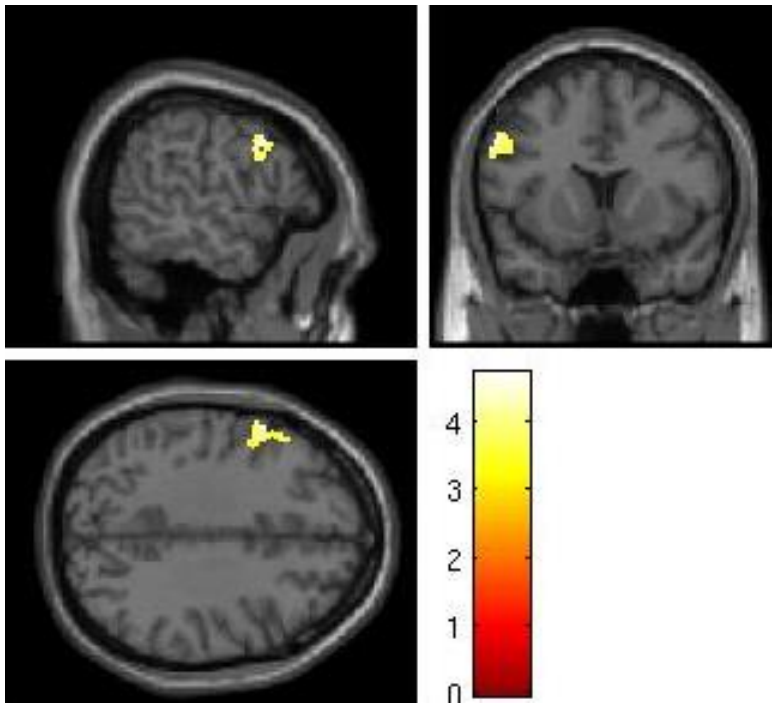


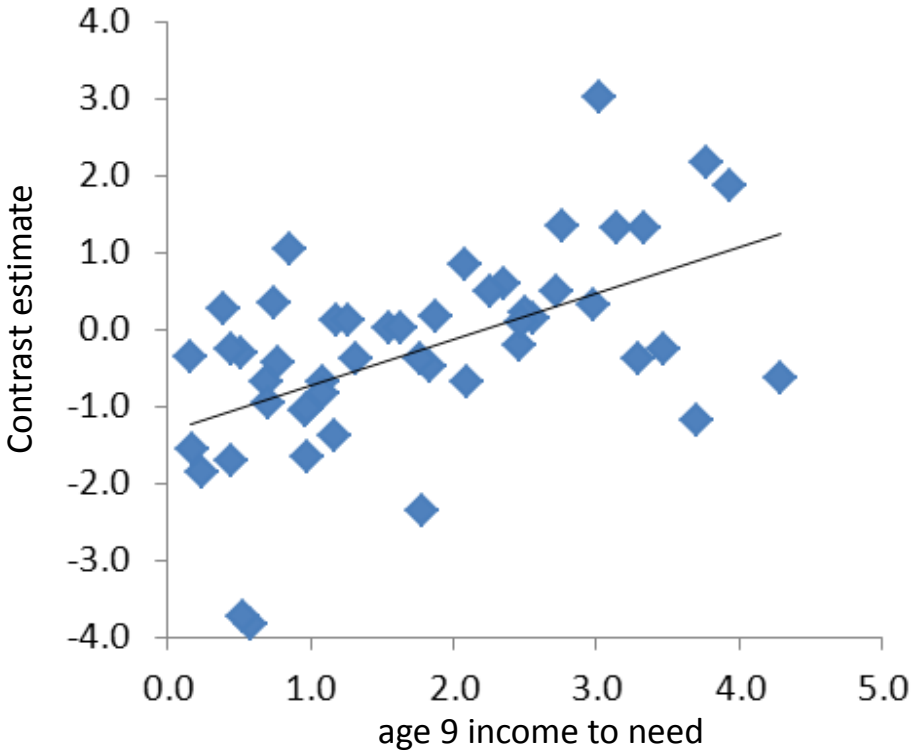
Cognitive appraisal

Accuracy results



Main effect of task < 0.001 **Main effect of emotion < 0.001 Main effect of group = 0.010** (4 way repeated measures ANOVA)

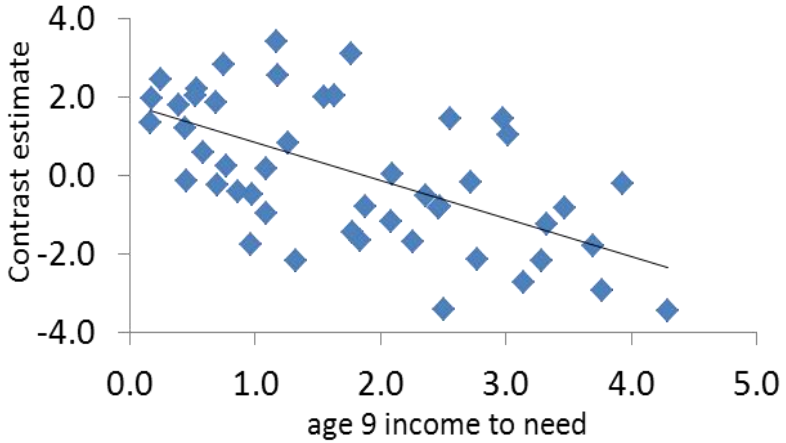




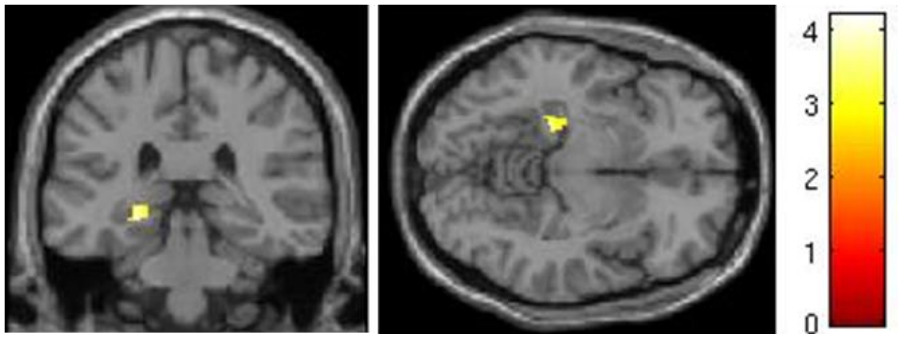
left IFG (BA9) activation during appraisal (Like/Dislike – Male/Female) was positively correlated with childhood income. Scatter plot shows the contrast estimates extracted from the cluster correlating with the childhood income.

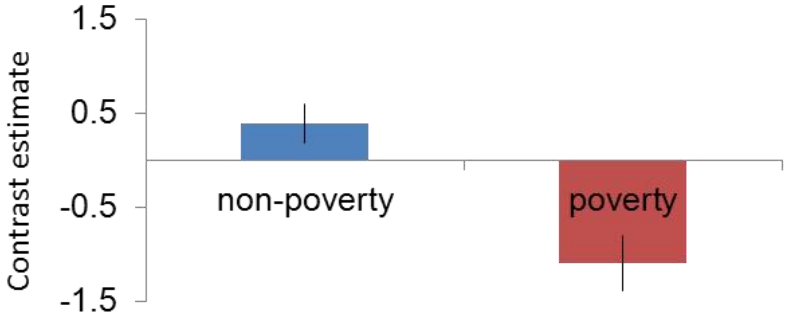
The more childhood income the more left IFG was activated during appraisal.

Effects of Stress/TSST

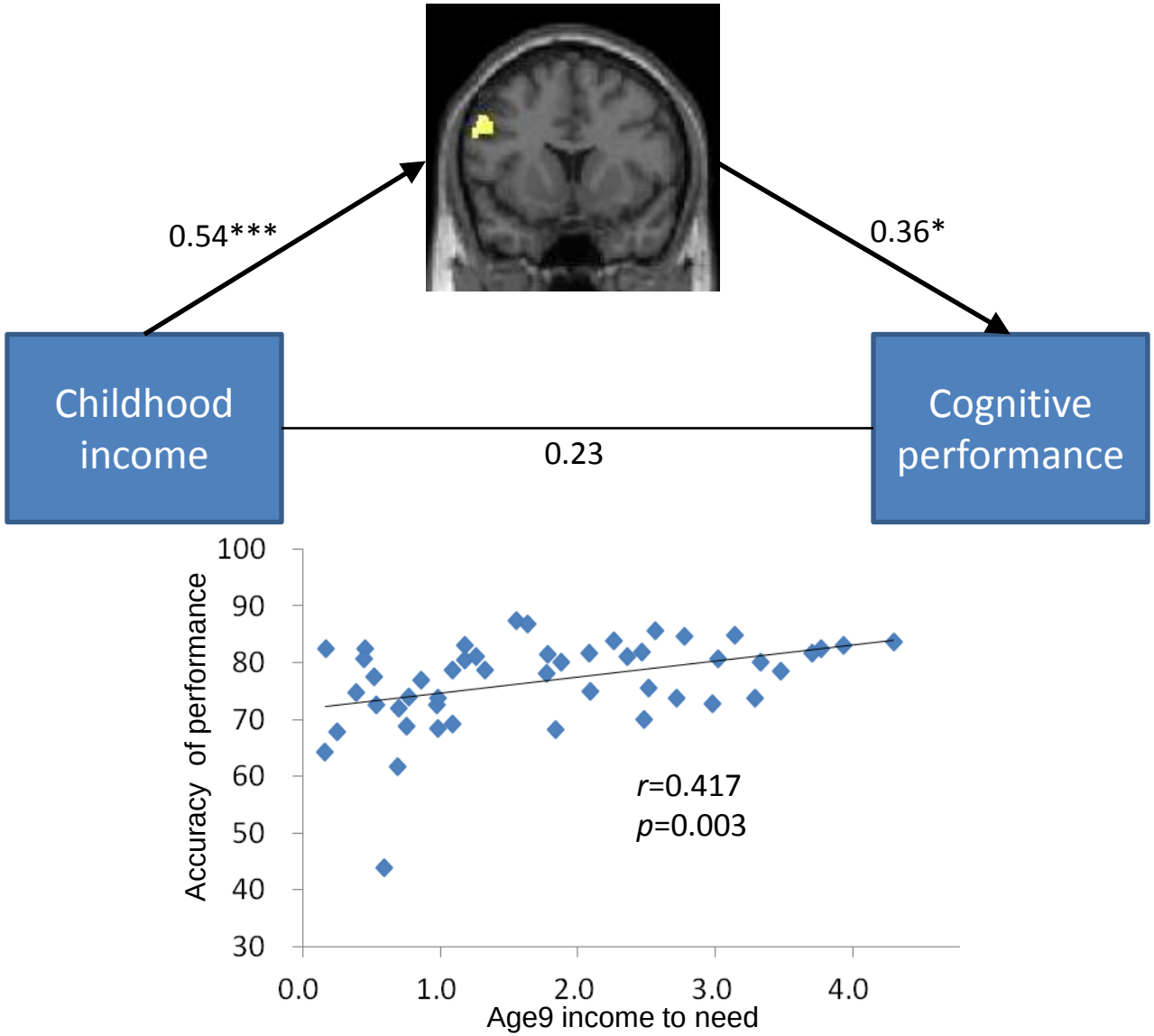


Childhood income negatively correlated with stress induced change (Male/Female-Indoor/Outdoor)×(stressed – non-stressed) in insula. The less childhood income the more insula activation was enhanced by stress.





Stress decreased appraisal associated activation (Like/Dislike – Male/Female) ×(stressed – non-stressed) in hippocampus in poverty group Stress reduced hippocampus activation in poverty group.


0.54***
0.36*
Childhood income
0.23
Cognitive performance
Accuracy of performance
100
90
80
70
60
50
40
30
0.0
1.0
2.0
3.0
4.0
Age9 income to need
r=0.417
p=0.003

Summary SEAT

• Childhood poverty was associated with decreased accuracy of gender and place identification

• Independent of stress it was associated with decreased recruitment of IFG/lDLPFC during appraisal

•Childhood poverty interacted with stress leading to higher Insula and lower hippocampus signals – i.e. favors emotion generation as opposed to emotion regulatory regions

•The Poverty –sensitive changes in IFG mediated the effects of childhood poverty on adult cognitive performance

Summary – Emotional Reactivity (Resting State and EFAT)

- Childhood poverty associated with: 1) increased within-SN connectivity, and 2) reduced within-DMN connectivity

- These, were associated with higher cortisol in anticipation and response to stress, respectively. Possible brain basis for higher threat sensitivity, especially under stress in individuals with impoverished backgrounds

- Amygdala reactivity to fearful faces vs happy faces followed a childhood SES gradient in regression analysis suggesting “negative bias” in subjects with lower SES

- Increased connectivity between left amygdala and mPFC in higher SES subjects, suggestive of a more effective emotion regulation

Summary – Emotional Regulation (ERT and SEAT)

- Childhood poverty is associated with with decreased recruitment of IFG/lDLPFC during implicit emotional regulation appraisal, which also mediated effect of childhood poverty on cognitive performance

- Childhood poverty interacted with stress leading to higher signal in Insula and decreased signal in Hippocampus favoring emotion generation as opposed to emotion regulatory regions

- Childhood poverty is associated with reduced activity in the DLPFC and VLPFC but increased amygdala activity, during volitional emotion regulation with cognitive reappraisal.

Thank You