Effects of poverty on the developing brain

Martha J. Farah
University of Pennsylvania
On April 17, 1997, the President and First Lady hosted The White House Conference on Early Childhood Development and Learning: What New Research on the Brain Tells Us About Our Youngest Children. The day-long conference highlighted new scientific findings on brain development in very young children and points to the importance of children's earliest experiences in helping them get off to a strong and healthy start and reach their full potential.

Clinton Administration Commitment to Young Children. The Clinton Administration has invested heavily in research to help us...
15 years of cognitive, affective and developmental neuroscience
Why apply neuroscience to problems of child poverty?

• Understanding human behavior is hard – need all the sources of understanding you can get!

• There are principles and mechanisms at work that are, at root, neural

More later…
Low SES

Raise children in poverty

Grow up to become

Compromised physical and mental health
Initial questions

• What aspects of brain function differ between children raised in poverty and children who are non-poor?

• By what mechanisms do these differences emerge?
Task battery approach: Sets of tasks from imaging literature used as probes for system integrity

- Occipitotemporal/pattern vision
- Parietal/spatial cognition
- Medial temporal/memory
- Left perisylvian/language
- Prefrontal/executive
  - DLPFC/working memory
  - ACC/cognitive control
  - VMPFC/reward processing
Over three initial studies...

- Different ages, tasks -> generally consistent results
- SES disparities uneven
- Small borderline significant effects found in most systems
- Strongest relationships to:
  - Language (all 3 studies)
  - Executive function (esp cognitive control and working memory) (all 3 studies)
  - Declarative memory (2 out of 3 studies)
Direct measures of brain structure
Direct measures of brain structure

- Prefontal cortex (EF) (from Lawson et al, in press)
Direct measures of brain structure

- Hippocampus (memory) (from Noble et al, in press and Hanson)
Why?

- Somatic factors: nutrition, environmental toxins, natal and prenatal factors
- Psychological factors include:
  - Stress
  - Parenting
  - Cognitive stimulation
Language and Memory differences

Middle schoolers from Hallam Hurt’s longitudinal study of GCE HOME visits at ages 4 and 8
- Cognitive Stimulation composite
- Parental Nurturance composite
Also prenatal substance exposure, mother’s IQ, as well as child’s gender, current age
Results

• Language:
  – Environmental stimulation matters
  – Sole factor (along with the child’s age at language testing)

• Memory:
  – Parental nurturance matters
  – Sole factor in forward regression (and strongest factor in backward, along with effects of prenatal substance exposure and the child’s age at memory testing)

Effect of early experience on hippocampal volume
Parental nurturance, not cognitive stimulation (no gender effect or interaction)
Why does parental nurturance affect memory and hippocampus?

- Maternal care buffers pups’ hippocampi from effects of stress, resulting in
  - Better memory
  - Better stress response
Direct test of effects of parental nurturance on human stress response

Arrive, 25 min baseline rest period (watch Dr. Doolittle)

Prepare and give 3-minute talk: Why should someone hire you for a summer job?

Serial subtraction for 3 minutes

Remain in quiet room for 75 min and finish watching Dr. Doolittle

Saliva samples throughout
Early experience
Parental nurturance, not cognitive stimulation (no gender effect or interaction)

(a) Reactivity (AUC-I) vs Parental Nurturance

(b) Cortisol (µg/dL) vs Minutes from baseline

Daniel Hackman et al. (under review)
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• There are principles and mechanisms at work that are, at root, neural
• Mechanisms are basis for prevention, intervention
• Framing
Thank you

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