

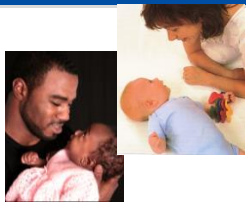


How the Brain and Mind Change with Parenthood: Implications for Interventions

Linda C Mayes, MD
Yale Child Study Center
October 7, 2014




Parenting as an Adult Developmental Stage

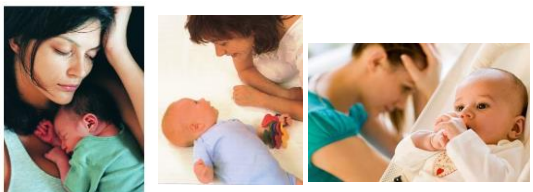



How minds are shaped in relationships & how relationships shape ability to care for others

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TRANSLATION OPPORTUNITY

How Prevention and Intervention Programs for Parents Can Be Informed by Basic Science of Parenting



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SLIDE 3

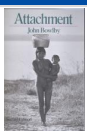
Intervention Themes Emerging from Basic Science

- Extending beyond parent "education"
- Focus on adult development
- Attachment based integrating mentalization /reflective functioning approaches
- Working with families with multi-generational difficulties including trauma, addiction, and related problems
- Including focus on adult skills

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SLIDE 4

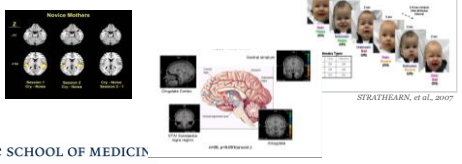
Basic Science of Parental Attachment



Decades of work on impact of parental care on child health and development, but.....



How does becoming a parent impact adults' psychological and neuropsychological development?



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SLIDE 5

TEXTS OF PARENTING

"I do not believe it is possible to understand the functioning of the mother at the very beginning of the infant's life without seeing that she must be able to reach this state of heightened sensitivity...and recover from it."

"I can't quite describe it but something is different in me since she came into our lives. She is center of nearly every waking moment, my thoughts, my plans – and when I wake up at night, she's the first thought in my head. Everything I thought was important before has slipped down the list... Not only have I centered around her but somehow she has made me a different person...and I only want to be with her and attend to her every need"

D. Winnicott, 1956



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WHAT THESE TEXTS SUGGEST

- Becoming a parent is a developmental process
- With transition to parenthood, there is a change in attentional focus, investment, what is rewarding, and what is stressful
- State of being “preoccupied” both reflects change in mental “economy” by facilitating a shift in attention to reward/salience of infant
 - i.e., “enhanced signal detection” or sensitivity to infant cues (Rutherford & Mayes, 2011)



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Two critical pieces of parenting



Reward



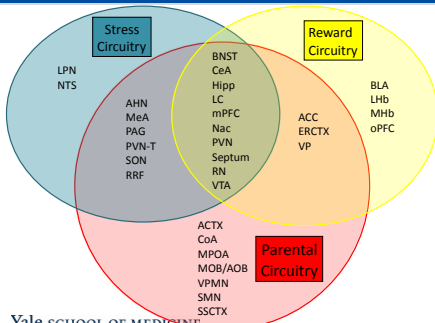
Stress



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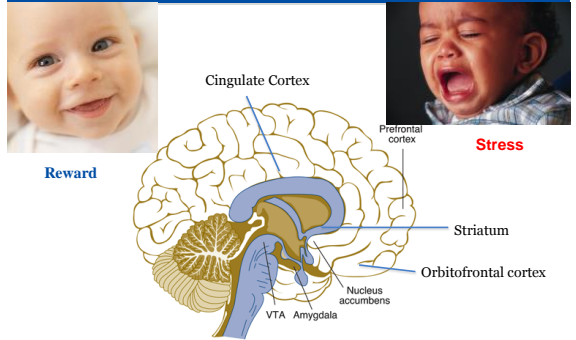
SLIDE 8

Overlapping circuits of reward, stress & parenting



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Child Study Center Rutherford, Williams, Moy, Mayes & Johns (2011)

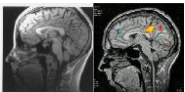
Stress and reward brain regions in parenting



SLIDE 10

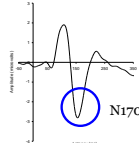
Measuring the adult brain: fMRI and EEG/ERP

Where?



Functional Magnetic Resonance Imaging (fMRI)

When?



Electroencephalography (EEG) / Event-Related Potentials (ERPs)



How do parents perceive infant expressions of emotion relative to non-parents?

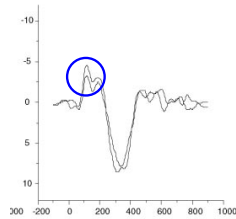


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SLIDE 12

Parents and Non-Parents: Cry Perception

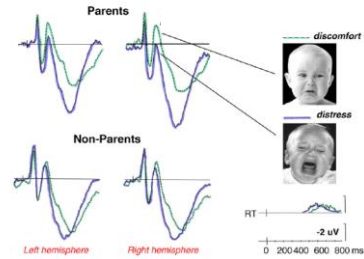
- ERPs heightened in mothers for infant cries compared to non-mothers (Purhonen et al., 2001; 2008)



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SLIDE 13

Parents and Non-Parents: Face Perception



ERPs are sensitive to parental status when viewing infant faces and to differences in facial affect (Proverbio et al., 2006)

SLIDE 14

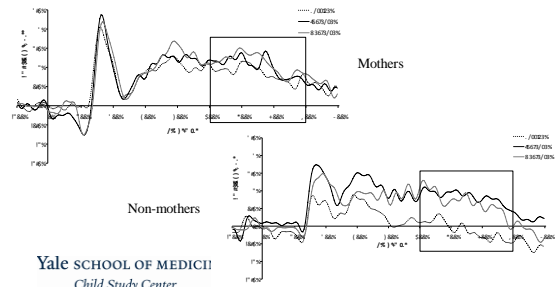
Parents and Non-Parents: Emotion Regulation

Instructions:
Passively watch
Up regulate
Down regulate

SLIDE 15

Evidence of Differences between Parents and Non-Parents

- LPP marker of emotion regulation differentiates mothers from non-mothers (Rutherford et al, under review)



What do we know about mothers and their brain responses to infant signals?

Happy, but not neutral or sad own-infant faces, activated nigrostriatal brain regions.



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SLIDE 17

OWN BABY VISUAL CUES ACTIVATE NEURAL REWARD CIRCUITS

Own vs Other: VTA/SN, striatum, mPFC, ACC, insula

Happy, but not neutral or sad own-infant faces, activated nigrostriatal brain regions.

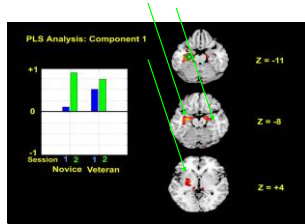
STRATHEARN, et al., 2008

SLIDE 18

MATERNAL CIRCUITS ENHANCED WITH EXPERIENCE

Functional relation between R hippocampus (memory) and regions related to reward and stress regulation

- Increasing connectivity for novice mothers between 2 wks -3 mos
- More modest increase for veteran mothers
- Experience based learning

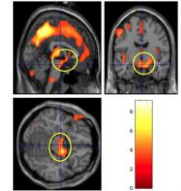


Analyses conducted by Leslie Jacobsen; Data from Swain, Leckman, Mayes, 2008

Gray Matter Change With Experience and Parental Investment (Kim, Leckman, Mayes, Feldman, Wang, & Swain, 2011)



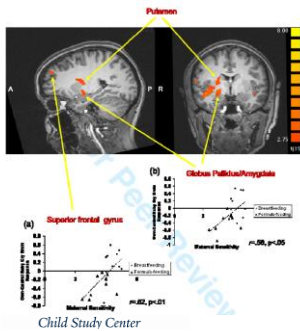
- Grey matter increase from 2-4 weeks to 3-4 months postpartum ($n = 19, p < .05, (FDR \text{ corrected}) > 100$ voxels)
- Grey matter increase from 2-4 weeks to 3-4 months postpartum predicted by mothers' positive perception of own baby at 2-4 weeks postpartum



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SLIDE 20

Predicting Maternal Sensitivity at 3-4 months with neural response to infant cries (Kim, Feldman, Leckman, Mayes, and Swain, 2011, JCPP).



- Measured neural response to own vs other infant cry at 2-4 weeks postpartum
- Maternal sensitivity at 3-4 months postpartum positively correlated with activations in right superior frontal gyrus ($r=.62, p < .01$), and right lateral globus pallidus/amygdala ($r=.53, p < .05$)

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Key Points

- Consistent differences with parents vs non – parents in patterns of neural response
- Activate components of reward circuitry
- Own infant especially salient & motivating
- Negative cues such as cries activate both reward as well as stress systems
- May be consolidation/changes in connectivity in circuitry over time with exposure to infant

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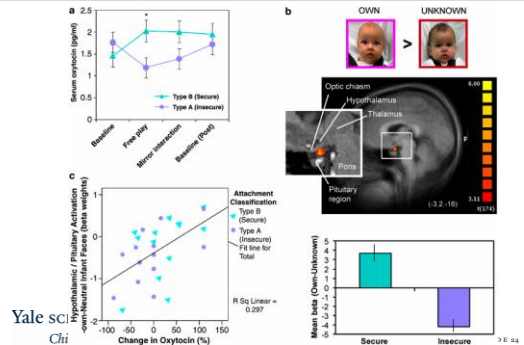
SLIDE 22

SOURCES OF INDIVIDUAL DIFFERENCES IN MATERNAL RESPONSE TO INFANT CUES

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SLIDE 23

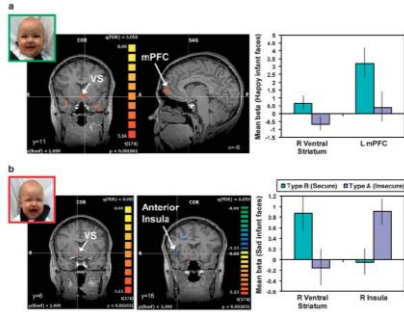
Oxytocin and Attachment Security Predicts Striatal Response (Strathearn, et al, 2010, Pediatrics)



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Chi

SLIDE 24

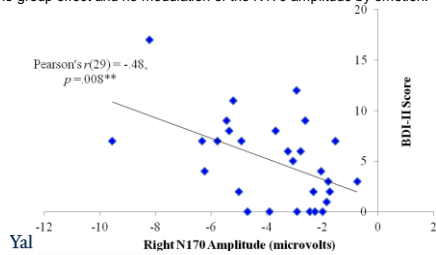
Differential Response to Infant Affect by Attachment Profile (Strathearn, et al, 2010)



SLIDE 25

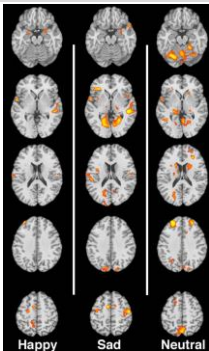
Maternal Mood and Infant Face Response (Noll, Mayes, & Rutherford, 2012)

Moms (17) and Non-moms (12); Viewed happy, sad, and neutral infant faces – no group effect and no modulation of the N170 amplitude by emotion.



SLIDE 26

Differences within parents: Substance use & fMRI

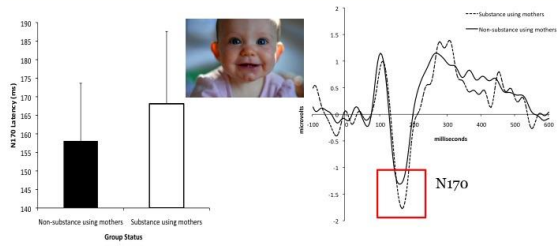


Substance users showed reduced activation in prefrontal regions, including the dorsolateral and ventromedial prefrontal cortices and limbic regions (Landi et al., 2011)



SLIDE 27

Differences within parents: Substance use & ERP



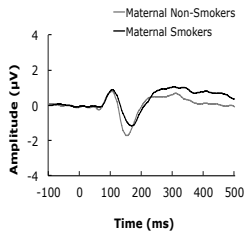
Substance users have slower response to infant faces (Rutherford et al, in prep)

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Smoking Versus Non-Smoking Mothers

- N170 delayed in smoking vs non-smoking mothers viewing infant faces
- Increasing nicotine dependence associated with increasing delay



Rutherford, et al, 2014, under review
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SLIDE 29

Tolerance of Infant Distress



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SLIDE 30

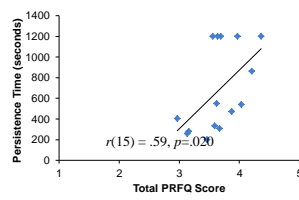
Katherine



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SLIDE 29

MOTHERS WITH HIGHER "MINDFULNESS" SKILLS PERSIST LONGER COMFORTING A "SIMULATED" BABY



Time with simulator associated with increases in heart rate ($p=.016$) and systolic blood pressure ($p=.002$) pre- compared to post-interaction

Simulator Performance

- Positive correlation between persistence times and total parental reflectiveness score

Rutherford, et. al., 2012, under review

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SLIDE 30

Key Points



- Number of sources of individual differences in changes in parental sensitivity at neural & behavioral level
- Addiction reduces parental sensitivity to infant cues (and enhances parental stress)
- Parental capacity to respond to infant's stress (e.g., crying) also related to own ability for reflectiveness (and emotion regulation)

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TRANSLATION OPPORTUNITY

How Basic Science of Detecting and Responding to Infant Emotion Refines Prevention and Intervention Programs for Parents

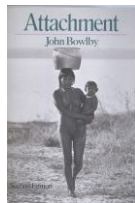


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SLIDE 34

The adult transition to parenthood

- Becoming a parent brings a change in mental "economy" with a shift in attention ("enhanced signal detection" or sensitivity to infant cues—greater reward) and increased emotional responsiveness



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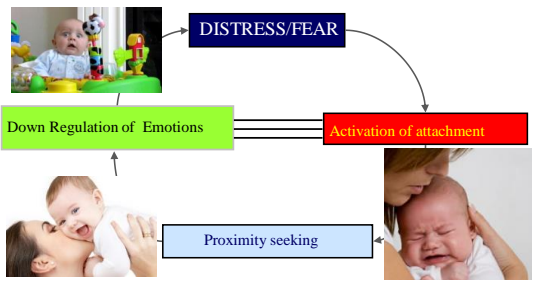
A Common Parenting Story



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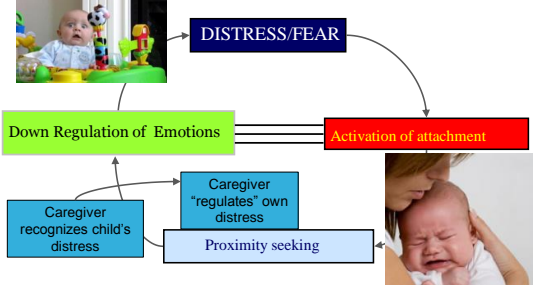
SLIDE 36

Attachment Models



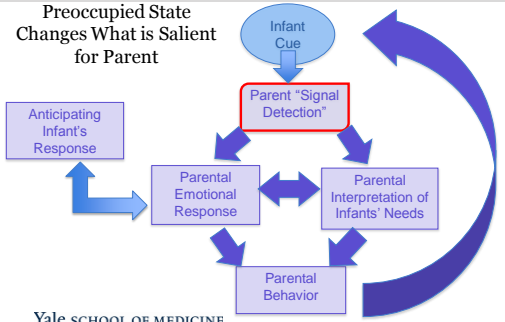
*Luyten, P., Mayes, L.C., Fonagy, P., & Van Houdenhove, B. (2012). The interpersonal regulation of stress. Yale SCHOOL OF MEDICINE Child Study Center SLIDE 37

Opening up the "Blue Box"



*Luyten, P., Mayes, L.C., Fonagy, P., & Van Houdenhove, B. (2012). The interpersonal regulation of stress. Yale SCHOOL OF MEDICINE Child Study Center SLIDE 38

Parenting Side of Attachment Response



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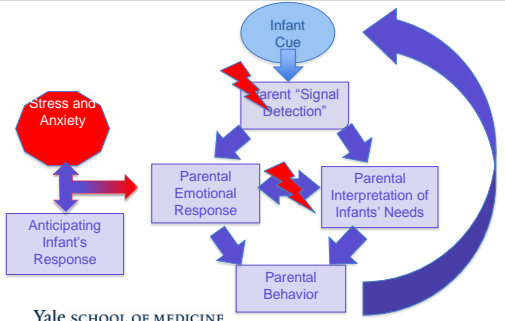
THREATS TO CHANGING PARENTAL MENTAL ECONOMY

- Early Adversity in Parent's Own Childhood Impacting Stress & Reward Response Systems
- Current or Chronic Depression, Addiction, Anxiety
- Chronic Stress related to Poverty, Domestic Violence



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How Early Adversity/Chronic Stress Disrupts Parental Responding



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MATERNAL DEPRESSION

"I can't quite describe it but something is different in me since she came into our lives. She is center of nearly every waking moment, my thoughts, my plans - and when I wake up at night, she's the first thought in my head. Everything I thought was important before has slipped down the list... Not only have I centered around her but somehow she has made me a different person...and I only want to be with her and attend to her every need"

"I started to experience a sick sensation in my stomach; it was as if a vise were tightening around my chest. Instead of the nervous anxiety that often accompanies panic, a feeling of devastation overcame me. I hardly moved. Sitting on my bed, I let out a deep, slow, guttural wail. I wasn't simply emotional or weepy, like I had been told I might be. This was sadness of a shockingly different magnitude. It felt as if it would never go away."

New mother 2011



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from "Down Came the Rain: My Journey Through Postpartum Depression" (Brooke Shields)

CLINICAL FEATURES OF PARENTING IN MATERNAL DEPRESSION

- Attitudes toward Infant:
 - Infants perceived to be more bothersome
 - Make harsh judgments of infants
 - Feelings of guilt, resentment, & ambivalence toward infant
 - Increased risk for abuse
 - Ego dystonic thoughts of harming the baby (Miller, 2002)

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CLINICAL FEATURES OF PARENTING IN MATERNAL DEPRESSION

- Behaviors with Infant:
 - Gaze less at infant
 - Take longer to respond to infant's utterances
 - Show fewer positive facial expressions
 - Lack awareness of infant's cues
 - Alternate between flat affect, low activity level, & lack of contingent responding or alternating disengagement and intrusiveness

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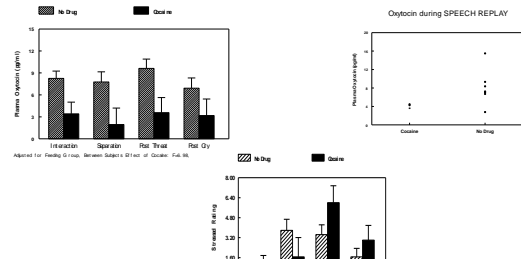
Parenting Behavior Among Substance Abusing Adults

- In human mothers:
 - Withdraw in face of infant distress
 - Less attentive to infant bids for attention
 - Less contingent responding or increased non-contingent behaviors
 - Higher rates of negative affect in interactions and heightened physical provocation and intrusiveness
- ? Each as markers of heightened stress in response to infant

Truman and Mayes, 2005
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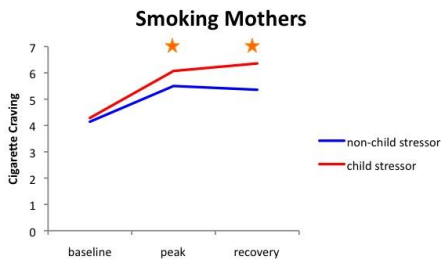
Cocaine-Using Mothers Show Diminished Oxytocin Response and Greater Perceived Stress in Response to Infant Cries



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Light et al. (2007)

Craving for Cigarettes



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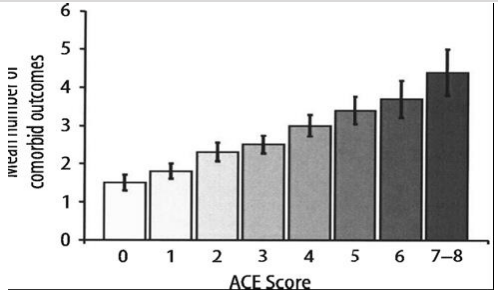
A Hypothesis

Common across a number of psychopathologies associated with impaired parenting is a dysfunction/dysregulated stress response and a history of early adversity

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Cumulative Early Stress and Later Outcomes

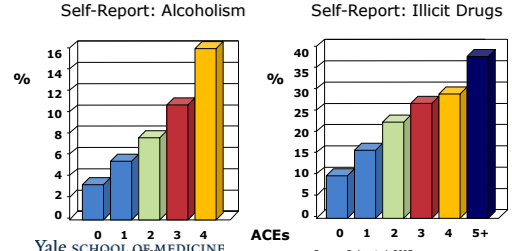


Anda, R.F. et al. (2006). The enduring effects of abuse and related adverse experiences in childhood: A conceptual model. *Psychology and epidemiology*. *Eur Arch Psychiatry Clin Neurosci*. 2006 Apr;256(3):174-86.
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SLIDE 49

NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD

Risk Factors for Adult Substance Abuse are Embedded in Adverse Childhood Experiences

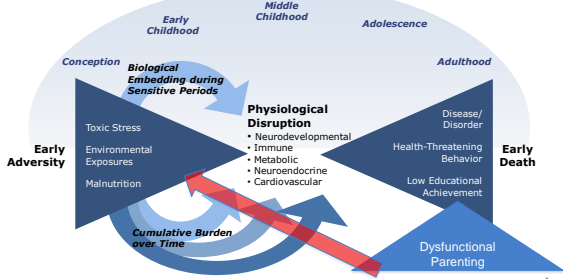


Yale School of Medicine Child Study Center Schilling et al. BMC Public Health 7 (2007) Source: Dube et al, 2005

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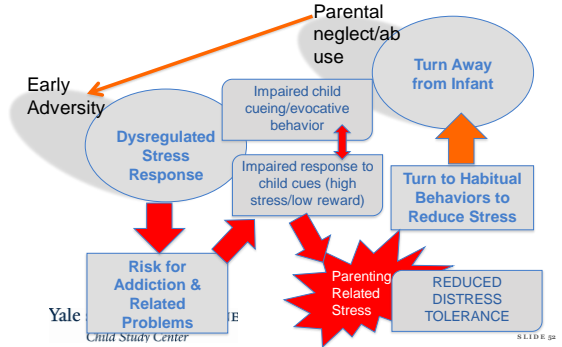
NATIONAL SCIENTIFIC COUNCIL ON THE DEVELOPING CHILD

The Childhood Roots of Health and Parenting Disparities: How Adversity is Built Into the Body and Transmitted Intergenerationally



SLIDE 51

How Early Adversity Impacts Parenting & Intergenerational Transmission of Early Adversity



SLIDE 52

INTERVENTION APPROACH

- Focus on adult's needs as a parent
- Focus changes from "what baby needs" demands of caring for infant are stressful and impact understanding infant's needs and how parent perceives and experiences the infant's cries
- Focus on increasing adults' distress tolerance/capacity to maintain decision making in face of stress/ remain mindful of own and child's emotional states



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SLIDE 53

Two Complementary Approaches in Programs for Parents

Parental Mindfulness/Mentalization



Psychological ability allowing us to make sense of the actions of others as well as our own actions by reference to desires, thoughts, memories, feelings

Parental Social Networks/Building community

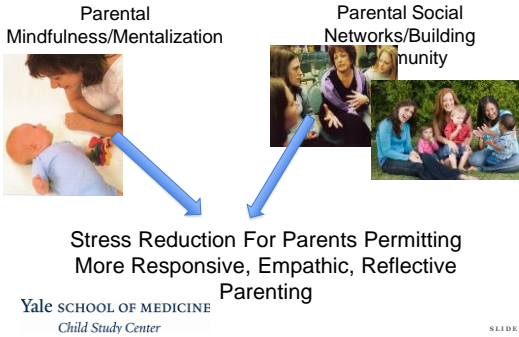


Social relationships, or the relative lack thereof, constitute a major risk factor for health—rivaling the effect of well established health risk factors such as cigarette smoking, blood pressure, obesity and physical activity
House, Landis, & Umberson; Science 1988

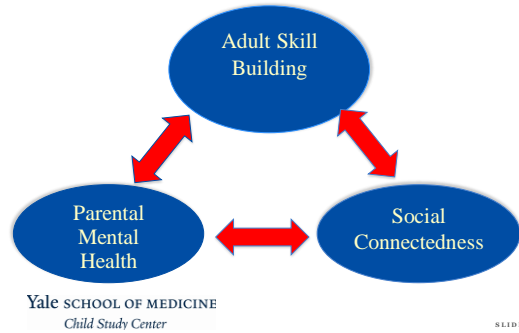
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SLIDE 54

Common Pathway of Effect



Helping Parents at Many, Interconnected Levels



MINDING THE BABY

A Reflective Parenting Program for Young Families

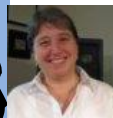


Window of opportunity before and after infant's birth to enhance understanding of infant cues, "model" parental mindfulness skills about self and baby and connect parents to a network of other parents

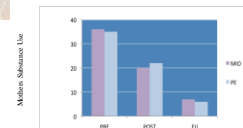
Lois Sadler, Ph.D., Arietta Slade, Ph.D., Nancy Close, Ph.D.
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SLIDE 57

Mothering from the Inside Out



Relationship/reflectiveness-based therapy for mothers with substance use



Nancy Suchman and colleagues
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SLIDE 58

Megan Smith

THE NEW HAVEN MOMS PARTNERSHIP

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Ensuring the Emotional Health of Our City's Families



The New Haven Mental Health Outreach for Mothers (MOMS) Partnership

- Partnership of multiple agencies and programs serving mothers and families
- Training and employing mothers to provide intervention (e.g. community ambassadors)
- Delivering services in neighborhoods
- Unique understanding of the experience, language and/or culture of low-income mothers



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MOMS PARTNERSHIP

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Connectors: Community Mental Health Ambassadors

- Conduct culturally appropriate mental health care and outreach in public housing complexes, schools, shelters, local businesses, neighborhood parks, and community centers
- Innovation in location: Locate evidence-based mental health services in locations where families live, learn, work, play and network



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SLIDE 44

MOMBA: Harnessing smartphone technology to improve maternal social connectedness and mental health



Linda Mayes, Fred Shic, & Megan Smith



Promoting the Social Connectedness & Mental Health of Mothers



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MoMba's Goals



Connect new mothers to each other (social support and networks)

Connect new mothers to infants (attachment theory)

- Connect new mothers to local resources (community connectedness)

- Connect new mothers to information about their health and the health of their children (health behavior)



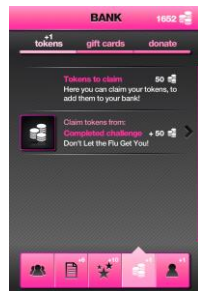
- Incentivize pro-social, health promoting behaviors (behavioral economics)

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Behavioral Economics

Mothers earn tokens to invest in their baby, themselves, their friends, and their larger community



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SLIDE 45

Parenting as an Adult Developmental Stage

• Transition to parenthood is a key adult developmental phase; and an adult's development as a parent is key to healthy child development

• Transition to parenthood involves key changes in mental economy (preoccupation), in perceptual sensitivity, and in neural reward and stress systems

• Understanding the psychobiology of parent development informs the shape of prevention and intervention programs for families

• Addressing adult development as a parent also has impact on child's health and development and impacts intergenerational cycle



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Collaborators and Support for Parenting Research Program

- Yale collaborators: Helena Rutherford, Marc Potenza, Rajita Sinha, Nancy Suchman, David Reiss, Megan Smith, Lois Sadler, Arietta Slade, Nancy Close, Nicole Landi, Einar Mencl, Hedy Kober, Jessica Montoya, Patrick D. Worthunsky, James Leckman, Tara Chaplin, Kevin Pelphrey, James McPartland, Carla Stover
- London Collaborators: Eamon McCrory, Pasco Fearon, Peter Fonagy, Mary Target, Essi Viding, Tessa Baradon
- UNC Collaborators: Joey Johns, Karen Grewin
- Baylor: Lane Strathearn and Thomas Kosten
- U. Illinois: David Bridgett
- U. Maryland: Carl Lejuez
- Belgium: Patrick Luyten
- University of Milano-Bicocca: Alice Proverbio, Ph.D
- Sewanee: University of the South-- Karen Yu, James Peterman, Bonnie McCardell, Emily Partin, Sherry Guyear
- Scholastic Publishers: Karen Baiker, Anna Bardaus Janelle Charrington, Morgan Ford

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THANK YOU

For Questions or PDF of Presentation
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