NW Children’s Fund
presents
Childhood Adversity
and the Developing Brain
Using Neuroscience to Inform Effective Interventions

Featuring:

Dr. Katie McLaughlin
Keynote Speaker & Moderator
Assistant Professor of Child Clinical Psychology
University of Washington

Childhaven
Childhood trauma therapy

HopeSparks Family Services
Mental health services and family support

King County Sexual Assault Resource Center
Sexual assault-related services for people of all ages

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Victoria Peattie Helm
Executive Director, NW Children’s Fund

nwcf.org
Dr. Katie McLaughlin
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University of Washington
CHILDHOOD ADVERSITY AND THE DEVELOPING BRAIN: IMPLICATIONS FOR INTERVENTION

Katie McLaughlin, Ph.D.
Department of Psychology
University of Washington
Trauma in US Children

- Violence: 22.2%
- Network/Witnessing: 38.1%
- Accident: 30.3%
- Other: 12.1%
- Total: 61.8%

(McLaughlin et al., 2013, Journal of the American Academy of Child & Adolescent Psychiatry)
Childhood Adversities in US Children

(McLaughlin et al., 2012, Archives of General Psychiatry)
Adversity and Adolescent Disorders

(McLaughlin et al., 2012, *Archives of General Psychiatry*)

![Graph showing the relationship between the number of adverse childhood events and the odds ratio for disorder onset.](Image)
Population Attributable Risk Proportions

- **Childhood**: 44.6%
- **Early Adulthood**: 28.6%
- **Adolescence**: 32.0%
- **Mid-Later Adulthood**: 25.9%

(Green, McLaughlin et al., 2010, *Archives of General Psychiatry*)
What Explains These Relationships?

Childhood Adversity

Mental Disorders

Birth - Childhood - Adolescence - Adulthood
Neurodevelopmental Mechanisms

Childhood Adversity \( ? \) Psychopathology
Co-Occurrence of Adversities

(McLaughlin et al, 2012, *Archives of General Psychiatry*)
The ACEs Approach

(Felitti et al, 2006)
McLaughlin, Sheridan, & Lambert, *NBR*; Sheridan & McLaughlin, *TICS*
• Harm or threat of harm (e.g., violence exposure, abuse)

• Exposure to threat influences neural systems involved in **fear learning** and **saliency processing** including amygdala, hippocampus, medial PFC

• Heightened emotional reactivity and poor regulation
How does trauma exposure influence brain responses to emotional information?
Sample

- 42 adolescents
  - Aged 14-19 years
  - 21 exposed to physical or sexual abuse
  - 21 age, gender, and handedness-matched controls

(McLaughlin et al, 2014, *Psychosomatic Medicine*)
LOOK
Positive Emotion – Total Sample
Maltreatment and Negative Emotion

Maltreated > Control

Amygdala, anterior insula, putamen, thalamus
NO GROUP DIFFERENCES
What are the implications of these patterns of neural activity?
Boston Marathon Terrorist Attack
Amygdala Reactivity and Later PTSD

$\beta = .97, p = .009$

$R^2 = .54$

(McLaughlin et al., 2014, Depression & Anxiety)
Intervention Implications

- Intervention strategies to reduce amygdala activation and heightened attention to threat:
  - Relaxation training
  - Emotion regulation skill training
  - Cognitive restructuring
  - Exposure
  - Systematic desensitization
  - Increasing safety and predictability*
How does trauma influence children’s ability to regulate emotional responses?
DECREASE
INCREASE
STRENGTH OF EMOTION

LOW | MEDIUM | STRONG

0   | 1     | 2     | 3     | 4
1. Negative stimuli: **Psychological distancing**
   (the situation is far away, the people aren’t real, the situation isn’t relevant to you)

2. Positive stimuli: **Psychological immersion**
   (the situation is close to you, the people are real, the situation is relevant to you)
Negative Emotion Regulation
Total Sample
Positive Emotion Regulation
Total Sample
Maltreatment and Negative Emotion Regulation

Maltreated > Control

Superior Frontal Gyrus, Dorsal Anterior Cingulate Cortex, Fusiform Gyrus
NO
GROUP
DIFFERENCES
Self-Reported Emotion

Intensity of Emotion

Neutral | Negative | Decrease

Maltreated | Control

* Indicates significant difference.
Intervention Implications

- Training in cognitive reappraisal (e.g., TF-CBT)
  - Effectively reduces amygdala response to potential threats
  - Can be used as effectively among children with trauma histories as those without
  - Can be applied in a wide variety of settings
  - May be particularly helpful to focus on cognitions around perceived threats
  - Establishing safety first is paramount
McLaughlin, Sheridan, & Lambert, *NBR*; Sheridan & McLaughlin, *TICS*
Deprivation

- Deprivation in environmental complexity, social inputs, language exposure

- The brain requires input from the environment to develop normally

- If expected inputs are absent, the connections that process that information are eliminated

- Deprivation in social and cognitive inputs may hijack the developmental processes of synaptic pruning
Development Differences in Synaptic Density of Layer 3 Human Frontal Cortex (Huttenlocher 1979)

(Huttenlocher, 1979)
Grey Matter Development

A certain degree of cortical thinning during childhood reflects pruning, increased efficiency of neural processes.

(Lenroot & Giedd, 2006)
Early visual deprivation in kittens

(O’Kusky et al., 1985; Lepore, et al., 2010)
How does psychosocial deprivation influence brain development?
Bucharest Early Intervention Project

- 136 children aged 6-30 months living in institutions in Bucharest
  - Half of children randomized to foster care intervention
- 72 community controls
- Brain development assessed using MRI at age 8-10 years
- Mental health assessed at multiple time points

(Zeanah, Nelson, Fox, et al., 2003)
Institutionalization

- Insensitive Care
  - High caregiver/child ratios
  - Rotating shifts – little psychological investment in children
  - No responses to distress

- Isolation
  - Little interaction with peers or adults
  - Lack of individualized attention

- Low cognitive complexity
  - Infrequent language exposure
  - Highly routinized environment
Structural MRI
How the Brain Looks to MRI
How the Brain Looks to MRI

- 3 km of axons
- 90,000 neurons
- 400 m of dendrites
- 4,500,000 synapses
Cortical Grey Matter

(Sheridan, et al., 2012, PNAS)
Frontal Lobe Gray Matter

Volume in ml vs. Age in years

(Lenroot & Giedd, 2006)
Working Memory

(Tibu et al, under review)
(Tibu et al, under review)
Institutionalization and ADHD

ADHD Prevalence

- Institution
- Foster Care
- Community

** Significant difference between Institution and Foster Care.
** Significant difference between Institution and Community.
Neurodevelopmental Mechanism

64.8%

Institutional Deprivation

Inattention

(McLaughlin et al., 2014, *Biological Psychiatry*)
Neurodevelopmental Mechanism

81.7% 

Institutional Deprivation → 81.7% → Hyperactivity

(McLaughlin et al., 2014, Biological Psychiatry)
What about other deprived environments?
• More than 1 in 5 children in the U.S. lives in a family below the federal poverty line

• Low income and parent education are associated with deprivation of multiple kinds
  • Complex language
  • Access to food and shelter
  • Enriching cognitive experiences in the home and at school
  • Supervision by adults
  • Consistent routines
Language Exposure by SES

Cumulative Language Experiences

- Professional: 45
- Working-Class: 26
- Low-Income: 13

Cumulative Words Spoken to Child (in millions)

Age of Child

Hart & Risley, 1995
SES and Executive Function

(Noble et al, 2007)
Neural Function during Cognitive Control Task
McNab & Klingberg, 2008
Neural Function during Cognitive Control Task

McNab & Klingberg, 2008
Neural Function during Cognitive Control Task

McNab & Klingberg, 2008
Neural Activation During Working Memory
Parent SES and Performance

B = .47, p = .010

*No effects of child maltreatment on performance
Parent SES and Neural Recruitment

*No effects of child maltreatment on neural recruitment*
How do we build executive functions in our clients?
- Parent management training
- Increase consistency, predictability of environment
- Consistent reinforcement patterns
- Executive function building through games?
All games available for purchase and download at: Bigfishgames.com

<table>
<thead>
<tr>
<th>Reasoning games</th>
<th>Speed of processing</th>
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<tbody>
<tr>
<td>Set</td>
<td>Spoons</td>
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<tr>
<td>Qwirkle</td>
<td>Pictureka</td>
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<tr>
<td>Rush Hour</td>
<td>Speed</td>
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<td>Tangoes</td>
<td>Blink</td>
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<td>Chocolate Fix</td>
<td>Perfection</td>
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<td>Azada</td>
<td>Feeding Frenzy</td>
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<td>Azada II</td>
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<td>Big Brain Academy</td>
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<td>(Think Games)</td>
<td>Super Cow</td>
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<td>Picross</td>
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<td>Professor Brainium’s Games (Mind Bender)</td>
<td>Bricks of Atlantis</td>
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<td>Neves</td>
<td>Nervous Brickdown</td>
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<td>Pipe Mania</td>
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<td></td>
<td>Mario Kart</td>
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<td>Ratatouille</td>
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</tbody>
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Intervention Implications

Matrix reasoning

\[ p < 0.001 \]

\[ n.s. \]

Cognitive speed

\[ n.s. \]

\[ p < 0.001 \]

(Mackey et al., 2011, *Developmental Science*)
Psychosocial interventions can alter patterns of brain development, meaning that plasticity and resilience are possible following trauma and adversity.
White Matter Development

White Matter

(Lenroot et al., 2007)
White Matter Reflects Myelination

Speed 100x

Diagram showing the process of action potential propagation in myelinated and unmyelinated axons.
Cortical White Matter

(Sheridan et al., 2012, *PNAS*)
Conclusions

• Childhood trauma influences brain development in systems underlying emotional reactivity and emotion regulation

• Childhood neglect and poverty influence brain development in systems underlying language and executive functioning

• Psychosocial interventions can alter these patterns of development, holding promise for our ability to intervene to promote healthy brain development following trauma and adversity
Thank You

Children and Families who Make this Work Possible
Help Us with Our Research

• Recruitment of children and families
  • Children aged 8-16 years with trauma exposure
  • Interpersonal violence (maltreatment, domestic violence)

• Provide recruitment materials to families
  • Hand-outs with information about the study
  • Lab business cards
  • Refer families who might be interested to the study
Participation in Studies

• Benefits for Families
  • Compensated for time
    • $165 for children and teens
    • $85 for parents
  • Free parking and transportation
  • Education about the brain
  • Connection to additional services
  • Free babysitting for siblings
In the Piñata Task we were interested in seeing how your performance improved when you had the chance to win a bigger reward. When there are 4 or 5 stars on the piñata, most kids will hit the piñata faster than when there is only 1 star on the piñata. The brain region involved in learning about rewards is called the Ventral Striatum. This region of the brain is activated when you think about something rewarding or engage in behaviors to try to obtain a reward.
Children in Non-Clinical Functional Magnetic Resonance Imaging (fMRI) Studies Give the Scan Experience a “Thumbs Up”

Moriah E. Thomason, Stanford University
Thank You

Children and Families who Make this Work Possible
Lisa “Lou” Olson, MSW, LSWAIC
Infant & Early Childhood Mental Health Specialist
HopeSparks Family Services

Home Visitation to Increase Parent-Child Bonding and Create Supportive Environments

nwcf.org
Larraine Lynch, LICSW
Clinical Manager
King County Sexual Assault Resource Center

END THE SILENCE

Trauma-Specific Assessment and Therapies for Children Who Have Experienced Sexual Abuse

nwcf.org
KCSARC’s Programs

- **A 24-Hour Resource Line** for individuals calling on behalf of themselves or someone else.

- **Trauma-Specific Therapy** to provide empirically based trauma-focused interventions for children, youth, and adult victims of sexual violence and their families.

- **Parent Education & Family Services** because a parent/caregiver’s reaction to a child’s disclosure of abuse is one of the strongest predictors of a child’s ability to heal more quickly.

- **Legal Advocacy** to help individuals and families navigate the legal system and access other needed services to support healing.

- **CourtWatch**, a court monitoring program to improve the judicial system with the goal of increasing access for victims of sexual assault by in-depth analysis and advocacy.

- **Prevention Programming** that focuses on changing beliefs, attitudes, and behaviors about sexual violence to stop the violence before it occurs.

- **Dando Voz** offers all of KCSARC’s current services for victims of sexual assault in Spanish.
KCSARC’s Therapy Approach

- KCSARC’s priority is to treat the trauma resulting from sexual abuse.
- Therapists assess a client’s unique experience of trauma and make recommendations tailored to the client’s needs.
- Because treatment is a focused and structured intervention, most clients complete therapy in an average of 16-20 sessions. Some individuals participate in fewer sessions, some may participate in more.
- Treatment is flexible and individualized based on client’s needs.
- Use targeted interventions to not only reduce post-traumatic stress symptoms, anxiety and depression but address other related issues.
- Caregivers are an integral part of the therapy process.
**Therapy Process**

- **Comprehensive trauma-specific assessment** that includes caregivers, children and other involved professionals.
- **Individual trauma-specific treatment**
  - Psychoeducation
  - Relaxation Training
  - Emotion Regulation Skills Training
  - Cognitive Re-structuring
  - Prolonged, Gradual Exposure
    - Imaginal
    - In Vivo
- **Parent Education**
  - Psychoeducation
  - Parent Management Training
Nell Robinson, MS
Parenting Skills Program Manager
Childhaven

Strengthening Executive Function Skills
in Children Facing Adversity

nwcf.org
Strengthening Executive Function Skills in Children Facing Adversity

NW Children's Fund
3/27/15

Nell Robinson
Parenting Skills Program Manager, Childhaven

Silvia Bunge
Professor at UC Berkeley
What we offer:

- Early Childhood Intervention and Prevention Services
- Child and Family Therapists
- Transportation
- Evidenced-based Parenting Interventions: PCIT, Triple P, Incredible Years, PFR
- Play Therapy, Individual Treatment Plans
And why:

- Incarceration, domestic violence, loss of culture, poverty
- Parent in foster care, child in foster care
- Trans-generational cycle of neglect and abuse
- Adult health, mental health complications
- Fetal alcohol effects, SGA, developmental delays
What we’re adding:

Strengthening Executive Function Skills

EF = memory, attention, self-control

IDENTIFY PROBLEM – EF

– EF skills are low in children with early life adversity

SOLUTION/INTERVENTION – PLAY

• Can we promote EF skills through group and dyadic play?
  – Why *play*?
  – What kinds of *play*?
Why *play*?

There are many types of play, and there is no reason to assume that they all confer the same benefits.

The ingredients of play *fuel learning*:
- Intrinsically motivating
- Opportunity for novel experience
- Active engagement
- Opportunity to learn from peers
- Relaxed, low anxiety state
What kinds of play?

Many forms of play, some of which may be more effective than others at building prefrontal cortex (PFC)-dependent skills.

Structured, rule-based games target those PFC-dependent skills.
Video
What we saw!

- Novel activity, single-rule
- 38-month-old child, EF skills??
- Hard working, perceptive mom
- What did I just learn?
What have we learned?

Sequential acquisition of skills?
EF Skills
- Early adversity has long-lasting effects on the developing brain and acquisition of EF skills
- Structured, rule-based play can build EF skills

Game-Play Coaching
- Kids are intrinsically motivated to play
- Can “teach” parents how to play

Future Plans
- Build out this “game-play” intervention and fold it into an existing home visitation program
Thank You

• nellr@childhaven.org
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Lisa “Lou” Olson
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Home Visitation

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