The Brain-Behavior-Resilience Connection

Neurobiological & Neurodevelopmental Impact of Traumatic Stress & Prenatal Drug/Alcohol Exposure In Adolescents: Using the Intersection of Prenatal Exposure & Toxic Traumatic Stress to Transform Primary Healthcare Practice

Mark A. Sloane, DO, FACOP, FAAP
Kalamazoo, MI
8 March 2014
Who Am I ???

And...

Why are YOU here today???
"My question is: Are we making an impact?"
LASSIE! GET HELP!!
TAKE IT EASY BUDDY
WE'RE ALL IN THIS TOGETHER
A Vision for Children Everywhere
A Resiliency / Well Being Vision for Children & Teens Everywhere
Challenging Teen Behavior

Why vs How
Brain-Behavior-Resiliency: A conceptual model that embraces *Why & How*

The Omnibus

- **Behavioral Choice / Free Will**
- **Social Communication**
- **Complex Affect Regulation**
- **Brakes vs Accelerator**
- **Sensory Processing / MSI**

**Neurodevelopmental Core Base**
(IQ, Language, Learning Style, Attachment potential, etc)
Building Resiliency Protection

Maintaining your shields (when the going gets tough)
Resiliency in Children
Buffering Trauma / FASD: Primary Care Role

- Mastery / Efficacy
- Relatedness
- Complex Affect Regulation
Brain – Behavior Functional Model:
Building resiliency one level at a time

- Neurodevelopmental Core Base
  - (IQ, Language, Learning Style, Attachment Potential, etc)
- Brakes-Accelerator Balance
- Complex Affect Regulation
- Social Communication
- Behavioral Choice / Free Will

Neurodevelopmental Core Base
Initial Point of Clinical Contact
Accelerator vs Brakes

- This level is where the *action* is!
- Huge impact on *all behavior*
- Assessment at this level is critical
- Many *physiological treatments* impact here:
  - Psycho-active medication
  - Physical exercise / complex movement
  - Sensory-focused occupational therapy
  - Music / art / dance therapy
- Let’s examine this level in some detail...
Delicate Balance of Arousal / Behavioral Regulation: Control of brain energy / behavior

Top-Down “Brakes” (Prefrontal Cortex)

Bottom-Up “Accelerator” (Brainstem/Limbic System)
Accelerator vs Brakes: Real World Impact

Way too wound-up / “wild” (“Tigger - on crack”)

Too wound-up (Tigger)

Bored / Low energy / Tired & sleepy (Ee-yore)

Total shut-down (via parasympathetics) “Ee-yore on Quaaludes”

Optimal “Goldilocks” Arousal

“Goldilocks” Comfort Zone
“Just Right” Energy Level
Linking Teen Brain Maturation & Risky Teen Behaviors: 3 Changes

- Change in Gray Matter / White Matter ratio
  - Gradual ↑ in myelination (girls ahead of boys)
  - Gradually improved brakes / regulation

- Connectivity between PFC & other brain regions (striatum, limbic, cerebellum)

- Dopamine activity in PFC-Striatal-Limbic pathways
  - Rapid rise in puberty
  - ↑ Novelty / Sensation seeking
Middle Adolescence (14-17 y)
Increased vulnerability to risky behaviors

Brain features:
• Peak of novelty/sensation seeking
• Trough of self-regulation (just say “no”)
  Brain Sensitivity to drugs / ETOH

Facts:
• Unprotected sex
• Suicide attempts
• Reckless driving
Brain – Behavior Functional Model: Social Communication is Critical Teen Skill

Neurodevelopmental Core Base
(IQ, Language, Learning Style, Attachment Potential, etc)

Sensory Processing / MSI

Brakes-Accelerator Balance

Complex Affect Regulation

Social Communication

Behavioral Choice / Free Will

Brain – Behavior Functional Model: Social Communication is Critical Teen Skill

Neurodevelopmental Core Base
(IQ, Language, Learning Style, Attachment Potential, etc)
Hyter-Sloane Model (2013) of Social Communication

- Language/Pragmatic Language
- Working Memory
- Social Cognition
- Complex Affect Regulation
All components are impacted by prenatal alcohol exposure and traumatic stress
Social Communication & Risky Behavior: Brain correlates in Teens

- Same brain areas responsible for these

- Social Brain processing activity (per fMRI data) when teens (vs adults) engage in risky behavior while peers are watching

- Teens discount delaying gratification more when peers are watching (vs adults)

Steinberg 2010
Brain – Behavior Functional Model: Teens make good & bad choices

Neurodevelopmental Core Base
(IQ, Language, Learning Style, Attachment Potential, etc)

Sensory Processing / MSI

Brakes-Accelerator Balance

Complex Affect Regulation

Social Communication

Behavioral Choice / Free Will

Neurodevelopmental Core Base
(IQ, Language, Learning Style, Attachment Potential, etc)
What about teen behavior / choice / free will / willfulness, etc???
Don’t Forget About the Steering

- Conscious control of behavior
- Importance of **tight structure** for optimal teen behavior management
- Willfulness misconceptions
  - It’s not *all* willful!
  - But some *is* willful!
  - And some *looks* willful!
  
  - Behavioral “curve balls” in homes, schools, detention...
Final Thoughts:
Teen Regulation / Willfulness:
Power Steering vs Manual Steering

- **Regulated** steering = *power* steering!
  - Easier to make appropriate motor / behavioral / emotional decisions while regulated

- **Dysregulated** steering = *manual* steering
  - Tougher to keep the behavioral “car” on the road
The Teen Brain-Behavior connection:  
3 *intertwined* components

• **Genetics / Epigenetics**  
  – What you inherit from both parents

• **Intrauterine environment**  
  – During pregnancy

• **Extraterine environment**  
  – After pregnancy
G X E = Complexity!
Kosofsky 2014

Prenatal Drug Exposure (ND-PAE)

Genetics
- Parents
- Child

Epigenetics
- Child
- Child’s Child

Genetic

Environment

- Prenatal alcohol exposure
- Drug Exposure
- Traumatic Stress

Postnatal Environs
- Complex trauma
- Poverty
Influence of Prenatal Alcohol Exposure
FAS: not the whole story
Fetal Alcohol Spectrum Disorders (FASD)

- Fetal Alcohol Syndrome
- Partial FAS
- Alcohol-related Neurodevelopmental Disorder (ARND) ("mild-moderate" FAS)
- Prenatal Exposure to Alcohol (clinically suspected to have FAS but appear physically normal)

Adapted from Streissguth
Severe brain damage caused by prenatal alcohol exposure

5-day old infants

Severe FAS

Normal Brain

photo: Clarren, 1986
Corpus Callosum

- 100 million neurons!!!
- Connects the two brain hemispheres
- Allows the left side to communicate with the right side
- Assists the individual child to calm down during / after “meltdown”
- Is often damaged/altered by prenatal alcohol exposure / traumatic stress
Corpus Callosum
Gross structural abnormalities in FAS
*(12 year old male subjects)*

Normal Development

Fetal Alcohol Syndrome
Star Trek Medicine: Diffusion Tensor Imaging

Inter-hemispheric Fiber Tractography through Corpus Callosum

Fractional anisotropy maps

FASD

Control

Anatomical images
Child Traumatic Stress & the Developing Teen Brain
“Trauma Trumps Everything (especially in Teens)!!!”

Sandra Bloom, MD
Complex Traumatic Stress
The Event vs the Impact

• Early relational trauma (sequential / simultaneous)
  – Neglect - Physical - Emotional/Psychological
  – Sexual - DV exposure - Impaired caregiver

• 38% of WMU CTAC referrals have FASD/ARND (n=1535)

• Combined ND impact: Trauma + FASD/ARND

• Not limited to foster kids (To PCP: “When is your trauma moment?”)

• “Too much $ / too little time with my Dad”
Types of Stress

Positive
Brief increases in heart rate, mild elevations in stress hormone levels.

Tolerable
Serious, temporary stress responses, buffered by supportive relationships.

Toxic
Prolonged activation of stress response systems in the absence of protective relationships.
Traumatic Stress & the Child’s Developing Brain

• Early and ongoing childhood toxic traumatic stress to the developing brain results in:

  – *Physical neuroplastic brain changes that*:
    • Cause abnormal functioning (including memory)
    • Contribute to problematic behaviors
    • Contribute to developmental delays
    • Result in child being unable to realize potential
Research reveals a *strong link* between all types of **child abuse /neglect** and the subsequent development of **psychiatric illness in adulthood**

Key findings (ACE) link child traumatic stress with variety of **child/adult medical illness**

VJ Felitti, MD
Prolonged Toxic Stress: Can Lead to Ill Health

- ACE (Adverse Child Experience) Study
- N=18,000+
- Via interaction between multiple components:
  - Behavioral
  - Cognitive
  - Physiological
  - Neural

Anda, Felitti 2009
Adverse Childhood Experiences Study (ACES)*

Felitti et al. 1998;
Traumatic Stress

• **Stress and the tiger**
  – Our bodies are designed to respond to stress
  – Adrenalin and cortisol help us *run* from tiger or *hide*
  – Threat of short duration
BUT...when the tiger lives in your home, neighborhood, or life...
Impact of chronic toxic stress on immune system function

• ...The developing Fight-Flight-Freeze system is chronically pressed into action:
  • Too much cortisol suppresses immune system, increasing risk of infection
  • Inflammatory response persists after it is no longer needed
Physical impact of trauma

- **Physical health effects on teens**
  - Somatic perception gets impaired
    - Headache, stomachache
  - Elevated cortisol impacts inflammation
    - Asthma – inflammatory component
    - Metabolic syndrome – obesity, insulin resistance, diabetes, cardiovascular disease
    - Cancer risk elevated
  - Infection fighting function impaired
    - Higher risk of infection
    - Autoimmune disorders
Tracking the Physical Impact: The Telomere Story

DNA link to aging, illness, trauma

- Exciting new development
- Imprint of your life journey on your DNA
- Critical trauma link for:
  - Prenatal
  - Infants
  - Children
  - Adolescents
  - Adults (including caregivers / professionals)
The Telomere Story
The Telomere Story

• Aging *shortens* telomeres leading to general breakdown of multiple body systems

• Trauma also shortens telomeres

• Does trauma *healing* lengthen telomeres?

• Role of *telomerase* in this dynamic process
Voices from the PCP Trenches

• “We’re traumatized now” by:
  – ACA / ObamaCare
  – EHR
  – ICD-10
  – Unfunded AAP mandates
  – Primary / Secondary Traumatic Stress (Avoidance)
  – AAP tool kits (TMI!)
  – Lack of resources in the office to deal with:
    • Screening for FASD / trauma
    • Lack of referral resources
    • Poor connections with psychiatry / child psychiatry
“She’s young, she probably won’t remember.”

“I think Mom was provoked?”

“Are you sure it happened this way?”

“I hope you’re not driving with the kids when you drink”

“Adult Avoidance”

“That Mom is really trying...she seems bright.”

“I’m not convinced it happened that way.”
The PCP Game of Life: Cumulative Risk Version

PCP as Eyewitness

Prenatal Exposure:
- to Alcohol / Drugs; Maternal Stress

Infancy:
- Unresponsive Caregiver
- Insecure attachment

Toddler:
- Physical Maltreatment

Child:
- Aggressive Behavior
- Emotional/Behavioral Dysregulation

Child as Bully
- Child being Bullied

Child / Adolescent:
- DSM Labels ODD, RAD, Bipolar, CD

Child / Adolescent:
- Academic Failure

Child enters Juvenile Justice system

Child: Exposure to Domestic Violence
How can we work *together* to build a comprehensive and collaborative trauma-informed system to help all challenging kids/teens *find* the state of well being?
## Current Tiered Models
### Healthcare / MH Care / Education

<table>
<thead>
<tr>
<th>Tier</th>
<th>Medical</th>
<th>Mental Health</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tier III (5%)</strong></td>
<td>Child Psychiatry (Outpt/Inpt)</td>
<td>Wraparound MST Residential</td>
<td>Restrictive Special Education</td>
</tr>
<tr>
<td><strong>Tier II (15%)</strong></td>
<td>Developmental-Behavioral Pediatrics</td>
<td>Home-Based Therapy Intensive Outpt</td>
<td>Inclusive Special Education Self-Contained Sp Ed</td>
</tr>
<tr>
<td><strong>Tier I (80%)</strong></td>
<td>Primary Care</td>
<td>Outpatient Therapy</td>
<td>General Education</td>
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Transformational Integrated Healthcare
Changing Transformational Healthcare

Trauma-infuser

Courts
Medical
Mental Health
Child / Family
Child Welfare
Schools

Trauma Champion
Trauma-informed Transformational Healthcare

Tier I
- Med: Primary Care
- MH: Outpatient Therapy
- Sch: General Education

Trauma infuser

Trauma Champion
Trauma-informed Transformational Healthcare

Tier II
Med: D/B Pediatrics
MH: Home-based Tx
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Trauma-informed Transformational Healthcare

Trauma-infuser
Courts
Medical
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Child Welfare
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Schools

Trauma Champion
Tiered Model of Integrated Trauma-informed Transformational Healthcare

Tier I: 80%
Tier II: 15%
Tier III: 5%

"Trauma I"
Thank you!

Slides available at: www.wmich.edu/traumacenter