Translating Developmental Science into Healthy Lives:

Realizing the Potential of Pediatrics

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My 3 Objectives For Today

- Provide a generalist’s overview of advances in developmental science
- Present an organizing, integrated, ecobiodvelopmental framework
- Discuss ways pediatricians might assist in translating science into healthier life courses

Critical Concept #1

Childhood Adversity has Lifelong Consequences.

Significant adversity in childhood is strongly associated with unhealthy lifestyles and poor health decades later.

ACE Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Women</th>
<th>Men</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abuse</td>
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<tr>
<td>Emotional</td>
<td>15.1%</td>
<td>7.8%</td>
<td>10.6%</td>
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<tr>
<td>Physical</td>
<td>27.0%</td>
<td>39.5%</td>
<td>28.3%</td>
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<tr>
<td>Sexual</td>
<td>24.7%</td>
<td>16.0%</td>
<td>20.7%</td>
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<tr>
<td>Household Dysfunction</td>
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<td>Mother Treated Violently</td>
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<td>11.9%</td>
<td>12.7%</td>
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<tr>
<td>House Subst Abuse</td>
<td>29.8%</td>
<td>23.8%</td>
<td>28.8%</td>
</tr>
<tr>
<td>Household Mental Illness</td>
<td>28.3%</td>
<td>14.8%</td>
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<tr>
<td>Parental Separation or Divorce</td>
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<td>21.0%</td>
<td>23.3%</td>
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<tr>
<td>Incarcerated Household Member</td>
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<td>4.1%</td>
<td>4.7%</td>
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<tr>
<td>Neglect*</td>
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</tr>
<tr>
<td>Emotional</td>
<td>16.7%</td>
<td>12.4%</td>
<td>14.8%</td>
</tr>
<tr>
<td>Physical</td>
<td>8.2%</td>
<td>18.7%</td>
<td>9.8%</td>
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* Wave 2 data only (n=8,667)

Data from www.cdc.gov/nccdphp/dnpa/ace/demographics

The Foundation of a Successful Society is Built in Early Childhood

Healthy Child Development

Successful Parenting of Next Generation

Educational Achievement
Economic Productivity
Responsible Citizenship
Lifelong Health

HEALTHY CHILD DEVELOPMENT

ACEs Impact Multiple Outcomes

Dr. Pam Shaw - Keynote
Developing a Model of Human Health and Disease

Defining Adversity or Stress
- How do you define/measure adversity?
- Huge individual variability
  - Perception of adversity or stress (subjective)
  - Reaction to adversity or stress (objective)
- National Scientific Council on the Developing Child (Dr. Jack Shonkoff and colleagues)
  - Positive Stress
  - Tolerable Stress
  - Toxic Stress

Critical Concept #2
Epigenetics:
- Which genes are turned on/off, when, and where
- Ecology (environment/experience) influences how the genetic blueprint is read and utilized
- Ecological effects at the molecular level
- Stress-induced changes in gene expression
  - “Genes may load the gun, but the environment pulls the trigger”
  - “Epigenetics: Not your parents’ genome!”

Defining Adversity or Stress
- Toxic Stress
  - Long lasting, frequent, or strong intensity
  - More extreme precipitants of childhood stress (ACEs)
  - Physical, sexual, emotional abuse
  - Physical, emotional neglect
  - Household dysfunction
  - Insufficient social-emotional buffering
    (Deficient levels of emotion coaching, reassurance and support)
  - Potentially permanent changes and long-term effects
    - Epigenetics (there are life long / intergenerational changes in how the genetic program is turned ON or OFF)
    - Brain architecture (the mediators of stress impact upon the mechanisms of brain development / connectivity)
Critical Concept #3
Developmental Neuroscience:
- Brain Architecture is experience dependent (individual connections or “synapses” and complex circuits of connections or “pathways” are both dependent upon activity)
- Ecology (environment/experience) influences how brain architecture is formed and remodeled (plasticity)
- Diminishing cellular plasticity limits remediation
- Early childhood adversity -> vicious cycle of stress
- Potentially permanent alterations in brain architecture and functioning

Two Types of Plasticity
- **Synaptic Plasticity** –
  - Variation in the STRENGTH of individual connections
  - “from a whisper to a shout”
  - Lifelong (how old dogs learn new tricks)
- **Cellular Plasticity** –
  - Variations in the NUMBER (or COUNT) of connections
  - “from one person shouting to a stadium shouting”
  - Declines dramatically with age (waning by age 5)

Differential Brain Maturation
- The Gas Pedal + PFC (with some hippocampal help)
- Prefrontal Cortex: Abstract thought, reasoning, judgment, planning, impulse and affect regulation, consequences
- Temporal lobe (outside): Processing sound and language
- Limbic System (inside): Emotions and impulsivity
- Amygdala:
- Brain Stem & Cranial Nerves: Vital functions

Out of Balance?
- Prefrontal Cortex:
  - Cold Cognition
  - Judgmental
  - Reflective
  - Calculating
  - Think about it
  - Biological maturity by 24
- Amygdala:
  - Hot Cognition
  - Emotional
  - Reactive
  - Impulsive
  - Just do it
  - Biological maturity by 18

Impact of Early Stress
- CHILDHOOD STRESS
- Hyper-responsive stress response; calm/coping
- Chronic “fight or flight;” cortisol / norepinephrine
- Changes in Brain Architecture

Developing a Model of Human Health and Disease
- Declining plasticity in the developing brain results in potentially permanent alterations in brain functioning and development
**Eco-Bio-Developmental Model of Human Health and Disease**

And together they drive development across the lifespan.

**Advantages of an EBD Framework**

- Though grounded in developmental science, the simplicity of the EBD framework may promote understanding as well as support for translation (early investments are the right thing to do biologically).
- Psychosocial stressors and other salient features of the ecology are every bit as biological as nutrition or lead (no distinction between mental and physical health, just healthy vs. unhealthy development).
- Emphasizes the dimension of time – to reflect the ongoing, cumulative nature of benefits and threats to health and wellness.

**Development results from an ongoing, re-iterative, and cumulative dance between nurture and nature**

Experience: Protection and Personal

Brain Development: Epigenetic Changes

Epigenetic Changes: Alterations in the Way the Genetic Program is Read

Behavior: Adaptive vs. Healthy Coping Skills (vs. Maladaptive or Unhealthy Coping Skills)

**Critical Concept #4**

The Science of Early Brain and Child Development

Education

Health

Economics

**One Science – Many Implications**

The critical challenge now is to translate game-changing advances in developmental science into effective policies and practices for families with children to improve education, health, and lifelong productivity.

**Advantages of an EBD Framework**

- Underlines the need to improve the early childhood ecology in order to:
  - Mitigate the biological underpinnings for educational, health and economic disparities
  - Improve developmental/life-course trajectories
  - Changing the early childhood ecology demands a PUBLIC HEALTH approach and COLLABORATION!!!
- Highlights the pivotal role of toxic stress
  - Not just “step on the gas” or enrichment
  - But “take off the brake” by treating, mitigating or immunizing against toxic stress.

**Reinventing the Wheel - All over again?**

Unmet needs are potential sources of STRESS!!!
Linking Childhood Experiences and Adult Outcomes

Childhood Adversity → Toxic Stress → Poor Adult Outcomes

- Epigenetic Modifications
- Disruptions in Brain Architecture
- Behavioral Allostasis

The BIG Questions are...

If TOXIC STRESS is the missing link between ACE exposure and the unhealthy lifestyles and poor outcomes seen as adults, it raises the following BIG questions:
1) Are there ways to treat, mitigate, and/or immunize against the effects of toxic stress?
2) What are the long term costs due to toxic stress versus the up-front costs to treat, mitigate or immunize?

Addressing Toxic Stress

- **Treatment of the consequences**
  - TF-CBT and PCIT are evidence-based
  - Reactive – some “damage” already done
  - Very COSTLY
  - Efficacy linked to age and chronicity
  - Declining brain plasticity?
  - Insufficient number of / access to providers
  - Limited reimburments; carve-outs
  - Mental Health Parity?
  - Persistent STIGMA
  - “Character Flaws” vs “Biological Mal-adaptations”

- **Secondary / Targeted Preventions**
  - Focused, targeted interventions for those deemed to be “at high risk”
  - Visiting Nurse Programs (Nurse Family Partner.)
  - Parenting Programs (Triple-P, Nurturing Parent.)
  - More likely to be effective; minimize “damage”
  - Requires screening
  - Still issues with stigma, numbers of / access to providers

Addressing Toxic Stress

- **Primary / Universal Prevention**
  - Proactive, universal interventions to make stress positive, instead of tolerable or toxic
  - Acknowledges that preventing all childhood adversity is impossible and even undesirable
  - Actively building resiliency (“immunizing” through positive parenting, 7C’s of resilience, promoting optimism, formalized social-emotional learning)
  - SE Buffers allow the physiologic stress response to return to baseline
  - Parenting skills for younger children
  - SEL skills for older children

Social-Emotional Skills Can Be Taught / Learned

- Illinois Learning Standards
- Social Emotional Learning (SEL)
- SEL skills for older children (www.casel.org)
**Critical Concept #5**

**SOCIAL-EMOTIONAL SKILLS...**
(a.k.a – Affect Regulation, Non-Cognitive Skills)

*Are learned* (they can be modeled, nurtured, taught, practiced, and reinforced)

*Effectively buffer against toxic stress* (by helping to turn off the physiologic stress response)

*Increase test scores* (an average of 11 points by meta-analysis!)

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**Parenting as Primary Prevention**

*Early maternal support exerts a positive influence on hippocampal development*

*The positive effect of maternal support on hippocampal volumes was greater in nondepressed children* (by helping to turn off the physiologic stress response)

*Notes and encourages foundational coping skills as they emerge (Maslow levels 1+2 – PROTECT)*

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**Critical Concept #6**

*For young children, parent/caregiver support is critical:*

*Turns off physiologic stress response by addressing physiologic and safety needs (Maslow levels 1-2 – PROTECT)*

*Turns off the physiologic stress response by promoting healthy relationships and attachment (Maslow level 3 - RELATE)*

*Notes and encourages foundational coping skills as they emerge (Maslow levels 4+5 - NURTURE)*

**Pediatricians are ideally placed to:**

*Promote this sort of “Purposeful” Parenting*

*Advocate for a public health approach to address toxic stress*
**Public Health Implications**

- ACE data provide a working model for understanding and addressing the childhood antecedents of adult disease.
- Is there a gap between what we do and what we know?
- What we DO:
  - 95% of the trillions of dollars that we spend on health is on treatment and NOT prevention.

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**Linking Childhood Experiences and Adult Outcomes**

- Advocacy to minimize childhood adversity (e.g. - efforts to address poverty, food scarcity, domestic violence, parental substance abuse)
- Health and social services to deal with adverse outcomes (e.g. - efforts to address the behavioral, social, health and economic consequences)

**Proximal Causes of Death: Chronic Disease**

**Distal Causes of Death: Unhealthy Lifestyles**

<table>
<thead>
<tr>
<th>Table 2. Actual Causes of Death in the United States in 1990 and 2000</th>
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<tbody>
<tr>
<td><strong>Actual Cause</strong></td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>All causes</td>
</tr>
<tr>
<td>Heart disease and stroke</td>
</tr>
<tr>
<td>Cancer</td>
</tr>
<tr>
<td>Diabetics</td>
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<tr>
<td>Other infectious diseases</td>
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<tr>
<td>Meningitis</td>
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<tr>
<td>Injuries</td>
</tr>
<tr>
<td>Poisoning</td>
</tr>
<tr>
<td>Suicide</td>
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<tr>
<td>Total</td>
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</table>

*Data are from Centers for Disease Control and Prevention, National Center for Health Statistics.

If these unhealthy lifestyles are manifestations of behavioral allostatic stress, a FUNDAMENTAL cause of death is TOXIC STRESS!
A Public Health Dilemma:  
Do we continue to treat disease,  
the unhealthy lifestyles that lead to disease,  
or the TOXIC STRESS that leads to the adoption of unhealthy lifestyles??

SUMMARY  
What can I do?  
- Pediatricians CANNOT change the ecology alone!  
- Public Health Approach demands:  
  - Collaboration  
  - A common language ("Communities That Care" model)  
  - Med Home that is integrated vertically and horizontally  
  - Build on local strengths  
  - Advocate to fill the gaps  

"Don’t let what you cannot do interfere with what you can do!" - John Wooden

CONCLUSION:  
It is easier to build strong children than to repair broken men.

Frederick Douglass
Three Core Concepts of Development

1. Brain Architecture is Established Early in Life and Supports Lifelong Learning, Behavior, and Health
2. Stable, Caring Relationships and "Serve and Return" Interaction Shape Brain Architecture
3. Toxic Stress in the Early Years of Life Can Derail Healthy Development

HEALTHY CHILD DEVELOPMENT

"On a purely economic basis, it makes a lot of sense to invest in the young... Early learning begets later learning and early success breeds later success."

-- James J. Heckman, Ph.D.
Nobel Prize laureate and University of Chicago economist

Why?
• "Skill begets skill" (self-productivity): early abilities provide a foundation on which later capabilities are constructed
• Later remediation of early achievement failures is difficult and costly; prevention of these difficulties is more cost-effective
• Both cognitive and noncognitive skills are essential foundations to adult workforce productivity
• Early investments have a multiplier effect: they facilitate the productivity of later investments

Developmental neuroscience, developmental psychology, and the economics of human capital formation are yielding a common focus on development in the early years.

Significant Adversity Impairs Development in the First Three Years

Number of Risk Factors

Data Source: Barth, et al. (2008)

Graph Courtesy: Center on the Developing Child at Harvard University
Brain Architecture is Built Over Time

- The early years matter because the interaction between early experience and gene expression shapes the maturing architecture of the brain.
- The development of the brain incorporates experience, whether positive or negative, that shapes the brain’s capacities.
- Brain development is built in a hierarchical, “bottom-up” sequence, with advanced skills built on more basic capabilities.
- As it develops, the quality of brain architecture establishes a sturdy or weak foundation for learning and behavior.

Brain Architecture Supports Lifelong Learning, Behavior, and Health

- Early experiences shape brain architecture.
- Simple skills come first; more complex skills build on top of them.
- A strong foundation in the early years improves the odds for positive outcomes and a weak foundation increases the odds of problems later in life.

Brain Architecture is Integrated

- Brain development occurs through the brain’s active engagement in everyday experience.
- Social, emotional, and cognitive development are integrated in brain development because each draws on common, interrelated neural functions.
- Emotional health and social competence provide a strong foundation for emerging cognitive abilities, but early mental health problems can impair learning along with emotional well-being.

Experiences Shape Brain Architecture

- 700 neural connections per second in the early years.

The Plasticity of Brain Architecture Decreases Over Time

- Brain circuits consolidate with increasing age, making them more difficult to rewire.
- The timetable of brain plasticity varies: it is narrow for basic sensory abilities, wider for language, and broadest for cognitive and social-emotional skills.
- Early plasticity makes the young brain both more vulnerable to harm and more capable of recovery.
- At all ages it is more efficient – biologically and economically – to prevent later difficulty than to try to remedy problems that emerge.
Relationships are the “Active Ingredients” of Healthy Brain Development

- Supportive early relationships offer protection from the effects of stress, and the absence of such relationships can imperil the brain's capacities for managing stress and/or its recovery.
- Early relationships also protect against biological hazards to healthy brain growth – nutritional inadequacy, physical illness, sensory impairment, dangerous exposures – beginning prenatally.
- The intersection of brain maturation and relational experience also helps to explain fundamental aspects of healthy psychological development.

Relationships also inspire psychological understanding and self-awareness.

Burden of Early Relationship Problems

- Approximately 500,000 of the 4 million American women giving birth each year experience postpartum depression (PPD).
- PPD is under detected and under treated.
- Many barriers exist to detection and treatment.
- In the United States, depression is the leading cause of non-obstetric hospitalizations among women aged 18-44.
- In the year 2000, 205,000 women aged 18-44 were discharged with a diagnosis of depression.

Postpartum Blues

- Most common, 50-80%
- Relatively brief
- Few hours to several days
- Onset usually in first week to 10 days PP
- Typically remit spontaneously
- May represent the initial stages of PPD/PPP

The “Baby Blues”

- Normal condition in postpartum mothers
- Occurs in 50-80% of new mothers
- Symptoms include feelings of loss, anxiety, confusion, fear, or being overwhelmed
- Symptoms peak ~5 days after birth and resolve within a few weeks
- Does not disrupt function or daily routines


Postpartum Psychosis

- Rare: 1/1000 postpartum women
- Hallucinations and/or Delusions
- Risk Factors:
  - History Bipolar Affective Disorder/Psychosis
  - Family history of psychosis
  - Having first child
- Aggressive intervention absolutely necessary
Postpartum Depression

- Not as mild or transient as the blues
- Not as severely disorienting as psychosis
- Range of severity
- Often undetected

Postpartum Depression

- Same diagnostic criteria as for clinical depression
- Affects 8-20% of childbearing women
- May negatively impact:
  - Mother’s ability to be responsive to child
  - Child’s behavior
  - Other family members
- Risk may be identified in primary care practice
- Occurs any time during first 12 months postpartum, but most often begins in the first 4 weeks.
- Symptoms persists in half of untreated mothers one year postpartum.
- Symptoms last from 2 weeks to more than a year.


Effects of Perinatal Depression: An Overview

- Depression negatively effects:
  - Mother’s ability to mother
  - Mother—infant relationship
  - Emotional and cognitive development of the child

Behaviors of Depressed Mothers*

- Less responsive to baby’s cues
- Less aware of baby’s needs
- Reduced ability to communicate range of emotions
- Reduced care and stimulation of baby
- Less empathy
- Less interactive behavior
- Less likely to obtain preventive healthcare for baby

*In some instances, maternal depression has no effect on parenting.


Face-to-Face/Still-Face Paradigm

Studies parent-child relationship

- Focuses on Infant’s reactions during structured interactions
- Mothers asked to
  - Engage spontaneously
  - Turn away, return with still-face
  - Turn away again, reunite/re-engage spontaneously with infant

Why Screen for Perinatal Depression?

Which Mother is Depressed?
You can’t tell by looking.

Perinatal Foundation
Madison, WI
June 2003

http://www.youtube.com/watch?v=apxXG3Ezht0
Importance of Screening: Why Screen Mom during Well-Child Visits?

- Well-child care providers see mothers with regularity in child’s first year of life
- Mother’s mental health affects well-being of baby and family
- Child’s development influenced by early relationship history

What is Required for Effective Screening?

- A screening tool
- A schedule for screening
- A plan for implementation
  1. Who does the screening?
  2. Where is it done?
  3. How is the primary care health provider informed of the results if not done in their office?

Maternal Depression Screening Tools

- Edinburgh Postpartum Depression Scale (EPDS)
- Primary Care Evaluation of Mental Health Disorders Patient Health Questionnaire (PHQ-9)
- Beck Depression Inventory (BDI)

Note: All of the above tools are available in Spanish-language format and are eligible for reimbursement.

The Edinburgh Postnatal Depression Scale (EPDS)

- 10-item self-report questionnaire
- Identifies depressive symptoms in pregnant women/new mothers
- Does not diagnose postnatal depression
- Validated cross-culturally
- Available in 21 languages


EPDS Scoring

- Each question ranked on four-point scale (e.g., 0-3)
- Maximum score = 30
- Consider action/referral when score ≥ 10 (indicates possible depression)
- A score > 13 indicates likely depression
- Review answers to individual questions
- Discuss items with high scores

The Edinburgh Postnatal Depression Scale (EPDS)

Advantages:
- Easy to administer (usually requires 5 minutes for patient to complete)
- Easy to score (“positive” cut-off 10 - 13 out of 30)
- Designed & well-validated for peripartum use
- Cross-cultural; available in 21 languages

Disadvantages:
- Not linked with formal (DSM-IV) diagnostic criteria
- Cannot be used for assessment or treatment tracking

Bottom Line: Good choice for clinics that only serve peripartum patients and those that follow “screen & refer” model

When to Screen Using the EPDS

**Recommendations**
- Screen all mothers
- Develop practice guidelines for frequency
  - At least once during pregnancy
  - At least twice postpartum
  - Initial screen when child is 4-6 weeks old
  - Subsequent screen(s) at 2-, 4-, or 6-month visits

*Note: The American Academy of Pediatrics have issued specific maternal depression screening guidelines in 2010.

Who ya gonna call?

- Most doctors other than those in urban settings don’t have ready referrals
- Kansas Chapter of AAP recognizes this problem
- Developed a resource for clinicians: KidLink which is an online resource to find out who is available in their area

Summary and Conclusions

- Postpartum depression is a clinically significant illness that may have long-lasting effects on the well-being of the mother and her family
- Postpartum depression differs from “baby blues,” a normative condition that resolves within 2 weeks following birth
- Postpartum depression is treatable and can be easily screened during well-child visits and routine checkups
- Establishing a culturally-effective office will help the provider to screen and assist women whose cultural milieu may discourage the admission of mental illness.

School Readiness Requires a Balanced Approach

If we really want to build a strong foundation for healthy development and effective learning for infants and toddlers . . . then we must begin early, and we must devote as much attention to children’s emotional well-being, motivation, and social capacities as we do to their cognitive and academic skills

Serve & Return Builds Brains and Skills

- Ongoing, reliable interaction with trusted adults is essential for the development of healthy brain circuits.
- Systems that support the quality of relationships in early care settings, communities, and homes help build brain architecture.
Early prevention is better than later remediation

If we truly believe that early intervention is crucial to preventing the development of serious later problems, then we must:
- enhance parental education about young children’s emotional lives,
- create screening and referral networks in pediatric health care, child care, home visitation, and other systems of family support,
- develop a national cohort of well-trained practitioners in early childhood mental health,
- and provide targeted family-based interventions for young children experiencing toxic stress.

Supporting Early Mental Health Requires Enlisting Nested Relational Networks

- If we really want to provide developmentally-relevant screening, preventive, and treatment services to support early mental health, then we must:
- create consultancies with child care providers who are often the first to become aware of early behavioral and emotional problems,
- create liaisons with child protection, welfare, primary health care, education, and other agencies,
- enlist multigenerational sources of family support, and
- support professional development of ECMH practitioners.

Sustained, High Quality Interventions Can Make a Difference

If we want to assist vulnerable, troubled young children in a manner that improves behavioral and brain functioning and future capability . . .

then we must make a sustained investment in evidence-based interventions staffed by reliable, well-trained personnel in the context of family-based supports, and with reliable funding streams.

Quality Early Care and Education Pays Off: Cost/Benefit Analyses Show Positive Returns

![Cost/Benefit Analysis Graph]

Total Return per $1 Invested

“Change the First Five Years and You Change Everything”

http://www.youtube.com/watch?v=GbSp88PBe9E

Keys to Healthy Development

A balanced approach to emotional, social, cognitive, and language development, starting in the earliest years of life.

Supportive relationships and positive learning experiences that begin with parents but are strengthened by others outside the home.

Highly specialized interventions as early as possible for children and families experiencing significant adversity.

For more on the science: www.developingchild.harvard.edu

For more on business champions: www.ReadyNation.org