

Early Education Commission

A community leadership collaborative supporting the United Way's goal of ensuring children are ready for school



United Way of
Metropolitan Atlanta

Introduction/Highlights: Brain Development Research

Brain development research and understanding increased significantly in the 1990s, in part because of improvements in imaging technology. This research changed the understanding of how the brain develops, that underlying structures develop at the same time rather than sequentially. This underscores the importance of early childhood experiences and learning for a child's early brain development and capacity for subsequent learning. Following are some key points from the articles abstracted for this meeting.

Brain Development Research – What We've Learned

- Some aspects of the brain are genetically determined, and most neurons (nerve cells) are present at birth
- The structures supporting social, emotional and mental development are developed in early childhood; capacity to build these foundations is greatest in early childhood and decreases over time
- The brain develops rapidly in early childhood, creating periodic “blooms” of synapses (connections among neurons) that present “windows of opportunity” for brain development; by age six the brain is about 95% of the size of an adult brain
- The brain “prunes” the synapses that are not used, making it harder to acquire some learning later in life (e.g., foreign language), although the ability to learn continues through life
- Early stimulation -- interaction with parents, caregivers and the environment -- is required for brain development; observation is not sufficient
- Ongoing “toxic” stress, such as from child abuse, neglect, maternal depression, substance abuse or family violence, can damage developing brain structures
- Poor nutrition can damage developing brain structures

Implications – What We Need

- Adequate, accessible medical care and nutrition for expectant and new mothers and young children
- Child and brain development education for expectant and new parents as well as non-parental caregivers so they understand the importance of interaction and stimulation
- Stimulating environments for young children
- Interactive relationships for young children
- Child abuse and neglect prevention
- Quality, accessible mental health services for parents
- Early identification of developmental concerns
- Weigh long-term benefits against short-term costs

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Research Abstract

Title: “From Neurons to Neighborhoods: The Science of Early Child Development”

Author(s): Jack P. Shonkoff and Deborah Phillips
National Research Council, Committee on Integrating the Science of Early Childhood Development

Date: 2000

Abstract

For this book, the Committee conducted a comprehensive review of research in neurobiology and the behavioral and social sciences. The committee’s findings are summarized in four major themes:

- All children are born wired for feelings and ready to learn
- Early environments matter and nurturing relationships are essential
- Society is changing and the needs of young children are not being addressed
- Interactions among childhood science, policy and practice are problematic and demand dramatic rethinking

The research indicates that human development is the result of an interaction of nature (biological factors) and nurture (experience factors), with culture affecting parenting practices. Children seek out opportunities to learn and need relationships with other humans for healthy development. However, temporary and chronic disorders can be difficult to identify as children mature at different rates with different personalities.

Effective interventions can reduce risks and improve the developmental outcomes of young children. Recommendations based on the research review include: allocate equitable resources to activities that will enhance children's emotional, regulatory, and social development as well as increase their math and language skills; respond to the mental health needs of young children; increase public awareness of quality child care programs; and provide greater access to prenatal and postnatal services. The study also suggests the creation of a multi-level task force to assess public policy on child care, early education, and economic support for families and the use of program-based research methods to ensure the applicability of findings.

(Adapted from the abstract and executive summary produced by the National Academy of Sciences)

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Research Abstract

Title: “A Science-Based Framework for Early Childhood Policy: “Using Evidence to Improve Outcomes in Learning, Behavior and Health for Vulnerable Children”

Author(s): National Scientific Council on the Developing Child, Center on the Developing Child, Harvard University

Date: August 2007

Abstract

This paper builds on the authors’ earlier work, “Closing the Gap Between What We Know and What We Do.” In reviewing brain development concepts they note that “Early experiences determine whether a child’s developing brain architecture provides a strong or weak foundation for all future learning, development and health.”

The authors then review and discuss more fully early intervention program evaluations of the past few decades. Based on their review, the authors identify “effectiveness factors” from programs that demonstrated a positive impact on child development/outcomes. Briefly, these factors include:

- Access to basic medical care for children and pregnant women
- Intensive home visitation for vulnerable mothers expecting their first child
- High-quality, center-based early education programs for children from low-income families
- Programs that provide direct supports for parents and high-quality, center-based care and education for children in families experiencing significant diversity
- Intensive services matched to specific problems for children experiencing toxic stress from recurrent abuse or neglect, severe maternal depression, parental substance abuse or family violence
- Work-based income supplements for working parents in families living under the poverty level
- Environmental policies that reduce the level of neurotoxins in the environment

The authors point out that “no single approach or mode of service delivery has been shown to be a magic bullet,” but that the basic concepts of neuroscience and child development remain valid regardless of program approach. In addition, scaling-up/replicating effective programs, not always effective, requires establishing quality standards and routine monitoring of service delivery. They recommend, “developing new intervention strategies for children and families for whom conventional approaches appear to have minimal impact” and “ongoing, constructive evaluation and continuous program improvement.”

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Research Abstract

- Title:** “Economic, Neurobiological and Behavioral Perspectives on Building America’s Future Workforce,” World Economics, July-September 2006; and Proceedings of The National Academy of Sciences (PNAS, July 2006, vol 103)
- Author(s):** Eric I. Nudsen, James J. Heckman, Judy L. Cameron, Jack P. Shonkoff
- Date:** July 2006

Abstract

A growing proportion of the U.S. workforce will have been raised in disadvantaged environments that are associated with relatively high proportions of individuals with diminished cognitive and social skills. A cross-disciplinary examination of research in economics, developmental psychology, and neurobiology reveals a striking convergence on a set of common principles that account for the potent effects of early environment on the capacity for human skill development.

Central to these principles are the findings that early experiences have a uniquely powerful influence on the development of cognitive and social skills and on brain architecture and neurochemistry, that both skill development and brain maturation are hierarchical processes in which higher level functions depend on, and build on, lower level functions, and that the capacity for change in the foundations of human skill development and neural circuitry is highest earlier in life and decreases over time.

These findings lead to the conclusion that the most efficient strategy for strengthening the future workforce, both economically and neurobiologically, and improving its quality of life is to invest in the environments of disadvantaged children during the early childhood years.

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Research Abstract

Title: “Starting Smart: How Early Experiences Affect Brain Development” (2nd Edition)

Author(s): Theresa Hawley, Ph.D., with contributions by Megan Gunner, Ph.D. For Ounce of Prevention Fund and Zero to Three

Date: 2000

Abstract

In this article the authors overview the nature of brain development. They note that young children have “windows of opportunity” in which they develop an excess of synapses (connections among neurons), but the synapses that are not used are eliminated. “Infants and children who are rarely spoken to, who are exposed to few toys, and who have little opportunity to explore and experiment with their environment may fail to fully develop the neural connections and pathways that facilitate later learning.” They also note new research showing the impact of abuse and neglect on brain development; maltreated children with post-traumatic stress disorder have elevated stress hormones even when nothing stressful is happening; they also have smaller brain volumes.

Several recommendations are presented;

- Educate parents about the importance of early experiences for their children’s development – written materials, parenting classes, coaching, home visiting
- Prevent abuse and neglect – high quality home visiting programs that begin as soon as a child is born
- Provide accessible, quality mental health services for parents; if depression or mental illness is untreated the parents may fail to respond to their children’s needs
- Ensure adequate nutrition prenatally and in the first years after birth to prevent the “devastating effects on intelligence and brain development of a lack of basic nutrients”
- Promote high quality infant-toddler child care – licensing standards, pre-service and in-service training, low child-to-teacher ratios, small group sizes, child care reimbursement rates to fund well-trained teachers

The authors conclude that “high rates of child abuse and neglect across the country as well as persistently high rates of school failure in some communities indicate that far too many children do not receive what they need during their first few years for health brain growth and development.”