

Early Intervention and Brain Development: Can Babies Wait?

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Abstract

Due to the critical window of brain plasticity and the impact of the quality of parent-child interaction on child development, stakeholders, to include the United States Congress, are urged to take serious note of the available research and mandate changes that would lead to more cohesive and coordinated early intervention services across the United States. At present, all 50 states in the United States of America are providing early intervention services for young, eligible children with special needs. Eligibility for services is based on a cross-categorical label of developmental delay. At the same time provisions of IDEIA, Part C provides each state with the freedom of how developmental delay is defined in their respective state. The occurrence of determining developmental delay has created numerous discrepancies and variations now trans versing all states and will require a re-examination of current policies.

Keywords: early intervention, developmental delay, IDEIA Part B & C, neurodevelopment

Our Global understanding is that young children are in need of being nurtured and protected by their primary caregiver as well as through the laws that have been put in place by each government for all children, and in particular for children with disabilities. However, these services can often have limited availability, complex eligibility requirements, or maybe improperly founded on antiquated science. In turn, it becomes essential that programming for young children with disabilities should be supported by empirically sound evidence, be geographically stable, and, perhaps most importantly, is responsive to the latest research findings in medicine, human development, and other areas. Although significant advances have occurred over the years, there is still much to be done to promote child and parent-friendly policies at the national and international levels. To do so, legislative bodies within each community needs to enact mandates and provide funding to ensure consistent service delivery models where babies with special needs will receive necessary interventions regardless of the ambiguity or discrepancies about factors such as geographical location or financial status. (For further understanding of this topic, readers are referred to an earlier 2013 publication by Hadadian & Koch). To put in perspective, throughout the history of special education, early childhood specialists have witnessed how each society has attempted to provide services for children with disabilities within their financial means and cultural understanding. The United States of America is no exception and like any other country has gone through many phases of service delivery for individuals with disabilities. Using the U.S. as an example, this position paper will explore essential research developments that can positively impact services for young children. The purpose of this article is to make a strong case for consistent and coherent policies to ensure an optimal level of services for a very vulnerable population.

Brief History of Services for Young Children with Disabilities in the U.S

In America, the zeitgeist of the 1960's was fueled by a number of impactful societal events including President John Kennedy's influence on promoting services for individuals with developmental disabilities, and President Lyndon Johnson's focus on breaking the cycle of poverty which led to the establishment of Head Start programs across the United States for young children from disadvantaged backgrounds. Similarly, the U.S. Federal Government leadership resulted in the enactment of another law in 1968 that was called the Handicapped Children's Early Education Assistance Act. This federal initiative provided funds to support some experimental centers, which were collectively referred to as the First Chance Network.

Several model demonstration projects also ensued as a result of this legislation. Later in 1972, the Head Start mandate (P.L. 92-424) required 10% of the total enrollment to be reserved for children with disabilities. Advocacy efforts by parents of children with disabilities also brought about many changes throughout the United States federal court system which served as a prelude to the sweeping reforms of the 1970's including the enactment of the significant special education law (P.L. 94-142) in 1975. Since then, even though the United States Congress (USC) has mandated services and has provided each state with financial resources, there are still gaps in services particularly in the area of early identification for very young children with special needs. Although significant progress was made for the provision of programming for young children with disabilities before the 1980's, services were still fragmented and not as broadly available as desired. Also, the USC realized there was an urgent need to:

1. Enhance the development of young children with disabilities.
2. Reduce educational costs to society by providing early intervention services when infants and toddlers with disabilities reach school age.
3. Empower families to meet the individual needs of their young children with disabilities.

A sense of urgency was further stimulated by reports that indicated the cost-effectiveness of early intervention services and the significant financial burden placed on families when accessing critically needed services. Consequently, the USC amended the 1975 law (P.L. 94-142) in 1986. Within the provisions of that act (P. L. 99-457), the USC mandated early childhood special education services for children ages three to five years. Guidelines were provided to each state for the initial planning and development of specific strategies for implementing the required provisions of this federal statute (Howard, Williams, & Lepper, 2010). Under P.L. 99-457, each state was also provided funding and was given five years to determine how they were going to offer early childhood special education services. At the same time, the USC offered additional incentives for those states expressing a willingness to provide early intervention services for children ages 'birth to three years. Within the incentive program, each state was afforded the option to choose how these services would be provided. Once an individual state received funding from the federal government for children birth to three years old, it became mandatory for the state to provide early intervention services. Currently, all of the 50 states are providing early intervention services.

As was mentioned earlier for children from ages three to five years, each child had to be identified and referred for evaluation to determine eligibility for special education services. One primary criterion for eligibility was that each child had to be labeled with one specific category of disability under the previous federal/state law. These categories included Autism Spectrum Disorder, specific learning disabilities, cognitive disability, developmental delay, emotional disability, deaf or hard of hearing, blind or low vision, traumatic brain injury, other health impairment, orthopedic impairment, and language or speech impairment. However, the notion of labeling a child as young as three years of age created considerable debate among experts in the United States within the field. At the center of the discussion was both the misidentification and mislabeling of young children with a specific disability label. Subsequently, the USC amended the earlier provisions and allowed a developmental delay (DD) label to be used up to age nine under part B of IDEA (2004). In addition to a DD label, the USC created at-risk categories as an option for the states to serve young children from birth through two years who were at-risk for becoming developmentally delayed later in their childhood.

Issues Related to Identification and Labeling Under Individuals with Disabilities Education Improvement Act (IDEIA) Part C

Per IDEIA Part C provisions, the cross-categorical label of DD had to be established by all 50 states for children ages birth to three. However, the USC allowed each state to create their own specific criteria for a DD label. As a result, children who demonstrated a delay, as determined by each state, became eligible for receiving early intervention services. This practice created a vast amount of variation from one state to the next. Some states have selected quantitative criteria, such as standard deviation, while some states have used criterion-referenced tests, with a set determination of what percent of delay must be present. Other states have implemented the criteria of developmental age while specifying a 20% to 50% range of delay. Still, additional states have chosen to use informed team consensus with professional clinical judgment. Given the variation in the definition of the DD label for the population birth to three years of age, a child's status could quickly change if they moved to a different state (Georgetown University Center for Child and Human Development, 2009).

Likewise, the Individuals with Disabilities Education Improvement Act (IDEIA 2004) provisions allowed a DD label to be applied at the discretion of each state. IDEIA's requirements have created numerous issues to include: over/under identification, children with low incidence disabilities, appropriateness of norm-referenced tools, and costs involved in providing necessary services (Council for Exceptional Children, Division for Early Childhood, 2009). The authors intend to put discrepancies of the DD definition and the urgency of the matter into perspective. Further objectives include stating the importance of three areas of research: brain development, parental stress, and the role of policymakers. A similar situation applies to an "at-risk" definition because each state has the option not only to define what "at-risk" means in their state, but they also have the option to offer or not offer the necessary services to that specific population of babies. Currently, to our knowledge, only six states have elected to identify and provide these services for young children under the age of three. The in-depth discussion of issues related to "at risk" category is beyond the scope of this manuscript. Instead, the focus of this position paper is about very young children who already exhibit a delayed.

Brain Development and its Connection to Parent-Child Interactions

To provide a better understanding of the issues related to early intervention as a matter of policy, the authors have highlighted two areas of discussions per below.

Brain Development

Developmental neuroscience informs the study of young children and its relationship to their brain development (Thompson, 2001). Today we know that genes provide the blueprint for the brain's structure and the environment will provide the canvas for neurocircuits to be connected to each other. In other words, the mutual interaction among our genotype and phenotype could impact how an infant's fully developed brain evolves. Developmental scientists' observations of early development provide other valuable information on what should be expected in a developing brain. Brain growth begins early and advances quickly during the prenatal months. By the sixth fetal month, for a typically developing fetus, nearly all of the billions of neurons have been produced at the average rate of more than 250,000 per minute. Eventually, the neurons would form synapses with other neurons that will then enable these circuits to communicate and process information (Thompson, 2001).

Given the newborn's drive for novelty, focus on sensory experience, and preference for social stimulation, significant changes in the brain's neuronal architecture should be expected after birth. It is understood that little-used synapses are gradually eliminated for the brain to function efficiently. However, neurons continue to form synapses with other neurons throughout childhood. As a result, the architecture of the developing brain becomes adapted to the needs of everyday stimulation and experience of each baby. We may say that experience is the central factor regarding which neural pathways are going to be retained or disappear (Thompson, 2004). Consequently, early experience in life is critical for the brain development of all babies, particularly with children who are delayed or are at risk of becoming delay. Therefore, the message that needs to be communicated to policymakers is:

1. The environment can change the expression of genes (United States Administration for Children and Families. Office of Planning Research and Evaluation, 2012, p.20).
2. Specific genes can turn "on" or "off" due to an increase in the cortisol level in the brain (National Scientific Council on the Developing Child, 2005/2014, p.3).
3. The stress hormone production in young children can be influenced by parent-child relationships (National Scientific Council on the Developing Child, 2005/2014, p.4).

As early as the 1990's, a majority of researchers took notice of the importance of the nurturing parent-child interaction and its influence on brain development. For example, Dr. Lally (1998) wrote that we have become knowledgeable of why the brain is not fully developed at birth. Experience and gene interaction will influence brain development as it pertains to its form and functions. Rich language experience with a primary caregiver will, in turn, impact language development and its potential correlation with future academic function. Furthermore, correlation to a nurturing social and physical environment will increase and enrich the intellectual process. Also, he stated that the early experience would influence the social and emotional functions of the brain. He further said, "early nurturance and prolonged stress can set emotional thermostats affecting brain functioning and sometimes even increasing the secretion of cortisol, lowering levels of serotonin and elevating levels of noradrenaline" (Lally, 1998, p. 46).

A more recent view from Gunnar states that “Groundbreaking new research is leading to a better understanding of how genes are regulated and perhaps a better understanding how early childhood experiences can permanently alter the function of specific genes” (Gunnar, 2006, p.4). The words “permanently alter” should indeed become a billboard item!

Examining a more distant history, Skeels and Dye’s (1939) pioneer study, they removed 13 children under the age of three from an orphanage and placed them in a ward with women who were institutionalized due to their developmental disability. The study indicated changes in cognitive development and the IQ of the children due to environmental stimulation was groundbreaking. If the zeitgeist of the time were right, we would have had early intervention services in place a half-century ago. Rene Spitz also did similar work where he showed identical results about the critical role of parent-child interaction and initial environmental stimulation (Spitz, 1949). Unfortunately, the validity of research results by these earlier pioneers was called into question most likely due to the prevailing norms and beliefs prominent at the time. The Bucharest Early Intervention Project (BEIP), which was the first randomized controlled study of babies in foster and institutional care, arrived at somewhat similar results as of those of Spitz, Skeels, and Dye. They concluded that severe early neglect had a severe impact on the brain and cognitive development (readers are referred to the original study for more in-depth information) (United States Administration for Children and Families, Office of Planning, Research and Evaluation 2012, pp.9-10). Our current knowledge further points to the critical role of early daily experiences. In the words of Dr. Gunnar: the developing brain organizes itself through the interaction of genes responding to the local environment, and it’s influenced by many things from outside. So the architecture is about far more than just the “wiring,” or how the brain forms its synaptic connections. It’s about nerve myelination (formation of the fatty insulation around the brain’s nerve cells that promotes speedy transfer of signals). It’s about chemical receptors. It’s about how finely tuned we are to receiving different kinds of information and stimulation (Gunnar, 2006, pp. 1-2).

Therefore the wave of new knowledge about brain plasticity in the early years of development needs to be placed in the public domain and become an urgent matter of public policy within each community. It was understood that the United States federal government had provided financial resources and leadership since the 1960’s in relation to services for young children with special needs. Given the new knowledge gained in the area of brain plasticity, this leaves early childhood specialists with no room to delay in providing seamless mandated early intervention services. We must move from a fragmented system where there is no consistency from one state to the next; to a more coordinated system which ensures all young children with special needs will receive appropriate and timely services.

Parent-Child Interaction and Disability

Given over three decades of research in the area of parent-child interaction and attachment relationships including current research on brain development, it should not be difficult to make the connection between the impact of environmental factors and brain development. According to Bowlby’s theory of parent-child attachment, the primary caregiver’s relationship with the child sets the stage for child development relationships that would follow as a result of the parent-child interaction. Equally, over thirty years of research has indicated parental responsiveness to the child’s needs as the primary variable relating to qualitative differences in mother-child attachment relationships (e.g., Hadadian & Merbler, 1996). More recently Thompson (2010) reported a correlation between emotional stress in the family and the security of the attachment relationship. He said an association between child insecurity after controlling for differences in maternal sensitivity in high levels of emotional stress. Further, Thompson (2001) argues when these parent-child relationships are disturbed or becomedys functional, and the child faces unpredictable challenges and changes in their daily experience it could impact their capacity to manage their emotions effectively. In his words, “... when caregivers are depressed, stressed, absent, or otherwise have neither time nor energy to devote to caring for young children. In these circumstances, attachment relationships become insecure, conflict negotiation results in coercion, self-concept is shaped by denigrating evaluations of the child, and young children do not develop the sense of secure self-confidence that is their birthright,” (Thompson, 2001; p. 31). Given our knowledge of attachment research, we can state that in the absence of nurturing relationships, it would not be surprising to find insecure attachments develop more frequently in homes where parents are stressed or depressed. It is alarming how early in life babies can show signs of depression and exhibit social withdrawal, which could have stemmed from the quality of the parent-child relationships (Thompson, 2004).

At the same time, it is equally important to note the significant body of research which has consistently reported high levels of stress among parents of children with disabilities (e.g., Change & McConkey, 2008; Dyson, 2003; Hauser-Cram, Warfield, Shonkoff & Krauss, 2001). These parents are often faced with feelings of depression, sadness, guilt, anger, and hopelessness. Similarly, the research literature has indicated parental stress increases if support services are not readily available and parents have to search for appropriate services for their children with disabilities. (e.g. Redmon & Richardson, 2003; Change & McConkey; Russell, 2003). Therefore, young children with special needs who already may be at biological risk could automatically become at environmental risk (e.g., lack /inadequate early intervention services can lead to higher stress in parents which in turn could impact parent-child interaction and as a result change the dynamic of brain development in very young children). It does not take a scientist to conclude situations like this would compound the negative impact of a disability. Wilson in his 1998 text titled *Consilience: The Unity of Knowledge* stated succinctly, has said it best “We are drowning in information while starving for wisdom”(Wilson, 1998, p. 269).

Role of the Federal Government and Policy Makers

The foundational importance of the early years is increasingly recognized across different political arenas, and there is a growing recognition because each community has a distinctive role to play in assuring the healthy development of all young children. An increasing body of evidence has already provided us with a framework for policymakers. This structure is based on the brain to be impacted by biological memories, carried in through early years of experience.

Similarly, decades of research in child development have taught us that families and communities play the central role in providing the supportive relationships and positive learning experiences which young children need for healthy growth (Shonkoff & Phillips, 2000). There has also been considerable documentation of the extent to which public policies and regular services can enhance developmental outcomes for young children living in a wide variety of communities (Karlovy, Kilburn, & Cannon, 2005). The newly acquired bio-developmental framework will hopefully allow the decision makers to take more prompt action about identification and service delivery for very young children with special needs. In the authors’ view, it is the moral duty of each society to pay attention to the youngest population and to identify as early as possible those infants and toddlers in need of services to ensure that intervention is provided when the developing brain is most capable of change. Our interpretation supports the position that response is likely to be more efficient and less costly when it is provided earlier in life rather than later. Based on the findings of Thompson (2012), our understanding of the neuroplasticity of the brain has opened the door for further preventative and intervention efforts. Therefore our knowledge of developmental neuroscience should be undertaken by lawmakers and policymakers more seriously.

In the United States of America, even though there has been an increase in the number of young children being provided early intervention services (e.g., from around 194,000 in 1990 to 343,000 in 2010) Danaher (2011), many young children are either not receiving early intervention services or could become ineligible. In our view and the lead author’s professional experience, this could mostly be due to the discrepancies in the definition of DD as well as continued freedom of each state to change the DD. High-quality early intervention programs for vulnerable infants and toddlers with special needs can reduce the likelihood of future problems in their development (Danaher, 2011). Equally, the existence of high-quality early intervention services could mitigate parental stress for families of children with special needs and as we have stated previously positively impact the brain development.

Conclusion

Due to the latest research concerning brain plasticity and its implications for child development, this position paper proposes that early intervention services should become a matter of public health/education policy. Within the context of this discussion, the authors provided a summary of the development of a service delivery system for young children with disabilities in the U.S. and had examined some of the factors that have both facilitated and hindered the evolution of this service infrastructure. Furthermore, the role of early intervention services on parental stress and its ultimate impact on brain development must be further examined for purposes of highlighting the vital importance of early intervention services which will ensure a coherent and coordinated service delivery system in all countries including the USA. Given the importance of parent-child interaction, brain development, and the fact that children are born wired to learn we can summarize some of the focal points of this position paper as follows:

1. The plasticity of the brain in the first few years of life leaves no time to spare. The timing of the intervention is of vital importance because in the words of Danaher (2011) appropriate early intervention services can change a child's developmental trajectory.
2. There are over thirty years documented research that has shown parents of children with disabilities are under higher stress which in turn can impact on the quality of the parent-child interaction. There is also a body of research that has shown how parental support could equally help in reducing the stress.
3. We now have an abundance of research that has demonstrated the effectiveness of early intervention. However, there is a critical need for the USC as well as other governments to take further action in providing a consistent policy for adequate early intervention services.
4. Adequate funding needs to be allocated for further research and direct services. Dr. Gunnar has said it best: "The development of young children needs to be taken seriously and not to short change it by assuming that compensation can be made in the future" (Gunnar, 2006, p.1). See Figures 1.1 and 1.2 for an illustration of the importance of federal government involvement.

As researchers engage in additional observations and data collections, we are predicting further changes may produce added amendments at the federal and state levels in the United States of America. The dilemma is that final decision may be mostly based on funding availability and not on best practices. As a result, we may continue to see a discrepancy of services across the country until we will have a clear mandate from the USC. In the words of Shonkoff and Phillips (2000), "Interactions among early childhood science, policy and practice are problematic and demand dramatic rethinking." It is agreed that each state has considerable autonomy to make decisions regarding education within the United States Constitution. However, we believe a matter of this significance should not be left to become a budgetary line item within each state agency. Once again, the USC needs to take the lead as they did in 1968 when the Handicapped Children's Early Education Program P.L. 91-230 Part C, Title V was passed. This initiative was similar to the funding model for preschools which followed 20 years later with the passage of The Education for All Handicapped Children Act P.L. 99-457. This act was responsible for mandating preschool special education. We are in need of an immediate and coordinated action in providing a clear policy for the identification of young children and a seamless allocation of resources across the country. No baby with a disability and their families should be penalized based on their geographical place of birth within the United States

At the global level, we are equally facing similar issues, from malnutrition, poverty, and abuse, which impacts brain development. Therefore, each community needs to advocate for the welfare of their young children and demand allocation of funds and services across the board. In particular, babies with special needs can no longer be denied intervention services and support because we now know early intervention can impact the wiring of the brain and the clock cannot be turned back. The time is now to promote more consistent, integrated, and comprehensive policies to benefit infants and young children.

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