

Poverty's Most Insidious Damage

The Developing Brain

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Because the brain is the organ from which all cognition and emotion originates, healthy human brain development represents the foundation of our civilization. Accordingly, there



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is perhaps nothing more important that a society must do than foster and protect the brain development of our children. Building on a well-established body of behavioral data and a smaller but expanding body of neuroimaging data, Hair et al¹ provide even more powerful evidence of the tangible detrimental effects of growing up in poverty on brain development and related academic outcomes in childhood. Using data from the National Institutes of Health Magnetic Resonance Imaging Study of Normal Brain Development, the investigators demonstrated that children living 1.5 times below the federal poverty level had smaller volumes of several brain regions critical for cognitive and academic performance (gray matter, frontal and temporal lobes, and the hippocampus). While smaller brain volumes in children reared in poverty have been previously demonstrated in several investigations^{2,3} and poor academic and cognitive outcomes of children living in poverty have been well known for several decades,⁴ Hair et al¹ went further to elucidate the mechanism of this relationship. The findings of the Hair et al study¹ showed that poor cognitive and academic performance among children living in poverty was mediated by a smaller hippocampus and frontal and temporal lobes and that the decrease in volume of the latter 2 structures explained as much as 15% to 20% of the achievement deficits found. Given the nature of the study sample investigated, where children facing numerous other risk factors for poor brain development were screened out, it is likely that the effects reported represent an underestimate of the magnitude of risk in the general population.

These study findings should be understood in the context of the well-established animal literature and emerging data in humans showing that environment, both physical and psychosocial, has a material effect on the development of the brain. This early childhood experience-dependent plasticity underscores both the relative high vulnerability and adaptability of the developing human brain. Further, data from experimental studies of children who are reared in institutional settings, experiencing relative deprivation, and randomized to therapeutic foster homes have shown that these environmental effects on brain development are more powerful during the highly neuroplastic period of early childhood.^{5,6} This converging developmental evidence gives new meaning to the impor-

tance of protecting and enhancing the nurturing environment for developing young children during this window of opportunity in the early years of life.

In keeping with this body of evidence and adding to the findings of Hair et al,¹ prior research from our own group has also shown that the deleterious effects of poverty on the development of the hippocampus were partially mediated by maternal support experienced during the preschool period of development.⁷ Taken together, these findings now elucidate a clear and coherent risk trajectory in which caregiving nurturance mediates the development of key brain regions in the context of poverty and that the development of these brain structures mediates academic outcomes. This line of evidence demonstrates that enhancing parental support during early childhood is a critical and specific intervention target for more effective prevention of poor cognitive and academic outcomes for children living in extreme poverty. The importance of such neuroscience-informed interventions has been emphasized by investigators in this field.⁸

In keeping with this conclusion but based on an economic analysis, Heckman and colleagues⁹ demonstrated that psychosocial interventions in the form of enhanced stimulation, support, and nurturance applied during the preschool period of development have a very powerful positive effect on adult outcomes. The Heckman et al analysis⁹ also clearly shows that environmental enhancements applied during the preschool period have a far more robust effect when compared with similar interventions applied in later childhood, adolescence, and early adulthood. After decades of research, there is now a powerful converging literature on the efficacy of early childhood interventions to support caregiver nurturance for child outcomes.¹⁰ These findings provide very strong evidence that a public health focus on enhancing the early nurturing environment for the developing child at risk is not only a critical but cost-effective approach. Given that an alarming 22% of US children are estimated to be living in poverty,¹¹ early childhood interventions to support the nurturing environment for these children must now become our top public health priority for the good of all.

In developmental science and medicine, it is not often that aspects of a public health problem's etiology and solution become clearly elucidated. It is even less common that feasible and cost-effective solutions to such problems are discovered and within reach. Based on this, scientific literature on the damaging effects of poverty on child brain devel-

opment and the efficacy of early parenting interventions to support more optimal adaptive outcomes represent a rare roadmap to preserving and supporting our society's most

important legacy, the developing brain. This unassailable body of evidence taken as whole is now actionable for public policy.

ARTICLE INFORMATION

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