Translating Developmental Science to Address Childhood Adversity

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ABSTRACT

Demystifying child development is a defining element of pediatric care, and pediatricians have long appreciated the profound influences that families and communities have on both child development and life course trajectories. Dramatic advances in the basic sciences of development are beginning to reveal the biologic mechanisms underlying well-established associations between a spectrum of childhood adversities and less than optimal outcomes in health, education and economic productivity. Pediatricians are well positioned to translate this new knowledge into both practice and policy, but doing so will require unprecedented levels of collaboration with educators, social service providers, and policy makers. Pediatricians might recognize the negative impact of family-level adversities on child development, but developing an effective response will likely require the engagement of community partners. By developing collaborative, innovative ways to promote the safe, stable, and nurturing relationships that are biologic prerequisites for health, academic success, and economic productivity, family-centered pediatric medical homes will remain relevant in an era that increasingly values wellness and population health.

KEYWORDS: adverse childhood experiences; child development; childhood adversity; medical home; pediatrics; susceptibility to context; toxic stress; trauma

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IN 1966, JULIUS B. Richmond, MD, received the C. Anderson Aldrich Award from the American Academy of Pediatrics (AAP). In his acceptance speech, entitled "Child Development: A Basic Science for Pediatrics," Richmond encouraged the academic pediatric community to embrace child development as the unique, organizing principle that would drive future advances in pediatric research, practice, and policy.[1]

Since then, the basic science of development has advanced dramatically in at least 3 major areas: life course science, gene–environment interactions, and the biology of adversity (chronic physiologic stress). With this new knowledge in hand, the pediatric community is well positioned to drive health care reforms as well as provide renewed investments in education, social services, and future human capital. However, translating this knowledge of development into practices and policies that benefit children and their families will require a coordinated, integrated public health effort that supports both generations (children and their parents/caregivers) and that encourages both innovation and collaboration among the health care, educational, social service, and government sectors.

Here we provide a brief overview of recent advances in developmental science and their implications for future research, pediatric practice, and the policies that govern systems supporting children and their families.

ADVANCES IN DEVELOPMENTAL SCIENCE

LIFE COURSE SCIENCE: UNDERSTANDING THE LINKS BETWEEN CHILDHOOD EXPERIENCES AND ADULT OUTCOMES

Research on life course trajectories reveals strong associations between experiences in childhood and a wide array of outcomes years, even decades, later. Both retrospective and longitudinal studies have demonstrated that significant adversity in childhood is linked with poor health, academic struggles, and limited economic productivity as an adult. Although adversity is often envisioned as catastrophic or traumatic (eg, abuse, neglect, witnessing violence), it can also be more commonplace (eg, poverty, parental dissension, mental illness). The landmark Adverse Childhood Experiences (ACEs) study[2] demonstrated a dose-dependent, statistically significant relationship between 10 different categories of childhood adversity (5 forms of maltreatment—physical, sexual, or emotional abuse; physical or emotional neglect; and 5 measures of household dysfunction—

parental separation, mental illness, substance abuse, fighting violently, or incarceration) and a wide array of outcomes decades later, including unhealthy lifestyles, poor health, mental illness, and social/employment difficulties.[3]

Because the original ACEs study was retrospective, no assertions can be made about causality. In addition, a traditional ACEs score, the sum of the 10 ACEs categories experienced by age 18 years, is a relatively insensitive measure of adversity as a result of issues with recall (patients tend to suppress traumatic experiences), repetition (there is no accounting for being assaulted once vs daily for years), and redundancy (having a father who used heroin and a mother addicted to pain medications yields just 1 point for household substance abuse). Moreover, the traditional ACEs score is not calculated until at least 18 years of age, so it lacks meaning in the pediatric setting. In addition, an assessment of the maltreatment categories (abuse and neglect) would require that the caregivers of young children know and disclose that these events occurred. The limitations of the traditional ACEs score have prompted the development of modified childhood ACEs scores, which have been shown to predict childhood distress,[4] developmental delays, behavioral problems, and injury visits.[5] Despite its limitations, the original ACEs study is significant for confirming what pediatricians have long recognized: significant childhood adversity—be it traumatic, catastrophic, or commonplace—is strongly associated with less than optimal outcomes decades later.

Conversely, significant investments to minimize adversity in childhood yield better health, educational, and economic outcomes decades later.[6,7] Even for children who have experienced adversity, outcomes are improved with engaged caregivers,[8] quality preschool,[9] and access to family-centered health care.[10] Although many of these programs are community or school based, primary care interventions are also feasible and known to improve short-term outcomes.[11,12] Childhood experiences, both positive and negative, are strongly associated with outcomes in learning, behavior and health, and not just in childhood but across the life span.

The associations between childhood experiences and life course trajectories may be quite strong, but they are also imperfect. For example, even in the ACEs study, many adults with high ACEs scores were able to avoid negative outcomes. Similarly, proponents of corporal punishment point to individual children who were raised under harsh conditions but grew up to be well-adjusted adults. Conversely, not all children raised in privileged conditions do well. The compelling advances in life course science therefore raise 2 important questions: what explains the individual variability in response to childhood adversity, and how do events in childhood become biologically embedded and affect outcomes like behavior and physical and mental health decades later? Recent advances in gene–environment interactions and the physiology of stress are beginning to address both of these important questions.

Gene–Environment Interactions: Differential Susceptibility to Context

In the past, notions of nature versus nurture dominated discussions of development. The consensus now is that it is not simply one's genetic blueprint (nature) or one's experiences (nurture) that determine outcomes. Rather, development, both in childhood and across the life span, results from an ongoing and cumulative dance between the two.[13] This dynamic interplay between the genome and experience may well account for the individual variability in response to childhood adversity.

Two prominent models have emerged to account for the strong but imperfect linkage between adverse experiences and later outcomes. The first, the diathesis stress model, predicts that some children may have a genetic predisposition or vulnerability to do poorly (compared to their nonpredisposed peers) when faced with adversity. Many alleles have been identified that appear to confer an increased vulnerability for poor outcomes when paired with an adverse experience. Because these alleles would not confer any advantage in a nurturing environment, it is unclear why these "vulnerability" alleles are often highly conserved.[14,15] The second model, the differential susceptibility to context (DSC) model,[16,17] better explains the strong but imperfect linkage between childhood experiences and developmental outcomes. According to this model, some children are genetically predisposed to being more sensitive or reactive to the environment (the so-called orchids), whereas others are simply less responsive or swayed by their experiences (the so-called dandelions). From an evolutionary perspective, both groups of children could have an advantage depending on context. Under adverse conditions (eg, children growing up in Syria today), the dandelions would have the advantage because their relative insensitivity to the environment may buffer them from ongoing adversity. However, under nurturing conditions, the orchids would have the advantage because their sensitivity and reactivity could drive them to be exceptionally intuitive and productive. Because the pivotal alleles underlying these tendencies could be either an advantage or a liability depending on the context, one would expect a higher degree of allelic conservation.

A growing body of evidence supports the DSC model. For example, children with a particular polymorphism of the dopamine D4 receptor (DRD4, 7 repeat) were most likely to exhibit externalizing behaviors in the context of maternal insensitivity,[18] but they were also the most likely to respond to positive parenting techniques.[19] Similarly, when compared to children with low cortisol reactivity, children with high cortisol reactivity were rated by teachers as being less prosocial when living in adverse contexts; however, the high-reactivity children were more prosocial when living in more nurturing contexts.[20] Finally, children with difficult temperaments as infants demonstrated both the most and the least behavioral problems in child care, depending on whether the child care they received was of poor or high