

SCIENCE TO POLICY AND PRACTICE

3 Principles to Improve Outcomes for Children and Families

2021 UPDATE



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ABOUT THE AUTHORS

The Center on the Developing Child at Harvard University's mission is to drive science-based innovation that achieves breakthrough outcomes for children facing adversity. We believe that the science of development provides a powerful source of new ideas focused on the early years of life. Founded in 2006, the Center catalyzes local, national, and international innovation in policy and practice for children and families. We test and implement these ideas in collaboration with a broad network of research, practice, policy, community, and philanthropic leaders. Together, we seek transformational improvements in lifelong educational achievement, economic security, and physical and mental health.

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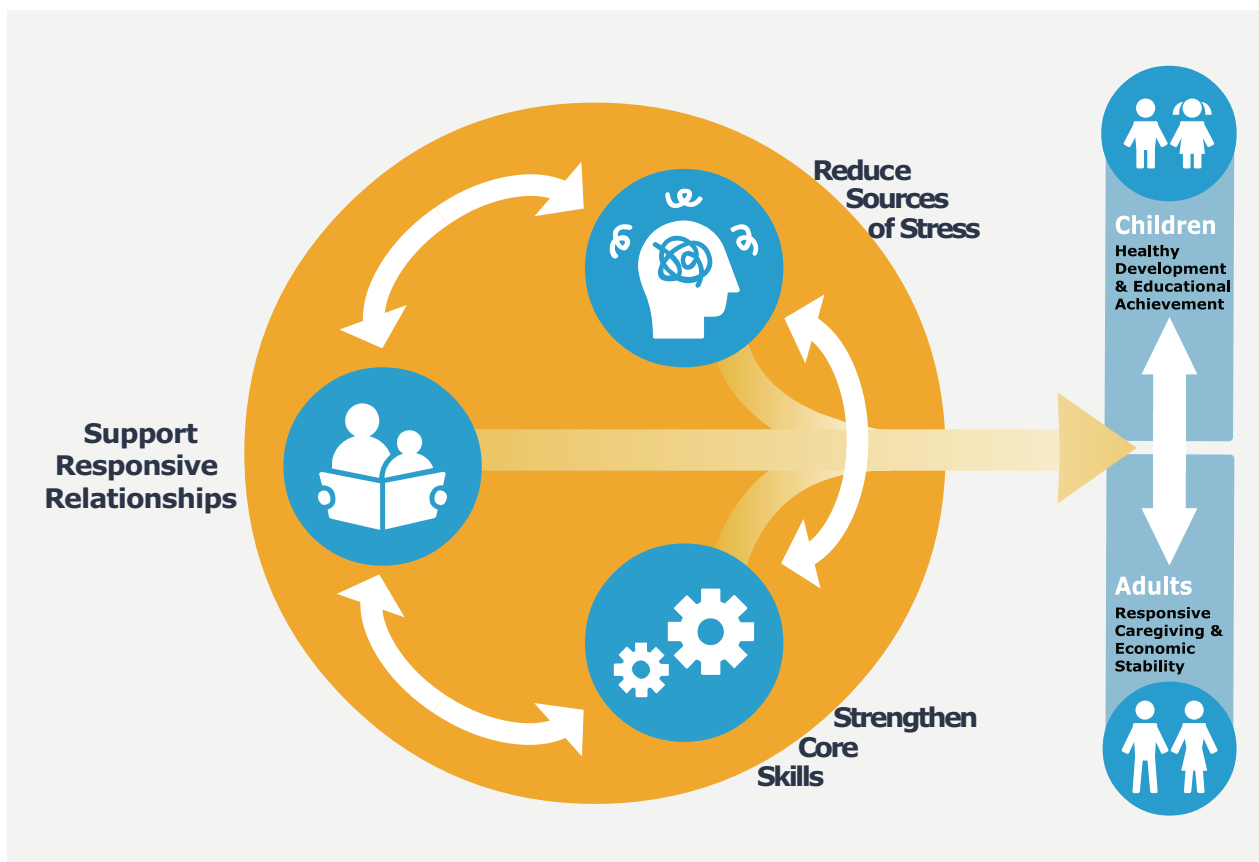
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Core Principles of Development Can Help Us Redesign Policy and Practice

RECENT ADVANCES IN THE SCIENCE OF EARLY CHILDHOOD DEVELOPMENT OFFER US AN unprecedented opportunity to solve some of society’s most challenging problems, from widening disparities in school achievement and economic productivity to costly health problems across the lifespan. Understanding *how* the experiences infants, toddlers, and pregnant women have can affect lifelong outcomes—combined with knowledge about the core capabilities adults need to thrive as parents and in the workplace—provides a strong foundation upon which policymakers, service providers, and civic leaders can design a shared and more effective agenda.

The science of child development and the core capabilities of resilient adults point to a set of “design principles” that policymakers and practitioners in many different sectors can use to improve outcomes for children and families. To be maximally effective, policies and services should:

1. **Support responsive relationships for children and adults.**
2. **Strengthen core skills for planning, adapting, and achieving goals.**
3. **Reduce sources of stress in the lives of children and families.**



Grounded in science, these three principles can guide decision-makers as they choose among policy alternatives, design new approaches, and shift existing practice to best support building healthy brains and bodies. The principles point to a set of key questions: What are current policies, systems, or practices doing to address each principle? What could be done to address them better? What barriers prevent addressing them more effectively?

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Moreover, these principles can lead policy-makers to think about changes at all levels that could lead to better outcomes for young children. At the individual level, services can focus on active skill-building for both kids and adults. At the human services level, systems might focus on the critical role of relationships in promoting healthy development, supportive parenting, and economic productivity. At a systemic level, policies can reduce structural inequities and institutionalized sources of stress, such as unequal access to high-quality health care and child care, disparities in school funding, and bias in lending. These and other long-standing inequities continue to create lifelong challenges for children and make it extraordinarily difficult for adults to thrive as parents and breadwinners. This science-based framework offers a guide for generating new ideas to address these challenges—and, in the end, achieve significant improvements in outcomes for the children and families who are the foundation of our communities and our shared future.

The Science Behind the Principles

Scientists have discovered that the experiences children have early in life—and the environments in which they have them—not

only shape their brain architecture, but also affect whether, how, and when the developmental instructions carried in their genes are expressed across multiple biological systems. This is how the interpersonal relationships young children experience with adult caregivers (within and outside the family) get “inside the body” and influence lifelong learning, behavior, and physical and mental health—for better or for worse. Throughout life, our ability to thrive is affected by our relationships, experiences, and interactions with our physical and built environments (including, for example, access to nutritious food and exposure to toxic chemicals). The degree to which these environments are health-promoting, supportive, and responsive—or not—directly affects prenatal development, child well-being, and family life. And all of these environments are shaped by the policies, supports, and structural inequities that create the conditions in which families live.

The biology of stress activation explains why significant hardship, threat, or trauma (e.g., from abuse, neglect, extreme poverty, systemic racism, or interpersonal discrimination) can lead to physiological and behavioral disruptions that can have lasting impact. However, not all stress is bad—children need to experience manageable amounts of adversity with help from supportive adults to develop coping skills and healthy stress response systems. But frequent or prolonged experiences that cause excessive stress activation can be toxic to the architecture of children’s developing brains and other biological systems. These experiences can also overload adults’ capacity to engage productively in work, families, and communities. Children whose environment of relationships includes supportive caregivers, extended families, or friends *who are not overly burdened by excessive stress themselves* can be protected from potential harm and develop the building blocks of resilience that lead to healthier and more productive lives.

Experiencing significant adversity early in life can set up our body’s systems to be more susceptible to stress throughout life, with long-term negative consequences for

physical and emotional health, educational achievement, economic productivity, social relationships, and overall well-being. For adults who have experienced a pile-up of adversity since childhood, the additional weight of *current* adversity, such as from poverty, racism, or unsafe communities, may overload their ability to provide the stable, responsive relationships their children need and consistently meet the demands of the modern workplace. Therefore, these scientific findings are relevant to policy choices

in a wide variety of areas—from traditional child-focused domains such as pediatrics, early care and education, parental leave, and nutrition to adult-focused domains such as employment, foster parenting, health care, income support, and housing. Even policies related to commercial zoning, banking practices, minimum wage, environmental regulations, public spaces, and criminal justice reforms all affect the conditions and environments experienced by families across generations.



PRINCIPLE 1: Support Responsive Relationships

FOR CHILDREN, [RESPONSIVE RELATIONSHIPS](#) WITH ADULTS HAVE A DOUBLE BENEFIT: PROMOTING healthy brain development and providing the buffering protection needed to prevent very challenging experiences from producing a toxic stress response. For adults, healthy relationships also boost well-being by providing practical advice and emotional support, which strengthen the hope and confidence needed to weather stressful situations. When public policy and effective services for families support responsive, [serve-and-return](#) interactions between adults and children—and strong relationships between service providers and their adult clients—they have the power to promote children’s healthy development *and* reinforce core adult skills, ultimately helping children become healthy, responsive parents themselves.

Why?

Responsive relationships early in life are the most important factor in building sturdy [brain architecture](#). Think of building a house: The foundation establishes a base upon which everything else is built. The same is true with developing brains. Brain architecture is comprised of *trillions* of connections among *billions* of neurons across different areas of the brain. These connections enable lightning-fast communication among neurons that specialize in different kinds of brain functions.

A major active ingredient in this developmental process is the [interaction](#) between children and their parents and with other caregivers in the family or community. When an infant or young child babbles, gestures, or cries,

and an adult responds appropriately with eye contact, words, or a hug, neural connections are built and strengthened in the child’s brain. Given the foundational importance of the first few years of life, the need for responsive relationships in a variety of settings, starting in infancy, cannot be overstated.

Supportive relationships also help build a foundation for [resilience](#) across childhood and into adulthood. The most common protective factor for children and teens who develop the capacity to overcome serious hardship is having at least one stable and committed relationship with a supportive parent, caregiver, or other adult. These personalized, responsive relationships buffer children from developmental disruption and model the capabilities that

enable individuals to thrive in school, work, and maintaining a stable household.

Responsive relationships help children and adults deal with stress, regulate emotions and behaviors, and build hope for the future. In contrast, the social isolation experienced by many families that are dealing with mental health problems or substance abuse—and the stigma associated with them—also damages relationships and increases isolation. Public policies and human service programs that are specifically designed to support the skills and environments that foster responsive relationships between children and those who care for them support healthy development and improve child outcomes. Likewise, service providers who listen responsively and treat clients with respect are more likely to be effective in promoting positive change.

Here are some examples of ways to apply the **support responsive relationships** design principle to **policy**:

- Prevent children from cycling in and out of programs. The loss of a child care subsidy, housing instability, or involvement in the child welfare system can all disrupt the stability of relationships. We can prevent these disruptions by providing sufficient benefits to help families consistently meet their basic needs and through more flexible program guidelines that enable families to stay consistently connected to service providers.
- Establish policies that allow families to preserve and strengthen their relationships. For example, promote frequent contact between children in out-of-home care and their parents and siblings, minimize changes of placement for children in out-of-home

care, and facilitate the involvement of parents who are incarcerated or facing uncertain residential status.

- Ensure that workers in service programs have adequate compensation and benefits, professional development, social-emotional support, and supervision in order to reduce the high level of turnover in these positions that disrupts relationships among staff, children, and families.
- Offer services through trusted organizations and individuals in the community who have already built strong relationships with families.

Next, here are examples of opportunities to apply this principle to **practice**:

- Coach adult caregivers on serve-and-return interaction with children in a wide range of settings, including pediatrics, early care and education programs, home visiting, and even employment training programs.
- Develop hiring practices aimed at identifying and selecting staff who reflect the cultural/racial/ethnic backgrounds of families being served, as well as individuals who are motivated to build strong relationships with families that have different cultural backgrounds and diverse needs. For example, use an interview process in which candidates can be observed relating to others.
- Reduce caseloads and class sizes to give service providers enough time to develop relationships with the people they are expected to help. Allow interactions of sufficient duration, frequency, and consistency, and reduce administrative requirements that can cause staff to spend too much time with forms and too little with the people they serve.



PRINCIPLE 2: Strengthen Core Skills

THERE IS A SET OF [CORE SKILLS](#) THAT HELP PEOPLE MANAGE LIFE, WORK, AND RELATIONSHIPS successfully in a society that rewards the ability to focus, plan for and achieve goals, adapt to changing situations, and resist impulsive behaviors. No one is born with these skills; they are

developed over time through practice and feedback, with some children needing more time and support than others to build them. Policies that help children and adults strengthen these core skills affect not only their success in school and jobs, but also the ability of parents to support the development of these capabilities in the next generation.

Why?

Scientists call these capabilities [executive function and self-regulation skills](#). Just as an air traffic control system at a busy airport safely manages the arrivals and departures of many aircraft on multiple runways, the brain needs this skill set to filter distractions, prioritize tasks, remember rules and goals, and control impulses. These skills are crucial for learning and development. They also set us up to make healthy choices for ourselves and our families.

Children can develop these skills—and adults can strengthen them—when policies, programs, and skilled caregivers or caseworkers create environments that provide “scaffolding” for efforts to use them. Scaffolding is age- and context-appropriate support that gets people started and steps in as needed, enabling practice with gradually less support. Adults can facilitate the development of a child’s executive function skills by establishing routines, modeling appropriate social behavior, and creating and maintaining supportive, reliable relationships.

Science shows that the brain continues to adapt to experiences throughout life and that adults, too, can [strengthen these skills through practice and feedback](#). Most people develop a range of core skills that are highly attuned to the environment they live in. Time management, for example, is a set of skills that is strongly influenced by context—in some cultures, punctuality is highly valued and a focus of skill-building, while in others it is considered less important. Recent research indicates that some children who grow up in harsh environments develop enhanced skills for solving problems in threatening circumstances—for example, faster cognitive processing or the ability to track and respond flexibly to new information under duress. Building on existing strengths and channeling their use productively, as well as practicing new skills in multiple situations, may be the key to strengthening capacities that are needed and valued in a variety of environments.

In the first three years after birth, infants and toddlers can start learning to use these core ca-

pabilities in basic ways—like learning to focus their attention, responding to limit-setting, and following simple rules. Between ages 3 and 5, most children make huge gains in using these skills through creative play, learning to adjust flexibly to different rules for different contexts, and resisting impulsive behaviors.

By later childhood and adolescence, with the benefits of growth-promoting experiences and support, our brains are ready to build on these foundational skills to navigate more complex situations—resisting peer pressure, setting long-term goals and plans, and dealing productively with setbacks. Although it’s much easier to begin developing the building blocks of these skills early in life, it’s never too late to improve them. Even in adulthood, people can still learn new skills and strengthen others, but it requires far greater effort if the foundation is weak.

Core skills are crucial for learning and development. They also set us up to make healthy choices for ourselves and our families.

Included below are examples of ways to apply the **strengthen core skills** design principle to **policy**:

- Assure funding for programs that explicitly focus on self-regulation and executive function skills and incorporate opportunities for program participants to practice these skills.
- Increase incentives for two-generation programs to actively strengthen core skills in children and in the adults they depend on.
- Develop education and early learning policies that recognize the importance of executive function and self-regulation as an important strand in the “braided rope” of skills children need to succeed academically.
- Seek and eliminate structural bias in policies that prevent people of color from

achieving their goals. A sense of self-efficacy is critical to strengthening these skills, and persistent barriers to success that are outside of one's control can thwart the motivation to keep trying.

And, here are examples of opportunities to apply this principle to **practice**:

- Adopt coaching models that help individuals identify, plan for, and meet their goals. Scaffold skill development with tools such as goal-setting templates, text reminders, timelines, and planners.
- Model actions that increase success in goal achievement by focusing on

small, incremental steps with frequent feedback.

- Create regular opportunities to learn and practice new skills in age-appropriate, meaningful contexts, such as play-based approaches in early childhood; planning long-term school projects in adolescence; and role-playing a difficult conversation with a boss in adulthood.
- Recognize, appreciate, and build on the skills people already have that have helped them to survive and thrive in their environment—the skills that have gotten them to where they are today.



PRINCIPLE 3: Reduce Sources of Stress

LEARNING TO DEAL WITH STRESS IS AN IMPORTANT PART OF DEVELOPMENT, BUT THE unremitting [stress](#) experienced by millions of children and families experiencing deep poverty, systemic racism, intergenerational trauma, community violence, interpersonal discrimination, parental substance abuse and/or mental illness can, without treatment, cause long-lasting problems for children and the adults who care for them. Reducing the pile-up of potential sources of stress will protect children directly (i.e., their stress response is triggered less frequently and powerfully) and indirectly (i.e., the adults they depend upon are better able to protect and support them, thereby preventing lasting harm). Children are better able to thrive when we lighten the load on their parents so they can meet their families' essential needs, when teachers and caseworkers have effective training and manageable class sizes/caseloads, and when policies and programs are structured and delivered in ways that reduce stress rather than amplify it.

Why?

[Excessive activation of stress response systems](#) affects the brain and other organ systems in many ways. When we feel threatened—including the state of “high alert” or vigilance that comes with being in an acutely threatening environment, or even one that has felt threatening in the past—our body prepares us to respond by increasing our heart rate, blood pressure, blood sugar, and stress hormones, such as cortisol. When stress response systems are activated within an environment of supportive relationships, these physiological ef-

fects are moderated and brought back down to baseline. However, if the stress response is extreme and long-lasting—and supportive relationships are unavailable—it can lead to [toxic stress](#), which disrupts the healthy development of brain architecture and other biological systems. Like revving a car engine for days or weeks on end, constant activation of the stress response has a wear-and-tear effect on the brain and other biological systems.

Constant stress also drains precious energy the brain needs: in childhood, for healthy development; and in adulthood, to deal with

consequential decisions, of which there are many for parents dealing with structural inequities related to economic instability, systemic racism, or other problems. Chaotic, threatening, and unpredictable situations and environments that activate the “fight or flight” response can make it difficult to engage [executive function skills](#)—the underlying capacities we need to plan, focus, adjust, and resist impulsive behaviors. And while it’s good to practice these skills, constant and intensive demand to deal with continually stressful situations can deplete them—just as exercise is good for physical fitness, but trying to run multiple marathons in a week would leave us physically exhausted.

In addition, people who have experienced serious early adversity, chronic personal discrimination, or inter-generational trauma are more likely to perceive and focus attention on potential threats throughout life. Frequently experiencing circumstances that seem beyond our control can also lower our sense of self-efficacy (the belief that we can do things to make change and improve our own lives), which is key to our ability to plan and engage in goal-oriented behaviors.

For all of these reasons, a multi-generational approach to reducing external sources of stress on families has double benefits: It clears the way for adults to provide responsive relationships and stable environments for children, and it helps children to develop healthy stress response systems and sturdy brain architecture, to focus on learning, and to receive a lifetime of benefits from these early building blocks of resilience.

Listed below are examples of opportunities to apply the **reduce sources of stress** design principle to **policy**:

- Create the conditions in which families can meet basic needs, such as affordable and nutritious food, safe shelter, medical care, and mental health services, as well as have opportunities to build financial assets to withstand unexpected losses or emergencies.
- Focus special attention on the needs of children during periods of severe hardship, such as homelessness.

- Establish simplified, streamlined rules to determine eligibility and re-certification for benefits and services, while minimizing punitive regulations that add stress to already challenging situations.
- Actively reduce community-level sources of stress in areas of concentrated disadvantage, such as recurrent violence, exposures to environmental toxicants, food deserts, and lack of services and economic opportunity.
- Provide consistent, adequate funding to prevent unexpected loss of services, which is a source of stress to both service providers and families, in order to offer stability that enables adults to focus on responsive caregiving.

Constant stress drains precious energy the brain needs: in childhood, for healthy development; and in adulthood, to deal with consequential decisions, of which there are many for parents dealing with structural inequities related to economic instability, systemic racism, or other problems.

Finally, here are examples of ways to apply this principle to **practice**:

- Help families achieve economic stability and strengthen the skills needed to create a supportive home environment with consistent and predictable routines.
- Routinely ask about and respond to the major stressors affecting families as part of the assessment process conducted in many types of service programs.
- Provide services in calm, organized, and welcoming environments.
- Provide workers in service programs with the supports they need, such as reasonable caseload/class sizes, responsive supervision, and skill development, to manage their own stress so they can help their clients effectively.



How the Policy and Practice Design Principles Interact

THESE THREE PRINCIPLES DO NOT OPERATE IN ISOLATION. IN FACT, THEY ARE HIGHLY interconnected and reinforce each other in multiple ways. First, progress on any of the three makes progress on the other two more likely. For example, reducing sources of stress makes it easier to access and use executive function and self-regulation skills; it also frees up time and energy to participate in responsive interactions. Likewise, helping parents and caregivers improve executive functioning supports their ability to engage in serve-and-return interactions with the children in their care and to create a more stable and predictable caregiving environment.

Second, each individual's functioning has important effects on every other member of the family. It creates a self-propelled cycle of benefits to all. For example, when an adult caregiver creates a calm, orderly, predictable environment, children are likely to experience less stress, which supports their healthy development. Children's improved behavior in turn reduces stress for caregivers, providing a greater opportunity for the adults to continue to build their own self-regulation and executive function skills.

Using these design principles to promote positive change on all three dimensions is our best chance to help adults provide safe and responsive caregiving, and to help children get (and stay) on track for healthy development.

Unfortunately, the converse is also true: significant challenges in any one of these areas can lead to problems in the others. Using these design principles to promote positive change on all three dimensions is our best chance to help adults provide safe and responsive caregiving, and to help children get (and stay) on track for healthy development.

The Design Principles in Action

Understanding major influences on child development and how adults develop and use core skills—as well as recognizing the effects of excessive stress on both—is critical for improving outcomes for individuals and all of society. Drawing on a common understanding of how healthy development can be either promoted or derailed, practitioners and policymakers can think in new ways about how we can better support families raising young children and address the “upstream” sources of problems more effectively.

Below are three suggestions for how policymakers, system leaders, and practitioners can apply these design principles in their own contexts.

1. *Question, assess, and improve **current policies and operations**.* To what extent do current policies and operations promote (or hinder) responsive relationships and the development of core capabilities? To what extent do they diminish (or increase) sources of stress? What is preventing us from doing better? To find the answers to these questions, leaders might conduct a series of observations and conversations with front-line workers who are engaged personally with both children and adults. This is likely to produce important information about how things

work now and suggestions for how they might work better in the future.

2. **Test proposed changes in policy or system operations.** When changes to laws and/or regulations are proposed, they are commonly evaluated for their potential economic and budgetary impact. The three design principles in this paper provide an additional framework for analyzing such proposals. Compared to current operations, how might the proposed changes affect prospects for responsive relationships, for developing core capabilities in both adults and children, and for reducing sources of stress? Given those likely impacts, how strong is the case for (or against) the changes as currently envisioned? How might the proposals be modified in order to produce more positive effects and/or fewer negative consequences, particularly for families living in areas of concentrated poverty or dealing with systemic racism or other sources of intergenerational trauma?
3. **Use an organizing framework for developing new policies or program strategies.** Sometimes assessments of and changes to current policies are not enough. Making use of what has been learned from observations and conversations with workers and clients, leaders might ask questions like: Suppose we want our system to do the best possible job of reducing the sources of significant stress experienced by caregivers, children and providers of early childhood services. How would we redesign the system to do that? What are the changes we might adopt soon to get started, and what are the larger and more complex changes that we might aim for over time? How might the system help the most overburdened and underresourced families build their assets to stave off instability?

>>> LEARN MORE AT:

<https://developingchild.harvard.edu/innovation-application/science-x-design/>

A Note About the 2021 Update of This Document

THE PROCESS FOR UPDATING THIS PAPER BEGAN WELL BEFORE THE OUTBREAK OF THE COVID-19 pandemic, the widespread social protest against systemic racism, and the massive economic collapse that has affected most those who already had the least. It was undertaken in response to many comments we've received since we first published the paper in 2017 and launched a series of "[Science X Design](#)" workshops to help policymakers and system leaders apply these scientific principles to their own contexts and sectors. Over the course of 2020, with increased public attention to long-standing, structural inequities, updating this paper became even more urgent.

Many of the changes in this paper call out more explicitly the growing body of evidence that has been "hidden in plain sight"—evidence linking disparities in health and education outcomes to the ways in which public structures, systems, and services have been constructed (consciously or not) across many generations to systematically deny opportunity to people of color. In order to have the greatest impact, attempts by policymakers and system leaders to use the science of

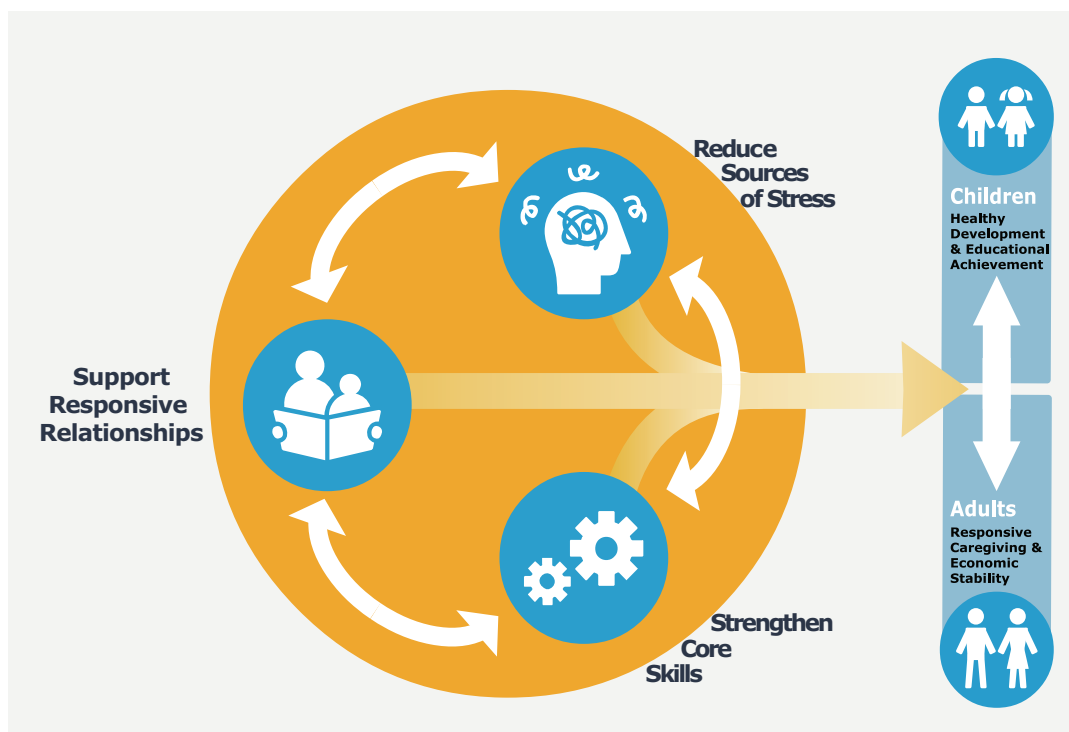
early childhood development to improve outcomes in our communities must include more attention to these "upstream" sources of stress.

Other updates reflect our own journey of listening more carefully to the voices of people who are experiencing multiple forms of adversity personally. We have come to better understand that the "executive function and self-regulation skills" that continue to be the focus of extensive research are, in fact, "core skills"

for a particular, culturally specific context that rewards goal-oriented planning, impulse control, and delayed gratification—while in other circumstances it may be more adaptive and effective in the short term to develop skills that enable a quick survival response. Biology tells us that human development is about adaptation, as our brains (and the rest of our bodies) adapt to the context in which we live. As we began to think more intentionally about the broad diversity of those contexts, it became increasingly clear that the skills we have been calling “core”—while still important— must be viewed as important only when they’re matched to a particular purpose in a particular set of contexts.

Finally, as we point toward a future that will require rebuilding systems and social infrastructures that have crumbled during the COVID-19 pandemic and its associated economic disruptions, several lessons are emerging.

- First, the need to base public policy on sound scientific concepts has never been more compelling. Science does not have all the answers, but science-informed insights combined with the lived experiences of families and communities, the expertise of service providers, and a diversity of perspectives among policymakers and civic leaders can catalyze fresh thinking and more effective action.
- Second, the science-informed design principles presented in this paper remain relevant in the midst of a pervasive crisis that affects everyone (albeit unequally) and will continue to be well-founded and much-needed in the future. The basic concepts of child development do not change: Responsive relationships still build sturdy brain architecture and support adult coping; core skills still comprise the building blocks of healthy decision-making and resilience in the face of adversity; and excessive activation of the stress response still disrupts both healthy development and the ability of parents and other caregivers to provide stable, supportive environments for young children.
- Third, the often shaky and, in some cases, non-existent “systems” that were in place to support families before the pandemic (particularly in the U.S.) need to be not just restored, but rethought and rebuilt to be stronger and more effective going forward. Reconstructing a new early childhood ecosystem that connects social services, health care, and education, and is guided by the best available knowledge (scientific and on-the-ground), is essential if we are to thrive in the future.



Additional Resources

Except as noted, all resources are from the Center on the Developing Child and available at <http://developingchild.harvard.edu>.

The science behind the principles

[*Connecting the Brain to the Rest of the Body: Early Childhood Development and Lifelong Health Are Deeply Intertwined. Working Paper 15.*](#) (2020)

[*Supportive Relationships and Active Skill-Building Strengthen the Foundations of Resilience. Working Paper 13.*](#) (2015)

[*From Best Practices to Breakthrough Impacts: A Science-Based Approach to Building a More Promising Future for Young Children and Families.*](#) (2016)

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Boyce, W.T., Levitt, P., Martinez, F.D., McEwen, B.S., & Shonkoff, J.P. (2021). [Genes, environments, and time: The biology of adversity and resilience.](#) *Pediatrics*, 147(2):e20201651.

Responsive relationships

“Key Concepts: Brain Architecture.”
<https://developingchild.harvard.edu/science/key-concepts/brain-architecture/>

“Key Concepts: Serve and Return.”
<https://developingchild.harvard.edu/science/key-concepts/serve-and-return/>

[*Young Children Develop in an Environment of Relationships. Working Paper 1.*](#) (2004)

[*The Timing and Quality of Early Experiences Combine to Shape Brain Architecture. Working Paper 5.*](#) (2007)

[*The Science of Neglect: The Persistent Absence of Responsive Care Disrupts the Developing Brain. Working Paper 12.*](#) (2012)

Core skills

“Deep Dives: The Science of Adult Capabilities.”
<https://developingchild.harvard.edu/science/deep-dives/adult-capabilities/>

(Resources continued on next page)

“Key Concepts: Executive Function & Self-Regulation.”

<https://developingchild.harvard.edu/science/key-concepts/executive-function/>

[*Building the Brain’s “Air Traffic Control” System: How Early Experiences Shape the Development of Executive Function. Working Paper 11.*](#) (2011)

[*Building Core Capabilities for Life: The Science Behind the Skills Adults Need to Succeed in Parenting and in the Workplace.*](#) (2016)

Stress

“Key Concepts: Toxic Stress.”

<https://developingchild.harvard.edu/science/key-concepts/toxic-stress/>

[*Excessive Stress Disrupts the Architecture of the Developing Brain. Working Paper 3.*](#) (2005, updated 2014)

Shonkoff, J.P., Boyce, W.T., McEwen, B.S. (2009). [Neuroscience, molecular biology, and the childhood roots of health disparities: Building a new framework for health promotion and disease prevention.](#) *JAMA*, 301(21), 2252-2259.

Shonkoff, J.P. (2016). [Capitalizing on advances in science to reduce the health consequences of early childhood adversity.](#) *JAMA Pediatrics*, 170(10), 1003-1007.

Shonkoff, J., Slopen, N., & Williams, D. (2021). [Early childhood adversity, toxic stress, and the impacts of racism on the foundations of health.](#) *Annual Review of Public Health*, 42, 23.1-23.20.

"Stress and Resilience: How Toxic Stress Affects Us, and What We Can Do About It." (2019).

<https://developingchild.harvard.edu/resources/stress-and-resilience-how-toxic-stress-affects-us-and-what-we-can-do-about-it/>

Notes

WORKING PAPER SERIES

- Working Paper 1** *Young Children Develop in an Environment of Relationships* (2004)
- Working Paper 2** *Children's Emotional Development Is Built into the Architecture of Their Brains* (2004)
- Working Paper 3** *Excessive Stress Disrupts the Architecture of the Developing Brain* (2005, updated 2014)
- Working Paper 4** *Early Exposure to Toxic Substances Damages Brain Architecture* (2006)
- Working Paper 5** *The Timing and Quality of Early Experiences Combine to Shape Brain Architecture* (2007)
- Working Paper 6** *Establishing a Level Foundation for Life: Mental Health Begins in Early Childhood* (2008, updated 2012)
- Working Paper 7** *Workforce Development, Welfare Reform, and Child Well-Being* (2008)
- Working Paper 8** *Maternal Depression Can Undermine the Development of Young Children* (2009)
- Working Paper 9** *Persistent Fear and Anxiety Can Affect Young Children's Learning and Development* (2010)
- Working Paper 10** *Early Experiences Can Alter Gene Expression and Affect Long-Term Development* (2010)
- Working Paper 11** *Building the Brain's "Air Traffic Control" System: How Early Experiences Shape the Development of Executive Function* (2011)
- Working Paper 12** *The Science of Neglect: The Persistent Absence of Responsive Care Disrupts the Developing Brain* (2012)
- Working Paper 13** *Supportive Relationships and Active Skill-Building Strengthen the Foundations of Resilience* (2015)
- Working Paper 14** *Understanding Motivation: Building the Brain Architecture That Supports Learning, Health, and Community Participation* (2018)
- Working Paper 15** *Connecting the Brain to the Rest of the Body: Early Childhood Development and Lifelong Health Are Deeply Intertwined* (2020)

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- Early Childhood Program Evaluations: A Decision-Maker's Guide* (2007)
- The Science of Early Childhood Development: Closing the Gap Between What We Know and What We Do* (2007)
- A Science-Based Framework for Early Childhood Policy: Using Evidence to Improve Outcomes in Learning, Behavior, and Health for Vulnerable Children* (2007)
- The Foundations of Lifelong Health Are Built in Early Childhood* (2010)
- Building Core Capabilities for Life: The Science Behind the Skills Adults Need to Succeed in Parenting and in the Workplace* (2016)
- From Best Practices to Breakthrough Impacts: A Science-Based Approach to Building a More Promising Future for Young Children and Families* (2016)
- Applying the Science of Child Development in Child Welfare Systems* (2016)