

The Two Year Window

The new science of babies and brains—and how it could revolutionize the fight against poverty.

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A DECADE AGO, a neuroscientist named Charles Nelson traveled to Bucharest to visit Romania's infamous orphanages. There, he saw a child whose brain had swelled to the size of a basketball because of an untreated infection and a malnourished one-year-old no bigger than a newborn. But what has stayed with him ever since was the eerie quiet of the infant wards. "It would be dead silent, all of [the babies] sitting on their backs and staring at the ceiling," says Nelson, who is now at Harvard. "Why cry when nobody is going to pay attention to you?"

Nelson had traveled to Romania to take part in a cutting-edge experiment. It was ten years after the fall of the Communist dictator Nicolae Ceaușescu, whose scheme for increasing the country's population through bans on birth control and abortion had filled state-run institutions with children their parents couldn't support. Images from the orphanages had prompted an outpouring of international aid and a rush from parents around the world to adopt the children. But ten years later, the new government remained convinced that the institutions were a good idea—and was still warehousing at least 60,000 kids, some of them born after the old regime's fall, in facilities where many received almost no meaningful human interaction. With backing from the MacArthur Foundation, and help from a sympathetic Romanian official, Nelson and colleagues from Harvard, Tulane, and the University of Maryland prevailed upon the government to allow them to remove some of the children from the orphanages and place them with foster families. Then, the researchers would observe how they fared over time in comparison with the children still in the orphanages. They would also track a third set of children, who were with their original parents, as a control group.

In the field of child development, this study—now known as the Bucharest Early Intervention Project—was nearly unprecedented. Most such research is performed on animals, because it would be unethical to expose human subjects to neglect or abuse. But here the investigators were taking a group of children out of danger. The orphanages, moreover, provided a sufficiently large sample of kids, all from the same place and all raised in the same miserable conditions. The only variable

would be the removal from the institutions, allowing researchers to isolate the effects of neglect on the brain.

Prior to the project, investigators had observed that the orphans had a high frequency of serious developmental problems, from diminished IQs to extreme difficulty forming emotional attachments. Meanwhile, imaging and other tests revealed that some of the orphans had reduced activity in their brains. The Bucharest project confirmed that these findings were more than random observations. It also uncovered a striking pattern: Orphans who went to foster homes before their second birthdays often recovered some of their abilities. Those who went to foster homes after that point rarely did.



In Romania's infamous orphanages, many children received almost no meaningful human interaction.

This past May, a team led by Stacy Drury of Tulane reported a similar finding—with an intriguing twist. The researchers found that telomeres, which are protective caps that sit on the ends of chromosomes, were shorter in children who had spent more time in the Romanian orphanages. In theory, damage to the telomeres could change the timing of how some cells develop, including those in the brain—making the shorter telomeres a harbinger of future mental difficulties. It was the clearest signal yet that neglect of very young children does not merely stunt their emotional development. It changes the architecture of their brains.

Drury, Nelson, and their collaborators are still learning about the orphans. But one upshot of their work is already clear. Childhood adversity can

damage the brain as surely as inhaling toxic substances or absorbing a blow to the head can. And after the age of two, much of that damage can be difficult to repair, even for children who go on to receive the nurturing they were denied in their early years. This is a revelation with profound implications—and not just for the Romanian orphans.

A PPROXIMATELY SEVEN MILLION American infants, toddlers, and preschoolers get care from somebody other than a relative, whether through organized day care centers or more informal arrangements, according to the Census Bureau. And much of that care is not very good. One widely cited study of child care in four states, by researchers in Colorado, found that only 8 percent of infant care centers were of "good" or "excellent" quality, while 40 percent were "poor."

MASHID MOHADERIN/REDFUX

The National Institute of Child Health and Human Development has found that three in four infant caregivers provide only minimal cognitive and language stimulation—and that more than half of young children in non-maternal care receive “only some” or “hardly any” positive caregiving.

Of course, children in substandard day care are not the only children at risk in the United States. There are also hundreds of thousands of babies born each year to American teenagers, about 60 percent of them poor. The vast majority of teen mothers are unmarried when they give birth, and frequently lack either family support or the financial resources to find capable outside help. Then there are the children who begin their lives in traumatic circumstances for other reasons—because they have a parent with clinical depression, or they witness violence in the home. Nobody has a precise definition of adversity, let alone a number for the children who experience it. But experts like Nelson think at least a few hundred thousand children suffer from serious abuse or neglect every year. Presumably they are disproportionately, although far from exclusively, in low-income families.

For a long time, social science has known of correlations between childhood turmoil and all sorts of adult maladies that carry massive social and financial costs—mental illness, addiction, tendencies toward violence. And for decades, we have attempted to address those problems with a variety of social interventions: Head Start, which aims to prepare low-income kids between the ages of three and five for school; investments in elementary and high school children; programs for rehabilitation of juvenile delinquents. While some have achieved important successes, many of the problems stemming from childhood poverty remain intractable.

But a scientific revolution that has taken place in the last decade or so illuminates a different way to address the dysfunctions associated with childhood hardship. This science suggests that many of these problems have roots earlier than is commonly understood—especially during the first two years of life. Researchers, including those of the Bucharest project, have shown how adversity during this period affects the brain, down to the level of DNA—establishing for the first time a causal connection between trouble in very early childhood and later in life. And they have also shown a way to prevent some of these problems—if action is taken during those crucial first two years.

The first two years, however, happen to be the period of a child’s life in which

we invest the least. According to research by the Urban Institute and the Brookings Institution, children get about half as many taxpayer resources, per person, as do the elderly. And among children, the youngest get the least. The annual federal investment in elementary school kids approaches \$11,000 per child. For infants and toddlers up to age two, it is just over \$4,000. When it comes to early childhood, public policy is lagging far behind science—with disastrous consequences.

THE ADULT BRAIN consists of about a hundred billion nerve cells, or neurons, that communicate with each other and the rest of the body by transmitting electrical impulses. A baby’s genes contain a blueprint for what cells to build and when, and how those cells are capable of operating, over the course of a lifetime. But experience and environment have profound effects on how the body reads and applies that blueprint.

Hormones affect this process, especially stress hormones. Like all living creatures, human babies are hard-wired with a stress reaction. It’s a survival mechanism that, millions of years ago,

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allowed humans to protect themselves from hunger, cold, or a saber-toothed tiger about to pounce. Today, that stress response kicks in whenever a baby perceives a threat, which can be as simple as hunger or the feeling of a wet diaper. Deep inside the adrenal glands, which sit atop the kidneys, cells pump out adrenaline—a hormone that makes the lungs breathe and the heart beat faster, increasing the supply of oxygen to the muscles. In the outer shell of the glands, different cells produce cortisol, which helps the body devour stored sugars and prepare the immune system to ward off invaders.

With these hormones sloshing around, blood pressure rises, muscles tighten, and energy surges. A baby wails, waiting for somebody to provide milk, dry clothing, or maybe just a warm embrace. When comfort comes quickly, the body produces fewer stress hormones, the baby calms down, and the brain goes back to

business as usual. And if this happens repeatedly, as it should, the nerve impulses crackling in the brain will carry the signals for effective coping with stress over and over again—building pathways that the baby can use later in life to solve problems and overcome difficulty.

But the baby who is ignored or neglected just keeps screaming and flailing. Eventually, he exhausts himself and may appear to withdraw. Yet the quiet child is not a content child. Constant activation of the stress system causes wear and tear on the brain, altering the formation of neural pathways, so that coping and thinking mechanisms don’t develop in the same way. For example, a baby who endures prolonged abuse or neglect is likely to end up with an enlarged amygdala: a part of the brain that helps generate the fear response.

Some of the earliest and most important research establishing this process dates to the 1950s, when investigators observed that rats were better at solving problems if they got more nurturing at very young ages. Among the pioneering scientists in this field were Seymour Levine of Stanford, Michael Meaney of McGill, and Bruce McEwen of Rockefeller University. McEwen’s work showed, among other things, that persistently high levels of cortisol altered the structure of the hippocampus, a part of the brain that plays a key role in forming memories and providing context for emotional reactions. Eventually McEwen introduced a term, “allostatic load,” to describe what was happening when stress hormones inundated the body for extended periods of time. Subsequent research showed that persistent childhood stress also leads to significant physical problems, such as far higher rates of cardiovascular disease and diabetes, as Paul Tough explained in an elegant *New Yorker* article in March.

But the links to cognitive and intellectual problems are just as concrete. Early adversity, says Nelson, can interfere with “planning ability, cognitive flexibility, problems with memory, and all of those will correlate with diminished IQ.” Every one of the researchers emphasizes that some children who go through these experiences end up OK—and that later interventions may still be helpful for those children who struggle. But, overall, says Nelson, “they’re more likely to have mental health problems. The top of the list will be anxiety. Second to that will be attention deficit disorder. And then depression.” One 2010 paper from *Psychological Medicine* concluded that “childhood adversities”—a category that includes abusive parenting and economic

hardship—were associated with about one in five cases of “severely impairing” mental disorders and about one in four anxiety disorders in adulthood.

These problems incur large costs. Think about the lost wages from serious mental health problems, which total \$200 billion a year, according to a 2008 study from the *American Journal of Psychiatry*. Or think about the expense of incarcerating criminals: about \$60 billion a year, according to a 2006 study from the Commission on Safety and Abuse in America’s Prisons. Childhood adversity obviously doesn’t account for all of these sums. But if the studies are correct, then adversity explains a significant portion—certainly in the tens of billions of dollars.

And the implications go beyond mental illness or crime. Children who fail to develop coping mechanisms struggle from the earliest days in school, because even the slightest provocations or setbacks destroy their focus and attention. They can’t sit still and read. They have trouble standing in line. They lash out at classmates or teachers. And these struggles, naturally, lead to other problems that perpetuate the cycle of poverty. All of this is to say that the science of early childhood may play a significant role in the dominant political question of our time: rising inequality.

It also operates its own child care center and school, called Educare, that became the model for a national network of such facilities designed to improve day care for infants and young children, including those too young for Head Start. But perhaps the program’s most intriguing initiative is its work with agencies that provide at-home visits to young women, particularly teenagers, who are either pregnant or are new mothers. Some of these agencies employ doulas, who are specially-trained to provide advice and support to mothers, from the prenatal period all the way up through early childhood.

A few weeks ago, I went on a visit with Maria Caref, a doula who works for Christopher House, an organization that partners with Ounce of Prevention. Maria was visiting Rosaria, a 17-year-old high school student with a four-month-old baby boy. (As a condition of my attendance, I agreed not to identify the real name of Rosaria or her baby.)

Rosaria lives on the second floor of a house in a lower-income, predominantly Latino neighborhood on the west side. When we walked in, her son was lying face-up on a Winnie-the-Pooh fleece blanket on the floor, playing with a ball. Rosaria was on the floor next to him. Children’s music was playing loudly in

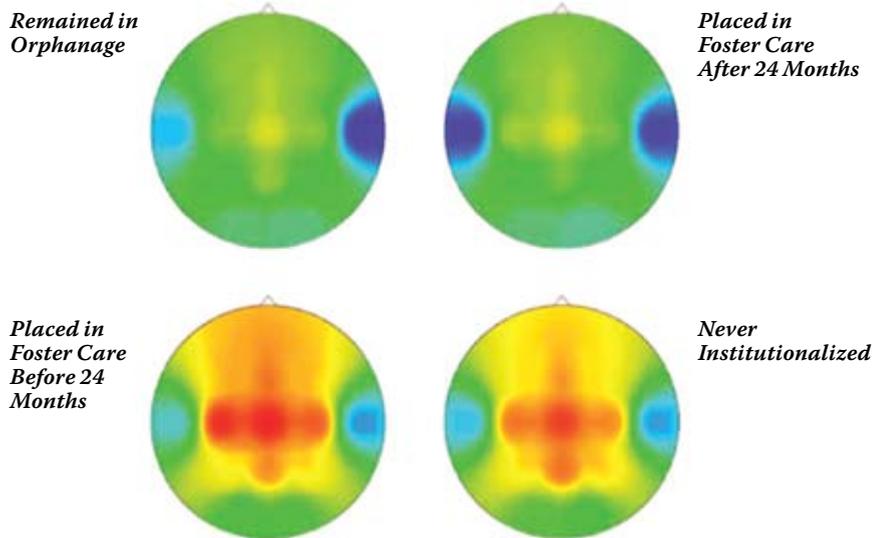
the background. Like most of the young mothers Caref visits, Rosaria came to Christopher House via a referral (in this case, from a health clinic) while she was pregnant. The official agenda for the visit was to assess whether she was still working toward her own goals as a student and as a parent. But, as always, it was also a chance to check up on the baby and how Rosaria was caring for him.

Rosaria told Caref she was pleased that her boy was aware of her voice and would turn his head to follow her. “He laughs all the time; he’s smiling,” she said. When Caref pulled out a rattle, it got his attention right away. “*Curioso*,” Rosaria said, “like Curious George.” At that point, Rosaria pointed out a plaything she’d made the baby, by sewing buttons onto socks that she’d turned into mittens. Caref smiled but, after tugging on the buttons with her fingers, warned that they were actually a hazard: “Wow, mom is so creative,” Caref cooed, while holding the baby. “But you have to be careful,” she said, carefully switching gears. “He can pull this hard and he can swallow this. It would be very dangerous.” Later the two talked about whether Rosaria had followed up with immunizations (she had) and whether she was still reading to the boy regularly (she was, although not as regularly as before

THE FIRST TIME I heard of this field of research was during a conversation with a woman named Diana Rauner. In the early ’90s, about a decade after graduating from Yale, Rauner had left a lucrative career in private equity to study developmental psychology at the University of Chicago. For her dissertation, she visited day care centers in the city, hoping to learn about how infants and toddlers pick up language skills. But she learned a lot more about the sorry state of child care. Rauner described facilities where infants were strapped in car seats, “watching *The Lion King* all day,” while the older kids were “circling the room almost like sharks” and throwing things at the infants, because they had nothing else to do. But the infants frequently didn’t cry. “A lot would just stare, which is almost worse,” Rauner says.

Today, Rauner runs a nonprofit organization called the Ounce of Prevention Fund, a \$40 million-per-year initiative that applies the latest scientific findings about early childhood—in particular, those first few years—to help some of Chicago’s most disadvantaged families. The fund trains workers at day care centers on how to nurture babies in ways that will stimulate positive brain activity.

Childhood Adversity: Inside the Brain



This figure from a 2010 study shows electrical activity in the brains of eight-year-old children involved in the Bucharest Early Intervention Project. These patterns show that children removed from orphanages before the age of two developed brain activity similar to children who were never institutionalized, while the brain patterns of children removed after the age of two were similar to those of children who remained in the orphanages.

because she was busy with her own homework). “For some mothers, it’s really hard to keep up,” Caref told Rosaria as we left. “You’ve been doing really well.”

A major goal of these visits is to establish long-term relationships, so that the young women come to see the visitors as both a source of support and an advocate for their interests. Visitors like Caref are trained to deal with a wide range of issues, from basic psychology to health. During the visit, Caref talked to Rosaria about breastfeeding, which has significant health benefits for both mother and daughter. They also spoke about birth control. Studies have shown that teen mothers who have more than one child, particularly in rapid succession, are by far the most likely to fall into crisis.

The model for these efforts is a visiting nurse program that David Olds, a University of Colorado pediatrician, tested in Elmira, New York, during the ’70s and ’80s, and which grew into the national Nurse-Family Partnership. In 2011, the program, which the federal government helps finance, will serve more than 20,000 families; they receive home nurse visits from when they become pregnant until their children are two years old. Olds’s program is one of the more unambiguous success stories in the modern history of social policy. Two long-term studies published in the *Journal of the American Medical Association* found that adolescents whose mothers had been in the program were less likely to run away, get arrested, or consume alcohol or tobacco. Reports of child abuse were lower by about 50 percent.

When the RAND Institute evaluated the initiative, it determined that the program would save between \$1.26 and \$5.70 for every \$1 spent, with the higher savings from the higher-risk families, thanks to reduced spending on hospitals, incarceration, and cash assistance. And according to Timothy Bartik, an economist and author of *Investing in Kids*, every dollar that goes into the Nurse-Family Partnership will raise incomes for the entire population by \$1.85, once you factor the economic benefits of a more productive workforce—and a tax base that won’t be so strained picking up the tab for remediation and crime. High-functioning day care centers that cover birth through age five, Bartik says, produce a larger payoff per dollar: \$2.25.

The science of early adversity, then, offers a blueprint for tackling the effects of poverty and neglect, one that is more precise and observable than any tools policymakers have ever had at their disposal. “The concept of disrupting brain circuitry

is much more compelling than the concept that poverty is bad for your health,” says Jack Shonkoff, a Harvard pediatrician and chair of the National Scientific Council on the Developing Child. “It gives us a basis for developing new ideas, for going into policy areas, given what we know, and saying here are some new strategies worth trying.”

AFTER MY VISIT with Caref, it was possible to imagine what a comprehensive policy response to the problems of impoverished early childhood might look like. Young families would have the option of home visits, from doulas or social workers. Child care would be higher quality across the board. It would also be affordable, even for families at or below the poverty line. Such services wouldn’t be available exclusively to the poor, since middle-class families could also benefit from many of these programs. That would make them more popular, too.

From a policy standpoint, probably the

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biggest question about home visiting is how well it would work on a much larger scale. Not all home programs are going to be as thorough as the effort I saw in Chicago, which means they may not produce the same benefits. This is a familiar problem: Studies of Head Start, for example, suggest that it does not have the long-lasting effects on test scores that exemplary programs like the famous Perry Preschool in Ypsilanti, Michigan, do. Instead, Head Start’s impact on test scores tends to fade (although many researchers argue plausibly that dismal assessments of reading or math skills overlook other advantages that Head Start students gain).

But the bigger questions right now are political. Nobody is talking about launching a new government initiative, no matter how much money it might save in the long run. On the contrary, the focus today is on slashing government spending. The Affordable Care Act has \$1.5 billion over five years for expanding visiting nurse programs for brand new mothers. That’s a massive expansion over the previous investment which, according to administration officials, was only in the millions. But even as that money works its way through the pipeline, the net investment in early

childhood care is probably declining, given how much of it flows through cash-strapped state governments that are frantically cutting their budgets. In Illinois, to give just one example, about 5,000 at-risk children will lose state-financed schooling, care, or developmental services this year because of a 5 percent budget cut, according to Adam Summers, from Illinois Action for Children. And that’s in addition to 14,000 kids who lost access to state-funded pre-kindergarten in the last two years. At the federal level, House Republicans have proposed eliminating the new home visit funds altogether.

Hard times require hard choices, of course. But these cuts can be counterproductive. One of the most convincing advocates for this argument is James Heckman, a Nobel Prizewinning economist from the University of Chicago. Earlier in his career, Heckman undertook a project to study the effects of high school equivalency (GED) programs. To his chagrin, he discovered that the graduates didn’t seem to be much better off, despite the considerable public investment in the programs. So Heckman began a quest to discover what kinds of government spending *would* work. His research led him to the conclusion that earlier is better, until eventually he came to focus on the first years of a child’s life.

Heckman argues that a dollar spent on the earliest years of life generates more payoff than a dollar spent on later childhood—let alone a dollar spent on adulthood. Neither he nor any of the scientific researchers believes the United States should stop funding later interventions as long as the programs actually have some impact. Among other things, plenty of infants with nurturing caregivers still develop problems later on, for other reasons. But Heckman agrees with researchers who argue that the older the child, the more expensive and difficult those interventions will be.

Heckman has tried to make this case to anybody who will listen, including members of the congressional super committee on deficit reduction, whose cuts to social services—either directly or through reduced aid to the states—could decimate existing services while leaving little room for new initiatives. “We can gain money by investing early to close disparities and prevent achievement gaps, or we can continue to drive up deficit spending by paying to remediate disparities when they are harder and more expensive to close,” Heckman wrote in a formal letter to the committee in September. “The argument is very clear from an economic standpoint.” ♦