

Conversations on Economic Inclusion with Andrew Garner

Dionissi Aliprantis

This is Conversations on Economic Inclusion. I'm Dionissi Aliprantis, the director of the Program on Economic Inclusion here at the Federal Reserve Bank of Cleveland. In our program, we aim to bring together researchers and practitioners to learn more about what it takes for more people to participate more fully in the economy.

In talking with experts, one of the areas I wanted to learn more about was the role of something called toxic stress on how young people develop, learn and build skills. To learn more, I sat down with Dr. Andrew Garner. He's a pediatrician, a Clinical Professor of Pediatrics at Case Western Reserve University, and a leader voice of the American Academy of Pediatrics who co-authored the book, "Thinking Developmentally," which summarizes the science that points toward childhood experiences having lifelong impacts. I spoke with him to learn what might be holding school-aged children back from having economic success later in life.

Before we get started, I should mention that the views expressed here are those of the participants, and not necessarily those of the Federal Reserve Bank of Cleveland or the Federal Reserve System.

And now, here's my conversation with Dr. Andrew Garner.

Dionissi Aliprantis

I was wondering if you could speak a little bit about the origins of the focus given to this issue of toxic stress. Can you tell me how people started paying attention to this or thinking about this?

Andrew Garner

I think historically there are two epidemiologic studies. These are studies that are population based and are retrospective, that really forced folks to look more closely at the developmental origins of adult health and disease. And interestingly, they were both dismissed as quackery pretty much by a scientific establishment because they didn't fit nicely into contemporary models of health and disease. The first was this thing called the Barker hypothesis. Barker was a British epidemiologist who in the late 1980s and early 1990s noted a correlation between fetal conditions and things like intrauterine growth retardation, low birth weight, and prematurity, and so-called metabolic conditions later in life. Things like hypertension, coronary artery disease and the non-insulin dependent diabetes mellitus.

This idea that in utero events could be impacting outcomes decades later was just really outlandish. And Barker was largely ridiculed and ignored, but his work really laid the foundation for an entire field of study in saying that what happens in utero and in early childhood does not stay in utero and early childhood. That there're ripple effects across lifespan. This suggested that there must be some form of biological priming or embedding that allow these early experiences to be influencing outcomes decades later.

Then in 1998, Dr. Felitti, who was an internist and Dr. Anda, who was another epidemiologist at the CDC, they published the Adverse Childhood Experiences Study. Felitti was actually an internist who was running a Kaiser Permanente obesity clinic. And he had a real problem because all his superstar

patients, the ones who lost huge amounts of weight using his program would invariably regain the weight back again. He is like, "I don't understand why my superstars are the ones that are rebounding back." So, he felt he must be missing something. He decided to use a standardized social work interview and he discovered that almost all of them had traumatic experiences in childhood and early life adversity. And he was really astonished by how frequently this came up. He asked his colleagues to do the same and they found similar results. He went to Robert Anda again, an epidemiologist at the CDC and said is it really possible that childhood adversity is this common and could this really be linked to poor outcomes down the line? And that was the nexus for this Adverse Childhood Experiences (ACEs) Study.

The Adverse Childhood Experiences Study looked at over 17,000 middle class, middle aged (most of them were in their 50s) Americans. They were living in the San Diego area, and they asked them if prior to the 18th birthday, they had any of 10 different types of childhood adversities. The 10 different adversities and these were just things that they had noticed were common, there weren't anything especially magic about these. There are other adversities as well, but the ones they looked at were three forms of abuse, physical, sexual, and emotional abuse, two forms of neglect, physical and emotional neglect, and five measures of household dysfunction. They were looking at parental mental illness, parental substance abuse, intimate partner violence, separation or divorce, and an incarcerated household member.

And what they found, in this population that you think was pretty well-to-do (most of them had had some college education) was that about two thirds had at least one adverse childhood experience and about 20% had more than four adverse childhood experiences. They wanted to try and come up with a way to try and quantify this adversity, and so they came with this thing called an ACE score. An ACE score, basically, was that you got one point for each of those 10 different categories of adversity. The ACE score now is something that's used widely to try and identify adversity in childhood. And I think it's really important for people to understand what the ACE score means. It was an initial measure looking at adversity, but it's actually a relatively poor measure of adversity. And what I mean by that is we know that there's a tendency to repress adverse experiences and traumatic experiences, so there are issues with recall, so probably it underestimates the adversity because of recall. It also underestimates adversity because of the issue of repetition. If you are abused once or abused every day for a year, you still get one point for that type of abuse. And then there's also issues with redundancy, so if your father was an alcoholic, but your mom preferred heroin, that's still one thing for substance abuse. The point is an ACE score is a relatively poor measure of adversity, but nevertheless, they were able to see a dose dependent and statistically significant graded effect that the higher your ACE score, the higher risk for just about any poor outcome you can think of.

I don't mean to overstate it, but really we're talking about things like obviously mental health conditions, we're looking at chronic diseases like heart disease and diabetes. We're looking at things like risky behaviors, substance abuse, that sort of thing. And then even educational attainment income and even early death. And so again, we should be clear, these are associations and are being done at the population level. So that does not mean that you're sitting there thinking, "oh my God, my ACE score is six, I'm hosed." That's not what this is saying. This is saying that at a population level, that increases your risk and there are other risk factors and protective factors to go into that equation. We'll talk more about those protective factors in a minute, hopefully. But the point is that clearly there is something going on in early childhood when you have these stressful experiences that can become biologically embedded and influence outcomes decades later.

Dionissi Aliprantis

So that is something pretty incredible, the ways that what happens in childhood doesn't necessarily stay there. Can you talk about some of the mechanisms at play here?

Andrew Garner

Absolutely. And so now I think we do need to define toxic stress. Toxic stress refers to the ongoing unmitigated biological responses to threats that happen in the absence of social-emotional buffers. So toxic stress is not about the precipitants or the triggers that's important, it's really about the body's stress response to those events. Again, it's an important distinction because we tend to think about different stressors or triggers, but those range from distinct catastrophic threats like violence or bullying to ongoing chronic conditions like poverty or exposure to racism. And the events or triggers can be very subjective, so one child hears a dog barking and things, "Ooh, puppy let's play," and another is, "Keep that beast away from me." Some of that has to do with their previous experiences. And on the other side too parental encouragement might be perceived as being very supportive or it could be perceived as applying undue pressure.

So, you're going to have a hard time getting objective handle on a wide range of adversities, unless you start looking at the response. Because the biological response is something we can begin to quantify and observe objectively. We adapt to chronic stress at the molecular, cellular and behavioral levels. It can truly change who we are. And this adaptation is sometimes called allostatic loading. In physiology, there's a concept of homeostasis. Homeostasis is manifest in the body's desire to maintain certain levels and within a normal range to maintain vital functions. But the question is what happens if those allostatic mechanisms cannot keep up with the change? We begin to exhaust our ability to get back to normal and we begin to break down. And so that's been sometimes referred again, this idea of allostatic loading.

So that's one mechanism through which adverse child experiences and the toxic stress that they precipitate can become biologically embedded and increased poor outcomes down the line. And there's a related concept there, and that's an important one called behavioral allostasis. So sometimes the way to get back to normal is through behaviors that help us cope with stress. So, for example, people smoke and drink and eat and have sex, that all turns off the stress response in a short term. They could be considered adaptive from a toxic stress perspective, but clearly they can become health harming over time, particularly if they become addictions or our default means of coping with stress. One of the really insightful precipitants of the ACE study once told Dr. Felitti, "Doc, it's really hard to get enough of something that almost works."

All those things almost work. Whether it's smoking, having sex, they almost work and so it's very easy to see how they can become addictive. They become our default means of coping, but in the long run, they can be health harming.

I should put out though that not all forms of stress are toxic, only those that are prolonged or frequent or extreme because there's no social, emotional buffering to turn it off and bring it back to the baseline. In the presence of safe, stable, nurturing relationships, stress responses can actually be positive, and build resilience and skills to deal with future adversity in an adaptive manner. For example a 15-month-old who can't express themselves may have a tantrum and we respond to the non-verbal cues and a two-year-old, who does a face plant while running we're going to offer consolation. And even a middle

schooler who has an overwhelming project, we're going to help them break that down in little bits that seem a little more manageable.

The point is that positive stress is not the absence of stress. We don't want to put kids in a stress-free bubble, we actually want to give them the skills they need to adapt to adversity in a healthy manner moving forward. I think that's an important point because in society we tend to let kids know in a million different ways that strong emotions are bad. You're not allowed to feel that way, you're not allowed to have strong emotions. If you do, there's something wrong with you and that's really not healthy. Big emotions are okay, but they demand a distraction.

And I think there's three different kinds of distractions, there're healthy distractions, there're escapes and there're unhealthy distractions. The healthy distractions are the kids' passions, we want to tap into the drawing and the reading and the music and the dance and the sports and the Rubik's cube and the chess, because they build skills and often generalizable skills, which are going to help them down the line. But some distractions are escapes, passive entertainment like YouTube or TV or video games and they're potent distractions, but they're not really helping you build new skills. They're fine now and then- we all need ways to blow off steam now and then. But if they become a default mode of coping, then we're start cutting into the skill building time. And then of course we talked about unhealthy distractions, that's the behavioral allostasis we talked about where they may be adaptive initially, but clearly there are health harming in the long run.

Dionissi Aliprantis

Yeah. You think about the ways that we evolved in a very different setting than the one that we live in now, and these responses that in that other setting probably were very, as you said, adaptive, they can be very maladaptive now. I'm curious if you could speak a little bit about toxic stress and brain development and especially the way that there's this phrase or expression that these early experiences can "get under your skin."

Andrew Garner

Sure. The Barker hypothesis and ACE study demonstrated those early experiences are becoming embedded, they're somehow altering these life course trajectories. The question is how, like you're saying. So it's almost as if, I like to picture it this way, there are these wide arrays of child experiences, both adverse and nurturing, I should say, and then there's this proverbial big black box. And then decades later we have these adult outcomes, some of them are good, some of them are bad. And so it's really a question of what's going on inside the box? I think we would say there are at least two main developmental sciences that help us look inside the box. The first is this idea of epigenetics. Epigenetics literally means above the genome and what it refers to are changes in gene expression that are not related to changes in the actual sequence of the DNA.

Dionissi Aliprantis

Sorry. As someone whose biology could use a little tuning, can you explain what that means?

Andrew Garner

So a gene can either be turned on, which means it ends up being transcribed and translated into a protein that does a job, or it's turned off, it's not turned on. And so if you think about the genome that way, there are many different types of genes, some genes get turned on and turn on a whole set, a cascade of other genes. We know in development, there's some genes that turn on and now you're

going to get a limb there. There are some genes that are master switches that have cascades of other genes. They turn on, this gene turns on a whole bunch of other genes.

There are some genes that are almost circadian, they go on and off very dynamic. So that makes sense. We have some circadian rhythms, so some genes come on, some genes go off, so they're very dynamic over time.

But there's some genes that are programmed early and then they persist across the lifespan. And so that's an important thing to understand is that what happens in early childhood, again, it can affect what happens down the line, there's almost an imprinting.

The idea of epigenetics though, is that what turns on those genes on and off is the environment. So that's critically important because we tend to think of the genome as being fixed, that was the old model. If you inherit these genes, you know what your destiny is. And there are models like that. If you know anything about Huntington's disease, we know that if you inherit that gene, it's pretty likely you're going to have problems down the line, but the vast majority of genes are not like that. We know that the environment plays a role and can determine whether or not that gene gets turned on or not. This is really liberating. So, if you inherit a gene that makes it very likely for you to be an alcoholic, but the environment never turns that gene on, well, it's not really much of a risk. This is really good news that the genome is almost somewhat plastic, and we can do things to determine, and the other way they put it, the American Academy of Pediatrics says, "Epigenetics is not your parents' genome." The idea being that just because you inherit the same genes as your parents, does not mean that they're going to interact in the same way, the same permutations of genes are going to get turned on because of how the environment impacts that.

And so if there is adversity in childhood, but there are opportunities, particularly relational opportunities, things like breastfeeding, opportunities just to touch and to nurture, we can reverse those patterns. And so that's probably the good take home message here is that yes, toxic stress is real, adversity can become biologically embedded, but relational health can change that. That was the first way, epigenetics.

The second way is the way the brain forms. There's five general principles about brain development that help organize things at least for me.

The first is that brain development is experience dependent, and that's very clear. So, the way the brain works is obviously there's things that happen, stimuli that happen in the exterior, gets translated into neural activity, neurons fire in a certain pattern. And there's this phrase that neurons that "fire together, wire together," the idea being that experience determines how the brain forms. And then there also is this pruning that happens where all those connections that are forming over time, if you're not using them frequently, you lose them. If you don't use it, you lose it. And so, both in terms of building the original connections and pathways in the brain, and then how they are honed over time, they are very experience dependent processes. So experience matters.

Second thing you have to remember though, is that it's really cumulative. The brain is built like a house it's built from the bottom up. If we have an unstable foundation where the original pathways are really aligned more towards stress responses as opposed to social responses, that's going to determine how the eventual house or how the brain looks down the line. So, deficits beget deficits and strengths beget strengths, and there's a cumulative effect there.

The third thing I would say is the brain is really integrated. We tend to think about different skills as being separate; we got cognitive skills and we got emotional skills, we got very different things. That's our meager attempts to understand the brain. Most skills actually are multidimensional. And that's

important in terms of development too, because I think about brain development almost like playing a game of solitaire. If you're ever playing a game of solitaire, if you don't get all the aces, you're only going to get so far. If you're missing certain skills, you're not going to get very far. And we know that from life experience too, we know people that are brilliant, but you don't want to work with them.

It's also dynamic. And this is an important thing because the brain, we talked a little bit about how there's plasticity in the genome, the brain we know is very plastic. And by plastic, we mean it literally is able to reshape itself on the basis of experience. The problem is particularly when we're talking about the on switch for the stress response, which is the limbic system in particular, this little almond size thing called the amygdala. It develops relatively early in development, which makes sense.

Evolutionarily, you want to shoot first and ask questions later, or there may not be a tomorrow. But as we get older, we want to be able to step back and begin to think about what our options are. The off switch for the stress response is thing called the prefrontal cortex that is right behind our eyes. And some people have said, that's the seat of civilization, that's what makes us huma. Our ability to think abstractly, to prioritize, to decide this is more important than this, and it also allows us to regulate our emotions. And so that's the off switch for the stress response. But the problem is that doesn't mature at least structurally completely until you're 24.

Dionissi Aliprantis

That's kind of old.

Andrew Garner

It is kind of old. The on switch is screaming through most of development and the off switch is finding its voice. And so that's why you can see if there is some significant adversity in childhood, it may be a lot harder for those kids to turn off that stress in and of their own. They need those safe, stable, nurturing relationships to help learn.

The point is, you asked how experiences in childhood, and I would say not only adverse experiences, but also nurturing experiences, how they become biologically embedded. I would say they can change who we are at the molecular, cellular and behavioral levels. And examples are epigenetics for molecular changes, developmental neuroscience for cellular changes, and behavioral allostasis for how we adapt to change and stress.

Dionissi Aliprantis

Okay. Great conversation. And being at the Fed, I'm now going to bring it to the labor market. So, we're going to go from just trying to think about this very meager attempt to understand the brain, which is, as you said, a super fascinating subject. I was wondering if you could speak a little bit about the association between ACEs and adult outcomes and especially any focus or any thoughts you might have about participation in the labor market and people's ability to do that.

Andrew Garner

The takeaway I would say is that unmitigated adversity in childhood has the potential to change who we are. ACEs have the potential to alter learning, behavior and health across lifespan. All those features are going to clearly impact on a person's economic productivity.

Dionissi Aliprantis

I was wondering if we could now turn a little attention to this idea of relational health. So, we talked a little bit about toxic stress and you described the way that we can react to environmental stressors. That can be okay, that can be maybe even positive, but it can also be toxic. But you point out that toxic stress, this whole framework is problem-focused. It's focused on what happens biologically without any mitigating social or emotional buffers. You had a recent policy statement where you were emphasizing the potential of focusing on relational health and you see that as a solution-focused approach. I'm wondering if you could elaborate on that. What do you mean by relational health and what do you mean by it being solution-focused?

Andrew Garner

I would define relational health as the ability to develop and sustain safe, stable and nurturing relationships. So relational health is a capacity and it reflects skills that are hopefully built over time. And it's dyadic, it's two person and it's often intergenerational. What I meant in that policy statement is that toxic stress really helps us define the problem. So many of our society's most intractable problems, including disparities in economic productivity, but also education and otherwise, they're rooted in our shared biology but divergent experiences and opportunities. And relational health really helps us define the solution. The individual family and societal capacities to develop and maintain safe, stable and nurturing relationships, they also buffer adversity and build the skills needed to be resilient, healthy, and productive citizens and the safe, stable and nurturing caregivers for the next generation.

I would say that minimizing adversity is necessary, but it's not sufficient. And there's good data to support that.

There was a study published by Christina Bethel on the flourishing of kids. And she defined flourishing as being, are they curious, do they complete tasks and do they stay in control? Let me be clear. That's a high bar, I'm not sure I meet that bar most days. What it really is getting at is this idea of executive function, which is the prefrontal cortex we were talking about. She defined this measure of flourishing, and what it showed was that there are more kids flourishing that have high adversity and high family resilience and connection than kids that have no adversity, but little family resilience and connection. I think what this really drives home, at least for me, and again, this was a light bulb moment for me is that we tend to think of adversity and nurturing experiences as being two ends of one axis like it's "experience." The reality is there're two completely different axes that coexist in kids' lives every day.

Dionissi Aliprantis

Yeah. You could have a really adverse experience one moment, and then a couple moments later, you could have some really nurturing relationship or some really nurturing experience.

Andrew Garner

Absolutely. And it's that restorative thing that's so incredibly important. It's so incredibly important. So again, you're the economist, I'm not the economist, but if I'm going to model this, I'm going to say they're two different axes and they both map onto a third axis, which is wellness. So, if you have obviously high ACEs, well, that's the negative side there, whereas fewer ACEs is the positive. And then more positive child experiences that's the positive there and then fewer negative. And then wellness from low wellness to high wellness is going to map onto that. And I think that's important, because if we just consider an ACE score, you might predict that kid would do relatively poorly in terms of being well. And if you factor in that they've had few positive child experiences, you might predict even do worse, but if you factor in the positive, they may actually fair relatively well.

And that's what Christina Bethell's data shows is that if you have adversity, but you have those nurturing relationships, you may actually do pretty well. Then this is the kicker for me, the reverse is also true. So just because you have material wealth, and you have these positive experiences does not necessarily mean you're in the clear. If you have few adverse experiences and then you factor in you have some great positive experiences, well then, yeah, you're probably going to do pretty well. But if you have low adversity, but you have low relational health, you're going to not do as well. And that's clear from her data. And so that's why this is so important to me personally, is that it's not just about those kids or those kids, it's about biology. We all need relational health to reach our full potential.

Dionissi Aliprantis

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