

## VIEWPOINT

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## Rethinking Attention-Deficit/Hyperactivity Disorder

The prevalence of attention-deficit/hyperactivity disorder (ADHD) has increased substantially over the past 20 years: by some estimates, as much as 30%.<sup>1</sup> Much like the rise in autism prevalence, the reasons for this are likely multifactorial, including an actual rise in incidence as well as increased recognition and diagnosis. The deficits seen in children with ADHD include impulsivity and inattention, and these salient features are part of what those of us researching cognition consider "executive function."

Executive functioning is controlled by the prefrontal cortex (or, as some call it, the chief executive officer) of the brain. Decades of research have shown that children with higher executive function do better in every aspect of life. Not only do they do better in school, they also have lower rates of substance abuse, divorce, depression, and imprisonment. Additionally, they have higher incomes and better physical health. Why might this be? There are many reasons beyond the fact that doing better in school can itself improve many aspects of one's life. Better executive function allows for more considered choices to be made. These choices can be large ones, such as who to marry, but equally important, they can be a series of infinitesimally small ones: should I tell Bobby that I don't like his shirt? Should I play with Shaquita today? Should I throw this rock? Taken in aggregate, the approach children take to the quotidian small decisions they make can substantially impact their lives. Consider the now famous Stanford marshmallow experiments.<sup>2</sup> Researchers brought preschool children into a laboratory and offered them 1 marshmallow immediately, or, if they could wait for 15 minutes, they would get 2. Succeeding in this task requires impulse control and focus. Only about 30% of children could muster the restraint to wait the entire time, but the longer they waited to eat the first marshmallow (if they waited at all), the greater their cognitive and academic competence and ability to cope with frustration and stress in adolescence. A study in Dunedin, New Zealand, that followed up a much larger sample of children for 30 years found the same thing: more control early in life led to better outcomes later.<sup>3</sup> Here, the outcomes were truly impressive: for example, more self-control early in life was associated with lower rates of substance abuse, divorce, and incarceration, as well as higher rates of college graduation.

The important thing to note in both of these studies, and others akin to them, is that there is no threshold at which executive function leads to better outcomes. In fact, there is a linear relationship, meaning that every increase in executive function early in life, however small, improves outcomes in adulthood.<sup>3</sup> What does this mean for ADHD? As with intelligence, attentional capacity has a "normal distribution," or, as some call it, a "bell-shaped curve." Like many medical diagnoses, in

testing for ADHD, we dichotomize a continuous variable: we draw a line at some point on that curve, typically at the 95th percentile, and define that as what distinguishes pathology from normalcy. In the case of ADHD, a clinician performs a series of assessments by having parents and teachers report their observations of the child on a standardized form. In one of the most widely used and well-validated measures of ADHD, a child needs to demonstrate 6 of 9 specific behaviors to be diagnosed as having ADHD.<sup>4</sup> Each of those behaviors are based on a parent or teacher reporting that a child does something "often" or "very often" such as "have difficulty organizing tasks and activities" or "loses temper." Those answers are used to determine whether the child falls in the pathological range. If they do, we prescribe medications or cognitive behavioral therapy. We give special accommodations at school and try to structure their environment to be less distracting. But if the child scores just below the cutoff, we reassure the parent that their child does not have ADHD and offer them essentially nothing. Paradoxically, many children would be better off if they scored 1 to 2 points worse on the assessment, thereby availing themselves of things from which they too would benefit in both the short and long term. Distinguishing between children with "pathological deficits" in attention and those without them belies the fact that all children would benefit from better executive function. In fact, much as we have moved from a diagnosis of "autism" to "autism spectrum disorder," we should move from a diagnosis of ADHD to one of attention-deficit/hyperactivity spectrum disorder. Accordingly, the shift should be from treating attentional capacity as a clinical disease to recognizing that we need to do all we can to help children maximize their ability to focus.

We have known for some time that ADHD has a genetic basis, but other factors clearly play a role. In fact, the 1999 Surgeon General report stated, "For most children with ADHD, the overall effects of these gene abnormalities appear small, suggesting that nongenetic factors also are important."<sup>5</sup> The fact that our genes have not changed appreciably in the past 20 years is alone sufficient to lead us to look for other, presumably environmental, factors that might account for this increase. For many years, my laboratory has been exploring what we call the overstimulation hypothesis: the notion that overstimulating the developing brain in the first years of life will condition it to expect high levels of input and will lead to shorter attention spans later. We have found that exposure to rapidly paced television programs in the first 3 years of life increases the risk of attentional deficits at school age.<sup>6</sup> We also found that cognitive stimulation during that same period in terms of reading, singing, and playing with children decreases the risk of attentional

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deficits.<sup>7,8</sup> Simply put, there are things that we can do for children that maximize their genetic potential. Unfortunately, we are not doing them. The typical preschool child today watches about 4 hours of television per day (note that this study predated touch-

screens and apps), meaning they spend about 30% of their waking hours in front of a screen.<sup>9</sup> Whether this alone accounts for the rise we are seeing in attention-deficit/hyperactivity spectrum disorder is unknown, but surely we can do better.

#### ARTICLE INFORMATION

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