Fact Sheet
Digital Intervention Software: "Brain Training" for ADHD

Solid research evidence supports two types of treatment for ADHD: medication and behavioral treatments (such as behavior management strategies and parent training in behavior management). Even though these treatments help most children with ADHD, they are not perfect. Many practitioners, parents, and patients themselves look for complementary approaches to include with their ADHD treatment plan.

One complementary approach that has attracted a great deal of interest uses digital products that resemble computer games to improve symptoms—often referred to as "brain training." Some digital products have even been approved by the FDA. These interventions, which often use a game-like design and format, are not the same games played for entertainment.

When you consider a computer program as part of your child's treatment, here are some suggested questions to discuss with your healthcare provider.

- How much is known about whether the program is effective?

- What are the odds it will help my child in real life? Consider:
  o To be considered as having strong evidence, a treatment should have been tried by different researchers in different settings with many kids, with the right comparison groups, and looking at long-term improvement for real-life behavior.
  o FDA approval for this kind of treatment does not require strong evidence, given the low risk of direct harm.

- What are the risks and costs? Consider:
  o Price can play a role even if something is covered by insurance, given co-pays, deductibles, and limits.
  o Time and effort are costs, particularly if something is not easy to use and if a child is not having fun using it.
  o Part of costs is also to think about what the

child would do instead—like whether the child would be playing another game purely for entertainment, or if the game takes up time used for sleeping, creative play, spending time with friends, or being physically active.

What we currently know about computerized cognitive training programs

Digital products are computerized training programs designed to improve the weaknesses in cognitive skills found in ADHD. These interventions run on computers, tablets, or smartphones, and ask children to practice cognitive skills for about thirty minutes daily for several weeks. Many digital products present gamelike situations to boost motivation and engagement. Most allow people to practice at home and on their own schedule.

These ADHD digital intervention software programs try to improve a person's mental skills. Available products target different skills:
- **Attention:** the ability to hold and shift your focus on the important parts of a task or situation. Think of being in control of when your brain zooms in, zooms out, or switches from one thing to another without wandering or getting stuck.
- **Processing speed:** the amount of time it takes to think through a situation. Think of doing math in

your head and coming up with a solution really fast or pushing a button as soon as a signal shows up.

- **Working memory:** the ability to hold and use information in short term memory. Think of reversing a string of numbers in your head.
- **Inhibitory control:** the ability to stop doing something or keep from doing something that is no longer appropriate because of changing circumstances or intentions. Think of slamming on the brakes when a ball rolls in front of your bike.
- **Cognitive flexibility:** the ability to switch between problem solving strategies or ways of thinking about a situation. Think of figuring out how to change an outside party to an inside party when it rains.
- **Visuospatial skills:** Seeing things in your mind's eye from different perspectives. Think of trying to figure out how to get a lot of luggage to fit in a trunk.

Generally, the digital products try to strengthen these skills using gamelike tasks (serious games) with different mental challenges that are tailored to each participant. When the child plays, the game adapts to their level of performance just like many computer or video games do. Like other games, they are designed to keep children engaged in play through rewards.

Why are digital interventions appealing?

There are many reasons why these types of games are appealing as a complementary approach for treating ADHD. Working memory, inhibitory control, cognitive flexibility, and visuospatial skills, among other executive functions, are critical in everyday life. We know from decades of research that people with ADHD experience problems in these skills. And these cognitive skills involve the prefrontal cortex of the brain (the front part of the brain), which is the last region in the brain to mature and therefore may have the greatest potential for change. Children enjoy technology and might find the games engaging. Games may be easier to access for some families than other treatments and may not have the side effects that ADHD medication can have or carry a sense of stigma that getting therapy may mean for some families.

Important facts on digital intervention software

- There is a lot to learn about whether and how ADHD computer games work. This is an active area of research, and we expect to know more in the future.

- It is difficult to be certain about whether ADHD computer games are beneficial because of the very limited evidence and the wide variation in the way the research has been done, such as:
  - Most ADHD computer games can only show that they improve the child's ability to do well on lab tests for the skills on which they were trained. There is very little evidence that the skills make a difference in real life, like in school or at home.
  - There is no evidence for the long-term benefits of ADHD computer games, because the studies did not examine them.
  - Many studies involved very few participants and did not use diverse groups of participants to make sure the games work for all types of children.
  - Some studies did not have a control group to compare to the group that played the game, or the control group did not do anything similar enough to be sure it was the game that made the difference, not other factors such as the attention the child received or the time spent with the researchers.
  - If a study used a control group, often the participant, parent, and researcher were aware of the treatment that that was given. Expectation that something good happens can affect outcome. "Blinding," which means that participants, families, and even the researchers do not know who is in the treatment or control group is an important way to avoid bias in the resulting data.
  - Most ADHD computer games focus on a limited set of mental skills. Most focus on working memory even though working memory is only one of the difficulties connected to ADHD.
  - Not all children with ADHD have problems in all the mental skills that the ADHD games try to improve. We do not know if a person must have a clear deficit in those skills to benefit from this type of training, meaning that even if the games are effective, we do not know for whom they are effective.

- Based on what we know so far, we can come to some tentative conclusions:
  - Some ADHD computer games seem to improve certain cognitive and attention skills, but effects are small and the skills that are improved are generally lab-based skills on which the children train and not real-life skills.
  - Little is known about how they work when

combined with other, established, and effective treatments like medication and behavior treatment.

o ADHD computer games are generally safe and free of direct adverse side effects (some children feel frustrated or develop a headache), but we do not know much about cost versus benefit for these apps, privacy and security, and people's preference for ADHD computer games over other forms of therapy.

o Most ADHD computer games are experimental, but some products are already in the marketplace. Keep in mind that FDA clearance does not mean that the FDA has certified the effectiveness of the medical device—and that FDA clearance for devices do not have the same high standards as for medications.

Talk with your child's doctor first!

Before choosing or adding an ADHD computer game, talk to your child's doctor.

References and Additional Reading

- Hsu, N.S., Jaeggi, S.M. (2013). The Emergence of Cognitive Control Abilities in Childhood. In Andersen, S., Pine, D. (eds) The Neurobiology of Childhood. *Current Topics in Behavioral Neurosciences*, vol 16. Springer, Berlin, Heidelberg.

- Cortese, Samuele et al. (2014). Cognitive Training for Attention-Deficit/Hyperactivity Disorder: Meta-Analysis of Clinical and Neuropsychological Outcomes from Randomized Controlled Trials. *Journal of the American Academy of Child & Adolescent Psychiatry*, v54 n3, p164-174.

- Tang, Hua et al. (2022). Prefrontal cortical plasticity during learning of cognitive tasks. *Nature Communications*, v13, n90.

- Kollins, Scott H. et al. (2020). A novel digital intervention for actively reducing severity of paediatric ADHD (STARS-ADHD): a randomised controlled trial. *Lancet*, v2, n4, e168-e178.

- Oldrati, Viola et al. (2020). Effectiveness of Computerized Cognitive Training Programs (CCTP) with Game-Like Features in Children with or without Neuropsychological Disorders: A Meta-Analytic Investigation. *Neuropsychology Review*, v30, p126–141.

- Hollis, Chris et al. (2017). Annual Research Review: Digital health interventions for children and young people with mental health problems—a systematic and meta-review. *Journal of Child Psychology and Psychiatry*, v58 n4, p.474-503.

CHADD