Reports

iMind: The Effect of Electronic Media Device Use on Mental Health in Children

Christopher Chamanadjian, M.D.[1], Misty Richards, M.D., M.S.[2]

[1] Psychiatry, Charles R. Drew University of Medicine and Science, [2] Psychiatry, University of California, Los Angeles

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Digital media devices have become an integral part of our lives. Electronic media device use during critical neurodevelopment periods may impact the mental health of children and adolescents. The ubiquitous use of digital media devices by youth in contemporary society warrants health care professionals to understand youth's relationship with technology and promote mindful media use.

INTRODUCTION

Steve Jobs opted not to provide his kids with an iPad and ensured they grew up in a strictly tech-free home; Bill Gates restricted his children's screen time to 1 hour per day and prohibited cell phone use until they were 14 years old; Mark Zuckerberg encouraged his daughters to read Dr. Seuss or play outside instead of using Facebook Messenger Kids.[1] These are just a few examples of the Silicon Valley gurus cautiously limiting their children's exposure to technology. As a technology enthusiast, this was a subtle warning for me. Discovering the existence of attention-controlling software, such as eye motion detection, designed to captivate users within their app for prolonged periods increased my concerns about the potential negative effects on developing minds.

Electronic devices and digital media usage have surged in the last decade. For instance, Apple launched the first-generation iPad in 2010 and sold 15 million units. Fast-forward 12 years to 2022, when Apple shipped more than 60.4 million iPads worldwide. By examining the business metrics of iPad sales over the past 10 years, we can compare them with the incidence of mental health disorders in children.

In the past decade, the prevalence of anxiety, depression, and suicide in the United States has increased within the pediatric and young adult populations.[2] Many correlational studies have associated the use of mobile electronic devices, digital media, and prolonged screen time to child depression and anxiety.[3] The debate of causality remains open and requires further prospective investigative studies accounting for several contributing factors. Considering the rapid proliferation of electronic media device use and the increasing prevalence of pediatric mental health conditions, this article aims to review the literature on critical brain development periods and discuss the potential impact of screen technology within the context of these periods.

BRAIN DEVELOPMENT AND ENVIRONMENTAL INFLUENCE

EARLY CHILDHOOD

Early childhood, generally considered the first 5 years of life, marks a critical phase in neurobehavioral development. During this period, the brain undergoes remarkable growth in size and structural organization, rapidly establishing new neural connections via synaptogenesis and myelination. Despite its rapid pace, this development is highly susceptible to environment. Exploratory studies suggest a link between neural centers associated with anxiety and depression, spanning from early childhood to mid-adolescence.[4] These interconnected mental health circuits mutually reinforce each other, with the frequency and consistency of this reinforcement impacting a child's susceptibility to expressing symptoms later in life.

External environment influences mental health development, as various environmental factors can influence both brain development and behavior. During this critical timeframe, processes like plasticity, synaptic pruning, and deprivation are sensitive to experience-dependent change.[5] For instance, adverse experiences such as abuse, neglect, and poor socioeconomic conditions can lead to alterations in the circuitry involved with emotion and cognition. Neglect, in particular, directly disrupts the critical development of processes and is associated with several detrimental, lifelong outcomes, including inattentiveness, anxiety, depression, and poor impulse control.[6] Numerous studies suggest a child's socioeconomic status (SES) can significantly impact their emotional and neurocognitive develop-

ment, with children from low SES environments being more susceptible to difficulties with their executive functioning, attention, and language skills during childhood and adolescence than their peers from higher SES backgrounds.[7] These environmental interactions during a critical brain-development window serve as input that shapes both the brain and behavior.

Screen-based media use tends to start in infancy and progressively increases with age. Several studies demonstrate an association between excessive exposure to electronic devices and detrimental behavioral and cognitive outcomes, including struggles with self-esteem and literacy comprehension.[8] Hutton's research, using diffusion tensor imaging, demonstrates that preschoolers who excessively use screen-based media exhibit less white matter structural integrity of neural tracts involved with language, literacy skills, and executive functioning.[8] As a result, overuse of electronics by young children may compromise language development and lead to language delay.

ADOLESCENCE

Adolescence is another pertinent period in brain development. During adolescence, the brain undergoes myelination and synaptic pruning, the removal of neural synapses, in neural circuits linked between the amygdala and prefrontal cortex (PFC).[8,9] Several studies highlight the susceptibility of these processes to environmental influences.[5] Disruptions caused by electronic device use may lead to different behavioral and cognitive outcomes in teenagers, including anxiety, depression, and ADHD.

Teenagers' PFC maturation relies on efficient neural circuitry development. Research suggests that immature processing in the PFC can lead to challenges in cognitive control, such as avoiding distractions and staying focused on intended goal-directed behavior.[9] As young adolescents become increasingly immersed in digital media during the maturing PFC period, they are more susceptible to potential difficulty with their attention and goal-directed task execution.

In 2019, Fors and Barch analyzed data from the Adolescent Brain Cognitive Development (ABCD) Study, involving 11,800 children aged 9 to 11 years, which illustrated the relationship between electronic media and depression and anxiety. In this study, they compared reports of electronic media use with depression and anxiety surveys from the ABCD Study's database. The study revealed a significant association between electronic media use and depression and anxiety, varying depending on the type of electronic media. Depression was associated with watching videos, while anxiety was linked to playing video games or video chatting.[3] Fors suggests that children with anxiety or depression may use electronic media as a means of coping with their negative emotions. Thus, exposure to powerful technologies during brain development could reinforce the unhealthy habit of turning to digital media to express depression and anxiety when dealing with negative emotions.

THE MODERN-DAY "PACIFIER"

Electronic devices have become increasingly common in households. Statistics from a 2023 survey reveal that 95% of U.S. teens own or have access to a smartphone at home.[10] It is not uncommon to see even young toddlers navigating an iPad with ease. In contemporary society, many parental stressors, such as busy schedules, remote working, or single parenthood, may contribute to increased screen time for children.

Arguably, these electronic devices have become modern-day "pacifiers." The more parents soothe their infants' distress with a screen, the stronger the conditioned behavior becomes. Similar to a feedback loop in addiction, habitual behavior becomes internalized. Well-intentioned parents are increasing the likelihood that their children will rely on devices to cope with stress. As a child grows into adulthood, they may increasingly internalize their emotions and engage with their mobile device rather than seeking connections with family and friends. Parents might eventually need to discipline the child by taking away the electronic device. If parents remove their child's primary coping mechanism, the electronic device, then an alternative method to cope must be introduced.

SOLUTIONS

By comparing the findings of digital media devices' effect on pediatric mental health with the decade's technological advancements, behavioral health professionals can project the landscape ahead. The trends among tech founders' approach to parenting, which alludes to the potential harm these advanced devices may hold on a young child's development, should be acknowledged by child and adolescent psychiatrists. Despite the limited data on this issue, it's crucial to remain careful and exercise caution. We must protect the developing brain and psyche in our pediatric patients today and avoid potential adverse effects on the children of tomorrow.

Medical institutions have released guidelines and recommendations for parents regarding screen time and digital media. The WHO guidelines recommend no screen time for children under 1 year old. For ages 1–2 years old, limit screen time to 60 minutes. The American Academy of Pediatrics (AAP) recommends avoiding screen media, except for video chat, if younger than 18 months old.

Herein we present a few solutions to consider:

- **Physician–Educator Role:** Openly communicate to educate families about the potential mental health outcomes of excessive screen time. Parents may be unaware of the changes in neural plasticity these devices can influence. Instruct them on the current WHO and AAP guidelines and relevant knowledge.
- **Coordinate a Media Plan:** The AACAP Screen Media Resource Center provides ample resources for families and health care professionals, such as videos, books, research, and websites. Health care professionals can use these resources to develop individu-

alized or family-based media plans and provide resources on parenting techniques best suited to the family's situation. Collaborate with pediatricians to establish an integrative approach and a comprehensive treatment team to create an appropriate media plan.

- **Innovative Child Stimulation:** The American Psychiatric Association (APA), American Academy of Child and Adolescent Psychiatry (AACAP), and American Academy of Pediatrics (APA) all have excellent resource libraries and sources to engage children and manage stress.

Take Home Summary

Digital media devices have become an integral part of our lives. Electronic media device use during critical neurodevelopment periods may impact the mental health of children and adolescents. The ubiquitous use of digital media devices by youth in contemporary society warrants health care professionals to understand this relationship with technology and promote mindful media use.

ABOUT THE AUTHORS

Christopher A. Chamanadjian, MD, is a Child and Adolescent Psychiatry Fellow at Charles R. Drew University of Medicine and Science. His interests include health care innovation, digital psychiatry, artificial intelligence, systems of care, and mental health care access for underserved communities. He serves as the Member-In-Training Representative and Social Media Chair of the Southern California Society of Child and Adolescent Psychiatry. He is also a member of the AACAP Media Committee and the Health Promotion & Prevention Committee.

Misty C. Richards, MD, is a child, adolescent, and reproductive psychiatrist at UCLA with a special interest in perinatal and infant mental health. Dr. Richards is the program director of the UCLA Child and Adolescent Psychiatry Fellowship and is the current President of the Southern California Society of Child and Adolescent Psychiatry.

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CORRESPONDENCE TO:

Christopher A. Chamanadjian, MD
email: christopherchamanadj@cdrewu.edu.

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