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The Impact of Screen Media on Children

An Environmental Health Perspective

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Are screen media good or bad for children?"

In essence, screen media constitute neurologically potent, arousing input to the developing brain. Unlike conventional toxins, their effects are mediated by sense organs. However, they have demonstrable effects on brain activity visualized on functional MRI (fMRI) and on behavior and function. As with commercial chemicals, media offer great benefits when used wisely. Similar to chemical compounds entering the market, screen media are widely used and disseminated before their full effects are understood. Nonprofit scientific and health groups find themselves playing catch-up to demonstrate their potential harms, while well-funded industry groups defend their use as essential to freedom and economic competitiveness.

fMRI studies of media use

fMRI studies during and after screen media exposure reveal pronounced and specific activation patterns. Viewing nonviolent television programs activates brain regions associated with visual and auditory processing. Viewing violent programs activates areas associated with negative affect, including the right amygdala, posterior cingulate, inferior parietal, premotor cortex, hippocampus and parahippocampus bilaterally, and dorsal anterior cingulate cortex.^{1,2}

One study of “gamers” who played over 20 hours a week showed increased glucose metabolism in the right orbitofrontal gyrus, left caudate, and right insula after play. Decreased metabolism was seen in the bilateral postcentral gyrus and bilateral occipital regions while at rest. These patterns were similar to those seen in drug addicts. Park and colleagues³ suggest that online gaming may be addictive to the genetically vulnerable. This is consistent with the repeated finding in studies of violent media: subjects tend to divide into those for whom violent stimuli are exciting and pleasurable and those for whom it is neutral or aversive. More males than females fall in the former category.⁴

Unlike drugs or toxins, there is no evidence that screen media alone are lethal in overdose; however, media clearly change behavior, and many people are unable to relinquish their use despite negative

consequences. For example, texting while driving increases the risk of crashing or near-crashing by a factor of 23; nevertheless, the practice continues to flourish.⁵ One survey found that 1 in 8 US adults is addicted to the Internet.⁶

The general rules of toxicology are that outcome depends on dose, potency (or in this case, content), route of exposure, developmental window of vulnerability, and constitutional and environmental risk modifiers. Another principle is that of hormesis: a small exposure may be beneficial through cellular adaptation that confers protection or even adaptive resilience. Screen media may be harmless or they may foster positive adaptation when used in appropriate doses by people of certain ages. However, as the dose increases, and during vulnerable developmental windows, negative effects overwhelm protective capacities and cause harm.

CHECKPOINTS

Screen media present highly arousing, abnormal sensory input to the brain's activating system. Downstream effects of arousal include the release of catecholamines, increased vigilance and irritability, motor behavior problems, a decreased attention span, and sleep problems.

One study showed that those who play video games for more than 20 hours a week have an increase in glucose metabolism in the right orbitofrontal gyrus, left caudate, and right insula after play, and a decrease in metabolism in the bilateral postcentral gyrus and bilateral occipital regions while at rest. This pattern is similar to that seen in drug addicts.

Overall, initial exposure to media with violent content increases short-term aggression, especially in younger children and boys. While early, excessive exposure to media statistically and independently increases the likelihood of later antisocial behavior in populations, this is not necessarily the case in individual children.

The risk of receiving an attention-deficit/hyperactivity disorder diagnosis at age 7 increased with every hour of television watched at 1 and 3 years.

Violent media and violence

It is difficult to link screen media in isolation to larger, social changes, such as increases in violence. These downstream, complex events are the cumulative results of multiple factors.⁷ Children's heavy exposure generally co-occurs with low parental monitoring and heavy overall viewing.⁸ However, population studies of isolated cultures after the introduction of media show an initial increase in youth aggression.¹ Overall, initial exposure to media with violent content increases short-term aggression, especially in younger children and boys. Moreover, early, excessive exposure to media statistically and independently increases the likelihood of later antisocial behavior in populations.⁹ As with most exposures, environmental and constitutional factors interact with media exposure to produce given outcomes.

Screen media effects on children

Prospective studies have causally linked media excess in young children with impulsive and aggressive behavior, obesity, and delayed development of language and reading skills.¹⁰⁻¹² A recent, large longitudinal study replicated and expanded previous findings that attentional problems associated with increased video game and screen media use persisted into adolescence.¹³

Keeping our toxicology model in mind, let's do a quick survey of the impact on the brain by developmental stage.

Babies through preschool. During the first 5 years of life, when the neurological foundations of learning and emotion regulation are being laid down, screen media appear to be most detrimental. Television for babies interrupts play, is not educational, diminishes time spent with family members, and interferes with sleep.¹⁴ *Sesame Street* and *Teletubbies* have been found to have a negative impact on vocabulary.¹⁴ The American Academy of Pediatrics recommends no screen use *by children younger than 2 years*.¹⁵ In fact, the average baby in the United States is exposed to 2 hours of screen media daily, and 65% of children up to age 6 have a television on half the time.¹⁶ In the average US home, the television is on 8 hours a day.¹⁷ By 3 months of age, 40% of children are exposed to screen media, and by 24 months, the percentage rises to 90%. Exposure rises from an hour a day for infants to over 1.5 hours a day by age 2.¹⁸

I don't like television myself. I suppose it's all right in small doses, but children never seem to be able to take it in small doses. —Willie Wonka.

Charlie and the Chocolate Factory The dose makes the poison. —Paracelsus

One large study demonstrated that the risk of receiving a diagnosis of attention-deficit/hyperactivity disorder at age 7 increased with every hour of television watched at 1 and 3 years, after adjusting for variables such as maternal function and the quality of home life.¹⁰ When the television is on, there are significantly fewer vocalizations between adults and babies, which may explain the finding that children who watch a lot of television before kindergarten are delayed readers and are at increased risk for learning disabilities.^{12,19}

Screen media affect not only children but adults as well. Parents become less adept at interacting with their youngsters as they carry on their own, adult functions of running a home. Media can disrupt the normal, attuned parent-child feedback that is the foundation of emotional regulation. This implies that while heavy media use tends to co-occur with other aspects of family dysfunction, it also appears to be an independent toxic agent.

Latency-age children (ages 5 to 10 years). Screen media present highly arousing, abnormal sensory input to the brain's activating system.²⁰ (Slow-moving shows are not harmful in this respect. However, most latency-age children have moved on from *Dora the Explorer* to *Sponge Bob Square Pants* or re-runs of *Buffy the Vampire Slayer*.) Downstream effects of arousal include the release of catecholamines, increased vigilance and irritability, motor behavior problems, a decreased attention span, and sleep problems.²¹ Chronically high levels of monoamines sensitize the threat response system to catecholamines.²¹ Thus, heavy early exposure to screen media puts the child at risk for having altered sensitivity to environmental stress. In particular, all novel experiences are unconsciously felt as threatening.²¹

CASE VIGNETTE

Four young children—ages 5 and 6—from loving, stable families who had no psychiatric risk factors besides heavy screen consumption (over 20 hours a week) presented with new-onset anxiety disorder: panic attacks, enuresis caused by simple phobia at school, pervasive obsessive-compulsive disorder (OCD), and trichotillomania.

Two of the children were obsessive viewers of the Harry Potter movies: in the first child, the panic attacks stemmed from a conviction that his parents were dead and were never returning, accompanied by the overwhelming image of Voldemort and Harry's dying mother. For the second child, the enuresis was based on a phobia linked to the ghost who haunts a school toilet. The symptoms stopped when the obsessive viewing of the videos stopped and a very brief course of play therapy was initiated. In the other children, OCD remitted immediately on ending computer access. The trichotillomania was behaviorally associated with television watching and remitted when the television was removed and new activities were substituted along with a simple behavioral system.

Excessive screen media viewing produced a variety of symptoms because of the dual effects on the arousal system and imagination in these young children. The content of children's television, with heavy emphasis on vivid facial expressions, is particularly potent. Children are wired to seek out and engage faces, but the screen's "response" to the child is abnormal. It is noncontingent, affectively exaggerated, and often chaotic. Interactive computer programs lack the complex but modulated sensory experience a developing brain needs. Under normal circumstances, inhibitory influences on the threat response system include:

- Movement: children who are sitting and watching a screen are extremely still
- Cortical input (conscious use of coping strategies): children who are excessively exposed to screen media have a smaller repertoire of strategies because of decreased opportunities to develop symbolic thought and the experience of mastery, including manual dexterity and knowledge of traditional games²⁰
- Impact on the hippocampus, the site of processing of explicit memories: if it has been abnormally loaded with early, excessive screen media exposure, it has a limited repertoire of soothing memories available for comparison, analysis, and generalization²⁰
- Parental comfort: children who are engaged in screen media rarely seek their parents, and their parents are unaware of their distress

While the children in the **Case Vignette** do not illustrate standards for scientific evidence, their cases demonstrate the potent effects of media at vulnerable developmental stages. A comprehensive review of studies on the effects of television viewing on the mental life of latency-age children indicates a negative impact on creative problem solving and play. The caveat is that with appropriate programs and in limited amounts (eg, potency and dose), television is not necessarily detrimental. Several studies have shown that the introduction of information from the television can be incorporated positively into play.²⁰

Effects on adolescents. The literature on screen media and teens is more contradictory. The Kaiser Family Foundation study found little correlation between hours of screen exposure and grades in high schoolers. This finding represents a change from a previous survey that found that low-performing students watched more television.²² Statistically significant correlations occurred only between time spent reading and good grades, and time spent playing video games and bad grades. On measures of contentedness, highly contented teens watched 1.5 hour less than teens who described themselves as having low personal contentment. A systematic review reiterated that violent outcomes in teens are correlated with multiple, covarying factors, of which media viewing is only one. We need better statistical methods and research methodology before we can come to firm causal conclusions.²³

The ability to access a wide circle of support or information through the Internet can sometimes be very positive for teens. A comprehensive data review on social networking and teens, a phenomenon too new

for reliable research, requires more time.²⁴ In my clinical experience, screen media can exacerbate mental illness in vulnerable teens and can contribute to disrupted sleep-wake cycles, obsessive preoccupations, social isolation, alienation from parents, bizarre behavior as a coping strategy, or weakening of reality testing in highly anxious or psychotic individuals.

Mindfulness or media?

Mindfulness—the capacity to reflect on one’s feelings and thoughts on a moment-to-moment basis—has emerged as an effective therapeutic tool for most psychiatric illnesses. In fact, the more we understand about psychotherapy, the more we understand it as retraining the brain to respond to novelty and adversity in planned, flexible ways. No studies on the impact of media on mindfulness are listed in PubMed. However, common sense informs us that multitasking and constant visual scanning for new electronic input is antithetical to this meditative practice.¹⁷

Making toxicology recommendations is tricky. Epidemiological studies rarely answer individual clinical questions. However, even on the basis of the limitations of our knowledge, there are several things to keep in mind, including windows of vulnerability, a child’s personality, and environmental factors. The **Table** presents recommended guidelines for managing screen media that I use in my practice.

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