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Children and Adolescents and Digital Media

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abstract

Today's children and adolescents are immersed in both traditional and new forms of digital media. Research on traditional media, such as television, has identified health concerns and negative outcomes that correlate with the duration and content of viewing. Over the past decade, the use of digital media, including interactive and social media, has grown, and research evidence suggests that these newer media offer both benefits and risks to the health of children and teenagers. Evidence-based benefits identified from the use of digital and social media include early learning, exposure to new ideas and knowledge, increased opportunities for social contact and support, and new opportunities to access health promotion messages and information. Risks of such media include negative health effects on sleep, attention, and learning; a higher incidence of obesity and depression; exposure to inaccurate, inappropriate, or unsafe content and contacts; and compromised privacy and confidentiality. This technical report reviews the literature regarding these opportunities and risks, framed around clinical questions, for children from birth to adulthood. To promote health and wellness in children and adolescents, it is important to maintain adequate physical activity, healthy nutrition, good sleep hygiene, and a nurturing social environment. A healthy Family Media Use Plan (www.healthychildren. org/MediaUsePlan) that is individualized for a specific child, teenager, or family can identify an appropriate balance between screen time/online time and other activities, set boundaries for accessing content, guide displays of personal information, encourage age-appropriate critical thinking and digital literacy, and support open family communication and implementation of consistent rules about media use.

INTRODUCTION

What Are the Differences Between Traditional Media and New Digital or Social Media?

Today's generation of children and adolescents are surrounded by and immersed in a digital environment. Traditional media, such as television

(TV), radio, and periodicals, have been supplemented by new digital technologies that promote interactive and social engagement and allow children and teenagers instant access to entertainment, information, and knowledge; social contact; and marketing. Traditional media, also referred to as broadcast media, typically were created externally by an established production source, such as a film studio, TV network, or editorial staff and were provided either to individuals or to a broader audience for passive viewing or reading. In contrast, newer digital media, which include social and interactive media, are a form of media in which users can both consume and actively create content. Examples include applications (apps), multiplayer video games, YouTube videos, or video blogs (vlogs). For children and young adults today, this evolving integration of passively viewed and interactive media is seamless and natural; the distinctions and boundaries between traditional/broadcast and interactive/social media have become blurred or imperceptible.

Digital media allow information sharing across a variety of media formats, including text, photographs, video, and audio. Today's video games, for example, often represent a merging of both traditional and social media, as users can virtually "inhabit" impressively produced worlds and interact with other users in remote locations. Video game participants can even work collaboratively to cocreate virtual worlds. Thus, digital media can provide an engaging experience in which the media experiences of children and teenagers become highly personalized.

MEDIA USE ESTIMATES

How Are Media Usage Patterns Changing in Young Children?

The evolution of media from traditional to newer forms of digital media in the past decade has resulted in changes in the patterns of media use. For example, in 1970, children began to regularly watch TV at 4 years of age, whereas today, children begin interacting with digital media at 4 *months* of age.

As new media platforms and social media have been incorporated into children's media diets, hours spent in TV viewing have slowly decreased over the past 2 decades. Loprinzi and Davis[1] examined trends in parent-reported TV viewing among preschoolers 2 to 5 years of age ($n = 5724$) and children 6 to 11 years of age ($n = 7104$) between 2001 and 2012 using data from the National Health and Nutrition Examination Survey (NHANES), showing significant decreases in mean TV viewing over time, primarily for preschoolers and, to a lesser extent, for school-aged children. Non-Hispanic white boys demonstrated the largest decrease in mean viewing of 29%, from 2.24 hours of TV per day down to 1.59 hours of TV per day. Despite these decreases, the majority of parents still reported that their children watched TV for 2 or more hours per day.

It is unclear whether these decreases are in part the result of parents heeding expert recommendations to limit screen time (evidence would suggest not)[2] or whether they represent a displacement of TV viewing by the use of novel platforms. In young children, use of mobile devices, such as smartphones and tablet computers, has risen dramatically since the Kaiser Family Foundation first began surveying parents of 0- to 8-year-olds about their technology use.[3] For example, in 2011, 52% of children 0 to 8 years of age had access to a mobile device (although only 38% had ever used one). By 2013, this access had increased to 75% of 0- to 8-year-olds.[4] Although these national surveys continued to demonstrate a digital divide on the basis of economic status, with less

access to mobile technology and the Internet in lower-income families, a smaller study in 2015 called this disparity into question by showing that almost all (96.6%) 0- to 4-year-olds recruited from a low-income pediatric clinic had used mobile devices, and 75% owned their own device.[5] This study also showed that most 2-year-olds used mobile devices on a daily basis and that most of the 1-year-olds assessed (92.2%) had already used a mobile device. Although a digital divide likely still exists in terms of access to quality content and reliable Wi-Fi, it is now clear that most young children seen by a pediatric health care provider will have used or have been exposed to mobile technology.

Exactly what young children are doing on mobile technology has not been studied in great detail, because mobile device usage is relatively recent and methodologically difficult to assess. By parent report, most children in the Kabali et al study[5] watched YouTube or Netflix primarily, and smaller proportions watched educational programs and played early-learning apps (eg, alphabet and counting apps). A large minority also played games or watched cartoons. Common Sense Media's Zero to Eight survey has found disparities in the use of educational media on mobile devices, with 54% of children from higher-income families often or sometimes using educational content on mobile devices but only 28% of children from lower-income families doing so.[4] Thus, younger children and those from lower-income families are more likely to use mobile devices for entertainment purposes.

How Are Media Being Used in Older Children and Teens Today? Which Modes of Use Are Most Popular?

Studies show that social media use patterns and rates among older

children and adolescents have continued to grow over the past decade, aided in part by the recent rise in mobile phone use among children and teenagers. At present, approximately three-quarters of teenagers own a smartphone, 24% of adolescents describe themselves as "constantly connected" to the Internet[6] and 50% report feeling "addicted" to their phones.[7] Mobile apps provide a breadth of specific functions, such as gaming, photo and video sharing, and global positioning system monitoring. Social media sites and their associated mobile apps provide a platform for users to create an online identity, communicate with others, and build a social network. Among the myriad accessible social networking sites, Facebook remains the most popular, with 71% of 13- to 17-year-olds surveyed by the Pew Research Center in 2014 and 2015 reporting using this site/app.[6] However, adolescents today do not typically dedicate themselves to just 1 site; most teenagers maintain a "social media portfolio" of several selected sites including, as indicated by rates of use in the Pew survey, Instagram (52%), Snapchat (41%), Twitter (33%), Google+ (33%), Vine (24%), Tumblr (14%), and other social media (11%).[6]

As communication moves from face-to-face and voice-only phone conversations to more screen-to-screen interactions via apps, such as FaceTime or Skype, daily communication is becoming intertwined with screen time. Texting, using a smartphone keyboard to send a written message or a visual symbol (emoji) to another smartphone, also has become a prominent means of communication for teenagers.

Lines are also becoming blurred between media use for communication versus for entertainment. With the ability to message your opponent while engaging in a remote video game or tweet while watching a TV show, viewers and gamers often link their entertainment to social media. Modes of communication have become more fluid, with conversations jumping back and forth between text messages to social media sites. Text messages also may include links to media, such as personal videos, YouTube videos, and links to Web sites and social networking sites.

Pew data from 2012 suggest that teenagers between 14 and 17 years of age sent a median of 100 texts a day. With all likelihood, this number will continue to increase as new data become available. Texting no longer is limited to cellular phone systems but can be facilitated by messaging apps, such as Kik or WhatsApp. Pew data from 2015 show that these apps are most popular with Latino (46%) and African-American (47%) teenagers, compared with white teenagers (24%).[6]

Video games also remain very popular among families; it is estimated that 4 out of 5 households own a device used to play video games, and approximately half of US homes own a dedicated game console.[8] Video games also are available via apps on mobile devices. Additionally, apps that have a practical function are also being marketed with a gaming perspective; this approach is known as "gamification."

It is common for adolescents today to engage in more than 1 form of media at the same time, a practice referred to as media multitasking. This multitasking may include watching TV and using a computer[9] or being online and engaging in more than 1 activity. In one study of older adolescents, approximately 50% of the time students were online, they were engaged in more than 1 activity.[10]

GAMIFICATION AND ADVERTISING

What Is Gamification? What Is the Impact of Gamification on Media Use by Children?

Gamification applies gaming elements to a real-world activity in a seamless, user-friendly, and attractive way. Commercial video games have incorporated cutting-edge graphics, behavioral reinforcers (ie, for reaching certain levels of play), and exciting stories, which have been delivered through stationary personal computers, dedicated gaming consoles, or multiplayer networks. One key difference today is the portability achieved via smartphones, mobile Wi-Fi, and broad social networks, which has changed how and where games can be played and how gaming functions can be applied. These portable "games" can now be integrated into daily life by functioning as sources for information and guidance and by providing motivation to achieve academic and wellness goals. For example, the Nike+ app tracks exercisers' routes, pace, steps, distance, and time and challenges runners to compete with friends and improve their performance. Such design also serves to reinforce behavior (both health behaviors and for using the app), resulting in more engagement with both.[11]

How Have Mobile and Social Media Changed the Ability of Advertisers to Reach Children and Teenagers?

Newer media have provided expanding opportunities for marketers and advertisers to adapt their messages to reach millions of children and teenagers.[12] These newer forms of media may broaden the types of products and behaviors to which children and adolescents are exposed. For example, although restrictions may exist to limit exposure to advertisements for alcohol in traditional media, research

suggests that the major alcohol brands maintain a strong presence on Facebook, Twitter, and YouTube.[13,14] From a marketing perspective, social media are consumer focused, allowing interaction and input that can build relationships.[15] Social media also allow targeted ads that reflect content that users have posted on their own pages. In one study, researchers found that placing content related to exercise or nutrition as a status update on Facebook led to advertisements for sports gear and diets as well as junk food.[15] Thus, social media ads can directly address individuals or groups who would be interested and responsive. Social media ads may also be interactive and are more affordable to create and disseminate. However, this ability for marketers to reach children through social media is understudied.

Marketing to parents of young children also is common, because advertisers know that many parents fear that their children may fall behind in the skilled use of technology without early exposure to it.[16] In reality, parents can be reassured that their children will learn to use digital media quickly when they are introduced at home or in school.

BENEFITS AND OPPORTUNITIES OF MEDIA USE

Fortunately, new media use is not without its benefits, but these benefits largely depend on a child's age and developmental stage, a child's characteristics, how the media are used (eg, with a parent or without), and the media content and design.

Early Childhood

At What Age Can Infants and Toddlers Learn From Screens?

Evidence continues to show limited educational benefits of media for children younger than 2 years. Earlier American Academy of

Pediatrics (AAP) recommendations to discourage media exposure for children younger than 2 years were based on research on TV and videos, which showed that in-person interactions with parents are much more effective than video for learning of new verbal or nonverbal problem-solving skills.[17] This research showed that infants and toddlers experience what was referred to as the "video deficit:" difficulty learning from 2-dimensional video representations at younger than 30 months of age. The video deficit is thought to be attributable to infants' and young toddlers' lack of symbolic thinking, immature attentional controls, and the memory flexibility required to effectively transfer knowledge from a 2-dimensional platform to a 3-dimensional world.[18] Before 2 years of age, children are still developing cognitive, language, sensorimotor, and social-emotional skills, which require hands-on exploration and social interaction with trusted caregivers for successful maturation.

Therefore, adult interaction remains crucial for toddlers to learn effectively from digital media. For example, from 12 to 24 months of age, toddlers can begin to learn novel words from commercially available "word learning" videos, but only if their parents watch with them and reteach the words, essentially using the videos as a learning scaffold to build the language skills.[19,20] In one longitudinal study of low-income families, 14-month-olds whose mothers had talked with them during educational TV programming since infancy showed more advanced language development than infants whose mothers did not talk with them during media use (although this finding also may have reflected how much mothers spoke to children in general).[21] The few experimental studies showing independent learning of words from videos at this age have been limited by their low ecologic validity[22] or have shown that

toddlers lose the knowledge learned over time without repetition.[23]

More recent research has shown that, under particular conditions, children between 15 and 24 months of age can learn from repeated viewing of video demonstrations without adult help. Dayanim and Namy showed that 15-month-olds could learn the meaning of sign language symbols after 3 weeks of watching a commercially available video 4 times per week.[24] However, children in a comparison study group whose parents used a book of sign language symbols to teach the content retained more knowledge about the symbols' meanings for a longer period of time.

Building parasocial relationships with TV or video characters (ie, the perceived relationship that audience members develop with characters who speak to them, such as Elmo or Dora) also has been shown to improve toddlers' learning. Calvert et al[25] showed that, after 3 months of playing with a personalized interactive toy, 21-month-olds could learn how to stack cups from a video demonstration by the same character, suggesting that building an emotional bond with an on-screen character improves learning potential. However, a primary limitation of such experimental studies is that they do not examine how repeated media use displaces other activities, and they do not examine longer-term outcomes. For example, in the study by Calvert and colleagues,[25] children randomly assigned to the group that did not receive the interactive toy for 3 months actually scored better in terms of language development at 21 months of age.

Are Touchscreens More Educational?

Pedagogic theory has long emphasized that interaction improves learning. This understanding has been the motivation for recommending coviewing of media, along with evidence that

parent interaction increases young children's engagement with media and understanding of content.[26] The interactivity of new media via touchscreens allows apps to "know" whether a child is responding accurately and tailor responses, reinforcement, and next steps to the child's input. Theoretically, this may increase educational potential by providing scaffolding to build skills at the child's edge of competence.

Empirical evidence regarding interactive media use in infants and toddlers is sparse. At 24 months of age, a child can learn words from live video-chatting with a responsive adult[27] or from carefully designed, interactive screen interfaces that prompt the child to tap on relevant learning items.[28] Starting at 15 months of age, toddlers can learn novel words from touchscreens in laboratory-based studies (with specially designed, not commercial, apps) but have trouble transferring this knowledge to the 3-dimensional world,[29] particularly if they regularly use touchscreen platforms to view entertainment media.

Is Skyping Appropriate for Infants and Toddlers?

Many parents now use video-chat (eg, Skype, Facetime) as an interactive media form that facilitates social connection with distant relatives. New evidence shows that infants and toddlers regularly engage in video-chatting,[30] but the same principles regarding need for parental support would apply in order for infants and toddlers to understand what they are seeing. Because video-chat episodes usually are brief,[30] promote social connection, and involve support from adults, this practice should not be discouraged in infants and toddlers.

What Is the Best Approach to Selecting Quality Content for Young Children?

High-quality TV programs (eg, Public Broadcasting Service [PBS]

programs, such as *Sesame Street* and *Mister Rogers' Neighborhood*) can demonstrably improve cognitive, linguistic, and social outcomes for children 3 to 5 years of age. Although there have been few large community-based, randomized trials, many observational studies and some small experimental ones have demonstrated that preschoolers can learn literacy, numeracy, and prosocial skills from high-quality TV programs.[31,32] In addition, Sesame Workshop and other child content creators have been responding to current child health and developmental needs (eg, obesity, resilience) by crafting programming aimed at teaching parents and children relevant knowledge and skills.

Choosing PBS content has been found to be protective of poor executive function outcomes observed in children who start consuming media in early infancy.[33] Preschoolers randomly assigned to change from inappropriate or violent content to high-quality prosocial programming were found to have significant improvements in their externalizing and internalizing behavior,[32] which also speaks to the importance of content. For families who find it difficult to modify the overall amount of media use in their homes, changing to high-quality content may be a more actionable alternative; to make these changes, pediatric providers can direct them toward curation services, such as Common Sense Media, for reviews of videos, apps, TV shows, and movies.

Are "Educational" Apps and e-Books Really Educational?

As content from PBS high-quality programs is translated into apps and game formats (eg, *Martha Speaks*, *Big Bird's Words*, and *Cookie Monster's Challenge* apps), educational benefits have been shown in preschoolers.[34] Unfortunately, very few of the commercially available apps found

in the educational section of app stores have evidence-based design input with demonstrated learning effectiveness. In fact, recent reviews of hundreds of toddler/preschooler apps labeled as educational have demonstrated that most apps show low educational potential, target only rote academic skills (eg, ABCs, colors), are not based on established curricula, and include almost no input from developmental specialists or educators.[35,36] An additional concern is that the formal features (ie, bells and whistles) that are designed to engage the child in an interactive experience may actually decrease the child's comprehension or distract from social interaction between caregivers and children during use, as has been shown for e-books,[37] which is important, because active parent involvement in both digital play and book reading improves children's learning from the experience.[38,39]

One reason that children may be less socially engaged during digital play is that gaming design involves behavioral reinforcement meant to achieve a maximum duration of engagement, which may explain why interrupting children's digital play leads to tantrums, particularly when games or videos are set on autoadvance.[40] To address these concerns, academic and industry leaders have recently recommended creating digital products for children that are appropriately engaging, but not distracting; that are designed to be used by a dual audience (ie, both parent and child) to facilitate family participation in media use and modeling of more effective social and learning interactions[35,41]; and that have automatic "stops" as the default design to encourage children and caregivers to pause the game use and turn to the 3-dimensional world.[40]

One recent app, for example, demonstrates such an adult–child dyad-centered design. Bedtime Math creates a platform and a structure for

parents and children to read stories and answer math problems together on a nightly basis. It is one of the few apps that has been tested in a randomized controlled community-based trial and shown benefits.[42] Embedding, indeed requiring, social interactivity for functionality may hold great promise for even younger children as well. However, recent population-based surveys suggest that joint media engagement[43] (and designs to facilitate it)[35] is not as common as individual use.

School-Aged Children and Teenagers

How Can Media Use in Older Children and Teenagers Increase Collaboration and Tolerance?

Research studies as well as anecdotal reports have suggested benefits of media use for today's children and adolescents, such as communication and engagement.[44] Additional benefits include exposure to new ideas and immersive learning experiences. Many social media platforms provide tools that students can use to touch base with and collaborate with others on projects. Communicating across distance is made easier by social media; these communications may include connecting via video-chatting with family or friends who are separated geographically. Traditional and social media can also raise awareness of current events and issues, and social media can provide tools to promote community participation and civic engagement.

A study by Kidd and Castano[45] indicated that reading literary fiction improves empathy in children. Although books are a traditional form of media, the study indicates that exposure to character-focused media can break stereotypes and help children understand people from whom they differ. Internet usage/digital media consumption is positioned to have a similar impact, which is important to help children learn about, understand, and empathize with marginalized groups.

How Can Social Media Be Used To Promote Improved Health?

Health benefits of social media may include enhanced access to valuable support networks. These networks may be particularly helpful for patients with ongoing illnesses, conditions, or disabilities[46] as well as for those identifying as lesbian, gay, bisexual, transgender, questioning, or intersex (LGBTQI) seeking helpful information or a welcoming community. Recent literature indicates that transgender teenagers who feel supported by their families have lower rates of depression and anxiety.[47] Connections with a supportive online community (eg, the "It Gets Better" project) may be beneficial to teenagers who identify as LGBTQI, but most such programs have not been studied to determine effects and outcomes.

Research also supports the use of social media to foster social inclusion or peer-to-peer connection among patients who might otherwise feel excluded, for example, patients with obesity[48] or mental illness.[13] Individuals with mental illness report greater social connectedness and feelings of group belonging when using social media in this manner, because they foster the ability to share personal stories and strategies for coping with challenges.[14] The advantages of these connections include avoiding feared stigma, enhancing social networks, learning about resources from peers online, and gaining information and insight. However, risks of such interactions can include exposure to misinformation, negativity or hostility in communications, delays in seeking out traditional resources, and unhealthy influences.

Young adults describe the benefits of seeking health information online and through social media and recognize these channels as useful supplementary sources of information to health care visits.[15]

Social media may be used to enhance health and wellness and promote healthier behaviors, such as smoking cessation and balanced nutrition.[44] However, there are a myriad of easily accessible Web sites and social networks that facilitate and even promote unhealthy behaviors, such as disordered eating. "Pro-ana" (anorexia nervosa) and "pro-mia (bulimia)" sites, for example, are forums in which peers actively support restricted eating or purging and frequently offer life-threatening suggestions and advice.[49]

Do Screen Time Limits Apply for Children With Disabilities Who Use Mobile Devices To Communicate?

An important benefit from new media has been the development and use of technology-aided interventions in children and adolescents with disabilities, particularly through the expanding use of assistive and interactive digital media to learn and to communicate in youth with autism spectrum disorder (ASD),[50] physical disabilities, speech impairment, and intellectual disability to learn and communicate.[51] However, because teenagers with ASD have higher rates of problematic media use,[52,53] limits still should be placed on entertainment media use, such as watching videos or playing gaming apps, which can represent a restricted interest in children with ASD.

HEALTH AND DEVELOPMENTAL RISKS OF MEDIA USE

What Are the Developmental and Behavioral Risks in Early Childhood?

Population-based studies continue to show associations between excessive TV viewing in early childhood and cognitive,[54–56] language,[57,58] and social/emotional delays.[59–62] Possible mechanisms for these outcomes include the effects of viewing inappropriate, adult-oriented content[54] (as well as

some inappropriate child-directed content),[58] a decrease in parent–child interaction when the TV is on,[63] and poorer family functioning in households with high media use.[60]

An earlier age of media use onset, greater cumulative hours of media use, and content that is not of high quality all are significant independent predictors of poor executive functioning (impulse control, self-regulation, mental flexibility)[33] as well as "theory of mind" deficits (ie, the ability to understand others' thoughts and feelings) in preschoolers.[64] Media multitasking, once thought to be a pastime only of only adolescents, now is observed even in children younger than 4 years.[13] The orienting response to novel stimuli is very strong in young children, so their attention is drawn to the engaging and quickly changing features of digital media, such as animation, sounds, and highlighted features they can tap and swipe.[65] These features, however, may decrease young children's comprehension.[66] It is unknown whether rapid shifts in attention to and from digital stimuli may have long-term effects on children's attention span or information processing.

Because strong associations between violent media content and child aggressive behavior have been clearly documented,[67] parents should continue to monitor the content of their children's media. Today, more children own and use mobile devices independently,[13] making monitoring and regulation much more difficult.[16,68] More research is needed on how parents can best supervise and guide their children's media use.

Are Certain Children or Families More Susceptible to These Risks?

TV has been used as an "electronic babysitter" for decades, but recent evidence suggests that excessive media use is more likely in infants and toddlers with a "difficult"

temperament[69,70] or self-regulation problems.[71] Toddlers with social-emotional delays are more likely to be given a mobile device to calm them down,[72] especially if their parents are facing parenting control challenges. However, it is not clear whether more "difficult" infants and toddlers have more positive or negative outcomes over time when exposed to longer media duration, which likely depends on content quality and other contextual factors. For example, Linebarger et al[73] found that the quality of parenting can modify associations between media use and child development: inappropriate content and inconsistent parenting had cumulative negative effects on low-income preschoolers' executive function, and warm parenting and educational content interacted to produce additive benefits.

Is Media Use Linked to Obesity?

High levels of media use are linked to obesity and cardiovascular risk[74] throughout the life course, but these associations are observed starting in early childhood. For example, heavy media use during preschool years is associated with small but significant increases in BMI,[75] which sets the stage for greater weight gain later in childhood. The association between using ≥2 hours of media per day and obesity persists even after adjusting for children's psychosocial risk factors or behavioral problems.[76] Research in preschoolers often uses a 2-hour cutoff to define excessive media use, but a recent study of 2-year-olds found that BMI increased for **every hour per week** of media consumed.[77] Moreover, media use behaviors may explain some of the obesity risk disparities among young black and Hispanic children.[78] None of these studies examined mobile media specifically, which may be more easily used during meals and, therefore, distract children from satiety cues.[79]

Studies of older children and teenagers show clear correlations between increases in hours of TV viewing and higher risk of obesity.[80] In a 1996 study of 5- to 10-year-olds, the odds of being overweight were 4.6 times greater for youth watching more than 5 hours of TV per day compared with those watching 0 to 2 hours.[81] This study greatly influenced the AAP recommendations for 2 hours or less of sedentary screen time daily for children 2 through 18 years of age. However, a more recent study in the Netherlands of children 4 through 13 years of age found that watching TV **over 1.5 hours per day** was a significant risk factor for obesity. In this study, however, an association between TV and obesity was only found for children 4 through 9 years of age.[82] A large international study with almost 300 000 children and adolescents found that watching **between 1 and 3 hours of TV a day** led to a 10% to 27% increase in risk of obesity.[83] These more recent studies suggest that setting limits of TV viewing to between **1 and 1.5 hours a day** may be more effective to prevent obesity than the 2 hours per day standard presented in earlier AAP recommendations.

Additional studies have identified relevant factors around TV viewing beyond solely the number of hours for families to use in developing household rules. Another recent study found that the association between TV viewing and obesity risk was only significant for children who were already at the higher end of the BMI distribution.[84] A large study using a national dataset of children reported that it was not just the hours of TV viewing that predicted obesity, but the combination of low physical activity and high sedentary TV viewing that was most contributory to obesity risk.[85] A 2008 study directly examined the AAP recommendations for 2 hours a day or less of sedentary media

consumption and found that **boys who exceeded 2 hours a day of sedentary media use** were 1.7 times more likely to be overweight compared with those who had 2 hours a day or less of sedentary media use. The results for girls were much less impressive, in that girls with over 2 hours a day of sedentary media use were only 1.2 times more likely to be overweight compared with girls who had 2 hours or less of media use time.[86]

The association between TV viewing and obesity previously attributed to food advertising[87] may now be decreased, because children watch more videos from streaming services (eg, Netflix, Hulu), which do not contain advertisements, but this has yet to be studied.

Another area of obesity risk is the presence of a TV in the bedroom. A 2007 study found that having a TV in the bedroom was an independent risk factor for obesity. A more recent study found that the combination of a TV in the bedroom and greater use of screen time had the strongest association with obesity.[88]

Fortunately, studies also suggest that making efforts to reduce children's sedentary media use can have positive health effects. An intervention study focused on third and fourth graders worked with the participants to reduce time spent watching TV and playing video games. The study demonstrated that children in the intervention group reported reduced TV viewing and meals in front of the TV and had reduced BMIs, illustrating that interventions to reduce sedentary media use can positively impact health behaviors as well as BMI.[89]

How Does Media Use Affect Sleep?

There is a growing body of evidence that suggests that media use negatively affects sleep.[90] Increased duration of media exposure and the presence of a TV, computer, or mobile device in the bedroom in early childhood have been associated with fewer minutes of sleep per night, especially among children of racial/ethnic minority groups.[91] Later bedtimes after evening media use and violent content in the media also may be contributing factors,[92] and suppression of endogenous melatonin by blue light emitted from screens is another possible cause.[93] Associations between media and sleep are seen in infants as well; 6- to 12-month-olds who were exposed to screen media in the evening hours showed significantly shorter night-time sleep duration than those who had no evening screen exposure.[94]

Studies of older children and teenagers have found that participants with higher social media use[95] or who sleep with mobile devices in their room[96,97] were at greater risk for sleep disturbances. One study of adults found that taking a phone into the bedroom led to longer sleep latency, worse sleep quality, more sleep disturbance, and more daytime dysfunction.[98] This study illustrates the multiple mechanisms by which media use around bedtime, or during bedtime, can disrupt sleep and affect daytime function.

Bruni et al[90] studied the use of technology on sleep quality in adolescents and preadolescents. Adolescents' bad sleep quality was associated consistently with greater mobile phone use and the number of devices in the bedroom, and in preadolescents, bad sleep quality was associated with greater Internet use and later media turn-off time. The authors concluded that evening circadian preference, mobile phone and Internet use, the number of other activities engaged in after 9:00 PM, later media turning-off time, and the number of devices in the bedroom have different, but significant, negative influences on sleep quality in preadolescents and adolescents.[90] Similarly, Lemola et al[99] reported associations between electronic media use in bed before sleep, sleep difficulties, and symptoms of depression in teenagers.

Daytime screen use may also affect sleep. According to a Norwegian study, daytime and bedtime use of electronic devices *both* affected sleep measures, with an increased risk of short sleep duration, long sleep onset latency, and increased sleep deficiency. A dose–response relationship emerged between sleep duration and use of electronic devices.[100] Ensuring that children and teenagers obtain the necessary hours of healthy sleep is an important goal of a Family Media Use Plan (www.healthychildren.org/MediaUsePlan).

What Are the Risks of Social Media Use In School-Aged Children and Teenagers?

The links between media and health behaviors among adolescents have been backed by decades of evidence in traditional media.[101–104] Studies have shown that exposure to alcohol or tobacco use or risky sexual behaviors in TV or movies is associated with initiation of these behaviors,[101,102,105,106] leading some to describe TV as a "superpeer."[107] A growing body of evidence suggests that these influences also are strong in digital and social media. Several studies have illustrated that adolescents' displays on social media frequently include portrayal of risky health behaviors, such as illegal alcohol use or overuse, illicit substance use, high-risk sexual behaviors, and harmful behaviors, such as self-injury and disordered eating.[108–112] A growing body of evidence suggests that peer viewers of this content are influenced to see these behaviors as normative and desirable.[113–115] Social media combine the power of interpersonal persuasion with the reach of mass media. Fogg described this mass interpersonal persuasion as

"the most significant advance in persuasion since radio was invented in the 1890s."[116]

Although restrictions exist to protect youth and children from exposure to alcohol, tobacco, and marijuana advertisements on traditional media platforms, such as TV, there is concern about the extent to which youth are exposed to promotion of these substances on social media Web sites from marketers or peers. For example, research from both the United States and the United Kingdom indicate that the major alcohol brands maintain a strong advertising presence on Facebook, Twitter, and YouTube.[13,14] Targeted advertising via social media may have a significant effect on adolescent behavior.

How Does Media Use in School-Aged Children and Teenagers Relate to Mental Health?

Research studies have identified both benefits and concerns regarding mental health and media use. In one longitudinal panel survey, 396 white and black preadolescent boys and girls were assessed to determine the long-term effects of TV consumption on global self-esteem. TV exposure was found to be significantly related to self-esteem, but whether it increased or decreased self-esteem was influenced by demographic factors. Greater exposure resulted in a decrease in self-esteem for both white and black girls and for black boys but resulted in an increase in self-esteem for white boys.[117] Analyzing these results, the authors postulate that the majority of the TV content served to reinforce both gender-role and racial stereotypes, which tended to be positive for white boys but not the other groups. The authors suggested that the black children and white girls could be internalizing the "social norms" portrayed and using these messages as a basis for self-evaluation, negatively affecting their self-esteem. There is also an opportunity cost

when more TV viewing displaces real-life experiences that might build self-esteem.

The interactive and selective components of social media may offset some of these traditional media drawbacks, because social media use in moderation can enhance social support and connection. However, use in moderation and the specific way in which social media are used may be the key. Previous research has suggested a U-shaped relationship between Internet use and depression, with increased risks for depression at both the high and low ends of Internet use.[118,119] A recent study examined social media use and depression and found a positive association.[120] Older adolescents who used social media passively by solely viewing content reported declines in well-being and life satisfaction, whereas those who used social media actively by interacting with others and posting content did not experience these declines.[121] Another study found that teenagers who used Instagram to follow strangers and engage in social comparisons had higher depression symptoms, but others who followed friends and engaged in less social comparison had fewer depression symptoms.[122] These studies illustrate that, beyond the number of hours spent on social media, a key factor is how an individual uses social media.

Do Children and Adolescents Understand the Privacy Risks Associated With Social Media Use?

An important issue across all social media and interactive apps is privacy, because content that a child or adolescent chooses to post on any site or app becomes public in some way. Removal of such content may be difficult or impossible. Previous work suggests that adolescents vary in their understanding of privacy practices, and even among those who do know how to set privacy settings, many choose not to do so.[123–125]

Despite efforts by some social media sites to protect privacy or even to delete content after it is viewed, privacy violations and content sharing are always possible.[126,127] This risk illustrates the need for continued discussion about media and privacy with children and teenagers with parents, caregivers, teachers, and other responsible adults. These discussions should be included in schools through their digital citizenship programs and in pediatric well-child examinations with parents and teenagers. Pediatricians can introduce and work with families to develop a Family Media Use Plan (see the AAP guide to making a plan at www. healthychildren.org/MediaUsePlan) that can mitigate or avoid such risks.

Is Cyberbullying Different From Traditional Bullying?

Cyberbullying is commonly defined as "an aggressive, intentional act or behavior that is carried out by a group or an individual, using electronic forms of contact, repeatedly and over time against a victim who cannot easily defend him or herself."[128] Unfortunately, there are many online platforms in which bullying may take place, including E-mail, blogs, social networking Web sites/apps, online games, and text messaging. There is clear overlap between cyberbullying and traditional bullying,[129] but several features of online bullying present new challenges. These challenges include that perpetrators can bully at any time of day and can be anonymous, the rapidity with which information can spread online,[130] and the fluidity with which bully and target roles can switch in the online world. Estimates of the number of youth who experience cyberbullying vary, ranging from 10% to 40%, depending on the age group and how cyberbullying is defined.

Cyberbullying shares many similarities and a few key differences

with traditional bullying. For example, victims of cyberbullying often do not know who the bully is or why they are being targeted, the hurtful actions of a cyberbully can reach a child or teenager anytime he or she uses a smartphone or computer (so there is no safe haven of home), and the bullying messages can also spread virally through the Internet to many other people at school or in the community, making this type of bullying potentially very embarrassing and lasting.

Descriptive research has shown that vulnerable populations exist and are more likely to be targeted for bullying. Youths identifying as LGBTQI are more likely to be victimized in bullying dynamics and are at risk online as well.[131] Children and adolescents with ASD are a population particularly vulnerable to bullying (https://www.autismspeaks.org/family-services/bullying) and could easily be a target for cyberbullying. The 2016 National Academies of Sciences, Engineering, and Medicine report, "Preventing Bullying Through Science, Policy, and Practice,"[132] addressed the concept of populations vulnerable to bullying to propose that there is a need for research that moves beyond descriptive studies and labeling of youth as vulnerable and considers processes that can explain why individuals may have differences in their bullying experiences and consequences depending on their context.

Previous studies have examined the negative effects that cyberbullying can have on both bullies and victims. Victims are more likely to report lower grades and other academic problems as a result of the experience. Similar to traditional bullying, cyberbullying can lead to short- and long-term[133,134] negative social, academic, and health[134–137] consequences for both the perpetrator and target. Both bullies and victims often report higher

levels of depression and lower self-esteem. Victims were at higher risk of both suicidal ideation and suicide attempts.

Fortunately, newer studies suggest that interventions targeting bullying also may reduce cyberbullying.[138] Moreno states: "Parents can play a role in preventing cyberbullying by educating their children about appropriate online behaviors. Parents should have discussions early and often about their child's friendships and relationships to develop and maintain open communication about these topics."[139] The Centers for Disease Control and Prevention panel reviewing effective prevention strategies recommends media literacy education as a "promising approach," along with collaborative strategies among teenagers, parents, and schools that encourage victims to report cyberbullying and seek adult support.[140]

What Is Sexting and How Can the Risks of Sexting Be Avoided or Addressed?

Sexting is a serious issue in adolescence. Sexting is commonly defined as the electronic transmission of nude or seminude images as well as sexually explicit text messages.[111] It is estimated that approximately 12% of youth 10 to 19 years of age have ever sent a sexual photo to someone else[112]; sadly, many youth who have participated in sexting report having felt pressured into sending a sext. When dealing with youth and sexting, adults, authorities, and schools need to be aware that the situation may be more complicated.

Spencer et al[141] examined sexting and youth in an urban population; 55 youth presenting for care at the Teen Health Center at Children's Hospital Los Angeles were surveyed to evaluate prevalence and sexting behaviors, such as forwarding sexts, reasons for sending sexts, and youths' concerns regarding sexting. Of those

surveyed, 48.5% of girls and 63.6% of boys had sent a sext, and 70% of girls and 82% of boys had received a sext. The authors report that girls expressed significantly more concern than boys about how sexting could affect their reputation, including getting caught by an adult with a sext and how others would think of them. Fortunately, 52% of respondents said they would be comfortable talking with their doctor about sexting. Pediatricians may, therefore, find their teen patients receptive to a conversation about sexting and its implications and risks.

Ybarra and Mitchell, in their article, "'Sexting' and its relation to sexual activity and sexual risk behavior in a national survey of adolescents,"[142] suggest that sexting is related to behaviors indicative of psychosocial challenge and risky sexual behavior for some youth. Significant findings include a higher frequency of sexting among females and lesbian, gay, and bisexual youth. Additionally, a greater number of past-year sex partners and a greater odds of depression and substance abuse were found among teenagers who sext.

Findings related to lesbian, gay, and bisexual populations are consistent with previous studies on sexting; of note, transgender youth were not included. Earlier research had demonstrated a significant association between sexting and risky sexual behaviors in lesbian, gay, bisexual, and transgender youth.[142]

Ybarra and Mitchell's study[142] found that sexting was indicative of sexual activity and risky sexual behaviors, and further research may identify predictive outcomes of sexting. One study suggests that sexting may precede sexual intercourse.[142] The predictive value of a sexting history may inform sex education and HEEADSSS (**h**ome, **e**ducation & **e**mployment, **e**ating, **a**ctivities, **d**rugs, **s**exuality, **s**uicide/depression,

and safety) assessments. Moreover, discussions between pediatricians and teenagers about sexting may indicate risky sexual behaviors and a number of psychosocial issues, such as depression, anxiety, and low self-esteem, that may be further addressed.

Temple et al[143] examined whether adolescents who report sexting exhibited more psychosocial health problems than their nonsexting counterparts. The authors reported that teen sexting was significantly associated with symptoms of depression, impulsivity, and substance use. When adjusted for previous sexual behavior, age, gender, race/ethnicity, and parent education, however, sexting was only related to impulsivity and substance use. The authors concluded that "while teen sexting appears to correlate with impulsive and high-risk behaviors (substance use), we did not find sexting to be a marker of mental health."[143]

Sexting is a behavior that will likely continue and expand with technologic advances that make photography and communication more accessible. Active debate continues regarding the ethical and legal components of sexting, especially among underage youth. Concerns include the identification of sexts as pornography or sexual misconduct. Even consensual, noncoercive sexting may result in criminal prosecution that may lead to long-term legal consequences.

Addressing risky sexual behaviors and psychological symptoms associated with sexting through education and guidance should help to promote wellness and responsibility within adolescent populations. Further research evaluating sexting among gender minority populations (eg, transgender adolescents) also will be valuable in understanding and discouraging the behavior

and providing safer and less risky alternatives for social connections.

CHILD PORNOGRAPHY AND CHILD ABUSE

How Has Social Media Changed the Landscape of Child Pornography and Child Abuse?

Unfortunately, the Internet has also created opportunities for the exploitation of children by sex offenders. Online predators can gain access to children and teenagers through social networking, chat rooms, E-mail, and online games. Cases of child trafficking, cybergrooming, and sexual abuse for private and commercial purposes have increased with the help of the anonymous cyberspace environment. For example, online grooming leads to establishment of a trusting relationship, often with the perpetrator misrepresenting himself as another child or teenager. This developing online relationship may lead to sexting or to convincing the child to meet the perpetrator in person. Children may be deceived, tricked, or coerced into engaging in sexual acts for the production of child sexual abuse materials (child pornography), which then can circulate online for years to come. Child sexual abuse images often involve young and very young children. Of 43 597 children assessed in sexual abuse images and videos, 49.6% appeared to have a sexual maturity rating of 1, and 28.7% appeared to have a sexual maturity rating of 2.[144] Besides the adverse effects associated with child sexual abuse,[145,146] victims who have had online sexual images (pornography and sexting) posted may experience significant anxiety and stress related to knowledge that the abuse images may be downloaded and viewed by millions of people for an indefinite period of time. Thus, the exploitation continues for months and years after the images were obtained.[144]

Online child sexual exploitation also may involve recruitment and advertisement of children for prostitution and other forms of exploitation.[147] The Internet may be used by human traffickers to facilitate movement of victims and to manage a criminal network.[148]

Internet-initiated sex crimes involving offenders who meet and groom children online tend to involve adolescents rather than very young children: 99% of victims in one study were 13 to 17 years old, and 48% were 13 to 14 years old. Many of these crimes involve face-to-face sexual contact, which the victim perceives as "consensual." Sexual relationships in early adolescence are associated with an increased risk of social, academic, and behavioral adverse outcomes.[149,150]

Research has shown that parents underestimate the likelihood that their child might engage in online conversation with people they do not know. Therefore, it is critical that parents promote online safety with their children from an early age, monitor children's Internet use, and use tools, such as parental control software, to maintain awareness of their child's online activities.[151] Pediatricians should consider asking appropriate questions to explore this possibility and to educate youth about protecting themselves from exploitation. All health care professionals should report any suspicions of sexual abuse/exploitation as per child abuse reporting laws.

USE OF MEDIA BY PARENTS AND CAREGIVERS

What Effect Does Parent Media Use Have on Young and School-Aged Children and Teenagers?

Parents and caregivers play an important role in modeling optimal behaviors for their children in general, including when it comes to

the consumption and use of media. The growth of digital and social media, particularly in the last 5 years, has seen dramatic increases in adults' use of social media as well as use by children and teenagers; more than 70% of adults now use social media[152] and 27% report feeling "addicted" to their mobile devices.[7] Social media can provide positive social experiences for adults, such as opportunities for parents to connect with their child in a college dorm via video-chatting services. Such services also can promote social and emotional connection among distant relatives or deployed parents and children. However, some parents can, themselves, overuse digital media. For example, research has shown that parents' own TV viewing distracts from parent–child interactions[153] and children's play.[154] Children younger than 2 years are more likely to be exposed to and watch inappropriate "background" media (eg, TV) than older children.[155] Heavy parent use of mobile devices is associated with fewer verbal and nonverbal interactions between parents and children[156] and may be associated with more parent–child conflict.[157]

Because parent media use is a strong predictor of child media habits,[158] reducing parental TV viewing, including "background" TV, and enhancing parent–child interactions may be an important area of behavior change that pediatricians can help to facilitate. Because parent–child interactions during family routines are an important opportunity for emotional connection, have been shown to be protective of child health outcomes, such as asthma and high-risk behavior,[159] and are the primary driver of early childhood development of language, cognition, social skills, and emotion regulation, it is important to preserve them. Parents often report feeling that technology speeds up their lives and work demands[160] and that it is difficult to multitask between

technology and childrearing, so pediatric providers can support their efforts to create boundaries and "unplugged" zones in their households.

THE FAMILY MEDIA USE PLAN

- How can pediatric health care providers help families use media in healthy ways?

- What is the AAP Family Media Use Plan?

Pediatricians and other pediatric health care professionals can be helpful resources for families seeking specific advice about how to develop and individualize family rules and guidelines to meet their distinct needs. Unfortunately, only 16% of pediatricians ask families about their media use. In addition, only 29% of parents report relying on their pediatrician for advice about broadcast and social media, although those who do tend to follow AAP recommendations.[161]

When discussing media use with families, pediatric health care providers can print out and help families begin completing the AAP Family Media Use Plan (www. healthychildren.org/MediaUsePlan). Providers can discuss with parents and developmentally ready children how each of the media-specific behaviors and health concerns can be addressed through practical, family-centered approaches. The Family Media Use Plan can act as a teaching tool through which pediatricians can provide information about the benefits and health risks of both traditional and new media. The potential risks of interactive media, such as reduced physical activity, inadequate sleep, and unhealthy influences like cyberbullying and weight bias, are important to discuss with families as well.

The plan also can be a tool through which the pediatrician can explore

and understand each family's values and health goals—for example, how good nutrition, an active lifestyle, good sleep hygiene, parent–child emotional connection, and creative play fit into the family's typical day—and identify areas in which good health and wellness can be enhanced. Pediatricians can suggest ways in which media can be used to connect, learn, and create instead of simply consume.

These discussions can also allow pediatric health care providers to consider screening for problematic Internet use and Internet gaming disorder using validated tools, such as the Internet Gaming Disorder scale (https://www.researchgate. net/publication/270652917_The_ Internet_Gaming_Disorder_Scale) and the Problematic and Risky Internet Use Screening Scale (http://mediad. publicbroadcasting.net/p/kplu/ files/201502/PRIUSS_scale_and_ guidelines.pdf).

If challenges in implementing a media use plan are anticipated, pediatric health care providers can consider introducing motivational interviewing or engaging in problem solving with parents and children about possible solutions. The pediatrician has an opportunity to discuss specific tools to address identified family needs and concerns, including social services and community resources, if needed. Finally, the pediatrician may be able to provide families with referrals to educational and informational resources, such as vetted Web sites (eg, www.HealthyChildren.org).

CONCLUSIONS

New digital and social media facilitate and promote social interactions as well as participation and engagement that involve both viewing and creating content. The effects of media use, however, are multifactorial and depend on the

type of media, the type of use, the amount and extent of use, and the characteristics of the individual child or adolescent using the media. Children today are growing up in an era of highly personalized media use experiences; therefore, parents should be encouraged to develop personalized Family Media Use Plans for their families that attend to each child's age, health, temperament, and developmental stage and ensure that each child can practice and benefit from the essentials for healthy growth and development, such as a healthy diet, good sleep hygiene, adequate physical activity, and positive social interactions.

Parents should recognize and understand their own roles in modeling appropriate media use and balance between media time and other activities. Pediatricians can help families identify and adopt a healthy Family Media Use Plan, minimize unhealthy habits and behaviors, and recognize and address issues that occur related to the use of traditional and new media that can negatively affect health, wellness, social and personal development, and academic performance and success.

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ABBREVIATIONS

AAP: American Academy of Pediatrics
app: application
ASD: autism spectrum disorder
LGBTQI: lesbian, gay, bisexual, transgender, questioning, or intersex
PBS: Public Broadcasting Service
TV: television

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