

HOW SHOULD CHILDREN AND ADOLESCENTS USE DIGITAL DEVICES
IN A HEALTHY MANNER, AND HOW SHOULD PARENTS
EMPLOY DIGITAL CONTROL?
A MAPPING REVIEW OF THE LITERATURE¹

Alexandra MAFTEI

alexandra.maftei@uaic.ro

"Alexandru Ioan Cuza" University

Ioan-Alex MERLICI

ioan.alex.merlici@gmail.com

"Alexandru Ioan Cuza" University

Abstract

The rising use of digital media in the last decade, including social networking, highlighted new challenges in discussing children and adolescents' mental and physical health. This paper aims to review the evidence to answer two primary questions: *How should children and adolescents healthily use digital devices?* and *How should parents employ digital control concerning their children's digital media use?* We reviewed the scientific literature (i.e., 38 systematic reviews and meta-analyses) published in the past five years and synthesized the related results to formulate specific guidelines regarding the (a) general recommendations for digital use among children and adolescents; (b) the benefits and risks of digital use among children and adolescents; (c) the guidelines that parents should follow regarding digital control/surveillance (i.e., digital parental control). Finally, we concluded the review of the literature by formulating a series of evidence-based practical recommendations for healthy digital use, with a particular focus on parents' role in this regard.

Keywords: children; adolescents; digital media; parents; guidelines.

Introduction

Digital devices are becoming ubiquitous in the lives of both adults and children. The exposure of children to digital devices from an early age has raised concerns related to the usefulness of these technologies in children's development and, more importantly, to the potential harm caused by these technologies (Madigan et al., 2020). The use of digital devices among children and teenagers was previously associated with improvements in education and development and cognitive impairment (Browne et al., 2021). On the one hand, digital devices

¹ **Acknowledgment:** This research was conducted with the support of SABS Innovation SRL, IASI, Romania, co-funded by the European Social Fund, through Competitivity Operational Program 2014-2020, project number POC/875/2/2/142817, project title Algorina Safe Web.

facilitate more efficient access to information, resources, and communication. On the other hand, simply turning a blind eye to the integration of digital devices in the daily lives of children and adolescents might also prove harmful, considering that the use of said devices is becoming an integral part of our society and failing to teach children digital literacy might further expose them to risks associated with digital technology (Turner et al., 2017). The use of digital technology is also becoming an integral part of interventions related to both mental and physical health (Liverpool et al., 2020). However, excessive screentime was associated with negative health outcomes (e.g., increased likelihood of obesity) (Robinson et al., 2017a) and poorer mental health and functioning (e.g., increased risk of depression, development of addictive behaviors, sleep difficulties) (Lissak, 2018b).

Therefore, developing optimal routines and supporting them through parental control might contribute to finding the right ways for children and adolescents to obtain the benefits of digital technology while minimizing the associated risks to their mental and physical health (Limone & Toto, 2021). The current research literature offers a considerable amount of studies related to the effects of prolonged screen time and practical methods of reducing the time spent using digital devices (Council on Communications And Media, 2016). However, to our current knowledge, the current literature does not provide a systematic review that synthesizes both the benefits and risks of digital technology usage among children and adolescents while also providing an overview of the general recommendations of health experts and a set of recommendations for parental control. We consider that a systematic review that meets all these requirements is necessary to better compare digital technology's advantages and disadvantages and propose appropriate and pragmatic solutions.

Different strategies for controlling children's screen time were previously tested in research, including the establishment of rules about the use of digital technology (Bjelland et al., 2015), discussions about technology use, and offering rewards for reduced screen time (Lin et al., 2021), all these strategies showing varying degrees of efficiency. However, by systematically reviewing multiple reviews and meta-analyses, we aimed to shape a comprehensive summary of the most useful strategies and suggestions that can contribute to the development of appropriate schedules for digital technology usage among children and adolescents. Furthermore, since the use of digital technology is becoming an important aspect in the lives of many children and adolescents, and digital devices can provide several important affordances (e.g., quick communication, access to information) (Nagata et al., 2020), it is important to establish appropriate schedules that regulate screen time and the periods of the day in which youngsters use digital devices, in order to maximize benefits and minimize harm. In the present research, we refer to *screen time* as "time spent with any screen, including

smartphones, tablets, television, video games, computers, or wearable technology” (Canadian Paediatric Society, 2019, p.402), and *digital media* as “content transmitted over the Internet or computer networks on all devices, unless particular ones are specified” (Canadian Paediatric Society, 2019, p.402).

Overview Of The Present Research

The present review aimed to answer the following general questions:

1. What are the general recommendations for digital use among children and adolescents?
2. What are the benefits and risks of digital use among children and adolescents?
3. When and how should parents use digital (parental) controlling options?

On a more specific level, we were interested in examining the following:

- a) How much time should children and adolescents spend daily using digital devices?
- b) Which digital apps are generally more beneficial, and which are the most harmful for children and adolescents?
- c) When and how should children and adolescents use social media networks?
- d) What are the most common benefits of digital use among children and adolescents?
- e) Which are the most common health, education, cognitive development, and adverse social outcomes of digital (mis)use among children and adolescents?
- f) What guidelines should parents follow regarding digital control/surveillance?

To answer these questions, we conducted a mapping review of the systematic reviews and meta-analyses published in the past five years.

Method

An online search of the peer-reviewed literature (i.e., systematic reviews and meta-analyses) utilizing PubMed was employed by two independent researchers. We included studies published in the past five years, i.e., from 2017 to 2022, focused on (a) children and adolescents aged 3 to 18 and (b) parental guidelines for monitoring digital use in children and adolescents aged 3 to 18. The search was limited to English-language literature, reviews, and meta-analyses (excluding preprints). For each question, we used a specific set of search terms, which generated several articles. We first screened the abstracts and removed the articles which were not focused on the primary theme of the current research. Following this initial screening, we analyzed the available full texts to re-evaluate their fit for the present investigation. This second screening step was the final decision to include the selected studies for further discussion. Table 1 (Annex 1) details the questions, the search terms, and the outcomes of the database screening steps.

Next, we performed the complete screening for all papers considered for the present investigation. As a result, 38 studies were included in the current revision after removing the duplicates (i.e., studies that were identified using the proposed search terms as relevant for more than one question), the papers that we did not have access to their full texts, and the papers that did not fit the general topic of the present paper.

Findings

Before the COVID-19 pandemic, adolescents engaged, on average, in 3.6 distinct digital media activities per day, with 'high-frequency usage' (several times per day), amounting to around six h and 40 min of screen media per day. In addition, more than 46% of adolescents report feeling 'constantly linked to the Internet,' as media habits develop at a young age, with 9% of toddlers under the age of two using a mobile device every day and 42% of children aged eight and under owning a tablet (see Nereim et al., 2019 for a review). Furthermore, according to previous research, even in urban, low-income, minority neighborhoods, 96.6% children aged six months to 4 years have used mobile devices, with the majority beginning before the age of one. Following the COVID-19 pandemic, these numbers have significantly increased, raising even more the need for specific guidelines that would shape the answer to the question *How should children and adolescents unhealthily use digital devices, and how should parents employ digital control?*.

The time spent on digital devices has been a growing subject of research in the past years. Digital media are increasingly integrated into the lives of young children, and parents feel compelled to adopt guidelines, such as time limits or content limitations, to protect their children from the adverse effects of digital misuse (Eichen et al., 2021). However, we already know that digital screens are strongly not recommended to users younger than two years old (i.e., infants and toddlers) for several reasons. For instance, previous studies suggested that media usage at such young ages, even when both the parent and the child are engaged, might decrease cognitive development, affect children's attention, and negatively impact the parent-child relationship (Pempek & Lauricella, 2017). However, the answer to the question related to how much time should children and adolescents spend daily using digital devices needs further attention. To offer some possible answers in this regard, we examined the studies identified as relevant to our research.

The review conducted by Lissak (2018) highlights several adverse physiological and psychological effects of screen time exceeding 2 hours, as previously recommended by Henderson et al. (2016) for children aged 8 to 10. For instance, an increasing number of studies

have suggested a significant association between higher screen time and sleep disturbances (Parent et al., 2016), further suggesting adverse effects concerning internalizing and externalizing behaviors. Among the conclusions formulated by Lissak (2018) are some ideas related to the fact that (1) excessive screen usage is associated with negative physical, psychological, social, and neurological health effects; (2) excessive screen usage is linked to increased ADHD-related behaviors and may be a barrier to the efficacy of therapies; (3) higher screen time is also associated with online pornography exposure and learning difficulties.

Furthermore, according to Lissak (2018), children and teenagers who spend too much time in front of screens are more prone to develop habituation to reacting to external stimuli rather than living in the present moment (i.e., mindfulness). Therefore, internal stressors like non-adaptive/negative thinking and emotions (which might be an effect of increased screen time) diminish life satisfaction and might predict longitudinal adverse health outcomes in adulthood, such as cardiovascular illnesses and infertility, in addition to emotional distress (e.g., anxiety and depression). Furthermore, the review concludes that screen time also reduces resilience, which is an essential factor for healthy psychological development.

Screen Time, Cognitive, and Motor Development

Furthermore, excessive screen time during brain development periods seems to increase the risk of Alzheimer's disease and related dementias in adulthood, according to the review conducted by Manwell et al. (2022), and one of the primary reasons could be related to chronic sensory stimulation (through digital use). Overexposure to digital media is associated with decreased brain activity, increased risk of mental illness, and impairs regarding memory formation and information storage, both of which are associated with an increased probability of developing dementia in later adulthood. These findings are reported with a particular focus on Generation Z members. For instance, as the Centres for Disease Control (CDC) anticipated, if no preventive measures are taken to control excessive screen time, until 2060 (i.e., less than 40 years from now), the current adolescents (i.e., 17 to 19 years old, who spend on average 6 hours on digital devices) will be facing dementia and general cognitive impairment, in an overwhelmed health system (Manwell et al., 2022).

The review conducted by Manwell et al. (2022) also points out that excessive digital exposure (i.e., more than 2-3 hours/a day), including television, computers, and smartphones, might contribute to a reverse Flynn Effect (i.e., a progressive decline in population intelligence), in addition to gray and white matter changes, attention, learning, and concentration impairments, as well as declines in emotional regulation and self-esteem, overall

well-being and physical health (Linebarger & Walker, 2005; Madigan et al., 2019; Neophytou et al., 2021). Finally, Manwell et al. (2022) concluded that early excessive screen exposure could affect cortical networks and cognitive-behavioral ability. If the neural circuits underlying these cognitive-behavioral abilities essential for general intelligence and lifetime adaptability are under- or abnormally-developed before adulthood, these changes will likely persist into early and middle adulthood and be more vulnerable to accelerated neurodegeneration in late adulthood, increasing the risk of early-onset dementia.

Motor skills develop in infancy and childhood, and are significantly linked with youth's physical activity, perceived physical competence, and body mass (Barnett et al., 2008). Motor skills proficiency is also connected with academic success. That is why a large number of studies examined the link between motor skills development and screen time use, and some of the findings are summarized in Puzio et al.'s review (2022). For instance, a longitudinal study revealed that more participation in screen device use at ages 4 and 5 was linked with reduced fundamental motor skills competence at age (Cadoret et al., 2018).

Digital use, Emotional, and Social Development

Learning to manage emotions, actions, and socialize is a fundamental developmental landmark (Hofmann et al., 2012). Self-regulation improves academic performance, resilience, and well-being. However, failing to self-regulate emotions might predict antisocial behavior and mental health problems (Moffitt et al., 2011). As a previous scholars suggested, early screen media exposure may affect self-regulation (Nathanson et al., 2014), primarily when digital screens are used as distraction techniques, reducing children's self-regulating ability. Digital screens might also replace responsive parental interventions and parent-child interactions, increasing the risk for low emotional and social development (Puzio et al., 2022). Moreover, screen media use appears to be a more prevalent way to calm youngsters in low-income homes. Scholars suggested that socioeconomic levels might explain over half of the self-regulation and media exposure correlations (Linder et al., 2020). However, these findings are subject to various limitations, such as the type of digital content (e.g., educational versus adult-oriented) and whether parents actively guided children through digital media use. Other studies suggested a positive link between screen time and preschoolers' low emotional and social development (Hinkley et al., 2018).

One of the most interesting facts described by Puzio et al. (2022) is that, in some cases, preschoolers might learn better from digital assistants and digital interactions compared to face-to-face interactions and human agents. While screen-based avatars are becoming more lifelike

and attractive, they may also be able to evoke imitative reactions like in-person encounters (Fong et al., 2021). One study indicated that preschoolers were willing to try ineffective behaviors shown on a video but not in person (i.e., in the face to face interactions). This suggests that children trust digital gadgets and media and interpret the information received via digital screens as credible, highlighting the extremely important fact that youngsters require a competent adult to oversee their screen media use (Tong et al., 2022).

Screen Time and Myopia

Next, the effects of screen time overuse are also associated with myopia among youth. The review and meta-analysis conducted by Foreman et al. (2021) concluded that digital exposure (primarily through smartphone use) might be associated with an increased risk of myopia among 3 to 16 years old children and adolescents. The risk for myopia increases when children use smartphones more than one hour daily (Guan et al., 2019). In children and adolescents aged 5 to 15, using digital devices for more than 2 hours daily was associated with 8 to 33 times higher odds of developing myopia than using screens less than 2 hours per day (Singh et al., 2019). Another study included by Foreman et al's (2021) suggested that teenagers who use digital screens for more than six hours daily had up to 44% more chances to develop myopia than those who use digital screens for less than 30 minutes per day (Hansen et al., 2020).

We must also acknowledge the impact of the COVID-19 pandemic on children and adolescents' screen time and subsequent digital use behavioral patterns (see Yang et al., 2022 for a systematic review and meta-analysis). According to a recent study among ten European countries, during the COVID-19 pandemic, around 70% of children and adolescents aged 6 to 18 exceeded the recommended limit of less than 2 hours a day (Kovacs et al., 2022). In addition, Musa et al. (2022) systematically reviewed digital screen time and adolescents' risk of metabolic syndrome. The conclusions drawn by the authors from the ten studies included in their review suggested that screen usage during the pandemic increased significantly, and so did the health effects associated with sedentary behavior fueled by screen time use. Similar researchers reported that, during the early stages of the pandemic, the average time spent on screens increased to almost 6 hours per day (Nagata et al., 2022).

Screen Time and Eating Behaviors

Several researches reviewed the relationship between screen time and obesity among children and adolescents, generally highlighting their significant link. The review by Robinson and their collaborators (Robinson et al., 2017b) highlights the evidence in this regard.

According to this review, youngsters who spend more time on screens eat more processed foods, fewer fruits and vegetables, and a more significant percentage of their daily calories from fats and fast food. The evidence examined suggested that one of the possible explanatory mechanisms might be related to the fact that children and adolescents seem to eat when watching screen media without a corresponding rise in appetite or a reduction in overall intake. In other words, youth's calorie consumption rises significantly when they spend time on digital screens, primarily because they eat while watching.

Moreover, Robinson et al.'s (2017) review also discusses the evidence regarding the impact of food commercials concerning children and adolescents' eating habits. For instance, studies included in the analysis suggested that even a 30-second add/food commercial (embedded in animated programs) might affect their preferences, taste perception, and food intake (e.g., automatic eating) (Borzekowski & Robinson, 2001; Harris et al., 2009; Kraak et al., 2006). However, Robinson et al. (2017) also underline that using interactive media might efficiently reduce the negative effect of screen time use and promote healthy eating and physical activity, which might further contribute to a decrease in obesity prevalence among youth. Furthermore, it also seems that school-based interventions based on screen-time reduction might significantly contribute to less time spent in front of screens and fewer meals eaten while consuming digital media (Robinson, 1999).

Screen Time and Sedentary Behavior

Recent estimates suggested that more than 80% of adolescents aged 11 to 17 are insufficiently physically active, and the rise of digital use has significantly contributed to this (Oh et al., 2022). Furthermore, these numbers increased even more due to the COVID-19 restrictions (Guthold et al., 2020). The World Health Organization's (2020) recommendations for children and adolescents aged 5 to 17 highlight the need for at least one hour a day of moderate-to-vigorous physical activity (Chaput et al., 2020).

The review conducted by Oh and their collaborators (2022) highlights the need for systematic interventions to decrease screen time and increase physical activity among youth to decrease the risks of sedentary behaviors. These interventions might include exercise breaks and physical activity classes (Colin-Ramirez et al., 2010), peer-to-peer education about the health effects of excessive screen media use (Bickham et al., 2018), school environment modifications and parental workshops (S. Andrade et al., 2015), parental monitoring on TV screen time (Epstein et al., 2008), advertising and media promotion on digital use limitations (Gentile et al., 2009), education on healthy lifestyle behaviors (Lloyd et al., 2018), and self-monitoring of screen time use (Robinson, 1999).

Screen Time and Sleep Quality

When discussing the relationship between sleep and digital media during childhood and adolescence (5 to 17 years old), LeBourgeois et al. (2017) concluded that experimental studies are needed to understand better how the current digital revolution is affecting sleep and circadian cycles from infancy through maturity, which can lead to poor health, learning, and behavior. The studies explored in their review suggested that 75% of children and 60% of adolescents usually interact with digital screens one hour before bedtime (Mari Hysing et al., 2015). Furthermore, insufficient sleep is common when digital devices such as television, computers, or phones are left overnight in children's and adolescents' bedrooms (6 to 17 years old). The mechanisms underlying the significant negative association between electronic media and sleep generally include time displacement, psychological stimulation based on media content, and the effects of light from digital devices (especially among prepubertal children, compared to postpubertal children) – which negatively affects circadian timing and users' sleep physiology (Council on Communications and Media, 2016). In addition, the outcomes of poor sleep quality due to the use of digital devices include daytime tiredness, which further leads to poor school performance and psychological negative effects, especially among younger children. Finally, some recommendations are made by LeBourgeois et al. (2017), based on their review of the literature examining sleep and digital media use and the recent American Academy of Pediatrics policy statements:

- a) sleep should be made a top priority; discussions with families regarding the importance of quality sleep and the negative effects of bright light might help set this priority and understand its importance;
- b) digital media and screen time, in general, should not be available at least one hour before bedtime; such habits should be replaced with healthy bedtime routines, such as reading or other calming activities;
- c) all electronic media (including TV-s) should be removed from children and adolescents' bedrooms.

Mental Health Risks

Digital-mental health-related outcomes among children and adolescents comprise a significant and increasing research topic in the past years. Various researches suggested that the proliferation of smartphones and social media use may have a significant contribution for the rise in suicidal tendencies, depression, anxiety (Glover et al., 2022), and loneliness, especially among females (e.g., Twenge et al., 2018). The review conducted by Odgers and Jensen (2020) summarizes some of the findings focused on children and adolescents,

highlighting, however, the mixed patterns of associations between depression and social media use. Also, the authors draw attention to the fact that “adolescents’ online risk often mirrors offline vulnerabilities” (p. 11), and that further research is needed to conclude that technology is significantly responsible for youth’s increasing depression rates. Also, they highlight the fact *the nature* of online interactions and digital use, in general, might be more relevant than measuring screen time, which might no longer be a useful construct when examining digital media effects on children’s and adolescents’ mental health.

Screen-based sedentary behaviors can result in social isolation, which may increase the risk for internalizing symptoms (Rubin & Burgess, 2001). Previous research also examined the characteristics that may attenuate the link between screen-based sedentary behaviors, depressive symptoms, and anxiety symptoms in youth. The review conducted by Zink et al. (2020) in this regard suggested that screen type, physical activity, and gender may influence the magnitude of screen-based sedentary behavior-internalizing symptom associations, highlighting potential sources of heterogeneity in this regard. Also, the authors emphasize that prior to the development of tailored intervention strategies designed to decouple screen-based SB and internalizing symptoms among youth, additional studies targeted at elucidating potential mechanistic explanations for the above moderators are required.

Social Media Use and Risky Behaviors

According to previous estimates, up to 97% of 13–17-year-olds use social media (Barry et al., 2017), three hours daily – on average, and most of them use three to eight social media networks (Vannucci et al., 2020). Teenagers' online and offline life revolve on social media, and a large body of literature linked social media use to risky behaviors among teenagers. For instance, the Facebook influence model (Moreno & Whitehill, 2014) suggests that individual interactions and social networks affect individual views and create communities with similar risk perceptions and behavioral norms, who subsequently replicate desired or rewarded behaviors. Hence, peer-posted information on social media and online forums may encourage dangerous behaviors, such as substance use (Vannucci et al., 2020).

Although adolescents primarily post positive, non-deviant content on social media this theoretical approach explains how risky behaviors posted by a minority of social media influencers and popular peers have greater reach, desirability, and influence in the social media context due to its publicness, widespread availability, and quantifiable reinforcement. Thus, social media exposure might shape positive attitudes toward risky behaviors, and teenagers might consider them normal or less risky than they actually are for their physical and mental health. Adolescents might engage in such risky behaviors to mimic or comply to the social

norms of valued or high-status persons, obtain social reinforcement, and develop a positive social identity (Vannucci et al., 2020).

Some of the documented risky behaviors among adolescents – subject to social media use – include, according to the comprehensive review conducted by Vannucci et al. (2020), engagement in risky sexual behaviors (e.g., unprotected sex; Smith et al., 2016), alcohol use and alcohol-related problems (Curtis et al., 2018), sexting (Doyle et al., 2021 for a review on the outcomes of sexting for children and adolescents; Ybarra & Mitchell, 2015), engagement in overt aggression toward peers and weapon possession (Baker & Pelfrey, 2016), exposure to online pornography (Collins et al., 2017). According to the review conducted by (Hogan & Strasburger, 2018), one potential explanation might be related to the alcohol-related online media exposure and marketing. Also, numerous studies linked social media use with cyberbullying, which can further lead to mental health, academic, and social problems and suicidal behavior (Hinduja & Patchin, 2010). Finally, some specific risky behaviors exhibited in the online environment (particularly on YouTube) are particularly dangerous, such as the choking game (i.e., asphyxial games) (Guilheri et al., 2017).

Digital Benefits

The benefits of digital use and social media, in particular, are also highlighted by Odgers and Jensen (2020). Their conclusions following the review of several meta-analysis and systematic reviews draw the attention upon the various positive outcomes of online platforms, especially among adolescents. For instance, adolescents with lower social and emotional well-being are more likely seek and find support within online communities, increasing their well-being (e.g., Rideout & Fox, 2018). Anonymity, privacy, immediacy, accessibility, inclusion, connecting with others and sharing experiences, and a stronger sense of control over the help-seeking path were identified as key benefits regarding youth's online help-seeking (see Pretorius et al., 2019 for a review). Internet assistance-seeking may satisfy self-reliant people or lead to further support. Lack of mental health knowledge, privacy and confidentiality issues, and online resource trustworthiness, however, might prevent help-seeking.

Also, adolescents' peer relationships may benefit from digital interactions since they may support displays of affection and closeness, and might increase friendship quality (Yau & Reich, 2018). Social media can be a valuable tool for self-exploration among teenagers, enhancing self-concept clarity and providing a suitable platform for practicing identity development skills such as self-presentation and self-disclosure (see Uhls et al., 2017, for a

review). Also, online social networking might also help adolescents with learning disabilities and identity issues (Korchmaros et al., 2015).

Furthermore, the review conducted by Puzio and their collaborators (2022) highlights some interesting findings regarding the use of digital programs by preschoolers. For instance, it seems that a 5-week computerized training enhanced children's working memory, compared to children who used screens to play video games (Thorell et al., 2009). Similar findings were reported by Goldin et al. (2014), suggesting that 15-minutes computerized training (i.e., three sessions per week, for a ten weeks period) might as well increase elementary school children's attention, which can further lead to better math and literacy grades. These results align with the idea that high-quality, age-appropriate digital programs may benefit children's cognition, while developmentally inadequate digital content, such as computer games, programs, or movies may lead to mental and health-related problems (Mares & Pan, 2013). However, in contrast with other findings suggesting the negative impact on digital playing, Puzio et al. (2022) highlight the benefits of gaming on children's (aged 9 to 10) intelligence, before controlling for parental education. The authors also underline the need to eliminate background TV exposure while sleeping, especially in preschool children, due to the detrimental effects on executive functioning (Nichols, 2022).

Digital Health Interventions: Serious Games and Games for Health

With the increased popularity and affordability of new technologies, pediatricians are interested in using digital devices and programming for preventative and therapeutic purposes (Cliffe et al., 2021). Thus, a particular topic regarding the benefits of digital use among children and adolescents is related to digital health interventions (Dallinger et al., 2022; Reynard et al., 2022). "Serious games" or "games for health" have been designed and tested to enhance children and adolescents' health via play, e.g., Re-Mission, Personal Investigator, or Play Attention (Anderson et al., 2010). A comprehensive analysis of randomized controlled trials suggested that adolescents using mobile phone apps for chronic conditions may enhance medication adherence: acne, asthma, diabetes, depression, and various other treatment results improved using applications that automatically email patients about medication time (Badawy et al., 2017; see Domhardt et al., 2021 for a meta-analysis regarding the efficacy of digital health interventions in youth with chronic medical conditions). Additionally, technology-assisted parent training programs for children and adolescents with disruptive behaviors have also been indicated as effective tools (Baumel et al., 2017).

Furthermore, *serious games* interventions were found to improve knowledge and self-management in pediatric diabetes, asthma, and cancer patients (Charlier et al., 2016), as well

as in children with developmental disabilities (Kokol et al., 2020; Păsărelu et al., 2020), or obesity (McMullan et al., 2020; see Azevedo et al., 2022 for a review). A recent meta-analysis suggested that virtual reality games might also enhance gross motor abilities in children with cerebral palsy (Ren & Wu, 2019). Additionally, related systematic reviews suggested that this type of video games may have similar outcomes as psychotherapy (Zayeni et al., 2020). Finally, *exergames*, which require gross motor exercise, have been shown to reduce childhood obesity as they may motivate overweight and obese children to exercise in a playful way (A. Andrade et al., 2019).

Smartphone apps can provide real-time data, responsive monitoring, and even supplementary therapy techniques to child and adolescent mental health treatments (Dwyer & Koutsouleris, 2022; Hollis et al., 2017). For example, Facebook flags posts about self-harm, mood-monitoring applications may track depression symptoms (Qu et al., 2020), and several apps provide self-help and treatment via the phone. However, as Wu et al., (2017) suggested, there are many unmet needs regarding confidentiality and privacy issues regarding digital health interventions, and child and adolescent psychiatry, in general. The authors highlight the fact that clinical smartphone applications' confidentiality and privacy are yet unknown or unclear. Disclosure, access privilege, privacy and trust, risk and benefit analysis, and standardization are important considerations; thus, child and adolescent mental health specialists must keep current on digital technology privacy, security (Psihogios et al., 2020), and confidentiality to assist patients and parents make informed decisions and influence future tools (see (Wies et al., 2021 for a review of the ethical promises and challenges of digital mental health interventions designed for children and adolescents).

Discussions

Problematic interactive media use and problematic Internet use have been defined in many ways. Despite the various conceptualizations, researchers agree on the addictive nature of these behaviors and the detrimental effects on children's and adolescents' mental and physical health. The recommended interventions in this regard include group and individual counseling, cognitive behavioral therapy, sports interventions, and sometimes medication (Nereim et al., 2019). We believe that, in addition to these suggested interventions, we must acknowledge and encourage the role of parents and teachers to prevent excessive digital use and the related negative consequences. In this regard, the position statement formulated by the Canadian Paediatric Society (2019) is a very useful starting point, underlying four principles that should guide healthy screen use in school-aged children and adolescents: "healthy

management, meaningful screen use, positive modelling, and balanced, informed monitoring of screen time and behaviours” (p.402).

Based on the findings from the systematic reviews and meta-analyses included in the present research, we formulated a series of recommendations regarding children’s and adolescents’ digital activity.

a. Screen time (duration)

The overall recommendation is that screen time and digital media access, in general, should be **less than two hours**, regardless of the youngster’s age. The risks associated with using digital screens for more than two hours include physical (e.g., obesity and unhealthy diet, interferences with sleep duration and quality, myopia and other oftalmological conditions, symptoms related to metabolic syndrome), emotional (e.g., depression, anxiety, emotion dysregulation), cognitive and motor development negative effects. However, low levels of recreational screen time (1 hour per day) are associated with a lower risk of depression compared to no screen time (Reid Chassiakos et al., 2016).

b. Screen time (contents)

Age-inappropriate or violent digital contents can severely impact development and behavior. However, age-appropriate digital content, **co-viewed with family members** (preferably parents) may be engrossing, enlightening screen experiences that can boost academic achievement, literacy, and favorable connections with teachers and classmates. Screen-based programs, especially educational ones, can foster curiosity, autonomy, and collaboration (Canadian Paediatric Society, 2019). In this regard, dynamic softwares, applications and educational games can improve math performance and lower learning gaps (Bruce, 2012; Coyne et al., 2014; Molyneux & Godinho, 2012).

Regarding social media use, despite the negative effects of excessive use and the potential associated harmful consequences of unsupervised social networking activity (Baldry et al., 2019), there are many benefits to be mentioned, such as enhanced self-esteem via improving friendship quality, a sense of belonging, identity-exploration. Nevertheless, the need for adults monitoring in this regard – especially through digital education - is undeniable. Next, when discussing video games, this specific digital content is significantly harmful when it becomes addictive and when violence is displayed (Anderson et al., 2010; Winther, 2017). However, action video game play in older children and teenagers has been shown to improve attention, visual, and representational processing, as well as executive function and visual spatial working memory (see the review of the Canadian Paediatric Society, 2019 for details).

c. Parental Monitoring

Regardless of the youngster's age, the general recommendation for parents is to be present and actively engaged in children's and adolescents' media use and screen time, in general. Based on the evidence consulted, we also recommend the following:

- Parents should make a Media Plan (or Digital/ Screen time plan) regulating time and content limitations. Also, they should encourage educational institutions such as schools and after-school facilities to employ a similar media plan/strategy for promoting digital literacy and reducing excessive screen use.
- Whenever possible, parents should co-view and discuss with their children the digital contents they interacted with/viewed. Parents should participate in children's media experiences (e.g., they can join them while they're gaming and inquire about their online experiences).
- Parents should manage and discourage multitasking (Uncapher et al., 2017).
- Parents should educate children and adolescents about digital privacy and the associated risks (e.g., doxxing; Eckert & Metzger-Riftkin, 2020), in addition to actively discussing acceptable and non-acceptable digital behaviors.
- Emphasize instructive, active, and sociable screen activities above passive or unsocial ones. For instance, parents could join children in e-book reading, given the documented benefits related to literacy skills improvement (López-Escribano et al., 2021).
- Promote screen-free meals and offline activities.
- Parents should also remember that they are a digital model to their children; thus, they should also review and control their own screen time and digital habits and behaviors (see Hung, 2022 for a detailed narrative review on digitalisation, parenting, and children's mental health).

Conclusions

- Screen devices are practically everywhere and accompany individuals from infancy, prompting concerns regarding functional duration of exposure and child use. Screen-device interactions, like other areas of learning, should be guided and moderated by parents and other caregivers.
- Informing caregivers about age-appropriate content for small children may protect them from watching dangerous programs.
- Just prohibiting screen time may cause parents to feel guilty, creating a negative feedback loop. It is critical to urge parents to participate actively in their children's play

and other social relationships. It may be able to limit the incidence of harmful, age-inappropriate media by teaching caregivers about content that poses little to no danger to the youngest children.

- Youngsters may be able to strengthen their executive functions by playing computer games, particularly those designed with that objective in mind.
- Excessive screen media usage hinders gross motor skill development in younger children and lowers physical activity in older children and adolescents.
- Obesity, cardiovascular disease, and other modern maladies are in jeopardy. Yet, certain apps and games may encourage youth to exercise. Exergames in digital media can serve as role models.
- Parents should avoid using screen gadgets as soothers because this habit has been connected to emotional and self-regulation disorders.
- Screen gadgets can provide valuable resources in health interventions, both directly, through activities that encourage healthy behavior, exercising and the development of cognitive skills, and indirectly, through screening and offering useful information and tools for organizing other activities.

Furthermore, the use of screen gadgets in health interventions serves two major roles. First, it provides individuals with various activities that can improve their health (e.g., games that promote physical exercising) or cognitive skills (e.g., memory games). Second, it can provide auxiliary functions during health interventions (e.g., providing communication networks for peers, screening the behaviors and regimes of children and adolescents etc.).

Screen gadgets provide both new opportunities for the intellectual and social development of children and adolescents, and risks related to their health and mental well-being. In order to mitigate the negative impact of screen time and to promote the healthy use of digital devices, parental control of screen time is imperative. Limits and rules related to the amount of time spent using digital devices need to be established, while also regulating the types of activities in which children and adolescents engage. Excessive screen time is associated with impairments of cognitive, motor and emotional development, obesity and problematic sleeping. However, screen time can also be used in order to improve children's development and also provide them with useful resources for other relevant activities.

The limitations of the current review ought to be addressed. First, we limited our search for relevant systematic reviews and meta-analyses to the PubMed database. Therefore, it is possible that potentially relevant articles were omitted. Second, the current review is limited to a narrative approach, focusing on presenting the main results of previous studies, while also

offering suggestions for screen time control strategies. This approach did not allow us to calculate overall effects of the previous studies. Therefore, future reviews can employ a meta-analytic approach, in order to better synthesize the findings of previous research. Third, it is important to acknowledge that a considerable amount of previous studies investigated screen time as a continuous variable that was associated with negative health outcomes, while previous research also highlighted the relevance of the quality of screen time and the types of activities in which individuals engage when using digital devices (Madigan et al., 2020).

Furthermore, while the effective amount of time spent using digital devices can have a negative impact on children's development, the specific time periods in which children use devices can also interfere with their growth and maturation (e.g., the use of digital devices while eating, or as a method to calm children can have a negative impact on their emotional development and maturation) (Domingues-Montanari, 2017). Therefore, further research is needed in order to better understand the impact of various types of activities that employ the use of digital devices. Finally, it is relevant to highlight that several previous studies that investigated screen time relied on self-report measures and employed cross-sectional designs, which limit the objectivity of the data and the extent to which the results reflect the real data. Therefore, further research is needed, and the development of longitudinal designs, that employ more objective measurements of screen time, will further contribute to the research literature.

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Annex 1

Table 1

Questions, Search Terms, and Outcomes

Question	Search terms	Outcome (initial screening)	Studies included in the review (following the final screening) n = 38
<i>Q1. How much time should children and adolescents spend daily using digital devices?</i>	children AND adolescents AND time AND screen AND digital use	30 articles matched the proposed search in the PubMed database. Following the initial inspection of the documents, 16 records were removed because the studies were not focused on the topic involved. Thus, 14 papers were included in the second screening step, i.e., full-text screening.	<ul style="list-style-type: none"> • Lissak G. (2018) • Robinson et al. (2017) • Manwell et al. (2022) • LeBourgeois et al. (2017) • Foreman et al. (2021) • Musa et al. (2022) • Odgers & Jensen (2020) • Stracker et al. (2018) • Oh et al. (2022) • Puzio et al. (2022) • Zink et al. (2020) • Yang et al. (2022) • Wu et al. (2017) • Vannucci et al. (2020) • Canadian Paedriatic Society (2019) • Hogan et al. (2018) • Nereim et al. (2019) • Hollis et al. (2017) • Kokol et al. (2020)
<i>Q2. Which digital applications are generally more beneficial, and which are the most harmful for children and adolescents?</i>	children AND adolescents AND digital applications AND benefits AND risks	We found two articles matching the proposed search criteria in the PubMed database. However, following the initial inspection of the documents, one record was removed since the study was not focused on the topic involved. Thus, only one paper was included in the second screening step.	

<i>Q3. How should children and adolescents use social media networks?</i>	children AND adolescents AND social media AND benefits AND risks	We found 15 articles matching the proposed search criteria in the PubMed database. However, following the initial inspection of the documents, eight records were removed (reason: other research topics). Thus, seven papers were included in the second screening step.
<i>Q4. Which are the most common benefits of digital use among children and adolescents?</i>	children AND adolescents AND digital use AND benefits	We found 49 articles matching the proposed search criteria in the PubMed database. Following the initial inspection of the documents, 27 records were removed (reason: other research topics). Thus, 22 papers were included in the second (full-text) screening step.
<i>Q5. Which are the most common negative outcomes of digital (mis)use among children and adolescents?</i>	children AND adolescents AND digital use AND negative outcomes	We found nine articles matching the proposed search criteria in the PubMed database. Following the initial inspection of the documents, two records were removed (reason: other research topics). Thus, seven papers were included in the second screening step.

- [Pretorius et al. \(2019\)](#)
- [Uhls et al. \(2017\)](#)
- [Doyle et al. \(2021\)](#)
- [Azevedo et al. \(2022\)](#)
- [Hung \(2022\)](#)
- [Dwyer & Koutsouleris \(2022\).](#)
- [Dallinger et al. \(2022\)](#)
- [Wies et al. \(2021\)](#)
- [Cliffe et al. \(2021\)](#)
- [López-Escribano et al. \(2021\)](#)
- [Domhardt et al. \(2021\)](#)
- [Qu et al. \(2020\)](#)
- [Păsărelu et al. \(2020\).](#)
- [Reynard et al. \(2022\)](#)
- [Collins et al. \(2017\)](#)
- [McMullan et al. \(2020\)](#)
- [Baumel et al. \(2017\)](#)
- [Guilheri et al. \(2017\)](#)

Q6. Which are the guidelines that parents should follow regarding digital control? children AND adolescents AND digital use AND parental control

For this final question, we found ten articles matching the proposed search criteria in the PubMed database. However, following the initial inspection of the documents, eight records were removed (reason: other research topics). Thus, **two papers** were included in the second (full-text) screening step.
