

“Increased Screen Time among Children” Physical, Cognitive, and social Consequences –Guidelines and Recommendations

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DOI: <https://doi.org/10.51244/IJRSI.2026.1305000280>

Received: 14 May 2026; Accepted: 19 May 2026; Published: 15 June 2026

ABSTRACT

The emergence of digital technology has caused drastic change in how children live their lives. Although technology is being used to achieve many positive outcomes in the learning environment, there is public health concern associated with too much time in front of a screen. Studies have shown that extensive use of screens have numerous adverse effects such as health complications, intellectual retardation, emotional imbalances, and social challenges. This article discusses the complex role of an increased screen time in children and identifies its dangers as well as its possibilities. It is built on the basis of recent empirical research and international health suggestions to indicate the necessity of moderated use, parental monitoring, and patterned screen interaction to result in healthy development of children.

Keywords: Screen time, Children, Digital media, Child development, Health outcomes

INTRODUCTION

Digital revolution has changed drastically the way children grow up in the 21st century. Children currently live in a media-saturated world like no other, as they now get access to phones, tablets, computers and televisions at an ever-younger age ^[1]. **According to the American Academy of Pediatrics, on average, children between 8 and 12 years old spend 4-6 hours a day in front of screens and teenagers up to 9 hours a day grasping digital media stories** ^[2]. This huge growth in screen time is coincided with the increasing number of concerns regarding the possible effects of screen time on children’s development, health, and well-being.

The increased exposure of children to the screen because of the COVID-19 pandemic has subsequently contributed to the accelerated screen time costs as most families reported the doubling or tripling of their screen time usage during the lockdown periods ^[3]. Remote learning required more time on educational screens, and time on entertainment and social media also increased because of a limited possibility to engage in traditional forms of play, as well as socialization. Massive screen usage has become an unprecedented phenomenon that people want to find answers to the immediate and long-term effects of screens on the human psyche and brain.

Screen time involves numerous activities such as the consumption of educative materials, playing, communication through the social media, and idling through entertainment. Heterogeneity is a feature of screen activities, which makes it hard to provide global directions or foresee any homogeneous effects.

This extensive literature-review summarizes the existing evidence in terms of how elevated screen time might affect the physical status of children, their cognitive development status, social functionality, and behavioural patterns. This analysis will result in a more comprehensive picture of the impact of digital media exposure on the development of children that can be used in further evidence-making recommendations to parents, educators and policymakers taking into account the discussion of both negative and positive influences of exposure to digital media.

Physical Health Impacts of Increased screen time. Fig.1

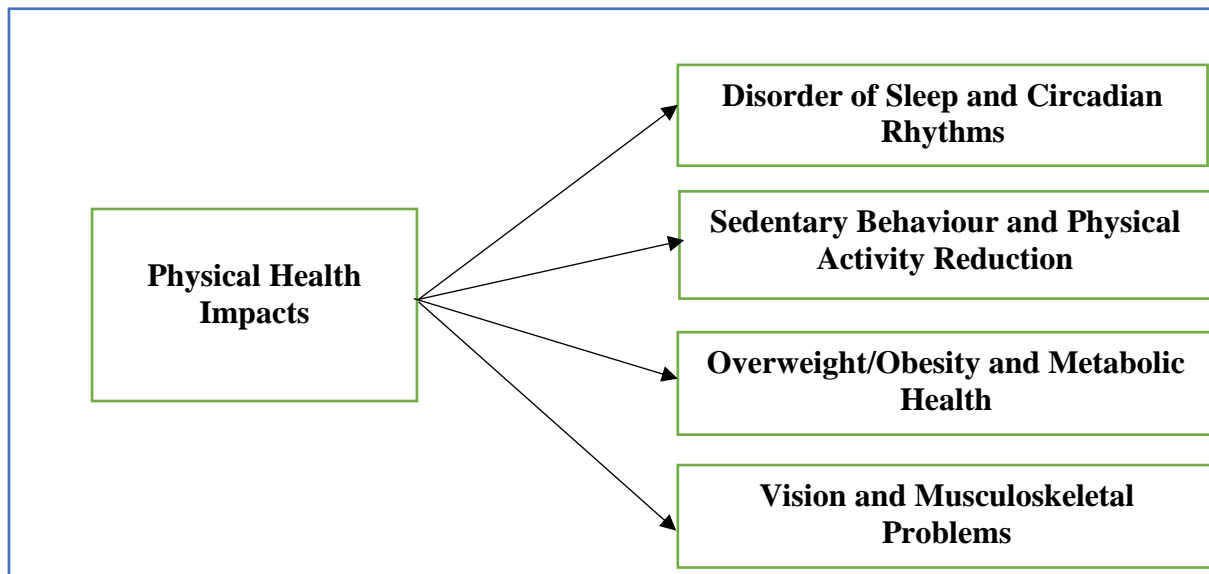


Fig. 1 Physical Health Impacts of Increased of use of screen time

Disorder of Sleep and Circadian Rhythms

The effect of higher screen time which has been consistently mentioned is the impact it has on the sleeping patterns of the children. Blue light that comes out of the digital devices keeps back the production of melatonin that interferes with the natural cycles of bodies and children find it hard to get sleep^[4]. The study conducted by Hale and Guan (2015) proved that children leaving screen use within one hour before sleep had increased sleep latency and a shorter total sleep time compared to the others^[5].

The connection between screen time and the quality of sleep does not cease at the point of direct contact with the screen at the moment of going to bed. Children with higher daily screen viewing had persistent sleep disturbances, more frequent wakings at night, and more early morning awakenings above that of their peers, reported Carter and colleagues (2016)^[6]. These sleep disturbances have far reaching consequences on the work of day time, school performance & their emotional control.

The interactive feature of the latest gadgets makes sleeping issues worse than passive television use. Gaming and social media are specifically built to keep a person active by means of intermittent reinforcement schedules, which makes it especially difficult to take part in before bedtime by children^[7]. Since interactive activities on screens are related to cognitive arousal, it can continue long after the person has put his or her device aside and it continues to push back the sleeping time.

Sedentary Behaviour and Physical Activity Reduction

An excellent relationship exists between screen time and lower measures of physical activity and higher amounts of sedentary behaviour in kids. According to displacement hypothesis, screen time takes the place of the corresponding activities that would be taken physically^[8]. In a longitudinal study, it has been demonstrated that children with increased exposure to the screens have less moderate to vigorous physical activity and a decreased cardiovascular fitness^[9].

Screen and physical activity have a complicated and two-way connection. Although screen time can replace physical activity, there is also the possibility that sedentary screen time can be preferred because of low physical fitness. This forms a negative loop that as exercise is reduced, a greater amount of viewing occurs which then reduces the level of exercise even further^[10]. **The COVID-19 pandemic has emphasized the relevance of such a connection, and the research indicates that children who did not decrease their physical activity levels during lockdowns did not suffer as many consequences of the increase in screen time^[11].** This implies that physical activity could act as a preventive measure to some side of screen exposure.

Overweight/Obesity and Metabolic Health

The linkage between screen time and obesity amongst children has been effectively reported among various populations and age groups. Meta-analyses always reveal that, children who are exposed to greater screen use have more chances of becoming overweight or even obese^[12]. There are a variety of ways in which this is mediated, namely, through a decrease in physical activity, excessive calorie consumption when staring at the screen (and, subsequently, food advertisement exposure).

There is also a connection of screen time and the exposure to high-calorie and nutritionally impoverished foods during the viewing sessions. Distraction of engagement by screens lowers awareness of satiety signals, thus causing an overconsumption of food intake. Furthermore, marketing of food and beverages on digital media specifically focuses on children through promoting products that are loaded with sugar, fat and sodium.

New studies indicate that screen timing might be especially relevant to metabolic health. It seems that evening screen time is more associated with weight gain than morning or afternoon exposure because it can alter the sleep schedule and disturb the sleep cycle since sleep quality and adequate sleep are essential components of good health and decent weight maintenance and gain specific sleep deprivation, which is a key factor in weight gain and maintenance problems or excess weight gain in general^[13].

Vision and Musculoskeletal Problems

Prolonged use of screens causes a number of ocular issues in children commonly known as Computer Vision Syndrome or Digital Eye Strain^[14]. It causes symptoms of eye dryness, eye irritation, blurred vision and headaches. Children are especially vulnerable as they regularly use the devices in closer proximity and over longer time and without a break than adults.

Myopia (near-sightedness) has largely increased in children in part to spending more time in front of a screen and less on the physical activity outdoors^[15]. Work that involves looking at screens among other near activities can be seen as a cause of axial elongation of the eye causing development of myopia. Nevertheless, the correlation between screen time and myopia seems to be more complicated and can be mediated by the decrease in light eye exposure and not screen exposure itself.

The number of children with musculoskeletal issues is on the rise as children tend to spend a lot of time on digital devices. The screen use may result in the neck pain, back, and the repetitive strain injuries which may be caused by poor posture during screen use^[16]. The ergonomics issues associated with handheld device use are of specific concern since the equipment especially those that demand prolonged awkward postures are likely to lead to instant discomfort as well as development of long-term musculoskeletal difficulties.

Cognitive Development and Academic Performance

Executive Function and attention

Screen time and the connection with the occurrence of attention problems in children is a topic that has been well studied with numerous alarmed results in several areas. Long screen time, in general, and fast-paced, highly stimulating content, in particular, have been linked to the propensity to attention issues and attention deficit hyperactivity disorder (ADHD) symptoms^[17]. Developing attention systems can be overstimulated by rapid scene cuts, high audiovisual stimulation and other such characteristics prevalent in a lot of types of digital media.

The skills related to executive functions such as working memory, flexible thinking, and inhibition are especially susceptible to risky screen time. Longitudinal studies have revealed that children who spend more time in front of the screen perform worse on tasks that urge sustained attention and cognitive control over time^[18]. The deficits tend to linger in even after the other factors are put into consideration like the socio-economic status and parental education.

The type of screen content seems important in the cognitive outcomes' determination. Educational material that is less paced and has a specified learning goal demonstrates less relationship with attention difficulties than

material only aimed at entertainment ^[19]. Nonetheless, even the educational content can go wrong as long as it is consumed too much or not at all suitable to the development stage of the child.

Language Development and Communication Skills

Screen time affects language development to a great extent and it depends a great deal on the age of the child and the kind of contents in the screens that the child sees. In the case of infants and toddlers, it has been linked to slow language development and limited learning of vocabulary with excessive exposure to screens ^[20]. The face-to-face level of a human communication offers vital language acquisition, which cannot be imitated with screen watching.

Nevertheless, the correlation between the amount of time spent in front of a screen and language development is more complicated in the case of older children. Language learning could be facilitated by good quality learning materials in combination with interactive talks with caregivers ^[21]. The quality of content, its appropriateness by age, and adult-supportive interaction during and after screen use seem to be the main factors.

Academic Performance and Learning outcomes

The association of screen time and grades is also complicated and subject to the involvement of various tenets consisting of the kind of screen activity, time of exposure and individual attributes. The general research findings are the presence of negative correlations between recreational screen time and academic performance in a variety of academic disciplines around the world ^[22].

A lot of screen time, especially in the form of games and social networks, is linked to a lack of accomplishment of home assignments, poorer grades, and loss of academic interest ^[23]. The immediate gratification provided by digital entertainment may reduce children's tolerance for the delayed rewards associated with academic work.

Nevertheless, it is apparent that educational screen time can facilitate the learning process provided it is used wisely. There have been the demonstrations of computer-aided learning in mathematics and reading abilities in a certain population. The trick seems to lie in making sure that the educational screen time is an addition, not a substitute to the conventional methods of learning and communication with fellow human beings.

Memory and Information Processing

Too much exposure to screens can affect the memorization process in children and information processing. Availability of the information that is constantly supplying them via digital devices potentially decreases the desire of the children to encode and store the information in long-term memory ^[24]. This can be referred to as digital amnesia, which could deteriorate the process of critical thinking and deep learning.

Multitasking is a frequent symptom of working with digital devices can negatively affect the process of memory consolidation and learning efficiency. The attempt of children to do homework simultaneously with using digital equipment may impair level of understanding and memorization of information in comparison to the single task approach ^[25]. This observation is critical in terms of study habits and academic performance.

Screen time leading to sleep disruption also has the potential of affecting the memory consolidation since sleep is essential in moving the information stored in the short-term memory to long-term memory ^[26]. The indirect consequences of screen time on memory due to sleep disturbance might be significant as direct consequences on attention and processing.

Social and Emotional Development

The Social Skills and the Interpersonal Relationships

The effects of exposure of children to more screen time on the social aspects have been the concern of the study by many researchers and clinicians. In-person communication offers vital experiences to the children of acquiring social competencies such as reading facial expressions, reading body language and reading social cues

to communicate with others around them^[27]. Once these interactions are replaced with screen time, then children can lose important social learning opportunities.

A study by Uhls and others (2014) proved that children who went to a camp where they had no access to screens increased their reading of facial cues and knowledge of emotion more significantly than a control group that did not attend the camp^[28]. There is an adamant argument that digital media and the internet are responsible for creating a culture where children do not read regular books and thus, they lack the knowledge on how to interpret facial cues and how to know and understand emotions when they see them on faces of others or when they are expressed by someone. This indicates that a cut in screen time could show direct benefits of enhancing social skills.

Digital communication is not like the interaction where people are present. A lack of emotional real-life feedback in online communication may prevent children and impede their emotional intelligence development and the acquisition of empathy^[29]. Nevertheless, online communication has been an option of social interaction, especially when children face the difficulty of intersocial interaction.

Emotional Regulation and Mental Health

Screen time and children's emotional well-being is an inverted two-sided relationship. Screen time also correlates with hyper-anxiety, depression, or dysregulation in young people^[30]. The processes of these connections could be associated with a replacement of sleep and exercise, social comparison in social networks, exposure to inadequate content.

Specifically, social media has been cited as causing higher cases of depression and anxiety in teenagers. This repetitive exposure to the tailored online images of others may result into feelings of inadequacy and poor self-esteem. Moreover, online bullying and online harassment may cause devastating effects in mind.

Nevertheless, it is also possible that digital media could offer moral support as well as contact to certain children. Online groups can especially be supportive to children who are facing any specific difficulties or who are lonely in their real-life conditions^[31]. The trick seems to be guiding children to learn how to utilise digital media in a manner that does not compromise their emotional wellness.

Behavioural Problems and Aggression

It has been found repeatedly that there is a correlation between excessive use of the screen and more behavioural issues in a child. Such exposure to the violent content is also of great concern and many studies prove that violent media exposure has certain relations to the aggressive behaviour^[32]. Interactive character of the violent video games perhaps proves especially detrimental since children practice aggressive behaviours on the rewarding virtual world.

The instant gratification that digital entertainment creates may also influence children and their tolerance to frustration as well as delayed gratifications^[33]. The more time that children spend in front of computers and other devices may accustom them to the instantaneous answers and reinforcement, and they will find it hard to persevere or wait throughout circumstances that demand patience.

There is also a couple of possibilities that screen time affects self-regulation in children's behaviour and emotions. The unvaried stimulation one can find in digital devices can disrupt the formation process of internal regulatory involuntary processes, thus making more impulsive and harder to control emotion^[34].

Content Quality and Context Considerations

Educational vs. Entertainments content

The difference between educational and the entertainment content of the screen is paramount in the comprehension of the effects of screen time on the development of children. Educational content of high quality

could help with learning and growth in case it is used constructively, and purely entertain-driven content is further prone to be linked to harmful effects ^[35].

A study conducted by Lauricella (2011), showed toddlers under age two can learn cognitive, logical reasoning skills from a video presentation when the onscreen character is socially meaningful to them ^[36]. Other programs that prompt children to respond to the material or pose questions or use the knowledge demonstrated has more positive educational value than direct viewing.

Nevertheless, the term educational is not an insurance policy. Lots of products being sold as educational do not show any favourable learning outcomes and might even be counterproductive to growth in case these products substitute more valuable activities instead. Parents and teachers are in need of either learning how to select really educational material or knowing how to make the greatest use of it.

Age-appropriate Content and Development Considerations

The kind of content on the screen differs greatly depending on the level of development of children. Even material that is appropriate to school aged-children can be too much or inappropriate to a toddler ^[37]. Features such as intensity and speed of appeal frequently seen with digital media can be especially troublesome to the young child who's attentive and processing capabilities are immature. The repetitive shorter exposures are more beneficial to young children than prolonged use of screen contents. Moreover, the timing of use of the screens can also influence its effects, with use in the evening being especially problematic to sleep and circadian rhythm process.

Temperament variability, needs of attention capacity, and developmental needs imply that the screen time recommendation cannot be universal across the population. There are children who are more vulnerable to the impact of screen time and there are also children who may derive some benefits of exposure to digital media of a particular kind ^[38].

Co-viewing and Parental Mediation

Parents or caregivers substantially alter the effect of screen time by their presence and involvement when children are exposed to screen time. The educational value of screen time can be maximized with the help of co-viewing, during which parents watch media with their children and discuss it ^[39].

The active parental mediation includes the possibility of discussing, asking questions, and assisting children to find links between the screen information and real life. Such measure can improve learning and the ability of children to think critically regarding the content of media information ^[40].

Nevertheless, not all families can use effective co-viewing tactics because of time pressure, ignorance of suitable content, or the lack of understanding of how to approach digital media ^[41]. To have the best experience of screen time in children, it is possible that helping parents build their media literacy skills and co-viewing practices could be of the essence.

Vulnerable Population and Individual Differences

Children with developmental disabilities can be especially susceptible to the negative effect of overusing screens and may at the same time be one of the groups who can make the greatest use of thoughtful educational experiences on them ^[42].

Screen-based interventions have been demonstrated as promising to aid the learning process under developmentally disabled children. Individualized learning through tablet-based applications has the potential to be used to engage the children in speech and language delay to develop communication by supporting the learning and understanding processes of adults and children with developmental delays through communication systems using tablets to enhance communication development and learning opportunities in children with speech and language delays ^[43]. The advantages of this, however, require due consideration of selection of suitable content, and combination with wider plans of intervention.

The question families and professionals need to answer is how to balance the possible advantages of educational screen time to children with the dangers of over usage. Children who have developmental disabilities might be predisposed to developing problematic patterns of screen use because of inability to control themselves and the addicting characteristics of digital space ^[44].

Socioeconomic variables and Digital divide

Socioeconomic factors play an important role in determining the exposure of children to screen time and its effects to their development. Children who belong to families with lower income tend to possess greater amounts of recreational screen time and little educational content of high quality. This digital-divide could serve to strengthen current educational-inequalities and health disparities.

Existence of quality devices and access to the internet connection is also socioeconomically uneven and influences the nature of screen experiences that can be offered to children. To the vast majority of parents of young children, media and technologies are far beyond the item that they have to control and moderate. New as well as old media technologies are just very few of the numerous tools that are instrumentally applied in their practice. The way they raise their children, such as occupying, educating, disciplining, rewarding and calming their children, depends largely on parenting practices. There was a battle with, whether it is children on one side and parents on the other hand, media and technology use is now a family matter ^[45]. A family with a low flow of resources might have access to older screens that have small screens or use slow internet connections which might affect the quality and educational benefit of screen time.

Digital technology however makes an opportunity to digitally bridge the educational divide to the disadvantaged children. Digital-based well-designed educational programs can make high-quality learning experience available to everyone in any geographic location and family resources independent way. It is all about fair distribution of technology and high-quality educational material.

Cultural and Family Factors

Screen time are motivated by cultural values, family dynamics and have a big impact on children's development. The attitude to using technology, focus in education, and patterns of communication within a family also vary in cultures ^[46]. The cultural forces may affect the incorporation of the screen time in the family life and support or contradict other developmental objectives.

There is also the family media policies and role models which are important influences during the child screen time. Children whose families have regular and consistent media regulations and whose parents display better screen time habits have better results of their screen time interactions ^[47]. On the other hand, the families that follow the inconsistent rules or have parents with screen use issues can display more adverse outcomes in children.

The task of the researchers and clinicians is to create culturally acceptable methods of screen time guidance that would consider the family morals as well as positively influence the healthy development. This necessitates the need to learn about the roles of several cultural contexts in making the meaning and impact of screen time on children and families ^[48].

Current Guidelines and Recommendations

Professional Organization Guidelines

Evidence-based guidelines in relation to screen time in children have been created by major pediatric organizations and psychological organizations. The American Academy of Pediatrics suggests that children less than 18 months should be discouraged to use screens other than video chatting, children between 18-24 months should be exposed to high-quality pedagogically sound content verbally presented by the parents, and children aged 2-5 years should be kept under less than an hour of high-quality content per day on a screen ^[49].

In case of school-age children, limiting by the time is no longer mentioned, instead, it is necessary to make sure that there is no conflict between screen time and sleep, physical activity, and face-to-face communication. Similar recommendations are provided by the World Health Organization that focuses on the necessity to balance screen time and other activities that facilitate healthy development. ^[50]

These instructions can be accepted as the evidence-based practice at the moment; however, they still proceed to the process of constant updating because of new research findings and technological advances. The task of professionals becomes how to translate these guidelines into some practical recommendation that families will use in their day-to-day lives ^[51].

Implementation Challenges and Barriers

There are directions that families do not manage to follow the recommended time on screen usage. The most frequent obstacles are the absence of awareness of recommendations, the inability to differentiate between educational and entertainments material, and difficulty coping with the opposition of children to time restrictions on the screens ^[52].

Implementation of screen time guidelines also becomes more difficult due to the introduction of technological elements at the place of learning. It is a challenge to distinguish between educative and entertainment screen time since children can use the screen to do their homework, online classes, and schoolwork projects of various descriptions. This breakthrough of boundaries needs more sophisticated ways of screen time management. Also, the fact that digital media is social implies that children can become victimized by the peer-to-peer group and left out whenever their screen-time usage is restricted to a high degree. This social pressure may interfere with the ability to families to exercise restrictive screen time policies ^[53].

Future Directions for Guidelines/ Intervention and Strategies

With the ever-changing technology, the recommendations on screen time have to change as well to meet new applications and tools as well as the patterns of use. Virtual reality, augmented reality and apps involving artificial intelligence introduce new opportunities and challenges to child development. Fig.2

There is a possibility that future recommendations should not relate only to restricting time itself but should rather be based on quality and context of screen experiences. In this strategy, there would be a need to have more better instruments to assess the pedagogical usefulness and developmental suitability of online material courts ^[54]. It may also be significant to develop the individual recommendations regarding specific time spent on devices depending on the individual child features, family situation, and developmental requirements ^[55].

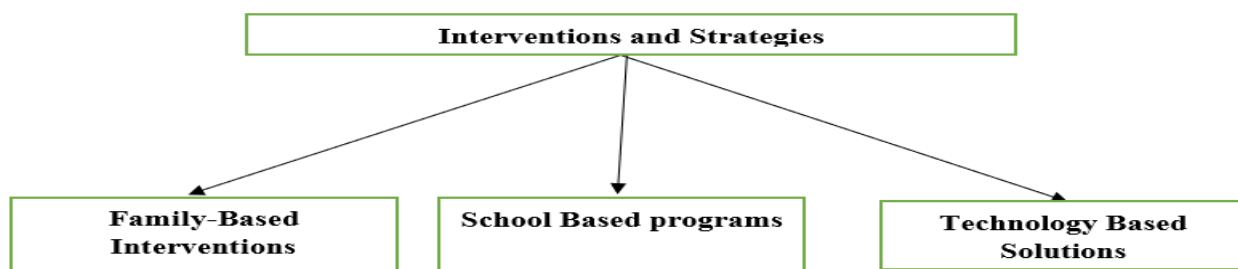


Fig.2 Interventions and Strategies to decrease the use of screen time

Family-Based Interventions

Interventions that are appropriate in the management of screen time among children tend to concentrate not on individual children but on a family system. Family-based solutions understand that behaviours of screen time use in children depend on family patterns, parental role modelling and family routine. Effective family-based interventions normally involve an education on the consequences of screen time, family media plans, and rules and boundary application. Such interventions tend to focus on the need to establish zones and time without the screen, e.g. the bedrooms, and mealtimes ^[56].

The studies have demonstrated that family-intervened programs are capable of minimizing children's screen-time and enhancing other related results like quality of sleep and level of physical activity. Nevertheless, family involvement and continued guidance through behavioural change make such interventions successful.

School Based programs

Schools have valuable influence on the relationship of children with the data technology, and may enact a program to encourage healthy screen use. Digital citizenship programs educate the children on the responsible online conduct, evaluate online information, and approaches to the screen time management ^[57]. Others have tried introducing device-free hours or sections of the school so that students can learn to interact with each other and not depend on the screens. Such initiatives can assist children in learning how to manage screen time and in some cases minimise any of the adverse effects caused by excessive use ^[58].

Nevertheless, with rising use of technology in school, schools make it difficult to encourage healthy screen using. Striking the appropriate balance between the positive use of technology in learning and potential overuse of screens involves either the strategic planning or the continued assessment of the positive or negative factors to take into consideration in such an undertaking ^[59].

Technology Based Solutions

Paradoxically, technology can solve the issue of too much of screen time. Screens are monitored and parental control software and in-built screen time monitoring tools may assist a family to track and monitor screen use. These apps are able to offer objective information regarding screen time trends and assist parents to realize the incorrect usage.

Nevertheless, when technology solutions are adopted as an educational intervention, they work best when coupled with education and family discussion and not as single interventions. When children know why such restrictions on screen time are put in place, they tend to learn to cooperate with management approaches ^[60].

Technology-based interventions can be made more effective by developing more advanced tools capable of discriminating between instructional and recreational material, monitoring the quality of screen experiences, and making individual recommendations based on the knowledge of the content and the user ^[61].

CONCLUSION

One of the most challenging public healthcare issues in the digital era is the influence of more time on the screens on children. Existing data proves that there are more than a number of adverse results of the extreme screen time consumption such as sleep disturbances, lack of physical activity, attention issues, language delay, and poor social skill development. Such effects seem to be strongest among young children and where the screen time replaces other significant development activities. Although there is a complex relationship between the screen time and child development, this relationship cannot be simplified to basic cause and effect relationship. The content of the screen, the context of its use and personal characteristics of children are all factors that determine the results. Learning benefits may come with high-quality educational material studied with the suitable support of parents; fast-paced forms of entertainment would be more likely to be malefic in excess.

COVID-19 pandemic has revealed the threats and advantages of digital technology in the life of children. Though the growth of the screen time during the lockdowns sparked the fear of harmful consequences to health, the digital tools also offered additional chances of learning and socialization. This case highlights the relevance of coming up with fine-grained management of screen time that takes into account the opportunities and threats. In the future, studying how screen exposure in childhood impacts individuals will also have to analyze long-term impacts as well as what factors moderate these impacts. The fast rate of technological advancements translates to the fact that the present-day research might not grasp the full impact of the new technologies and patterns of usage. Such longitudinal studies tracing children in early youth into adolescence will be important in capturing the long-term effects of exposure to the digital media.

The area of clinical practice and community health programs should be oriented on assisting families in making better decisions regarding the screen time of children. This involves the education about screen time effects, tools to estimate the quality of the content, and approaches to the use of healthy media use patterns. The idea must be to assist families in maximizing the use of digital technology and minimizing any of its dangers. To create evidence-based guidelines and interventions, researchers, clinicians, educators, technology companies, and families will have to join efforts. We can have the digital activities of the children build towards positive development and well-being than introduce challenges to their lives when we collaborate. After all, the issue does not lie in completely giving up screen time but in learning how to encourage kids to use digital technology in a healthy way that would feed them throughout their life. It needs continuous concern in the quality, quantity, and context of screen life experiences and further investigation of the explicated means by which digital media affects child development.

ACKNOWLEDGEMENTS

The authors thank all the contributors for the contributions and support.

Financial Support and Sponsorship

There is no sponsorship. Self-funding.

Clinical trial number

Not applicable.

Data Availability

The entire (copy of studies) data is available with the corresponding author. Its available on request

Author's Contribution

BG prepared the initial draft and proof reading. MG and STD did the proof reading. LKI is the corresponding author who did the proof reading, developed the figures from the many Literatures and finalised for the process for publication. ST and IS contributed to the literature search.

Declarations.

The authors declare that there is no conflict of interest.

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