

Systematic Review

Mitigating factors of screen time on children: a systematic review

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ABSTRACT

Screen time is a modern dilemma that has unplugged children from Mother Nature. It is a time that the child spends using technologically driven devices such as television, smartphones, computers, gaming consoles, etc. For children, this shift is profound as they grow up in an immersed digital era that has lasting effects on their development and well-being. This systematic review aims to identify the intervention strategies for lessening screen exposure and finding mitigating factors of screen time for young children aged 4 to 12 years old. Screen time-related studies were searched in two databases PubMed and EMBASE. The keywords of “screen time”, “television”, “video”, “computer”, “mobile device”, “children”, “interventions”, and “strategies” used for search. The inclusion criteria are limited to specific study populations, intervention, comparison, and outcomes (PICO), language, and published study types. The quality of articles was assessed using the Cochrane Risk of Bias (RoB) tool. Two researchers independently screened the literature and extracted the data. Seven eligible studies were included out of a total of four hundred and eighteen studies. The study sample ranges in the age range of (4-12 years) and the size ranges from (75 children and 39 parents to 709 children and 64 parents) participants. In included studies (randomized controlled trials), we found seven mitigating factors of screen time usage. It showed that in addition to educating people about the dangers of excessive screen time, effective programs, implementing restrictive practices, and providing a healthy home environment were the most common strategies used by the researchers. Future screen time reduction studies could benefit from incorporating more emphasis on implementing interventions like structured screen time, school involvement, health education, and more awareness programs to mitigate screen time among children.

Keywords: Children, Health, Mitigating factors, Randomized controlled trials, Screen time

INTRODUCTION

Screen time is one of the most widely exposed pandemic health issues among all age groups. It is spreading its roots widely among children and adolescents. Screen time refers to the time an individual spends on television, a mobile phone, or any electronic gadget. With advancements in science and technology, smart devices are used more often for work and daily life. Around 45 to 80% of children have failed to follow the international recommendations for screen usage not more than 2 hours per day.¹ In today's era, electronic devices have revolutionized learning, education, communication, and

information dissemination, but recent research indicates that excessive screen media use may have serious adverse effects on children's health over the long term, making this a pressing public health concerns.²

Numerous studies worldwide have affirmed the negative impact of screen time on the health, well-being, executive functions and physiological factors of children and adolescents.²⁻⁸ In addition, excessive screen viewing is correlated with increased sedentary lifestyle and obesity.⁹ Concerningly, 39% of children in the U.S. report getting addicted to their screen devices, and 58% feel distracted by their mobile phones at least once per day.¹⁰ Because of

these concerns, medical organizations like the American Academy of Pediatrics (AAP) have advised parents to limit their children's screen time.¹¹ In addition, an international organization such as the World Health Organization (WHO) and The Canadian Paediatric Society has also given recommendations and guidelines on how much time is appropriate for different age groups of children.¹² The COVID-19 pandemic continues to propagate over the world and has an impact on the lives of billions of people. Schools along with other public institutions have implemented several lockdown procedures. Some governments even issued orders to schools restricting the number of hours of online classes allowed per day during pandemic lockdown, in an attempt to appease worried parents.¹³

The number of primary and secondary schools that offer online classes has expanded, as has the amount of time that students use electronic devices for online learning. Younger children are exposed to electronics, and they are spending more time in front of screens. The physical and mental health of children can suffer from too much screen usage. This study used a quantitative systematic review method to analyze the mitigating factors of screen time among children and identify the interventions that help the screen time of children to provide strategies for mitigating screen time for young children.

This systematic review has objectives, to identify mitigating factors of screen time in children and to explore intervention strategies aimed at reducing screen time in children.

METHODS

Eligibility criteria

The following inclusion criteria are applied in the research.

The articles published in peer-reviewed journals (b) The research subjects of the literature include primary and secondary school students aged 4 to 14 years of age, including males and females. (c) Studies published in the English language (d) Studies with a randomized controlled trial research design only Exclusion criteria exclude (a) non-peer-reviewed pre-prints. (b) grey literature (books, dissertations, conferences), (c) studies with meta-analyses, systematic reviews, reviewal trials, cross-sectional studies, case studies, and cohort studies.

Information and search strategy

A systematic literature search was conducted with the help of two database search platforms (PubMed and Embase) through May 2023, and a total of 418 articles were retrieved. The search strategy used a mixture of keywords and boolean operators (AND and OR) and a wide variety of variable terms ('screen time' OR 'sedentary time' OR 'television viewing' OR 'mobile

phone use') AND ('reducing factors of screen time' OR 'intervention reducing screen time') AND ('children' OR 'child') AND ('randomized controlled trials'). The citations for identified articles were uploaded into Rayyan, a systematic review AI tool for reference management.

Study selection

Rayyan was used to remove duplicate articles from search results. Then we assessed all records for eligibility based on the titles and abstracts of studies and then the full text. We removed articles for non-eligibility reasons, with detailed documentation. Any discrepancies were resolved by discussion with a second reviewer (S.A).

Literature screening and data extraction

According to the search strategy and fulfilling the inclusion and exclusion criteria, two researchers independently conducted literature screening and gave unified results. Data extraction was performed independently by the two researchers using standard Excel datasheets. The content of data extraction includes author, journal name, publishing year, location, age range of participants, study design, number of participants, statistical techniques, main results, and conclusions.

Risk of bias assessment

The RoB 2.0 tool for randomized controlled trials calculates the risk of bias evaluation. It has five domains: the randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported results. The bias risk has three possibilities: low risk, some concerns, and high risk. For additional details, risk of bias summaries is given in figure 1 and figure 2.

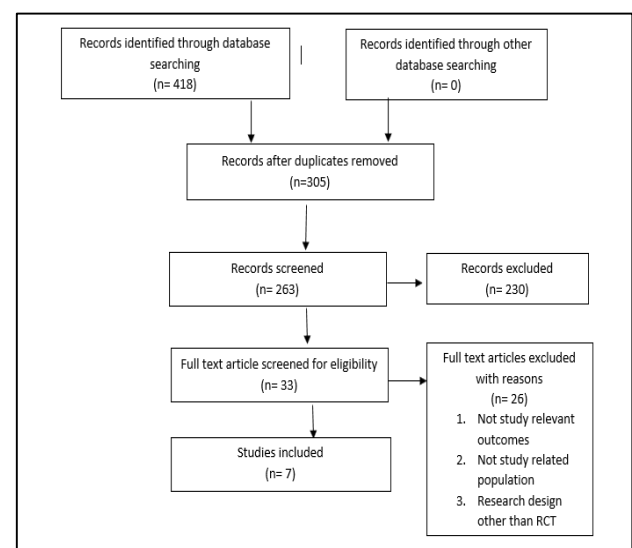


Figure 1: Study flow chart.

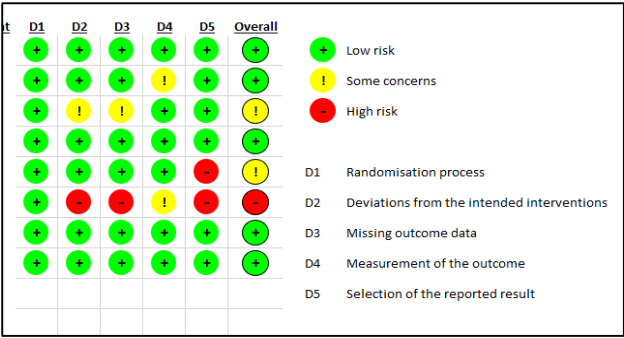


Figure 2: Risk of bias summary about each study included in the review.

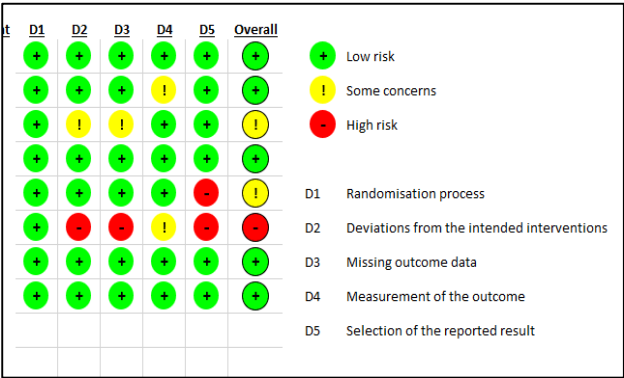


Figure 3: Risk of bias evaluation results from included studies presented as percentages.

RESULTS

Study characteristics

Rayyan an AI tool was used for the study selection process in a systematic review. The preliminary search obtained four hundred and eighteen articles, after the duplicate removal, three hundred and five articles were retained for further analysis. After dual screening of abstract and full text, two hundred and sixty-three articles were included, and two hundred and thirty articles were excluded due to inconsistent characteristics such as research design and a lack of screen use data. Twenty-six articles were excluded due to a lack of results showing positive outcomes. Finally, seven articles were accepted to be included in the review.

Their basic information is shown in table 1. The study by Pearson N et al, conducted the RCT Kids FIRST 12-week program, a home-school study to reduce screen time for children. The findings suggest promising results for more accurate results. A more diverse family sample is required. Also, the study by Sanders W et al, was included, as parenting is one of the crucial factors in reducing screen time in children. A combined tactic and hands-on approach to technology-specific session intervention is a promising way to reduce screen time.

A study in southern California in the 20th century found that healthy sleeping habits promote less screen time and sedentary behavior in children along with EF.¹⁴ A decade ago, one of the interesting mitigating factors of screen time was shown in an African-American study as culturally tailored dance.¹⁵ To reduce children's screen time, a study conducted on 91 participants concluded that a family-based intervention can be chosen to change the child's lifestyle as well as their screen time.¹⁶ The six-week healthy homework program is an effective approach to reducing screen time by inculcating the promotion of physical activity and a healthy diet among children.¹⁷

Mode of delivery

A combination of mixed modes of delivery like online and face-to-face sessions can be seen in all included studies. In the study by Pearson, Parents in the intervention group received four individually tailored resource packages and four online "sessions" for their group. During school hours, kids had four lessons that lasted 30 minutes each. Children reported their snacking habits, and parents reported their screen-time habits. In a pilot study, 39 parents of kids aged 5 to 12 were randomly assigned to the intervention, which focused on technology-specific parenting through a combination of didactics and hands-on activities.

In the low-income areas of Oakland, California, culturally tailored dance and health education interventions were provided to females in face-to-face sessions after school. to assess the efficacy of three different family-based therapies, including those that are group-based, individual-based, or online A variety of experts provided group-based interventions to group 1, group 2 had one-on-one family consultations with a dietician, and group 3 got instruction via a specially designed website. The six-week 'Healthy Homework' program and complementary teaching resource mode of delivery were in the home setting. In the SCREENS trials, the family's screen media was objectively monitored through the use of different software and hardware monitoring systems.

Intervention activities

All the studies have used different intervention strategies and activities to bring down screen exposure among young children. A study incorporated by Pearson used Kids FIRST home- and school-based pilot randomized controlled trial to reduce screen time and unhealthy snacking in which parents in the intervention group received four individually tailored resource packages and four online "sessions" for their group.

During school hours, kids had four lessons that lasted 30 minutes each. a combined didactics and hands-on approach focused on technology-specific parenting). A culturally tailored dance and health education

intervention was provided to female children after school time. In a recent study conducted by Varagginis, three different family-based interventions: group-based, individual-based, or by website approach were used by the researcher to overcome the screen time and lifestyle of children.

Control groups

All the studies included in the present review did not give any treatment to the control groups. One of the studies had no control group they had seen the effectiveness of three family-based interventions.

Table 1: Characteristics of the study that were included in identifying the mitigating factors of screen time in children.

References	Targeted area	Sample size	Research design	Intervention name	Age	S.T definition	Mitigating factors
Pearson et al²²	UK	75 children 64 parents	Randomized controlled trial	Kids first	9-11	T.V/DVD Viewing High intake on energy dense snacks.	Parent child relationship and healthy behavioral habits
Sanders et al²³	Burlington, Jamaica Plain, Vermont, Providence	39 parents	Randomized controlled trial	Combined didactic and hand on approach	5-12	T.V, computer, video games	Parenting style
Warren et al¹⁴	USA	709	Randomized controlled trial			Sedentary time	Sleep
Robinson, et al¹⁵	USA	261	Randomized controlled trial	GEMS	8-12	Screen media use	Culturally tailored dance
Varagianni, et al¹⁶	Greece	91	Randomized controlled trial	for your family	8-12		Family based intervention
Duncan et al¹⁷	New Zealand	97	Randomized controlled trial	Healthy homework	9-11	TV	Healthy homework
Martin et al²⁴	UK	95 families	Randomized controlled trial	SCREENS	4-14	Social media, video games	Physical activity

DISCUSSION

Today's Gen Alpha is constantly inundated by technology; they are enveloped with smartphones, TV, online video games, and gadgets till dusk and dawn. As a result, screen time is one of the most widely exposed pandemic health issues among all age groups.¹⁸ Excessive usage of screen time has a variety of adverse effects on the health of children, including emotional, sleep, behavioral problems, and affects the growth and cognitive development of children.¹⁹

Some high-income countries or developed countries, such as the United States and Germany have already developed guidelines for restrictions on digital media overuse across age groups, while some low-and middle-income countries like India have not developed such screen time guidelines.^{20,21} It has been established that the Kids First intervention is practical and well-liked by kids, parents, and instructors. Before a complete trial, adjustments could be made, such as investigating the

viability of obtaining a more diverse sample of families and using this information to modify the recruitment tactics for a complete RCT trial.

Additionally, more development work is needed to increase user engagement with the Kids FIRST resources and explore additional dietary change-influencing tactics.²² The findings of a combined didactic and hands-on approach suggested that a sample could be recruited in a reasonable time (6 weeks) at a reasonable cost, randomized, and retained at 6 weeks post-intervention. The outcomes of this pilot study indicate that this single session intervention is a viable strategy for limiting kids' screen time.²³ The study conducted in the USA investigated the hypothesis that shorter sleep duration may negatively affect EF and promote sedentary behavior in children. The results indicate that sleep promotion initiatives may lessen a child's sedentary behavior both directly and indirectly by altering EF. For low-income, preadolescent African-American girls, a culturally-tailored after-school dance and screen time reduction

intervention did not significantly reduce BMI gain compared to health education, but it did result in potentially clinically significant decreases in lipids, hyperinsulinemia, and depressive symptoms. Mandatory health-related homework seems a successful strategy for raising physical activity, reducing screen time, and enhancing children's consumption of vegetables and unhealthy foods.

Analyses of the SCREENS trial's data will assist in addressing crucial causal concerns about leisure screen media habits and their immediate impact on children's and adults' sleep, physical activity, and other health-related outcomes.²⁴ A study used the ecologic model of sedentary behavior to examine associations between factors within the home setting and screen time among pre-school children the findings suggest that there are multiple factors at different levels within a specific setting that simultaneously influence pre-school children's screen time.^{25,26} The primary objective of this review was to determine the mitigating factors of screen time in children.

The most influential mitigating factor of screen time is a healthy home environment and parenting strategies. A study aimed to assess the relationships between parental and child screen use and the quality of the child's home environment findings reveal a link between parental screen use and both positive (responsivity) and negative (variety) aspects of the home environment, particularly on weekends when screen time increases.²⁷ More recent work has concluded that parental screen time is the strongest predictor of screen time for children 0-to-8-years-old.²⁸

The majority of findings from the final literature pool represented the statistically significant association between screen time and the parent-child relationship. Researchers have stated that there are interventions that can reduce the screen time of children and adolescents as well as promote physical activity, cut down on inactive time, and improve sleep.^{29,30,31} Both intervention content and context are important to consider when designing interventions to reduce children's screen time.³² Despite enough evidence on the effectiveness of intervention strategies reducing screen usage among children, it is unclear what mitigating factors are most critical to screen time among children.

There is a need to report and/or improve properties of screen time assessments which was recently highlighted in a systematic review examining assessment in early childhood.^{33,34} This review has given more focus on only mitigating factors from each of the intervention strategies that has been included in the review. Overall, we can say that more interventions need to be conducted by the researchers across the world to tackle the situation of increasing screen time among children. Invasion of technology and upgradation of electronic devices is on its peak needs an attention on its adverse effects among all

age group. A proper guideline needs to be prepared for less developed countries.

This review has some limitations. First, only randomized control trial studies are selected for identifying mitigating factors. Second, only two databases are used to search the relevant studies. Third, in the selected studies the national conditions vary from country to country. In addition to this, literature published in languages other than English is not part of this review. The search was limited to published works of literature, which could result in publication bias and insufficient data collection. Studies after the COVID-19 pandemic are not reported in the present review. To accurately reflect the pandemic's effects on screen time, the most recent data collection may be carried out in the future.

CONCLUSION

Synthesizing the diverse range of studies, it is proved that screen time has various adverse effects on all age groups. Prolonged exposure to screens has been linked to a sedentary lifestyle, poor sleep, obesity, procrastination, academic performance, behavioural problems, broken links to mother nature, and green space, and long-term implications on overall well-being. In the present review, researchers have studied the mitigating factors of screen time. Future research should focus on understanding the long-term effects of intervention strategies and continue to explore innovative factors to mitigate screen exposure among children.

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