Negative Impact of Digital Technology on Children's Health

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Abstract: *Digital technologies are being used widely by children and increased rapidly over the past decade. Digital Technology in all its forms (such as computers, smartphone, video games, and the interne) can hold a person's attention for long periods. It seems that can negatively affect on eye, sleep, critical thinking, physical activity, musculoskeletal impacts for people of any age, children and adolescents is especially vulnerable. Children's incorrect use of technology in terms of content, duration, frequency, and posture when using it can lead to a number of health risks. The objective of this paper is an overview of negative effect of digital technology on children's health. And in order to achieve our goal, we addressed the following questions: Does overuse of digital technology have a negative effect on children health? Does using digital technology can make children's developmental problems, musculoskeletal problems, physical inactivity, obesity, and inadequate sleep quality? It is great to monitor the time, frequency, and content viewed while using technological devices and to certify that children have or develop adequate physical activity opportunities, healthy eating habits, proper sleep cycles, and a nurturing social environment. This study is based on qualitative research methods, using literature review by a specific keywords and search items, in order to obtain as many relevant papers as possible. All collected papers are used to recognize and develop a paper based on the research questions. This research includes articles published between 2015 and 2023, articles published prior to 2015 are not included.*

Keywords: Negative effects, Health, Technology, Eye, Sleep, Critical thinking, Physical activity, Musculoskeletal

1. Introduction

Digital technology includes digital devices as well as many digitally mediated activities that children today engage, such as using the internet, going on social networking sites, chatting online or playing video games, moderate use of digital technology tends to be beneficial for children's mental well - being, while no use or too much use may have negative impact [1].

In today's world of widespread usage of communication networks, social media has negative effects on the lives of children in the matter of violence, addiction and psychology. Social media applications are just tools. Negative situations occur because of misuse of the tool. This may be because a child is too young to use the tool or it is a situation the child is not ready for developmentally [2] [3]

Digital technologies have deeply changed childhood and adolescence behavior. Children under the age of two should not be exposed to technology in particular because during this time they need to be developing the spatial and visual motor skills that come from outdoor play. Therefore, early technological exposure may impede cognitive development. About two thirds of the children in the study had learning disabilities, according to the [7] study. This finding may have to do with the children's tendency to spend more time using technology and less time studying, which can have an adverse effect on children's ability to learn. Other study evaluates the efficacy of pre - school intervention to reduce screen time [4]

As stated by [5] Children who use technology inappropriately—that is, in terms of its content, duration, frequency, and posture—run the risk of developing obesity, musculoskeletal disorders, physical inactivity, developmental problems, and poor sleep quality, among other health problems.

Studies also show [6] that overuse of the internet indoors by younger children is predicted to have detrimental effects on their long - term psychological growth, physical and mental development, and general health.

The primary risks listed here include early childhood myopia, irregular circadian rhythms, insomnia, depression, and, in the end, addiction and the brain's central control functions being dysregulated due to a lack of exposure to optimal outdoor light conditions. parents play an important role in fostering and supporting preschoolers' developing maturity and decisions about digital technology use, and in protecting them from potential risk due to excessive digital technology exposure. The primary risks listed here include early childhood myopia, irregular circadian rhythms, insomnia, depression, and, in the end, addiction and the brain's central control functions being dysregulated due to a lack of exposure to optimal outdoor light conditions. parents play an important role in fostering and supporting preschoolers' developing maturity and decisions about digital technology use, and in protecting them from potential risk due to excessive digital technology exposure.

2. Digital technology Tools and Their Effects

2.1. Computer

Computers are now a necessary component of children's lives. Several studies have suggested that the impact of

computer use on children's development can be positive or negative, depending on the context of use [7]Early computer use can have a negative impact on academic achievement because of the poor focus, lack of attention, and disorganization, as well as the underdeveloped language skills, creativity, and imagination that children exhibit as a result of excessive computer use [8]

Young children are utilizing digital technology at all times and places, particularly since smartphones and tablet computers have replaced desktop computers. Also, the American Cancer Society has cautioned that radiation from phones and computers raises a child's risk of developing cancer [9].

2.2. Smartphone

Smartphones are popular devices capable of processing more information than other phones, Smart devices can have a negative impact on a child's social skills and cause them to become more reserved, shy, and neglected. Additionally, a smartphone can help a child escape reality by engrossing them in a virtual world [5].

Study also showed that the high smartphone use group scored higher on depression, anxiety, and daytime dysfunction than the low smartphone use group did. the Smartphone Addiction Scale scores showed positive correlations with anxiety, depression, and some sleep quality scores [10]. Another study from the University of Gothenburg in Sweden found a link between high cell phone use and youthful and depressive symptoms [7] [11]. Furthermore, studies have shown that parents' perceptions of the behavioral, social, and health implications of their children's smartphone use are adversely affected.

2.3. Video games

Numerous exploratory and panel studies have been conducted to assess the causal relationship between digital games and learning capacities. While some findings point to beneficial effects, others point to negative ones. Games are known to have a lot of attractive features, such as helping students and learners learn more effectively, attractiveness, motivation, active engagement, challenges, data handling skills, and the ability to facilitate learning by doing are a few of these attributes. To reap the educational benefits of digital gaming and avoid its detrimental effects, playtime should be restricted and supervised by parents [8]. The US Centers for Disease Control and Prevention (CDC) also cautions against children playing video games for longer than eight hours a day because it can cause vision problems like eye fatigue, focus problems, and blurry vision. In addition, the misalignment and strain from gaming can also cause poor posture. In fact, video game addiction is now recognized as a clinical disorder in China. As a result, clinics dedicated to the treatment of this addiction do exist. Children in the US are using their devices for up to 11 hours a day, so although the issue is not officially recognized, it does exist. Early childhood development is slowed down in toddlers and young children because they frequently miss out on what is happening in their environment. Young children learn best through observation of their environment. This is due to the fact that interactions with their caregivers help them

cultivate a curiosity that aids in the development of intelligence, empathy, and listening skills [12].

2.4. Internet

Addiction to the internet at a young age is a topic that is becoming more and more interesting to researchers across the globe. The effects that internet addiction may have on a person's life are demonstrated at the academic, professional, and social levels [13]

Long hours of exposure to digital technology or online activity have been associated with loss of sleep and/or symptoms of depression in young students [14] Delayed bedtimes resulting from late internet reading can have a significant negative impact on children and students who must rise early for school or college. According to a study, children who showed symptoms of internet addiction expressed a great deal of frustration, loneliness, and anxiety when they were made to disconnect from the internet for a full day [15] After conducting two studies, a group of Australian scientists found that teens' obsessive Internet use is associated with worse mental health [8]. A Swansea University study found that when heavy web users quit, they experience psychological withdrawal symptoms. Other study evaluates the efficacy of pre - school intervention to reduce screen time [4]

3. Health Risks of Digital Technology Usage

3.1. Digital Technology Usage and EYE

The health concern which is on the rise in children due to them being attached to their electronic gadgets and screens is the digital eye strain and computer vision syndrome. This condition is because of the focusing up close which is difficult and tiring to the eyes and causing dryness and headaches and eventually may lead to more near sightedness. These vision problems can be averted by taking a break every 20 minutes from focusing on the screen and looking at another object at least 6 meters away for about 20 seconds which will relax the eyes from focusing up close, changing the position of the screen from 0 to 15 degree below the eye level, wearing computer glasses or using anti glare screens [16]

The digital eye strain or Asthenopia is a subjective sensation of visual fatigue, eye weakness or eyestrain which is caused by the increasing use of digital devices, at a nearly age. The imbalance of extraocular muscles, uncorrected refractive errors, accommodative impairment and improper lighting result in asthenopia. Patients suffer from excessively watery eyes, double vision, blurred vision, itching, headache, sore eyes, dry eyesensation and redness. According to a recent meta - analysis by [17] the prevalence of asthenopia in children is 19.7%. The long periods spent looking at computer displays have intense accommodation and extraocular muscle strains, that often exhibit asthenopia [17]. The smartphones usage with short watching distances due to their small LED screens, inducing ocular fatigue, glare, and irritation [18]

Reading distance influences the magnitude of symptoms experienced by using digital devices. The optimum focus distance for reading and writing is 30–40 cm from the eyes. Smaller digital devices such as mobile phones are usually held at a distance of 20–30 cm from the eyes, fostering conditions for digital eyestrain. Long et al. recently reported that viewing distances are closer and the resulting eye - strain symptoms are greater after reading for 60 min from a smartphone [19]. Most digital screens are backlit and emit blue light or high - energy visible (HEV) light wavelengths. There is evidence that the eye is susceptible to blue light exposure, and that over a period of time the cumulative damage may increase the likelihood and severity of eye disorders (e. g. age - related macular degeneration and cataracts) [20]. Fortheromore, a faster evaporation of the tear film is caused by reduced blink rate during continuous smartphone use, which may then lead to dry eye disease [21]. Meanwhile improper posture, the postural variations and musculoskeletal symptoms leads to excessive straining of eyes and hunching of the back leading to pain in the neck and back muscles [22]

3.2 Digital Technology Usage and Sleep Quality

Delaying going to bed has been connected in a number of studies to poor academic performance, learning disabilities, and psychological issues [23] Children and adolescents who use electronic media, especially right before bed, have trouble sleeping. Although media use has been linked to shorter sleep durations overall, there are currently no comprehensive brain - behavior models that explain the underlying mechanisms. But it's now abundantly evident that children's cognitive development is negatively impacted by excessive digital environment exposure and the resulting metabolic changes in them [24]

Existing studies [14]on the association between electronic media use and sleep have largely focused on adolescents. It was reported that problematic Internet use is associated with sleep problems, including subjective insomnia and poor sleep quality.

Media usage may interfere with sleep quality through the increase of psychophysiological arousal caused by stimulating content watched, or through bright light exposure. Bright light may impact sleep by delaying the circadian rhythm when exposure takes place in the evening and also by causing an immediate activation in itself. Sleep may also be negatively impacted by electromagnetic radiation. Furthermore, screen use over two hours per day is significantly associated with long sleep onset latency especially in children that use more devices at the same time compared with those using only one device [21]The study by Brockmann, conclude that among children aged between 1 to 4 years old, the presence of a television in the bedroom is associated with significantly reduced sleep quality, sleep terrors, nightmares, and sleep talking [25]

Yoshimura et al. have reported that the reduced viewing distance when lying down has a positive correlation to a poorer quality sleep (R2=0.27P<0.05), longer sleeplatency (R2=0.35, P<0.05) and lower sleep efficiency (R2=0.38, P<0.05) [18] In another study about one fifth of

participants, 19.3% (111) used their smartphones at bed - time with lights switched off. They also observed that as age increased, the use of smartphones at bedtime with lights switched off also increased. Studies have previously shown that this type of usage may lead to reduced sleep quality, potentially increasing the likelihood of experiencing other ocular pathologies later in life [25] [21].

Udorie stated in her article that usage of the social media during late night hours may harm sense of wellbeing among adolescents which require sleeping more than adults. Recent studies point out that adolescents should sleep 9.5 hours per night rather than 7, 5 hours which is average one. Furthermore, signs of being tired, irritable, depressed can be seen as a result of inadequate sleep hour. Moreover, it causes people to become ill easily like catching colds, flu and gastroenteritis. In the light of all these fact, it is undeniable that people who use social media instead of sleeping at the night time can be open target to physical and mental diseases. if we do not be careful about the usage of social media for children, it may harm all of the kids. Children means the future and we should take care of our future [26]

3.3 Digital Technology Usage and Critical thinking

The computer/apps not only has an effect on critical thinking, but also on the learning abilities of children. As defined critical thinking, and intellectual outcomes are the ability to create concepts, read and interpret argument, employing inductive/ deductive reasoning in solving problems, keeping an open mind, inquisitiveness, flexibility, and the ability to develop individuality. A drop - off in reading has possibly contributed to a decline in critical thinking [27]

According to recent studies, touch screen usage may interfere with infant and toddler learning development. In fact, young children need direct first - hand experience with materials and equipment that challenge their thinking and problem solving skills. Moreover, no substitute for direct interaction with parents has been found [21]On the other hand, children younger than 3 years old can learn words through video if specific conditions are fulfilled. In details, children would be able to learn from video when the experimenter/parent/caregiver provide additional verbal and non - verbal information during the live action sequences [28].

Digital technology can be considered as an important element of life for today's children and adolescents since they spend a lot of time using it. This increased use of digital media is associated with poor behavior and health status [29]. Mobile phones could be a tool to reinforce what children are already learning at school. using well - designed educational apps promote learning among preschool and early - elementary - aged children [21]Un - fortunately, most of the downloaded apps are not designed for a dual audience (both parent and child), targets only rote academy skills and are not based on established criteria from developmental specialist or educators.

Empirical evidence suggests that children who use the internet frequently are likely to spend 100 minutes fewer

with friends and family than children who use it less frequently. Additionally, it has been discovered that these kids are happier when they are with their virtual online friends than when they are with actual people. Consequently, these kids would prefer to interact with their virtual friends than spend time on the internet.

Regarding the effects on the psychological and emotional well - being of the children under study, this study [30] reveals that approximately half of the children experience distraction on a regular or occasional basis, roughly two thirds experience emotional disturbance, slightly over half experience cognitive impairment, approximately half experience sleeping disturbance, approximately three quarters experience social isolation, and the majority experience social skill deficits. Both the physical and emotional well - being of technology users is significantly impacted. Being overly connected can affect consumers' mental health and lead to psychological issues like narcissism, depression, and expectations of instant gratification.

3.4 Digital Technology Usage and Physical Inactivity

Technology use among children is one of the predicting factors for physical inactivity research [31]found that extreme use of smartphones, tablets, computers, and videogames was positively related to a lack of physical activity. World Health Organization reported that technology use interrupts the daily activities of children, it can result in decreased physical activity. Approximately 3.2 million deaths per year globally are related to physical inactivity; it is thus a risk factor for high mortality. Physical activity is essential to stabilize blood pressure and glucose levels, maintain normal body weight, improve sleep patterns, and improve immune response and metabolism. According to the World Health Organization (WHO), the developing child needs at least one hour per day of moderate to vigorous intensity physical activity. The benefit is higher if the daily activity exceeds 60 min [12].

Other research [32] showed that high use of technology was significantly associated with low level of activity. Children who spend <5 h each week on their devices tend to have higher levels of physical activity compared to those who spend >6 h. Ownership of a device was significantly associated with higher technology time consumption. Furthermore, age of the child, educational level of the parents, screen time use, and owning electrical devices significantly predicted the level of physical activity among children of sampled parents. Thus, parental involvement is needed to reduce the time spent on screens, which can have a high impact on a child's physical activity level.

3.5 Digital Technology Usage and Obesity

Obesity is deemed one of the most challenging public health problems faced by developed and developing countries worldwide. Numerous observational studies discovered links between increased obesity risks and screen media exposure. It is believed that exposure to screen media is a known cause of childhood obesity and that obesity is a known result of screen media exposure [33]

Current statistics on childhood obesity collected by the World Health Organization Commission on ending childhood obesity [33] reveal that the number of overweight or obese infants aged 0 to 5 years has increased from 32 million in 1990 to 41 million in 2016 [34]. According to WHO projections, this number will rise to 60 million globally by 2035, and merely making sure our children eat a healthy diet won't be sufficient to stop this from happening. One of the most difficult public health issues that both developed and developing nations must deal with globally is obesity. The survey's [6] findings show that a child's obesity gets worse the more hours they spend in front of a screen each day. Previous theories based on the premise that a child who spends too much time on screens will be less physically active and will therefore gain weight attempted to explain the connection between screen time and childhood obesity. On the one hand, epidemiologic research suggests much more intricate causal relationships, while experimental research on the impact of less screen time on quantifiable increases in physical activity did not produce definite findings [35] This suggests that the lack of physical activity is not a self - sufficient direct link between long screen times and obesity. According to epidemiologic research, kids who spend more time on screens tend to eat less fruits and vegetables and more energy snacks, soda, or fast food. As a result, they get a larger proportion of their energy from fats and consume more energy overall.

There is stronger evidence for increased energy intake as a prominent causal link between screen times and childhood obesity [36]

3.6 Digital Technology Usage and Musculoskeletal System

An electronic devices such as mobile phones and touch screen devices for many daily purposes like the educational, communication and social media as well as researches focusing on effects of these devices use on musculoskeletal symptoms/disorders [37] [38] [39]These studies have been emphasized in the review of the significant physical effects of these mobile technologies. Consequently, prolonged use of these devices shouldn't come at the risk of developing musculoskeletal disorders. In adolescents and young adults, the use of electronic devices is linked to musculoskeletal symptoms in the head and neck, upper and lower back, and upper extremities specifically [40]

Regarding device availability, adolescents with musculoskeletal pain reported frequent use of a laptop at home, whereas desktop availability at home was reduced. These findings may be related to electronic devices use, probably because desktops are more ergonomic than laptops. Indeed, a recent systematic review found that high frequency of phone calls, texting, and gaming were associated with musculoskeletal disorders, especially those related to neck flexion posture [41]

In conclusion, a high prevalence of musculoskeletal pain and musculoskeletal pain syndromes was observed in female adolescents. Musculoskeletal pain was more commonly reported at a median age of 15 years (vs.14 years) in adolescents using at least two electronic devices. Cell phone

use was associated with musculoskeletal pain, and the most frequent sites of these complaints were the back, neck, and shoulders. Reduced electronic games use was associated with musculoskeletal pain syndromes. This [42]review explored the physical impact of touch technologies and shows that greater painful areas in the neck, shoulders, and neck flexion posture, as well as more activities like (texting, frequency of phone calls and gaming), are associated with musculoskeletal disorders muscle activity around the neck., also the highest proportion of use the technologies devices among users are the touchscreen devices. The literature review aimed to explore a musculoskeletal effect as a result the use of diverse types of electronic devices.

4. Conclusion

Digital technology facilitates and encourages social interactions as well as participation and engagement in the creation and viewing of content. However, the effects of technology use are complex and vary depending on the kind of media used, how it is used, how much and how often it is used, and the unique characteristics of the child or adolescent who is using it. There are many health risks associated with children's increased use of digital technology, such as poor sleep quality, obesity, musculoskeletal issues, physical inactivity, and developmental issues. Overuse of digital devices by teenagers presents a new risk of digital eyestrain at a young age, texting on a phone is a risk factor for musculoskeletal disorders, excessive use of technology was significantly linked to low activity, extended periods of digital technology exposure or online activity have been linked to sleep loss, children's daily activities are disrupted by technology use, and it can lead to a decrease in physical activity. In order to protect kids from the risks and hazards that can arise from using technology, parents should set limits on their children's internet usage and keep a close eye on it. They should also make sure that kids don't get too young of an introduction to technology so that kids can grow up with the best possible physical, mental, and social development. If parents have strategies for dealing with kids and teenagers, both online and offline, and are aware of the main issues, they can be of the most assistance. More research is needed in this area to determine the most effective health education strategies for raising parent awareness.

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