Reconnect Webinars

Fact Sheet – updated September 2024

INTRODUCTION

Reconnect Webinars provide evidence-based research on the impact of technology on human development, behaviour, and productivity. This fact sheet highlights the studies on this topic.

Technology Impact Research *pages 16-45*

Physical Development

Brain damage, breathing/eating disorders/headaches/posture, cardiovascular effects, care quality, developmental delay, myopia and vision impairments, obesity/diabetes, sleep disorders.

Social Development

Data privacy and security, manipulative design, pornography, sexting/sextortion, social media, social relationships, video games.

Emotional Development

Aggression and violence, artificial intelligence (AI) and radicalization, cyberbullying, data privacy/security, hate crimes, independence and self-regulation, resilience and risk, self-regulation/motivation.

Mental Development

Anxiety/depression/suicide, autism, dopamine deficit, mental health, psychosis, psychotropic medication, screen addiction/treatment.

Cognitive Development

Academic performance, attention deficit, brain injury, covid effect reversal initiatives, dementia, digital therapy, executive function, learning disorders, multitasking stress, outdoor schools, screens in schools.

Wireless Radiation and Humans *pages 46-52*

Wireless controversy

Wireless expansion

Wireless safety

Experimental Research

National Institute of Health – National Toxicology Program

Epidemiological studies

Brain tumors, breast cancer, cognition and behavior, physiological effects, sperm DNA/motility, vision

Cancer incidence statistics

Prenatal, pediatric, teens

Wireless expert recommendations

American Academy of Pediatrics

Wireless government initiatives Government guidelines

International Commission on Non-Ionizing Radiation Protection

Balanced Technology Management Initiatives *pages 52-58*

Home and families

Parental involvement, support networks

Schools

Playground safety, screens in school, screen management policies, outdoor schools, recess

Clinics

Mandatory screening for screen use, parent education, unplug – don't drug

Government

Federal, municipal, provincial/state

Researchers

Technology production corporations

Age limits, do no harm, funding provided for government initiatives for screen reduction, warnings on products

Workplace Ergonomics *pages 58-61*

Ergonomic Musculoskeletal Injury Prevention

Exercise and Fitness

Mental Health

STATISTICS AND EXPERT GUIDELINES

Nielsen Ratings 2021 report includes data from 40,000 individuals and indicates adults > 18 years consumed on average 12:21 hours per day of entertainment-based screen content. *The Nielsen Total Audience Report: August 2020.*

UK survey of 2167 5-16-year-old's said 53% of children owned a cell phone by age 7 years and by 11 years, 90% had their own phone, 57% of children slept with their phone by their bed and 39% said they could not live without their phone. *Childwise Monitor, 2020.*

Children from birth to 23 months old are watching TV for 55 minutes per day, and 2-4-year-olds are watching 90 minutes per day. Also, 38 % of all children below 2 years old have now used a mobile device for any media activity compared to 10% 2 years ago. *Lerner & Barr, 2014.*

The average seven-year-old will have already spent more than a year of 24-hour days watching screen media; the average European adolescent will have spent four years of 24-hour days in front of a screen by the age of eighteen. *Sigman, 2012.*

Males used the Internet for a wider range of purposes than females, including games and leisure. *Joiner, 2012.*

Elementary aged children now use an average 7.5 hours per day entertainment technology and two thirds of children report their parents do not restrict their access to technology. *Kaiser Foundation Report, 2010.*

Preschoolers' total screen time exceeds recommendations and most previous estimates. *Tandon, 2010.*

Around 40% of children watched television, DVDs, or videos on a regular basis by the age of three months. Within 24 months, this percentage had risen to 90%. Half of the time, parents watched with their children.

Zimmerman, 2007.

The average American household has the TV on 6 hours a day; children from heavy-television households watched more television and read less than their peers. *Vandewater, 2005.*

Children aged six and under spend an average of two hours a day with screen media; many parents believe that media has a positive impact on their children. *Rideout, 2003.*

"Kids & Media" is the first extensive national evaluation report of children's media consumption. *Rideout, 1999.*

Expert Guidelines

The following Technology Use Guidelines for children and youth were developed by Cris Rowan pediatric occupational therapist and author of Virtual Child, Dr. Andrew Doan neuroscientist and author of Hooked on Games and Dr. Hilarie Cash, Director of reSTART Internet Addiction Recovery Program and author of Video Games and Your Kids, with contribution from the American Academy of Pediatrics and the Canadian Pediatric Society in an effort to ensure sustainable futures for all children.

Technology Use Guidelines Chart for Children and Youth

Developmental Age	Duration	Non-violent, pro-social TV, cartoons	Non-violent, pro-social video games	OFFLINE violent video games	Handheld devices	ONLINE violent video games and/or pornography
0-2 years	none	never	never	never	never	never
3-5 years	**1 hour/day** total screens	okay	never	never	never	never
6-12 years	**2 hours/day** total screens	okay	limit to 15 minutes/day	never	never	never
13-18 years	**2 hours/day** total screens	okay	limit to 30 minutes/day	rated > 13 years	okay > 16 yrs	never

Canadian Pediatric Society in 2017 recommends no screens for children 0-2 years, no more than 1 hour per day ages 3-5 and no more than 2 hours per day 6-12 years. *CPS 2017.* CPS "softened" technology usage guidelines for pre-school children asking parents to focus more on content and less on duration. *CPS, 2022.* TV viewing is linked to a variety of negative health outcomes; to reduce the majority of the associated adverse health events, future guidelines could recommend limiting TV time to less than 2 hours per day. *Foster, 2020.*

The Canadian 24-Hour Movement Guidelines for Children and Youth recommend at least 60 min physical activity/day, < 2 hrs recreational screen time/day, and 9–11 hrs. sleep per night in children aged 8–11 years all associated with superior global cognition. *Walsh, 2018.*

The American Academy of Pediatrics in 2016 released a policy statement called Virtual Violence regarding the causal impact of violent media content on consequent aggressive behavior, recommending no violent media exposure for children less than 6 years of age, and no first-person online shooter games for ANY child. *AAP, 2016.*

Pediatricians are encouraged to take a media history and ask 2 media questions at every well-child visit and reiterate 2004 AAP policy of no technology exposure for children 0-2 years of age, and 1-2 hours of total technology per day ages 2-18 years. *AAP, 2013.*

AAP policy statement says safe and well-supervised recess offers cognitive, social, emotional, and physical benefits that may not be fully appreciated when a decision is made to diminish it. Recess is unique from, and a complement to, physical education—not a substitute for it. The American Academy of Pediatrics believes that recess is a crucial and necessary component of a child's development and, as such, it should not be withheld for punitive or academic reasons. *Murray, 2013.*

Children 0-2 years old should not be exposed to any technologies (even background TV), 3-5 years restricted to one - our total technology per day, and 6-18 years be restricted to 2 hours total technology per day. *American Academy of Pediatrics 2001* and *2013*.

Children less than two years old should not watch or be exposed to any TV or video games, *American Academy of Pediatrics 2001*, and children older than two should restrict usage to one hour per day if they have any physical, mental, social, or academic problems, and two hours per day maximum if they don't. *American Academy of Pediatrics, 2006.*

CHILD DEVELOPMENT – FOUR CRITICAL FACTORS FOR GROWTH AND SUCCESS

Early Child Development

Brain structure

Increased early childhood screen time is linked to reduced brain cortex thickness and changes in brain structure, potentially affecting cognitive development. Further research is needed to assess long-term impacts. *Hutton et al., 2022.*

Cognition

Infant screen use was linked to altered cortical EEG activity and subsequent executive function impairments in children, with EEG markers partially mediating this association; further research is needed to differentiate the effects of screen use from family factors. *Law et al., 2023.*

Increased screen time in toddlers may harm cognitive development, so caution is advised for parents and caretakers. *McHarg et al., 2020.*

Results showed that increased screen-time in pre-school is associated with worse inattention problems. *Tamana et al., 2019.*

The mere presence of a smartphone, even when not in use, can reduce cognitive capacity by occupying limited attentional resources, particularly affecting those who are highly dependent on their devices. *Ward et al., 2017.*

Children with early self-regulation issues watched more media by age 2, with persistent problems linked to even higher media use; this relationship was stronger in lower socioeconomic and English-speaking households. *Radesky et al, 2014.*

Screen-Induced Syndrome

Authors identify "early and excessive exposure to screens" (EEES) as a syndrome in young children, causing attention, language, and motor skill issues, which may improve if screen time is reduced early. *Marcelli et al., 2020.*

Self-regulation

Early-childhood tablet use at age 3.5 years was linked to increased anger and frustration by age 4.5 years, and higher frustration at age 4.5 years predicted greater tablet use by age 5.5 years, indicating a potentially harmful cycle affecting emotional regulation. *Fitzpatrick et al., 2024.*

Results show that parents of children with greater anger use digital devices to regulate the child's emotions, hindering self-regulation development. *Konok et al., 2024.*

Using mobile devices frequently to calm young children is associated with increased emotional reactivity, especially in boys and highly reactive children. *Radesky et al., 2023.*

Screen time disrupts essential parent-child interactions vital for infant development; stronger public health campaigns, tech regulation, and support from child-care professionals are needed to address this issue. *Linn, 2023.*

Children with early self-regulation issues watched more media by age 2, with persistent problems linked to even higher media use; this relationship was stronger in lower socioeconomic and English-speaking households. *Radesky et al, 2014.*

Sleep

These finding suggest that children may be able to influence sleep quality by influencing the light exposure patterns during day and night. *Stefanopoulou et al., 2024.*

Study shows irregular sleep and late bedtimes associated with worse grades for high school students as well as more school-related behavior problems among teens. *Mathew et al., 2024.*

Screen time was negatively related to total sleep time and nighttime sleep among infants and toddlers. *Lin et al., 2022.*

"Screen time negatively related to total sleep time and nighttime sleep among infants and toddlers. Authors consider small portable screens used over long periods of time "real neurodevelopmental disruptors". *Lin et al., 2022.*

The WHO has released the first global guidelines on physical activity, sedentary behavior, and sleep for children under five, based on systematic reviews and evidence assessment, to support healthier early childhood development and guide national implementations. *Willumsen et al., 2020.*

Excessive use of digital media is linked to adverse physical, psychological, and neurological outcomes, including poor sleep, cardiovascular risk factors, depression, ADHD-like behaviors, and structural brain changes; reducing screen time may help mitigate these effects and improve psychophysiological resilience in children and adolescents. *Lissak, 2018.*

Speech and Language

Associations with Communication and Problem-Solving Developmental Delay Screen Time and Developmental Performance Among Children at 1-3 Years of Age in the Japan Environment and Children's Study. "Increased television/DVD screen time in children aged 1 and 2 years was associated with lower developmental scores at 2 and 3 years, respectively; lower development scores were associated with increased screen time in children with maternal psychological distress. *Yamamoto et al., 2023.*

This cohort study of 7,097 children found that higher screen time at age 1 year is linked to increased risks of developmental delays in communication and problem-solving at ages 2 and 4 years; the association is dose-dependent, with more than 4 hours of screen time daily showing the strongest links to these delays. *Takahashi et al., 2023.*

Study shows "association between screen time among young children and subsequent developmental outcomes." Results suggest "a dose-response association between longer screen time at age 1 year and developmental delays in communication and problem-solving at ages 2 and 4 years." *Takahashi et al., 2023.*

The more the children used screen time alone, or the greater the amount of the mothers' screen time, the weaker the children's lexical and general language abilities when the children's age, maternal education level, and birth order were controlled for. *Mustonen et al., 2022.*

Lower parental educational attainment, but not maternal stress, was significantly associated with initial screen exposure in infants by 6 months of age; among those exposed, screen use was common during activities like meals and sleep. Wiltshire et al., 2021.

Study demonstrated a "significant association between mobile media device use and parent-reported expressive speech delay in 18- month-old children." *van den Heuvel et al., 2019, Canada.*

Infants' ability to distinguish foreign-language sounds declines between 6 and 12 months. Live exposure to Mandarin at 9 months reversed this decline, while prerecorded exposure did not, highlighting the importance of live social interaction for

phonetic learning. *Kuhl et al., 2003.*

Movement

In high-income nations, more screen time and less physical exercise were related to lower life satisfaction and more psychosomatic issues among teenagers. *Khan, 2021*.

The prevalence of plagiocephaly in infants aged 7 to 12 weeks has been estimated to be 46.6%. *Mawji, 2013.*

Installing Fitness Zones in parks in densely populated areas with limited facilities tends to be cost-effective and most effective. *Cohen, 2012.*

Stereotypy, aggressiveness, off-task behaviour, and elopement were all reduced in a study of children with autism who exercised. *Lang, 2010.*

Two-thirds of the over 400 members interviewed indicated they've noticed an increase in early motor delays in infants. *Jennings, 2005.*

Toddlers aged three did only 20 minutes of moderate to vigorous exercise per day. *Reilly, 2004.*

Literacy impact

Children's brains process written texts more deeply when read in print compared to on digital screens, with printed text leading to richer and more connected mental representations of the material; this study, using high-density EEG, highlights a "print advantage" for deeper processing and suggests that different media may serve distinct roles in education. *Lamiell, 2024.*

George G. Hruby professor of literacy education at Univ of Kentucky states that "Children aren't learning to read because they aren't being taught to read" and "I don't agree with the concept of 'learning loss' as it has been developed by the edtech industry to sell products." *Hruby, 2023.*

This study provides neurobiological support for the greater cognitive load and reduced focused attention during screen-based compared to print-based reading and suggest a different reliance on attention resources for the two conditions in children. *Zivan et al., 2023.*

Paper-based formats are more beneficial than screen-based formats for children, supporting AAP guidelines on limiting screen time and highlighting the importance of executive functions and attention in reading comprehension. *Zivan et al., 2023.*

Handwriting and drawing are more conducive to learning compared to typewriting, due to their ability to engage neural processes related to memory and cognitive effort. *Ose Askvik, 2020.*

"Handbook of Writing Research" synthesises current information on writing development and training at all grade levels, making it the essential reference in the field. *MacArthur, 2016.*

Teachers spend an average of 14 minutes per day teaching handwriting, significantly less than the 45 minutes per day mandated in the 1980s and slightly less than the 45 minutes per day spent in the 1960s and 1970s. *Graham, 2008.*

This article discusses some key aspects of digital reading, with a focus on the critical function of our bodies, particularly our fingers and hands, in creating an immersive fiction reading experience. *Mangen, 2008.*

"Best Practices in Writing Instruction" transforms cutting-edge research into practical writing instruction for students in grades K–12. *Graham, 2007.*

Handwriting is causally linked to writing, and explicit and additional handwriting teaching in the elementary grades is a crucial component in preventing writing issues. *Graham, 2000.*

Children who received traditional teaching in handwriting generated more legible handwriting than individuals who received whole-language instruction in handwriting, and they were able to write significantly more words under time constraints. *Goldberg, 1999.*

Significant progress was achieved between 1980 and 1994 in understanding the mechanisms involved in controlling and developing handwriting, as well as in instructing children with writing issues. *Graham, 1996.*

Movement Stats and expert guidelines

Physical activity accounted for 25% of children's activities, while sedentary activities accounted for 51% and indoor activities accounted for 81 percent. *Engelen, 2014.*

The findings show that, while rough and tumble (R&T) play is thought to be beneficial to young children's development, instructors are unsure of how to control it. The findings of this study highlight the necessity for early childhood programs to adopt policies that guide the management of R&T. *Tannock, 2008.*

Vestibular and proprioceptive input

Sensory integration dysfunctions, slow vision processing, decreased hearing, and reading difficulty are all related to delayed vestibular maturation. *Solan, 2007.*

The Test of Ideational Praxis is a reliable assessment tool that is the first objective evaluation for identifying ideational abilities. *May-Benson, 2007.*

The gaze instability caused by vestibular hypofunction affects reading ability in young children. *Braswell, 2006.*

In children with sensorineural hearing loss and vestibular dysfunction, an exercise intervention focusing on improving sensory integrative postural control abilities is beneficial in halting the progression of motor development delay. *Rine, 2004.*

Play

"Playing with toys and using object substitution in play (e.g. a child uses an object for something else other than its intended use when playing with it) potentially appear to be a moderating factor of the impact of children's screen-time on their bilateral coordination and Visual Motor Integration skills." *Dadson et al., 2020.*

Study found that early-life digital media exposure was associated with atypical sensory processing outcomes in multiple domains suggesting that digital media exposure might be a potential risk factor for the development of atypical sensory profiles e.g. autism. *Heffler et al., 2024.*

Touch

Anxiety reduction

A novel treatment approach for child anxiety, involving child-directed, unstructured independence activities, showed

promising preliminary results; the approach led to reductions in anxiety and avoidance, with high acceptability and improvements in secondary outcomes. *Ortiz et al., 2024.*

When the children and parents worked together during robot therapy, the parent's ability to adequately acknowledge the patient's pain appeared to reduce pain and emotional anxiety. *Okita, 2013.*

Tactile stimulation/deprivation

Sensory integration theory: Improving the processing and integration capacity of sensory stimuli may affect adaptive behavior and occupational performance. *Schaaf, 2007.*

Skin-to-skin contact has a favorable impact on mother-child interactions in infancy and into children's middle childhood. *Bigelow, 2020.*

Touch deprivation may have an influence on quality of life for persons who have less social contact. Human to non-human interactions, such as those between animal guardians and their pets, may help to promote health and wellness. *Young, 2020.*

Touch massage was perceived as a necessary need and a pleasant and dynamic experience that influences self-awareness. *Lindgren, 2014.*

Differences in response to tactile stimuli are common in ASD, and tactile contact in early infancy is the basis of the development of social and communication skills in ASD. *Foss-Feig, 2012.*

According to a study on phenotypes within sensory modulation dysfunction, the first subtype is characterized by sensory seeking/craving, hyperactivity, impulsive, externalizing, unsocial, maladaptive, and impaired cognitive/social behaviour; the second subtype is characterized by emotional withdrawal, movement sensitivity, and low energy/weak behaviour. *James, 2011.*

Early childhood sensory deprivation is positively associated with developmental delay. *Ardiel, 2010.*

Early sensory sensitivities in infants are associated with sensory over-reactivity status at school-age. *Ben-Sasson, 2010.*

Technology overuse may result in sensory over-reactivity. *Rowan, 2010.*

The study looked at the involvement of touch in early development, touch deprivation, reluctance to touch, emotions that can be expressed through touch, the need for touch in interpersonal relationships, and how friendly touch influences compliance in different situations. *Field, 2010.*

There are three global forms of maternal touch in natural caregiving (affectionate, stimulating, and instrumental) that evolve during the first year as mother-infant reciprocal communication develops. *Ferber, 2008.*

Sixty-nine percent of ADHD boys were classified as tactile defensive. *Parush, 2007.*

Kangaroo care had a substantial positive impact on the development of the infant's perceptual-cognitive and motor abilities, as well as on the parenting process. *Feldman, 2002.*

The ethical framework for research on severely disadvantaged children; epigenetic factors in brain development, damage, and sensory deprivation; neuroendocrinology of stress, cognitive development, and growth; stress hormone

and physical and psychological development in 2–3 year old in Leagane; and stress hormone and psychiatric and memory disorders are among the topics covered in this chapter. *Carlson, 1997.*

Early isolation that is sufficiently severe and long-lasting reduces monkeys to a social-emotional stage where fear is the primary social reactivity. *Harlow, 1965.*

Hearing loss

This review suggests that video gaming, especially at high volumes and extended durations, may significantly increase the risk of hearing loss and tinnitus, highlighting the need for further research and safer gaming practices. *Dillard et al., 2024.*

Human connection

Excessive social media use leads to relationship conflicts, negative outcomes and screen addiction. *Bouffard 2021.*

Prolonged use of social networking sites can adversely affect their academic performance, social interactions, and sleep duration. Kolhar 2021.

The number one factor required to achieve happiness and longevity is human connections. *Waldinger, 2017.*

Taking a break from Facebook has positive effects on the two dimensions of well-being: our life satisfaction increases and our emotions become more positive. *Tromholt 2016.*

During a restaurant dinner, 40 out of 55 parents were observed using their cellphones, and more absorbed parents reacted more harshly to child behavior. *Radesky, 2014.*

Parents in Canada spend an average of 3.5 minutes each week conversing with their children in a meaningful way. *Turcotte, Statistics Canada, 2007.*

In the majority of children, continued Parent-Child Embrace Therapy resulted in significant and long-term improvements in symptomatic behavior. *Welch, 2006.*

Background noise, the length of time parents or caregivers spend talking to a child, and the style a parent speaks to a child are all directly responsible for the development of a child's ability to speak. *Ward, 2004.*

Attachment and Relationships

“Parental absorption in media was found to significantly predict attachment insecurity. Greater child TV media use was associated with poorer attachment security when there was limited to no parental active mediation.” *Linder et al., 2021.*

Early-life deprivation was more closely related to the domains of inhibitory control and working memory than *early-life threat*; early-life adversity was associated with decreased executive functioning in children and adolescents. *Johnson, 2021.*

The interaction of attachment and psychopathology portends problematic Internet use earlier in life than that associated with problem alcohol use. *Shin, 2011.*

Humans are a "social animal."; the neurological foundation of attachment has been studied at a molecular, cellular, and systems level. *Insel, 2001.*

When children lack touch and human connection, they may 'turn in' (depression, anxiety) or 'turn out' (aggression).

Montagu, 1986.

Childhood adversity

Childhood adversity resulted in deaths related to heart disease, cancer and chronic lower respiratory disease, and can be attributed to more than 1 in 3 suicide attempts. *Grummitt, 2021.*

"Our National Obsession with Toddlers and Tiaras" addresses the issue of child beauty pageants and discusses the reasons behind their popularity. *Howell, 2013*.

Although the symptoms of pervasive developmental disorder (PDD) and reactive attachment disorder (RAD) are similar, the existence of pathological care and a positive response to treatment in RAD can be helpful in distinguishing PDD from RAD. *Mukaddes, 2000.*

Nature

Higher screen time at age 2 years was directly associated with poorer communication at age 4 years. It was also associated with daily living skills, but frequency of outdoor play at age 2 years 8 months alleviated it, suggesting outdoor play mitigated the association between higher screen time and suboptimal neurodevelopment. *Sugiyama, 2023.*

A review of 296 studies shows that nature exposure benefits children's physical activity and mental health, supporting the promotion of equitable access to natural environments. *Fyfe-Johnson et al., 2021.*

Current literature supports a positive relationship between nature contact and children's health, especially for physical activity and mental health, both public health priorities. The evidence supports pediatricians in advocating for equitable nature contact for children in places where they live, play, and learn. *Fyfe-Johnson, 2021.*

Study reports that children who play freely in the great outdoors are healthier in body and mind and active engagement with the natural environment reduces stress and relieves depression in all ages. Article recommends physicians prescribe outdoor play for children. *Bravender, 2020.*

It has been proven that spending at least 120 minutes per week in nature improves health and well-being. *White, 2019.*

Synthesis suggested that passive nature exposure promotes positive changes in attention, memory and mood. *Norwood, 2019.*

Provision of structural and loose play equipment after a period of 6 months resulted in a 23.3% increase in children engaging in *moderate to vigorous* physical activity during recess and 26.2% increase in children engaged in *vigorous* physical activity. These increases were sustained at 1 year from baseline, with an increase of additional 17.2% for *moderate to vigorous* physical activity and 33.1% for *vigorous* physical activity. *Frost, 2018.*

These findings suggest that greenspace has a positive impact on a variety of health outcomes. *Twohig-Bennett, 2018*.

AAP policy statement says safe and well-supervised recess offers cognitive, social, emotional, and physical benefits that may not be fully appreciated when a decision is made to diminish it. Recess is unique from, and a complement to, physical education—not a substitute for it. The American Academy of Pediatrics believes that recess is a crucial and necessary component of a child's development and, as such, it should not be withheld for punitive or academic reasons. *Murray, 2013.*

Overexposure to television and video games may cause children to lose contact with themselves, others, and nature; children are increasingly afraid of nature, which limits outside play, which is necessary for sensory and motor

development. *Louv, 2010.*

Behaviour management

According to the findings of this cohort study, a high proportion of parents and school-aged children reported no outdoor play 1 to 3 months after a brief, rigorous lockdown, which was more prevalent in lower-income homes. *Sum, 2022.*

This study shows that exposure to green space increases prosocial behaviors among children and adolescents. *Putra et al., 2020.*

Jaak Panksepp coined the term "Affective Neuroscience" and distinguished seven basic emotional systems called SEEKING, CARE, PLAY, LUST, FEAR, SADNESS, and ANGER. *Davis, 2019.*

Students with greater than 15 minutes per day of recess had teacher reports of better classroom behavior. *Barros, 2009.*

The use of physical and chemical restraints is on the rise as a result of school management challenges with a growing number of aggressive children. *Gaskin, 2007.*

Parasympathetic activation

The parasympathetic heart rate variability score was higher in about 80% of those who viewed a forest landscape. *Kobayashi, 2015*.

Faster recovery after surgery, reduced blood pressure and heart rate, lower stress hormone levels, increased parasympathetic nervous system activity, and inhibition of the sympathetic nervous system are just a few of the many benefits of spending time in nature. *Phillips, 2001.*

Productivity

In order to preserve or improve upon employee well-being and work performance, breaks are necessary to recover from work demands, prevent burn-out and create a positive work-environment *Lyubykh et al., 2022.*

More frequent universal-type work breaks yield positive effects on both employee health and performance in stressful work environments and increase overall job satisfaction *Scholz et al., 2018*.

Building in frequent work breaks for highly demanding occupations have a significant impact on overall mood, cognitive performance and neurophysiological state when compared to those who also work in highly demanding work environments without frequent breaks *Scholz et al., 2018.*

Nature exposure improves academic performance, personal growth, and environmental responsibility. *Kuo, 2019*. Access to green spaces in or around workplaces increases work productivity as improves physical and mental health. *Frost, 2018.*

Workers in green-certified buildings had 26.4% higher cognitive function scores and 30% fewer sick building symptoms than those in non-certified buildings, indicating that green certification provides extra health and productivity benefits. *MacNaughton et al., 2017.*

Within small worksite environments, frequent shorter work breaks and stretching exercises improved productivity, eye, leg and foot comfort *Henning et al., 1997.*

Physical Development

Brain Damage

Higher Screen Q scores (parent reported media use) were correlated with lower microstructural integrity of brain white matter tracts supporting language and emergent literacy skills. *Hutton, 2022.*

Screen media activity related maturational coupling or structural correlation networks in the brain, provides evidence that individual differences of these networks have mixed consequences for psychopathology and cognitive performance. *Paulus, 2019.*

Breathing, eating disorders, headaches, posture

Single-case of headache from using digital device resolved with deep breath and posture reset exercise. *Peper, 2021.*

DE (disordered eating) behaviors were reported by 51.7% of girls and 45.0% of boys, with strict exercise and meal skipping the most common. A total of 75.4% of girls and 69.9% of boys had at least one SM account where Instagram was the most common, used by 68.1% of girls and 61.7% of boys. A clear pattern of association was found between SM usage and DE cognitions and behaviors with this exploratory study confirming that these relationships occur at younger-age than previously investigated. *Wilksch 2020.*

A study found that using a smartphone for more than 4 hours a day can have a negative impact on posture and lung function. *Jung, 2016.*

The forces on the cervical spine increase gradually as the neck is in forward flexion, as is often the case with the use of smartphones. *Hansraj, 2014.*

Postures utilized while holding mobile devices such as holding a phone vs texting are believed to impact muscle and thumb positions *Gustafsson, Johnson & Hagberg, 2010).*

When texting, female exhibit higher muscle activity in the extensor digitorum and the abductor pollicis longus; also having greater thumb abduction and fewer pauses in thumb movements *Gustafsson, Johnson & Hagberg, 2010.*

Cardiovascular effects

Acute myocardial infarction associated mortality increased by 5.3% in the youngest (25-44) and 3.4% in the middle-aged groups between pre-pandemic and pandemic periods. *Yeo, 2022.*

Stronger blood volume pulse and respiratory responses, as well as weaker peripheral temperature reactions in individuals at high risk of Internet Addiction, indicate a heavy activation of the sympathetic nervous system in these people. *Lu, 2010.*

Developmental delay

Perinatal depression and anxiety in mothers have been shown to be negatively related to offspring development, making them important targets for prevention and early intervention to support mothers in parenting and the health and well-being of the next generation's offspring. *Rogers, 2020.*

Opinion paper summarizes research on the causal relationship between intensive early screen exposure of more than 4 hours per day prior to the age of six and neurodevelopmental disorders, specifically autism spectrum disorder; the author suggests a 3-month screen-free trial for all children who exhibit neurodevelopmental delays. *Harlé, 2019.*

Among the 2,441 children analyzed, the higher screen time levels at months 24 and 36 were substantially related with lower performance on developmental screening tests at month 36. *Madigan, 2019.*

Device use in child bedrooms results in negative child developmental outcomes *(Fu et al., 2017)*

Increased videogame play is associated with delayed development (lower brain tissue density and cell structure) of the microstructure in extensive brain regions and verbal intelligence, either directly or indirectly. *Takeuchi, 2016.*

In general, participants who used devices such as tablet computers or portable multimedia players quickly acquired verbal repertoires. When comparing these devices to picture exchange or manual sign language, studies found that using a tablet computer was often faster. *Lorah, 2015.*

Infants exposed to adult TV programs from age six to 18 months had higher pervasive developmental problems, oppositional defiant behaviours scores, emotional reactive problems, aggression, and externalizing behaviors. *Chonchaiya, 2015.*

Increased screen time exposure in infancy is associated with ASD where the infant develops skills that are driven by screen viewing, resulting in global developmental delay. *Heffler, 2015.*

As the number of children with disabilities caused by physical conditions decreased, the number of children with disabilities caused by neurodevelopmental or mental health issues increased dramatically. *Houtrow, 2014.*

Background TV reduces words per minute, utterances per minute, and number of new words in toddlers. *Pempek, 2014.*

In-utero exposure to cell phone radiation in mice, caused frontal cortex change, hyperactivity, and impaired memory. *Aldad, 2012.*

Sensory abnormality (a very common symptom in autism in young children), has been proposed for inclusion among the diagnostic criteria for ASD in the upcoming DSM-V. *Klintwall, 2011.*

The association between infant television viewing and delayed language development may be explained by a decrease in exposure to human adult speech and a decrease in child vocalisations. *Christakis, 2009.*

Only 55-65 percent of developmental disorders are discovered prior to school age enrollment, and one out of every six children has a developmental disability. *Hamilton, 2006.*

A developmental impairment was found in 32% of children admitted to an inpatient paediatric unit. *Petersen, 2006.*

The effect of age on neural development appears to be more pronounced below 9-10 years of age than after this age. More research is needed on age-related changes in school age. *Korkman, 2001.*

Myopia and vision impairment

Prolonged exposure to high levels of blue light pose a significant hazards to the visual system resulting in damage to the retina with associated remodeling of visual cortex neurons. *Theruveethi, 2022.*

During the pandemic, children between the ages of 6 and 8 spent significantly less time outdoors and much more time in front of a screen than before the pandemic, resulting in a 60% increase in myopia. *Kuehn, 2021.*

Increased time spent outdoors can delay the development of myopia. In terms of gender, girls should be targeted to more effectively prevent and control the development and progression of myopia. *Zhang, 2020.*

In just one session, exposure to the realistic yet caricatured scene data of digital screen media might change visual contour perception. *Hipp, 2020.*

Study findings show blue light found in digital displays induces DNA double strand breaks in retinal neurons and the damage is more pronounced compared to glia cells. *Chen, 2019*.

Blue light causes dry eye, cataract, age-related macular degeneration, inhibit melatonin, enhances adrenocortical hormone production and impairs sleep. *Zhao, 2018.*

The study investigated mechanisms of photoexcited retinal intercepting signaling networks in living cells. Retinal absorbs blue light and causes translocation of Phosphatidylinositol 4,5-bisphosphate sensor to the cytosol. *Ratnayake, 2018.*

Blue light resulted in production of reactive oxygen species, mitochondrial damage, DNA damage and apoptosis (cell death). *Chamorro, 2013.*

Myopia is irreversible and increasing the amount of time outdoors can be a simple strategy that can reduce the risk of developing it and reducing its progression. *Sherwin, 2012.*

The vast majority of children and adolescents with a history of video game seizures are photosensitive and should be tested with standardized photic stimulation. *Kasteleijn-Nolst Trenité, 2002.*

The most frequent type of epilepsy is reflex epilepsy, in which seizures are triggered by specific environmental events; the most popular precipitants are a television or a computer screen. *Singh, 2001.*

Obesity and diabetes

When compared to baseline, individualistic, family, and school-based obesity interventions were successful in lowering BMI by 0.46 and lowering obesity prevalence by 27.0 percent. *Aris, 2022.*

During the first year of COVID-19, the number of new cases of pediatric type 2 diabetes increased by 182 percent. *Monostra, 2021.*

The WHO has released the first global guidelines on physical activity, sedentary behavior, and sleep for children under five, based on systematic reviews and evidence assessment, to support healthier early childhood development and guide national implementations. *Willumsen et al., 2020.*

Overweight/obese children spent more time at low intensity during gameplay, but less time at vigorous level, and made less motions. *Hwang, 2019.*

Exposure to screen media leads to obesity in children and adolescents through increased eating while watching. *Robinson, 2017.*

Instagram's healthy eating community has a high incidence of orthorexia symptoms, with more frequent Instagram use associated with increased symptoms. *Pixie, 2017.*

Weight dissatisfaction, the desire for thinness, thin ideal internalization, and self-objectification were all linked to Facebook usage by teen girls. *Meier, 2014.*

In the United States, 31.8 percent of children and adolescents are overweight or obese, with 16.9 percent of children and adolescents being obese. *Ogden, 2014.*

Body image avoidance was linked to both male and female Internet addiction symptoms, as well as being a strong predictor of disordered eating in women. *Rodgers, 2013.*

Researchers found no increase in physical activity with active video games, possibly due to minimal effort when playing games and/or children being less physically active during the rest of the day. *Baranowski, 2012.*

Over the past 25 years, the prevalence of obesity has nearly tripled, with up to 26% of young children (ages 2 to 17) overweight or obese, and 41% of their Aboriginal peers. *Lipnowski, 2012.*

Watching TV in excess of 2 hours daily is associated with deterioration of physical and psychosocial health, and shortening the time spent sitting lowers BMI. *Tremblay, 2011.*

Research shows that 70% of Hispanic children have a TV in their bedroom, which increases the risk of obesity by 30%, increases TV use by an hour a day, and increases their consumption of junk food. *Feng, 2011.*

Childhood obesity is a growing problem; this study suggests a framework for understanding child protection concerns in obese children. *Viner, 2010.*

Mothers' perceptions of neighborhood safety were related to the television viewing time of their preschool children, but not to their outdoor playtime or risk of obesity. *Burdette, 2005.*

Obesity rates in toddlers aged 2 to 5 years old have doubled in the United States, rising from 2.1 percent to 5.0 percent in boys and 4.8 percent to 10.8 percent in girls over a 6-year period, according to a study. *Harvey-Berino, 2003.*

The association between childhood obesity and physical inactivity in Canadian children is supported by this study. *Tremblay, 2003.*

The findings show that over the previous 15 years, the prevalence of overweight and obesity has increased dramatically in Canada, with the problem being more prominent among children; obesity affected 10% of Canadian children aged 7 to 13 in 1996, costing the economy $ 1.8 billion. *Tremblay, 2002.*

Childhood obesity is on the rise. Long periods of time spent watching TV or playing video games are among the preventable causes of an increased BMI. *Strauss, 2001.*

Reduced usage of television, videotapes, and video games could be a promising population-based strategy for preventing childhood obesity. *Robinson TN, 1999.*

Sleep disorders

Longitudinal survey of 3,000 adolescents aged 11 to 14 collected before and during the early months of the COVID-19 pandemic in 2020 found that supportive relationships with family and friends, as well as healthy behaviours such as physical activity and better sleep, appeared to protect adolescents' mental health from the pandemic's harmful effects. *National Institutes of Health – News Releases. Jan. 24, 2022.*

Children's sleep and behaviors have been negatively associated with usage of technology. *Almuaigel, 2021*.

Greater heart rate differences between restless sleep phases and restful sleep indicated poorer nighttime recovery in children with more frequent use of touchscreen media. *Hackl-Wimmer, 2021.*

Exposure to electronic screen-based media was negatively associated with nighttime sleep (but not daytime sleep), such that an hour of screen time was associated with nearly 13 min less sleep on a typical night. *Ribner, 2019.*

Literature review found a link between screen media use and delayed bedtime and/or decreased total sleep time; there is a need to educate and motivate doctors, teachers, parents, and adolescents themselves to develop healthy sleeping habits. *Hale, 2018.*
Access to and use of a multimedia device at bedtime were significantly associated with the following factors: insufficient sleep, poor sleep quality, and excessive daytime sleepiness. *Carter, 2016.*

Children today have unprecedented access to technology and media, which is no longer limited to waking hours now that mobile devices have entered the bedroom. *Czeisler, 2016.*

In 90% of research, screen use is linked to poor sleep effects (mainly reduced length and delayed timing). *Hale, 2015*.

Smartphone use was associated with later bedtime and increased bedtime use. The use of electronic media was negatively associated with sleep duration, difficulty falling asleep and, as a result, depressive symptoms. *Sakari, 2015.*

30% of children consumed a caffeinated drink every day, reducing total sleep by 15 minutes a day, and 42% used a TV in the bedroom, reducing overall sleep by 45 minutes per night. *Calamaro, 2011.*

Sleep disturbances and sleep/wake transition disorders are caused by passive and active television viewing. *Paavonen, 2006.*

Social Development

Data privacy and security

Government officials such as Governor Newsom of California have passed legislation such as bill AB 2273 " aimed at protecting the wellbeing, data, and privacy of children using online platforms" *(Office of Governor, Gavin Newsom, 2022).*

Bill AB 2273 emphasizes child privacy rights and mandates that "… privacy information, terms of service, policies, and community standards be easily accessible and upheld," *Office of Governor, Gavin Newsom, 2022.*

Francis Haugen exposed condemning evidence that Facebook's (now Meta's) platforms including Instagram and What's App knowingly caused harm to children by ignoring mental health problems caused by its photo sharing function and allowing its algorithm to incentivize ugly and hostile content. *Kusisto, 2021.*

Apps used by young children had a high frequency of repeated transmissions of identifiers to third parties, suggesting federal privacy laws are not being enforced. *Zhao, 2020.*

A technical error detected on Facebook allowed children to join chat groups with unauthorized users. *Brandom, The Verge, 2019.*

Manipulative Design

Study of apps used by 160 children aged 3 to 5 years showed that majority (80%) were associated with manipulative design features including "parasocial relationship pressure, time pressure, navigation constraints, and lures." *Radesky et*

al., 2022.

Pornography

Survey by Common Sense Media reports 3 out of 4 children view porn prior to 13 years of age. 52% of children and youth have viewed violent porn (people get hurt). *Teens and Porn, 2022.*

According to a new report by the National Council for Missing and Exploited Children (NCMEC), Facebook reported over 20 million child sexual abuse photos to its platform in 2020. *Porter, 2021.*

Findings from 2020 quantitative research among 9–17 year old's states that 1 in 7 children aged 9-12 years shared their own nude photos in 2020, triple the number from 2019. *Torn, 2021.*

During the Covid-19 pandemic, Pornhub, one of the largest porn sites, saw porn use spike in many countries, with global traffic gaining more than 11%. *Mestre-Bach, 2020*.

Distributors of child sexual abuse material are becoming bolder, using major platforms to attract audiences. *Solon, 2020.*

A charity found that sex criminals nurture children on Instagram more than on any other online platform. *BBC News, 2019.*

Teenagers spam Instagram to combat the apparent web of child pornography. *Lorenz, 2019.*

Study found that games rated 'Mature' had the highest prevalences of sexual content at 34.5% and games rated 'Teen' at 30.7%. *Vidaña-Pérez et al., 2018.*

Exposure to sexual content in both traditional and digital media influences adolescent sexual attitudes and behaviors, often leading to earlier and riskier sexual activity; more research is needed to understand these effects and to develop effective interventions and media literacy programs. *Collins et al., 2017.*

A collection of research and reviews that show similarities between obsessive sexual behavior and the addiction paradigm. *IITAP, 2017*.

Survey of 1565 grade 12 students showed 77.9% use porn, and of these, 8% use daily, 59% perceive porn as always stimulating, 21.9% define it as habitual, 10% report that it reduces sexual interest towards potential real-life partners, 9.1% report addiction and 19% report an abnormal sexual response. *Pizzol 2016.*

Long-term internet pornography use resulted in erectile dysfunction and delayed ejaculation. *Park, 2016.*

135 studies were reviewed testing effects of media sexualization between 1995 and 2015 finding exposure to this content is associated with higher levels of body dissatisfaction, self-objectification, support of sexist and adversarial beliefs, and tolerance of sexual violence toward women. Experimental exposure to this content leads both women and men to have a diminished view of women's competence, morality, and humanity. *Ward, 2016.*

Meta-analysis showed porn consumption was associated with sexual aggression in cross-sectional and longitudinal studies. Associations were stronger for verbal than physical sexual aggression. The general pattern of results suggested that violent content may be an exacerbating factor. *Wright 2015.*

Internet gaming disorder is associated with pornography use. *Voss 2015.*

Brain scans of 64 male adults found a significant negative association between reported pornography hours per week and **gray matter volume** in the right caudate as well as **functional activity** during a sexual cue–reactivity paradigm in the left

putamen. **Functional connectivity** of the right caudate to the left dorsolateral prefrontal cortex was also negatively associated with hours of pornography consumption. *Kuhn 2014.*

Sexting/Sextortion

Hypersexual disorder is defined as a disorder relating to the lack of impulse control expressed in sexual behaviours which fails to properly classify it as a legitimate sexual disorder *Reed et al., 2022.*

The ICD-11 classifies compulsive sexual behaviour disorder within the list of impulse control disorders *Reed et al., 2022.*

Sextortion is defined as *"… the threatened dissemination of explicit, intimate, or embarrassing images of a sexual nature without consent, usually for the purpose of procuring additional images, sexual acts, money, or something else,"* *Patchin & Hinduja, 2020.*

Sextortion tactics may take place in a variety of ways including: stalking or harassing, being contacted online or via phone, victim impersonation via creating fake accounts or via posting publicly or privately sharing sexual images of the victim online without permission *Patchin & Hinduja, 2020.*

Victims of sextortion are more commonly targeted by individuals whom they share an existing friendship (romantic or otherwise). Males are more likely to have assumed the role as participant and victim of sextortion *Patchin & Hinduja, 2020.*

Often youth who use sextortion or sexually harass other youth online have been victims themselves *Patchin & Hinduja, 2020.*

Males and non-heterosexual youth are more likely to be the target of sextortion and online sexual harassment related incidences *Patchin & Hinduja, 2020.*

While few victims of sextortion disclose the severity of their experience(s) to their parents, authorities or adults, adolescent females are significantly more likely to seek out assistance than males *Patchin & Hinduja, 2020.*

Sexting is believed to be a form of victimization whereby a correlational relationship exists between mental health or psychological health. A bi-directional relationship is believed to exist between sexting, the sharing of sexual images and depression-like symptoms *Gassó et al., 2019.*

Victims of sexting are more likely to endure cyberbullying, online dating violence, or revenge porn *Gassó et al., 2019.*

Parents, educators, and the health care community need to gain a deeper understanding the negative impacts sexting may have in order to develop appropriate educational material and prevention plans in place *Gassó et al., 2019.*

Changes in the frontal lobe, amygdala, hippocampus, hypothalamus, septum, and reward-processing brain areas all play a part in the development of hypersexuality. *Kühn, 2016.*

Girls who post provocative photos choose to submit to sexual stereotypes in order to be socially accepted by their peers. *Mascheroni, 2015.*

Due to barriers, gender related stigmas, and socially constructed gender roles males are less likely to seek out support relating to sexual abuse/harassment; often believing limited support is available *Allen, Ridgeway & Swan, 2015.*

More frequent viewing of pornography is associated with a higher incidence of hooking up, a higher number of unique hook up partners, having had more previous sexual partners of all types, more one occasion sexual partners,

plans to have a higher number of sexual partners in the future, and more permissive sexual scripts. *Braithwaite, 2014.*

20% of students admitted sending a naked or semi-naked picture or video or text message of a sexual nature - any of which were classified as "sext" - and over 30% reported receiving a sext. *Fleschler Peskin, 2013.*

According to studies, 25% of ten-year-old children sext, 40% of teen girls have uploaded or sent sexually explicit photographs, and 80% of youths under the age of 18 have sexted. Sending a nude photo of oneself was classified as being sexted. *Englander, 2012.*

Desensitization and tolerance are consequences of porn addiction, which requires a higher level of stimuli to satisfy cravings, such as prostitution and sexual depravity. *Klein, 2009.*

Researchers report that 42% of children aged 10-17 are actively using pornography, with an average first exposure age of 6 years. *Wolak, 2007.*

Children using pornography are significantly more likely to report criminal behavior and substance use in the previous year, as well as depression and a lower emotional connection with the caregiver. *Ybarra, 2005.*

Males are less likely to report certain types of victimization including sextortion, sexual assault and abuse than females *Davies, 2002.*

Social media

"Social media can have direct impacts on users and indirect impacts to societies by under-mining key determinants of health". *Zenone et al., 2023.*

Study found that more time spent on social media was significantly associated with a higher risk of depression symptoms with association stronger for adolescent girls than boys. The risk of depression increased by 13% for each hour increase in social media use. *Liu et al., 2022.*

Study found that conscious engagement in physical activity and a regular sleep rhythm during the pandemic could enhance positive mental health and reduce addictive social media use. *Brailovskaia et al., 2022.*

Youth showed insight about negative impacts of social media and were especially concerned about safety on social media. Youth were more likely to report wanting to change the amount of time spent on their social media compared to the content they view. *Harness, 2022*.

Excessive social media use leads to relationship conflicts, negative outcomes and screen addiction. *Bouffard 2021.*

Prolonged use of social networking sites can adversely affect their academic performance, social interactions, and sleep duration. *Kolhar 2021.*

Facebook's own in-depth study reveals a major teen mental-health concern that it downplays in public. *Wells, 2021.*

This study found that in all countries, problematic social media users reported lower well-being. *Boer et al., 2020.*

Females who were exposed to thin-ideal images had greater body and facial dissatisfaction than female who were exposed to average images. *Tiggemann, 2018.*

Young people's perspectives on social media and relationships, both for themselves and for other young people who have suffered various forms of social marginalization, were gathered through semi-structured interviews. *Regan, 2017.*

Taking a break from Facebook has positive effects on the two dimensions of well-being: our life satisfaction increases and our emotions become more positive. *Tromholt 2016.*

Twitter usage leads to increased Twitter-related disagreements between intimate partners, which leads to infidelity, breakup, and divorce. *Clayton, 2014.*

A high amount of Facebook usage has been linked to poor relationship results. *Clayton, 2013.*

A significant number of students have problems related to their usage of the Internet, and Facebook may contribute to the severity of their symptoms. *Kittinger, 2012.*

The time spent using social media was not associated with larger offline networks or feeling emotionally closer to offline network members. *Pollet, 2011.*

Social relationships

Social technology use has become the predominant communication method among adolescents and the preferred method of communication when compared to face-to-face interactions *Hoge, Bickham, & Cantor, 2017.*

13-year-olds value their online social contacts at least as much as, if not more than, some of their in-person relationships. *Underwood, 2015.*

Lower video game playing time was linked with higher life satisfaction and prosocial engagement. *Przybylski, 2014.*

Study discovered evidence of a connection between self-esteem and internet addiction among females, as well as a mediation function for a preference for online social engagement. *Fioravanti, 2012.*

Adolescents reported more conflict when parents called for activity monitoring, school assignments, and when they were upset; calls seeking support are positively associated with adolescent self-esteem, while calls from upset parents are negatively associated. *Weisskirch, 2011.*

Communication quality in intimate relationships is significantly better in the Second-Life relationships than in 3D life and the levels of satisfaction is higher with virtual partners. *Gilbert, 2011.*

Teens are embracing text messaging as the core of their communication method with peers, and this pattern is growing. *Lenhart, 2010.*

Teenagers' awareness of nonverbal emotional cues improved dramatically after five days of face-to-face conversation without the use of any screen-based media; less screen time and more social interaction enhances teenager's understanding of nonverbal emotional signals. *Uhls, 2014.*

Video games

This review suggests that video gaming, especially at high volumes and extended durations, may significantly increase the risk of hearing loss and tinnitus, highlighting the need for further research and safer gaming practices. *Dillard et al., 2024.*

Gaming disorder is characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences. *WHO, 2022.*

Research has demonstrated that Video Game Disorders in adolescents may lead to adverse behavioural, affective and cognitive outcomes *Rojas-Jara et al., 2022.*

Predictive factors or factors that may increase risk of disorder development include genetic predisposition to/development of various psychological disorders, school commitment, parental supervision, involvement in extracurricular activities and sibling/social engagement *Rojas-Jara et al., 2022.*

A potential correlational relationship exists between gaming disorder and an increase in difficulty with psychosocial relationships, social skills deficits, and increased prevalence of low self-esteem and mental health related illness in adolescents *(Rojas-Jara et al., 2022).*

Adolescents are aware of changes relating to excessive video game use such as changes in personality, mood, diet, sleep habits, and behaviour; but do not view them as problematic *Rasmussen et al., 2014; Seok et al., 2018.*

Risky game users reported lower levels of happiness and satisfaction, as well as a significantly higher lifetime prevalence of major depressive disorder, alcohol dependence, and suicidal ideation; usual game players had a significantly higher lifetime prevalence of alcohol dependence and suicidal ideation. *Byeon, 2022.*

Discussion regarding major challenges for the existing research, namely, the lack of precise definitions of video gaming, the lack of distinct choice of cognitive ability under study, and the lack of standardized study protocols. Less research exists on neural changes in addition to cognitive changes due to video gaming. Existing studies reveal evidence for the involvement of similar brain regions in functional and structural changes. There seems to be a predominance in the hippocampal, prefrontal, and parietal brain regions; however, studies differ immensely, which makes a meta-analytic interpretation vulnerable. *Kuhn 2019.*

The majority (93.7 percent) of the members of the Royal Australia and New Zealand College of Psychiatrists were familiar with the principles of IGD/PIU; the majority (78.86 percent) also believed it was possible to be 'addicted' to non-gaming internet content, and 76.12 percent said non-gaming addictions could be added to the classification systems. *Dullur, 2017*.

More than two-thirds of individuals who played games did not report any symptoms of Internet gaming problem, and studies revealed that a very tiny fraction of the general population may qualify for a potential acute diagnosis of Internet gaming disorder. *Przybylski, 2016.*

Intensive video game playing, can cause elements from the game world evoke thoughts and imagery outside the game world, influencing the perception and interpretation of stimuli in everyday life. *Poels, 2014.*

Playing games with a prosocial, nonviolent, or problem-solving theme is likely to teach attitudes and encourage behaviours that are congruent with civic engagement, whereas playing games with a violent, immediate solution to conflicts of interest is likely to teach attitudes and encourage behaviours that are incongruent with civic engagement; parents who participate in their children's gaming activities may be able to mitigate the negative impacts of violent games. *Anderson, 2014.*

Overreactions, avoidances, and involuntary limb movements were all reported by many gamers in response to real-life stimuli as if they were still playing videogames. *Ortiz de Gortari, 2014.*

The realistic controller and large screen elicited higher hostility, presence, and excitement when playing violent video games than a standard mouse and small screen, respectively. *Kim, 2013.*

Being exposed to violent online games was linked to being both a perpetrator and a victim of cyberbullying. *Lam,*

2013.

The results showed a small to moderate effect between playing violent video games and lowered empathic concern and pro-social behavior among young adults. *Fraser, 2012.*

After controlling for previous levels of aggressiveness, more violent video game play predicted higher levels of violence over time. *Willoughby, 2012.*

Prosocial games reduce state hostility and increase positive state affect in college students while violent video games have the opposite effect. *Saleem, 2012.*

Greater amounts of gaming, lower social competence, and greater impulsivity seemed to act as risk factors for becoming pathological gamers, whereas depression, anxiety, social phobias, and lower school performance seemed to act as outcomes of pathological gaming. *Gentile 2011.*

Cue-induced activation to internet video game stimuli may be similar to that seen in people with substance abuse or pathological gambling during cue presentation. *Han, 2011.*

When comparing regular and infrequent video game players, the study found that frequent gamers had a greater left striatal grey matter volume. *Kühn, 2011.*

Many video game players have encountered the Game Transfer Phenomena, in which they appear to incorporate video game components into their everyday lives. *Ortiz de Gortari, 2011*.

Social activities with parents are negatively associated with gaming addiction, although no association has been found between gaming with parents and gaming addiction. *Jeong, 2011.*

The purpose of this article is to study video game usage trends with a focus on gender disparities, as well as to design a video game addiction questionnaire. *Choliz, 2011.*

Violent video games increase aggressive behavior and decrease prosocial behavior, however relaxing video games have the opposite effects. *Whitaker & Bushman, 2011.*

Playing video games during adolescence predicted later risky driving behavior by the attitudes and intentions of youths to display such behavior in the future. *Beullens, 2010.*

Violent video game exposure leads to an increase in aggressive attitude, aggressive cognition, and aggressive affect, as well as a decrease in empathy and prosocial behavior. *Anderson, 2010.*

Playing violent video games is a significant risk factor for later physically aggressive behavior, therefore reducing the exposure of youth to this risk factor is very important. *Anderson, 2008.*

Participants who had previously played a violent video game demonstrated a physiological desensitization to violence by having a lower heart rate and galvanic skin response when viewing filmed real violence. *Carnagey, 2007.*

In both the short and long term, viewing media violence increases the likelihood that a viewer or videogame player will act aggressively. *Huesmann, 2007.*

Family conflicts are reflected in children's interest in violent media, which has a positive association with violent use of electronic media. *Vandewater, 2005.*

Adolescents who were exposed to more violent video games were more aggressive, reported getting into more confrontations with teachers, were more likely to be involved in physical fights, and performed worse in school. *Gentile, 2004.*

Emotional *Development*

9.3 percent of respondents said that using the Internet has had at least one negative functional effect, including the neglect of recreational activities and issues with family/partner, work or school, and health. Problematic internet use was linked to increasing depersonalization, avoidance of negative feelings, preference for certain applications (gaming, gambling, online sex), and a longer average daily time spent online. *Beutel, 2011.*

Aggression and violence

Meta-analyses found that violent video game consumption increases aggression and decreases prosocial behavior, whereas prosocial video games have the opposite effects. Whether video games have a negative or positive influence on others depends heavily on their content *Greitemeyer 2022.*

Sexual assault related emergency department visits increased by 1533% between 2006-2019 *Vogt et al., 2022.*

Data collected from 2006-2019 demonstrate an increase in sexual assault emergency department visits *Vogt et al., 2022.*

Increases in FBI-reported rape and sexual assault cases between 2015-2019 may be linked to the presence of resources and campaigns such as the #MeToo movement and the Larry Nassar/USA Gymnastics case *Vogt et al., 2022.*

Canada's Assaulted Women's Helpline received 60% more calls between Oct. 1 and Dec. 31, 2020, compared to the same period the previous year - said Yvonne Harding, manager of resource development at the organization. *Thompson, CBC News, 2021.*

Study 1 surveyed rant-site visitors and found that while they become relaxed immediately after posting, they also experience more anger than most and express their anger in maladaptive ways. Study 2 explored the emotional impact of reading and writing rants and found that reading and writing rants were associated with negative shifts in mood *Martin, 2013.*

Viewing inappropriate media content by low-income preschoolers was associated with higher scores for hyperactivity and aggression, and lower ratings for social skills while the amount of viewing was not in line with those in the classroom. *Conners-Burrow, 2011.*

Research results revealed a positive relationship between exposure to profanity in various forms of media and beliefs about profanity, the use of profanity, and involvement in physical and relational aggression. *Coyne, 2011.*

Preschool boys who see violent programs are more likely to act aggressively later in life. *Christakis, 2007.*

Studies regarding the effects of violent video games on children found even violent cartoons increase aggression in 9-12-year-old children. *Anderson C, 2007.*

Excessive television viewing of violence can lead to a significant number of aggressive scripts being stored in long-term memory in the posterior cingulate gyrus, making it easier to recall violent events that act as a cue for overt social behavior *Murray, 2006.*

Media violence can increase aggression by priming aggressive thoughts and decision processes increasing physiological arousal and triggering a tendency to imitate observed behaviors. *Anderson, 2003.*

Longitudinal 22-year study ages 8-19 years shows childhood exposure to media violence predicts young adult aggressive behavior for both males and females. Identification with aggressive TV characters and perceived realism of TV violence also predict later aggression. These relations persist even when the effects of socioeconomic status, intellectual ability, and a variety of parenting factors are controlled. *Huesmann, 2003.*

Artificial Intelligence (AI) and Radicalization

Robotic methods of learning and education often perpetuate negative stereotypes, which yield harmful outcomes which should until proven safe and effective, be reprogramed, halted, or paused *Hundt et al., 2022.*

Robot powered by larger datasets and dissolution models often display negative stereotypes directed towards gender, race and scientifically- discredited physiognomy *Hundt et al., 2022.*

AI systems powered by larger datasets and dissolution models audited methods are less likely to acknowledge women and people of colour *Hundt et al., 2022.*

Social media is highly associated with the recruitment of and conversion phases of radicalization; with coverts being more vulnerable to online radicalization than alternate methods *Bastug, Douai, & Akca, 2020.* Gaming consoles and the presence of such devices in the bedroom may result in reduced social development in children *Fu et al., 2017.*

Content on online platforms such as YouTube may contain radical ideologies and such platforms may be used to recruit converts and carry-out radicalising agendas *(Bermingham et al., 2009).*

Cyberbullying

The cyberbully-victim group has the highest levels of depressive symptoms, as well as the lowest levels of subjective well-being and family support, according to a study of 1707 10-13 year old. *Hellfeldt, 2020.*

Fifty-nine percent of US teens have reported being bullied on social media. *Anderson, PEW Research Center, 2018.*

Instagram harassment can be extremely brutal, and many feel there is no escape from it. *Lorenz, 2018.*

An overlap and correlational relationship appears to exist between youth who bully online and offline *(Hoge, Bickham, & Cantor, 2017).*

Adolescents who have fallen victim to cyberbullying report experiencing negative emotional responses/feelings including embarrassment, worry, fear, depression, or loneliness afterward. Adolescents' victims of cyber bullying are more likely to experience negative mental and physical health outcomes including suicidal and self-harming thoughts *Hoge, Bickham, & Cantor, 2017.*

While internet and internet accessibility use can lead to increased risk of cyberbullying and negative outcomes, online support groups and access to therapeutic health resources can be beneficial *Hoge, Bickham, & Cantor, 2017.*

The frequency of internet use, cyberbullying, and browsing pornographic websites was linked to a number of physical and psychological health issues. *Mitra, 2017.*

"Bullying Today" provides practical, precise information to help school employees cope with bullying in the classroom and online. *Patchin, 2016.*

The Intel Security Digital Safety Program will give educators with standards-aligned tools, such as self-paced lessons for use in the classroom, to help students interact with timely, relevant topics such as Internet safety and security.

Hillman, Intel Security Digital Safety Program, 2014.

Peer victimization has been found to be associated with both suicidal thoughts and suicide attempts among children and adolescents. *van Geel, 2014.*

Internalizing, externalizing, and drug misuse problems in teenagers are linked to cyberbullying; family dinners are beneficial to adolescent mental health and may help adolescents avoid the detrimental consequences of cyberbullying. *Elgar, 2014.*

Cyberbullying is considered as a harmful and severe component of young people's life and online interactions, although it is relatively common. *Bryce, 2013.*

Cyberbullies had lower empathy responsiveness and were more fearful of being victims of cyberbullying than non-cyberbullies. *Steffgen, 2011.*

According to research, cyberbullying victims are nearly twice as likely to attempt suicide as children who have never been cyberbullied. *Hinduja, 2010.*

Youth who had been harassed online in the previous 30 days were eight times more likely to bring a weapon to school. *Ybarra, 2007.*

Online bullying is linked to school behavior issues, and media literacy programs can help young people cope with the harmful effects of electronic media. *Worthen, 2007.*

While cyberbullying takes place off-campus, resulting altercations happen on site. *Willard, 2007.*

In a survey of 3,767 students in grades 6, 7, and 8 from six schools in the United States, 11 percent said they had been bullied electronically in the previous month, and 4% said they had bullied a victim. *Kowalski, 2007.*

Hate crimes

In Canada, police reported 1,946 hate-motivated criminal events in 2019; from 2010 to 2019, 23 percent of people accused of hate crimes were between the ages of 12 and 17, and 86 per cent were male. *Statistics Canada, Moreau, 2021.*

“Incels - short for Involuntary Celibate – a community of males who hold misogynistic beliefs, and often launch violent attacks against women or minority groups.” *Center for Countering Digital Hate, 2022.*

A 59% increase in codewords used and terms relating to mass violence online has been observed within the Incel forum which is a pathway into the Incelosphere. One in five Incel forum posts includes misogynistic, racist, antisemitic, or anti-LGBTQ+ language. Mainstream social media platforms like YouTube and Google are enabling pathways to the Incelosphere *Center for Countering Digital Hate, 2022.*

Incel forum posts mention of rape every 29 minutes with 9 in 10 of posters in relevant discussions were supportive of sexual violence against women *Center for Countering Digital Hate, 2022.*

Forums such as those within the Incelosphere are known to encourage hate speech and violent ideologies which are believed to be linked to violent acts primarily directed towards females and/or racial/gender minorities *Center for Countering Digital Hate, 2022.*

Independence and self-regulation

Frequent use of mobile devices for calming young children resulted in higher emotional reactivity and displacement of opportunities for learning emotion-regulation strategies over time; pediatric health care professionals may wish to encourage alternate calming approaches. *Radesky 2023*.

Background TV and screen time in general is negatively related to children's self-regulation; watching fantastical content seems to have immediate negative effects on children's self-regulatory skills. *Uzundag, 2022.*

Higher levels of media emotion regulation in toddlers was associated with more problematic media use. Extreme emotions arose when the media was taken from the toddlers. *Coyne, 2021*.

Growing evidence suggests that diagnosing *Oppositional Defiant Disorder* may cause inadvertent harm by exacerbating stigma associated with reactive behaviour and allowing normative reactions to trauma to be mischaracterized as issues of self-control. *Beltrán, 2021.*

Negative feelings offline (primarily boredom and a lack of self-control) are related to problematic Internet use, as is too little time spent cultivating hobbies and interests. *Tomczyk, 2019.*

Clinical report by AAP states "Children need to develop a variety of skill sets to optimize their development and manage toxic stress; research demonstrates that developmentally appropriate play with parents and peers is a singular opportunity to promote the social-emotional, cognitive, language and self-regulation skills that build executive function and a prosocial brain." *Yogman et al., 2018.*

Talking out of turn was shown to be the most common and disruptive issue behaviour, followed by non-attentiveness, daydreaming, and inactivity. *Sun, 2012.*

Resilience and risk

Adventurous play, involving thrilling and risky activities, can help reduce childhood anxiety by teaching children to manage fear and uncertainty; by providing these learning opportunities, such play may decrease the risk of developing anxiety disorders over time. *Dodd et al., 2021.*

Peter Gray in 2015 reported the following trends in college students: needier and less resilient, increasingly afraid to fail, failure was perceived as catastrophic and unacceptable, need to be certain about things, don't take risks, complain about trivial matters, complaints demand quick remediation. *Gray, 2015.*

Schools without rules result in improved concentration, grades, 'in-seat' time, less need for movement breaks, less problematic behaviours, improved confidence, less bullying, less injuries. *Schofield, 2014.*

Adolescents who reported the highest amount of screen time, particularly the computer time, were significantly more likely to participate in risky behaviors. *Carson, 2011.*

Mental Development

Anxiety, depression, suicide

National Vital Statistics System data release reports that child and adolescent mortality rates in the United States rose by **20%** between 2019 and 2021, the largest increase in at least 50 years. Researchers found that suicide rates at ages 10-19 began increasing in 2007 and climbed by 70% by 2019. *Kochanek et al., 2024.*

Study shows in 2009, while male suicide rates remained stable, females rose 7% per year surpassing males in 2011. By 2018 the incidence rate had more than doubled for females. *Mitchell et al., 2023.*

Higher screen time in 9–11-year-olds is associated with increased odds of suicidal behaviors two years later, particularly with activities like texting, video chatting, watching videos, and playing video games. *Chu et al, 2023.*

Prospective cohort study shows suicide is the leading cause of death among adolescents. Each additional hour of total screen time (texting, videos, videogames, social media) was associated with 1.09 higher odd of suicidal behaviors at 2-year follow up. *Chu, 2023*.

The younger children get cell phones or tablets, the worse their mental health will be as adults. *Sapien Labs Report 2023.*

57% of teen girls say they experience persistent sadness or hopelessness (up from 36% in 2011) and 30% of teen girls say they have seriously considered suicide (up from 19% in 2011). *Youth Risk Behavior Survey - Center for Disease Control Feb. 2022.*

The mean total daily screen use doubled from pre-pandemic estimates from the same cohort at baseline, according to a review of data from 5412 adolescents predominantly aged 12 to 13 years. *Nagata, 2022.*

During the pandemic, at-home exercise is a powerful behavior for improving mental health in adults, especially in individuals with elevated levels of depressive symptoms. *Puterman, 2021.*

Visits to the emergency room for all mental health issues climbed by 60%, while visits for intentional self-harm soared by 329 percent. Children with substance use disorders saw a 159 percent increase in visits, whereas alcohol-related problems saw a 39 percent decrease. *Lo, 2021.*

Reduced in-person interactions among children, friends, social supports, and professionals such as teachers, school counsellors, pediatricians, and child welfare workers are among the effects of social media on youth during the pandemic, making it harder to recognize signs of child abuse, mental health concerns, and other challenges. *U.S. Surgeon General's Advisory, 2021.*

There are many specific types of risk factors associated with suicidal behavior in adolescents. *Sumner, 2021.*

Suicidal games are a prevalent and hard-to-manage cyber threat *Kobilke & Markiewitz, 2021.*

Social media has the potential to elicit imitation suicides in adolescents, whom use it as a means of involvement and identification with role models which are two factors believed to be correlational related with increased risk of imitation suicide when harmful messages or instructions are given by media role models *Kobilke & Markiewitz, 2021.*

Media content should be reviewed more regularly for specific terms, names, cues, and depictions of harmful and suicidal content used in prior suicidal games *Kobilke & Markiewitz, 2021.*

Approximately 30% of videos relating to the Momo Challenge are visible without safety warning; with 5% of the videos offering visual or auditory depiction of the challenge *Kobilke & Markiewitz, 2021.*

Mental health issues, especially depression and self-harm, have risen among U.S. adolescents, particularly girls, potentially linked to increased digital media use disrupting social interactions and sleep, and exposing them to cyberbullying and harmful content. *Twenge, 2020.*

Adults who reported more positive childhood experiences had a lower risk of depression and/or poor mental health. *Bethell, 2019.*

Schools are struggling with the problem of student depression as data indicates that the situation is worsening. *Blad, 2019.*

For every increased hour spent on social media, teens showed an increase in depression symptoms by 0.64 units. *Boers, 2019.*

Between 2010 and 2015, mental health issues were more frequently reported by adolescents who spent more time in new media than their peers who spent more time in non-screen activities. *Twenge, 2018.*

A growing body of studies shows a link between digital media and depression. *Hoge, 2017.*

Depression and anxiety are independent positive predictors of smartphone addiction. *Matar, 2017.*

Adolescents may seek digital distraction from emerging anxiety or distress emotions, creating a reinforced behavioral avoidance of emotional experiences *Hoge, Bickham, & Cantor, 2017.*

Interruptions that delay day-to-day technology use are associated with increased anxiety and stress symptoms among adolescents *Hoge, Bickham, & Cantor, 2017.*

Playing more games is linked to a higher risk of depression; adolescent depression is influenced by a variety of factors at the individual level (e.g., gender, health, and family background), as well as living in a community with more divorced families. *Kim, 2016.*

Teens who use social media sites for at least two hours a day are much more likely to suffer from mental illness, psychological distress and suicidal thoughts. *Sampasa-Kanyinga, 2015.*

National research reports that problematic use of video games was associated with lower life satisfaction scores and increased levels of anxiety and depression. *Mentzoni, 2011.*

Parents who keep contact with their university-aged children via social networks (SMS, e-mail, Facebook), have more anxious, lonely children, who show loneliness, anxious attachment, and conflict in the parental relationship, than children whose parents are in contact by phone. *Gentzler, 2011.*

Short sleep duration may play a part in depression's etiology. By prolonging sleep duration, earlier parentally established bedtimes may protect against adolescent depression and suicide ideation. *Gangwisch, 2010.*

Visit rates to Emergency Departments (Eds) significantly increased between 1997 and 2007, and EDs are increasingly serving as a safety net for medically underserved patients. *Tang, 2010.*

Depictions or discussion of suicide in the media may also lead to positive outcomes when discussed in the context of prevention, education, improved access to and relating to services available; encouraging vulnerable populations to seek support, overcome and participate in coping strategies *Niederkrotenthaler et al., 2010.*

Television and overall media exposure throughout adolescence are linked to an increased risk of developing depressive symptoms in young adulthood, particularly among young males. *Primack, 2009.*

People who report they are unhappy watch about 30% more television per day than those who report they are happy. *Robinson JP, 2008.*

Autism

"In young children (18 to 40 months) with ASD and high screen time, this intervention study, though small, was associated with 1) a significant reduction in the children's screen time, 2) a significant reduction in the children's autism symptoms and 3) a significant reduction in parent stress." *Heffler et al., 2022.*

Longer screen time at 1 year of age was significantly associated with an increased likelihood of being diagnosed with autism spectrum disorder (ASD) at 3 years of age, particularly in boys; no such association was found among girls. *Kushima et al., 2022.*

Children's screen viewing decreased from an average of 5.6 h/day prior to intervention to 5 min/day during the study. Significant improvements were observed in core autism symptoms and parental stress from pre- to post-intervention. Heffler 2022.

Longer screen time in boys at 1 year of age was significantly associated with ASD at 3 years of age. *Kushima, 2022.*

According to new data, one in every 44, 8-year-old children in the United States has been diagnosed with autism. *Verbanas, 2021.*

Virtual Autism is a new disorder that impacts babies and toddlers who spend long periods of time in front of screens. *The Durable Human, 2021.*

Excessive screen time is detrimental to children's socio-emotional, attention and cognitive functions, and can cause behavioral symptoms of autism. The authors recommend screen cassation for all children with neurodevelopmental delays. *Dieu-Osika, 2020.*

Early in life, more screen time and less caregiver-child interaction are linked to later autism spectrum disorder -like symptoms. *Heffler, 2020.*

First published autism extinction case with screen discontinuation. *Numata-Uematsu, 2018.*

Children with ASD who had an anamnesis history of excessive virtual environment consumption between the ages of 0 and 3 years old had a 37 percent increase in QD/IQ between the first and second complex psychological evaluations, while resources used were three times lower than in the control group. *Teodor Zamfir, 2018.*

Male individuals with ASD seem to have more hypersexual and paraphilic fantasies and behaviors than males in the general population. *Schottle 2017.*

Study included 8900 children aged 3-6 years showing positive correlation between screen time and autism. *Wu, 2017.*

From baseline to post-treatment, study participants made significant progress in all areas of functioning, including psychological symptomatology, social skills, pro-social behavior, and peer relationships, attributable to a novel behavioral intervention in the treatment of outdoor autism spectrum disorders. *Villalobos, 2016.*

Through a process of neuroplasticity, autistic infants develop skills that are driven by audiovisual viewing. The developed neuronal pathways for audiovisual processing compete with a preference for social processing, affecting the development of social brain pathways and causing a global developmental delay. *Frankel Heffler, 2015.*

"Romania's Abandoned Children" suggests that toddlers exposed to more than 4 hours a day in front of a screen should be described as experiencing "severe emotional deprivation" and illustrates a dose/effect relationship between screen time and autism. *Nelson, 2014.*

Even after controlling for age and amount of time spent playing video games, problematic game use and the genre of role-playing games were significant predictors of oppositional behaviour. The findings emphasise the clinical significance of investigating video game use patterns in children with ASD. *Mazurek, Feb 2013.*

Boys with Autism Spectrum Disorder spend significantly more time playing video games than boys with Typical Development (TD), and they are more likely to engage in problematic video game use than boys with TD. *Mazurek, Aug 2013.*

Individuals with autism spectrum disorder were found to use certain electronics more frequently in the previous month and on an average day, as well as to engage in more compulsive Internet and video game use than those without autism spectrum disorder. *MacMullin, 2013.*

The majority of adolescents with ASD (64.2 percent) spent the majority of their free time on non-social media (television, video games), while only 13.2 percent spent time on social media (email, internet chatting); when compared to other disability groups (speech/language impairments, learning disabilities, intellectual disabilities), the ASD group had higher rates of non-social media use and lower rates of social media use. *Mazurek, 2012.*

Data indicate that an excessive number of internet users have deficits in the early stage of face-perception processing but may have intact holistic/configural processing of faces. *He, 2011.*

Children born after shorter intervals between pregnancies are more likely to develop autism. *Cheslack-Postava, 2011.*

Unusual sensory processing is found in people with Autism Spectrum Disorders throughout their lives, and it has consequences for both therapy and diagnosis of ASD in adults. *Crane, 2009.*

There are no reliable, valid, or replicable studies showing genetic evidence for any psychiatric disorders, including ADHD, Autism, bipolar disorder, schizophrenia, depression or anxiety. *Joseph, 2003* & *Baughman, 2009.*

Sensory processing impairment was seen in 95 percent of autistic children. *Tomchek, 2007.*

69% of children with Autism demonstrated sensory symptoms on the Sensory Experiences Questionnaire. *Baranek, 2006.*

Touch treatment reduced touch aversion, off-task behaviour, orienting to irrelevant sounds, and stereotypic behaviors in children with Autism. *Field, 1997.*

Dopamine deficit

Overexposure to digital environments now affects even the youngest (ages 0 to 2) and triggers a chain of interdependent negative and potentially long-lasting metabolic changes; this deregulates the serotonin and dopamine neurotransmitter pathways in the developing brain, similar to severe substance abuse syndromes. *Dresp-Langley, 2020.*

Mental health

A 2-week reduction in screen media use among families led to significant improvements in children's mental health, particularly in reducing internalizing symptoms and enhancing prosocial behavior; further research is needed to determine the long-term effects and potential benefits of different types of screen media. *Schmidt-Persson et al., 2024.*

Concerns are growing about the referral of children and adolescents with mental health conditions to emergency departments. *Hoge, 2022.*

Study found that adolescents who spent less than one hour per day on screens were not negatively affected by it, but higher amounts were positively associated with increased incidence of mental illness. *Khan, 2021.*

Problematic Internet Use was associated with depressive disorders, combined presentation of ADHD, Autism Spectrum Disorder, higher levels of impairment, and increased sleep disturbances, even when considering demographic covariates and psychiatric comorbidity. *Restrepo, 2020.*

Over the last decade, the number of young adults with mental health problems has risen dramatically. *APA, 2019.*

Light digital media users reported significantly higher psychological well-being than intensive users. *Twenge, 2019.*

Internet activities and psychiatric diagnoses related to problematic Internet use vary with age, with implications for public health, e.g. younger children may have a diagnosis of autism or ADHD, while adolescents may have obsessive-compulsive disorder or anxiety. *Ioannidis, 2018.*

Physically, Post-Millennials are safer than any previous generation of teens, but they are on the verge of a mental-health crisis. *Twenge, 2017.*

Selective school-based alcohol prevention programs aimed at youth with personality risk factors for addiction and mental health problems have been shown to reduce substance use and misuse in those with high personality profiles. *Conrod, 2013.*

The concept that DSM disorders are distinct diseases with unique pathophysiology has been discredited; no physiological, genetic, or phenotypic specificity has been proven for the various DSM-5 disorders. *Ross, 2013.*

Mental health prevention programs can help to minimize the prevalence of mental illnesses in children. *Waddell, 2007.*

Current non-pharmacological approaches to stopping disturbed or aggressive behavior are not supported by evidence from controlled studies; clinical practice is based on evidence that is not derived from studies, and continuous practice entirely outside of well-designed, conducted, and reported randomized studies is difficult to substantiate. *Muralidharan, 2006.*

As pharmaceutical firms' infiltration of the educational system grows, teachers have taken on the role of "disease spotters" and "sickness brokers" for ADHD. *Phillips CB, 2006.*

Psychosis

Study found that longitudinal trajectories of media use during adolescence were modestly associate with psychotic events at age 23 years. *Paquin et al., 2024.*

Psychotropic medication

Study found that long-term exposure to ADHD medication was associated with an increased risk of cardiovascular disease, especially hypertension and arterial disease. *Zhang et al., 2024.*

Individuals treated with methylphenidate had a 87% posterior probability of having a higher rate of cardiovascular events after treatment initiation. *Hughes, 2024.*

(CCHR) reports that in 2023 the U.S., 6.1 million children ages 0-17 years are being prescribed psychotropic drugs including antianxiety, antidepressants, sedatives, stimulants and antipsychotics. 418,000 are between the ages of 0-5 years with 85,000 aged 0-1 years. Citizens Commission on Human Rights International, 2024.
Cohort study shows that within a large community-based health care network, most preschool-aged children with PCP-diagnosed ADHD or ADHD symptoms were NOT offered first-line, evidence-based behavioral treatment. *Bannett, 2022*.

Research relating to serotonin production show little consistent evidence to indicate a correlational relationship between serotonin and depression. *Moncrieff et al., 2022.*

Some evidence was consistent with the possibility that long-term antidepressant use reduces serotonin concentration *Moncrieff et al., 2022.*

The use of antipsychotics in privately insured young children decreased from 2009 to 2017. Despite this, the majority of use still remains off label and for situations for which there is insufficient evidence of efficacy and safety. *Bushnell, 2021.*
Polypharmacy was common among the 26 722 people with autism spectrum disorder ranging from 28.6% to 31.5 percent. *Feroe, 2021*.

Despite limited evidence of efficacy and mounting safety concerns, the use of medication from two or more psychotropic classes has increased among US youths; the most common diagnosis among youths who received psychotropic polypharmacy is attention deficit/hyperactivity disorder. *Zhang, 2021.*

Study found that 81% of children who take aripiprazpole (prescribed for autism, conduct disorder) have serious side effects; 94.1% of children who take risperidone (prescribed for adhd, impulsive disorder, bipolar disorder) have serious side effects. 15% of children taking these drugs reported suicidal thoughts. *Rafaniello, et al., 2020.*

Psychiatric Drugs informs law enforcement, legislators, policymakers, healthcare professionals, and educators about the risks of psychotropic drugs causing violent, illogical, and suicidal conduct, as well as the severe side effects of withdrawal. *Eastgate, 2018*.

"The Spiral Notebook" is packed with interviews with Generation Z, a generation plagued by big pharma with anti–depressants and ADHD medications, a doomsday/apocalyptic worldview present from birth, and an entertainment industry that has turned violence into parlor games. *Singular, 2015*.

Antipsychotics have a subtle but measurable effect on brain tissue loss over time, suggesting the importance of careful risk-benefit review in terms of dosage and duration of treatment, as well as their off-label use in children. *Ho, 2011.*

Reports and Publications. Children who use ADHD medication have lower academic performance and a higher risk of cardiac problems, according to the Department of Health. *Government of Western Australia, 2010.*

"Side Effects" provides a comprehensive picture of the disgraceful self-serving links that exist between drug firms and the psychiatric profession. *Bass, 2009.*

Twenty percent of children on ADHD stimulants exhibited an increase in heart rate and/or systolic and diastolic blood pressure, according to a three-year follow up study of treated ADHD patients. *Winterstein, 2009.*

Since the early 1990s, case reports and small case series have frequently raised concerns that stimulants may increase the risk of sudden unexplained death in children. *Vitiello, 2009.*

Even very young children with autism spectrum disorders frequently take psychotropic medications. Factors unrelated to clinical presentation appear to be strongly linked to prescribing practices. *Mandell, 2008.*

"Medication Madness" exposes the psychiatric drugs' harmful and severe side effects. *Breggin, 2008.*

An objective, well-informed examination of the widespread use of Ritalin in young children with Attention Deficit

Disorder discusses the drug's ethical and social consequences, as well as suggestions for those considering its usage. *Diller, 2008.*

After receiving stimulant medication, there is a drop in growth rates, according to the study. *Swanson, 2007.*

The percentage of visits resulting in a psychotropic prescription rose from 3.4 percent in 1994-1995 to 8.3 percent in 2000-2001; by 2001, one out of every ten adolescent male visits to the doctor resulted in a psychiatric medication prescription. *Thomas, 2006.*

Two children (out of 43) taking fluvoxamine, a serotonin reuptake inhibitor, exhibited drug-induced apathy (neither of them had a depressive illness). *Reinblatt, 2006.*

Nearly one-third of youths who received any psychotropic treatment used multiple psychotropic medications. *dosReis, 2005.*

Stimulants are increasingly being used to treat attention deficit/hyperactivity disorder. *Ruff, 2005.*

Antidepressant-treated depressed children are more prone to harm themselves than depressed children treated with placebo. *Lenzer, 2004.*

There was a proportional increase in females receiving stimulants and males receiving antidepressants during the decade, especially among the 10- to 14-year-olds. *Zito, 2003.*

In the 1990s, the use of antidepressants among teenagers surged. *Zito, 2002.*

GPs and pediatricians play a role in the in-office treatment of adolescents with psychotropic drugs. In this study, most psychotropic drug prescriptions (84.8%) were issued by general practitioners or pediatricians. *Goodwin, 2001.*

Between 1991 and 1995, the number of preschoolers administered psychotropic drugs climbed drastically. *Zito, 2000.*

Screen addiction/treatment

Study shows that addiction is not a dichotomous differentiation but rather a continuum from casual users to initial users to experimenters to addicts in denial to addicts. *Stangl et al., 2023.*

Study results found that both problematic internet use and problematic video gaming were predicted by impulsiveness, online social comfort, internalizing symptoms, parental attachment, and child's perceived warmth at home. *Kim et al., 2023.*

A latent class analysis identified four classes of gaming disorder. Results suggest that adolescents reporting problematic video gaming form a heterogeneous group with each profile requiring different considerations. *Marchica et al., 2022.*

Study showed that parental screen addiction can directly and indirectly affect children's screen addiction through parental anxiety and the parent-child relationship. *Li et al., 2022.*

Study found that conscious engagement in physical activity and a regular sleep rhythm during the pandemic could enhance positive mental health and reduce addictive social media use. *Brailovskaia et al., 2022.*

Internet Use Disorder is a rapidly growing behavioural addiction; this condition has been linked to a number of structural and functional brain changes. *Darnai, 2022.*

24.5 percent of adolescents were found to be addicted to video games. Research profiles useful intervention module for reducing video game addiction in adolescents, as. *Goswami, 2022.*

Short-term abstinence from gaming that is intentional and under control reduces Internet Gaming Disorder and improves mental health. *Brailovskaia, 2022.*

The prevalence of IGD among Chinese adolescents (ages 12-19) was 4.6%. This study provides evidence for retaining or deleting specific diagnostic criteria by the DSM framework in the future. *Luo, 2022.*

Among Internet Gaming Disorders, the five most commonly reported health-related variables are depression (67 times), internet addiction (54 times), anxiety (48 times), impulsivity (37 times), and attention deficit hyperactivity disorder (24 times). *Darvesh, 2020.*

Technology is a new addiction; the social networking app Snapchat is used by 78 percent of Americans between the ages of 18 and 24, with the majority of users (71 percent) using it numerous times per day. *Captain Ryan, 2018.*

Selfitis Behavior Scale may be a reliable and valid tool for assessing selfitis (the obsession of taking selfie pictures). *Balakrishnan, 2018.*

Due to distinctions in methodologies, the global incidence of Internet Gaming Disorder ranges from 0.7 to 27.5 percent. *Mihara, 2017.*

The study's conclusions offer recommendations for the design and efficient implementation of future interventions for Internet addiction among Korean teenagers. *Chun, 2017.*

In recent years, there has been a significant increase in research into Internet Gaming Disorder; however, research on its psychological treatment is still limited, particularly in terms of the efficacy of specific programmers. *Torres-Rodríguez, 2017*.

The shortened version (6-item) of the Problematic Internet Use Questionnaire also appears to be an appropriate method of distinguishing between Internet users exposed to problematic Internet use and those who are not. *Demetrovics, 2016.*

Addiction treatment specialists believe that the fundamental reason addicts stay addicted is less about pleasure-seeking and more about the need to escape and disassociate from the sorrow of his or her (often trauma-based) emotional isolation. *Weiss, 2016.*

Addiction to the Internet has been connected to functional alterations in the prefrontal cortex, as well as changes in other cortical (e.g., temporal) and subcortical (e.g., ventral striatum) regions, and manifests itself in loss of control over Internet use resulting in personal distress, symptoms of psychological dependence, and various negative consequences. *Brand, 2014.*

The structural trait that predicted addiction was its social component, and increased sociability was associated with higher levels of addiction-like experiences. *Hull, 2013.*

After twelve weekly sessions, Cognitive Behaviour Therapy-IA was found to be beneficial in alleviating symptoms related with Internet addiction for one month, three months, and six months after therapy. *Young, 2013.*

In adolescents with online gaming addiction (OGA), the amplitude of low frequency fluctuation values in the left medial orbitofrontal cortex and left precuneus were positively linked with the duration of OGA. *Yuan, Nov 2013.*

In late adolescence with online gaming addiction, imaging data demonstrated increased cortical thickness in the left precentral cortex, precuneus, middle frontal cortex, inferior temporal, and middle temporal cortices. *Yuan, Jan 2013.*

The right orbitofrontal cortex, bilateral insula, and right supplementary motor region all demonstrated significant

grey matter degeneration in Online Gaming Addicts. *Weng, 2013.*

According to data from 2257 students at an English university, 3.2 percent of the students were addicted to the Internet. *Kuss, 2013.*

Individuals with Internet addiction problem demonstrated increased sensitivity to winning and decreased sensitivity to losing. *Dong, 2013.*

Adolescents with internet addiction have changes in the orbitofrontal cortex, which are a common neurobiological marker of addiction-related conditions in general. *Hong, 2013.*

In the absence of global alterations in brain functional network structure, internet addiction is linked to a decrease in functional connectivity in cortico-striatal circuits. *Hong, 2013.*

Study found abnormal spontaneous brain activity associated with poor task performance in youth who have internet addiction. *Yuan, 2011.*

The grey matter density in the left anterior cingulate cortex, left posterior cingulate cortex, left insula, and left lingual gyrus was lower in Internet addiction teenagers. *Zhou, 2011.*

Populations are becoming more addicted to the Internet as it becomes more accessible. Parental bonding characteristics were the best predictor variables for Internet and computer addiction. *Siomos, 2012.*

Internet addiction disorder (IAD) can cause substantial brain damage, and neuroimaging data show that IAD is linked to dopaminergic brain system failure. *Hou, 2012.*

When compared to their healthy peers, men with internet addiction problem showed considerably more 'Stroop effect'-related activity in the anterior and posterior cingulate cortices. *Dong, 2012.*

The findings suggest that people who are addicted to the Internet have higher levels of trait impulsivity than people who are diagnosed with pathological gambling. *Lee HW, 2012.*

Fractional anisotropy in major white matter pathways was found to be reduced in Internet addiction disorder, and this altered white matter structure may be associated to various behavioural abnormalities. *Lin, 2012.*

In subdivisions of the striatum, people with Internet addiction have lower levels of dopamine D2 receptor availability. *Kim, 2011.*

Mood disorders were found to have a statistically significant link to a higher Internet Addiction Test score. *Liberatore, 2011.*

Lower academic success, higher truancy, shorter sleep time, limited leisure activities, and increased thoughts of suicide are all associated with video game addiction. *Rehbein, 2010.*

Parental rearing behaviours were commonly evaluated as intrusive, repressive, and unresponsive by adolescents with Internet Addiction Disorder. *Xiuqin, 2010.*

Cravings or urges to play video games cause brain alterations comparable to drug cravings. *Ko, 2009.*

Previous research had employed inconsistencies in classifying Internet addicts, according to the findings; scientists were given suggestions on how to strengthen this new branch of research. *Byun, 2009.*

The goal of the study was to evaluate alexithymia, dissociative experiences and Internet addiction in undergraduate students. *De Berardis, 2009.*

Internet addicts are more lonely and have lower self-esteem and weaker social skills than moderate users. *Ghassemzadeh, 2008.*

Video game addiction can be statistically predicted based on measures of aggression and poor academic performance. *Chiu, 2004.*

Two credible measures of television addiction were produced by composing items to mirror known criteria used in psychiatry for the diagnosis of drug dependency in an effort to find a way to empirically distinguish between normal and problem television viewing. *Horvath, 2004.*

Cognitive Development

Academic performance

Study shows irregular sleep and late bedtimes associated with worse grades for high school students as well as more school-related behavior problems among teens. *Mathew et al., 2024.*

New test scores reveal that 13-year-olds in the U.S. have reached their lowest levels of math and reading performance in decades, reflecting long-standing declines that were exacerbated by the pandemic. This drop highlights ongoing educational challenges, particularly among vulnerable student groups, and underscores the need for targeted interventions. *Goldstein, 2023.*

Participants' predicted enjoyment and engagement for a waiting task were significantly less than what they actually experienced. These results suggest an inherent difficulty in accurately appreciating how engaging just thinking can be, and could explain why people prefer keeping themselves busy, rather than taking a moment for reflection and imagination in our daily life. *Hatano 2022.*

During the 2020-21 academic year, women made up 59.5% of college students and men 40.5%. U.S. colleges and universities had 1.5 million fewer students compared with five years ago, and men accounted for 71% of the decline. In an increasing education disparity across the United States, the number of males enrolled in two- and four-year colleges has fallen to record lows. *Belkin, 2021.*

A greater quantity of screen use was negatively related to the child's language, while better quality screen use (educational programs and co-viewing with caregivers) was positively related to the child's language skills. *Madigan, 2020.*

The placement of electronic devices in child bedrooms is believed to negatively impact school readiness, especially in families with lower social economic status *Fu et al., 2017.*

Adolescents are less likely to follow academic pursuits and engage in structured after-school activities which positively impact social and interpersonal development if technology use is excessive, or if technology use interferes with said activities *Przybylski & Weinstein, 2017.*

Average final exam scores in schools that allowed computers were 0.18 standard deviations lower than exam scores in classrooms that did not allow computers. *Carter, 2017*.

The mean final exam scores of students assigned to computing-enabled classes were 18 percent standard deviations

lower than the student's final exam scores of students in classrooms that prohibited computers. *Payne, 2016*.

On conceptual problems, students who took notes on laptops did worse than those who took notes longhand; the tendency of laptop note takers to reproduce lectures verbatim rather than analyzing and reframing material in their own terms is harmful to learning. *Mueller, 2014*.

Participation in physical activity has a positive effect on children's academic performance. *Singh, 2012.*

At 29 months, each additional hour of television exposure resulted in 7% and 6% unit declines in classroom engagement and math achievement; 9 percent unit decreases in activities requiring physical exertion; 10% unit increases in victimization by classmates; 13% unit decreases in time spent doing weekend physical activity; 9% unit decreases in activities requiring physical exertion; 9% and 10% unit increases in soft drink and snack consumption; and 5% unit increases in body mass index. *Pagani, 2010.*

The more time students spend using media and the more violent the content is, the worse their grades at school will be, even when controlling for critical factors such as family, educational, or immigrant background. *Mössle, 2010.*

About 8% of video game players displayed abnormal play patterns. The presence of pathological gaming was found to be a strong predictor of low academic performance. *Gentile, 2009.*

The recess period is an important part of the primary school curriculum as it improves the cognitive abilities of children and helps them adjust to school. *Pelligrini, 2005.*

Television viewing during childhood (ages 5-11) and adolescence (ages 13 and 15) was linked to worse educational achievement later in life. *Hancox, 2005.*

Comparative literary examinations conducted in 1994 and 2003 indicated that 15% of Canadians scored at level one and only 50% at level three in the four literacy domains (at 5 levels of the ranking where level one was the lowest). *Sloat, 2000.*

Attention deficit

Most preschool children with symptoms of ADHD or ADHD who were diagnosed by primary physicians were not offered evidence- based behavioral treatment. *Bannett, 2022.*

An in-depth inspection was conducted on a high-profile study that suggested that ADHD is a risk factor for infection with COVID-19 and that stimulants reduce that risk. Seven manipulations and spins were identified, including inappropriate operational definitions, misrepresentations, and omissions that produced bogus results and might have concealed potential adverse effects of medications. These distortions illustrate how biased science can contribute to the ethically problematic phenomena of overdiagnosis and overmedication. *Ophir, 2021*.

Study found that 81% of children who take aripiprazpole (prescribed for autism, conduct disorder) have serious side effects; 94.1% of children who take risperidone (prescribed for adhd, impulsive disorder, bipolar disorder) have serious side effects. 15% of children taking these drugs reported suicidal thoughts. *Rafaniello, et al., 2020.*

Clinical practice guidelines emphasize parent training in behavior management (PTBM) as the first-line treatment for children aged 4 to 5 years with a diagnosis of ADHD or ADHD symptoms given stronger evidence for PTBM vs ADHD medications such as methylphenidate. *Wolraich, 2019.*

Brain structural changes related to cognitive control and emotional regulation are associated with digital media addictive

behavior. Screen time induced adhd-related behavior could be inaccurately diagnosed as adhd. Screen time reduction is effective in decreasing adhd-related behavior. *Lissak, 2018*.

Even when people manage to maintain constant attention - for example, avoiding the temptation to check phones – merely having these devices nearby diminishes available cognitive capacities; furthermore, people who are the most addicted to smartphones face the biggest cognitive consequences. *Ward, 2017*.

Expanding stimulant medications in the community for ADHD seemed to have no positive effects and may have been hazardous considering how these medicines are commonly used in the community. *Currie, 2014.*

In the last 30 years, ADD/ADHD has become an epidemic. Before the age of 18, one in every seven boys was diagnosed with this disease. *Peper, 2014.*

The findings revealed that among children exposed to lead, a heavier voice connection using a mobile phone was associated with an increased risk of developing ADHD symptoms. *Byun, 2013.*

Evidence suggests that ADHD and SMD are distinct diagnoses. *Miller, 2012.*

During childhood, watching TV and playing video games has been linked to an increase in potential attention problems. *Swing, 2010.*

A study on sensory overactivity in children with ADHD shows a solid association between sensory overactivity and anxiety in both typical children and children with ADHD. *Lane, 2010.*

"iBrain" focuses on how technology's inevitable march forward has changed how young minds develop, function, and comprehend data. *Small, 2009.*

The ADHD criteria were met by 9% of American children aged 8 to 15 years. *Rapport, 2009.*

The most common symptom of Internet Addiction was ADHD, followed by impulsivity. *Yen, 2009.*

Twenty minutes of walking in a park was enough to improve attention performance in children with ADHD when compared to the same amount of time in other environments. *Kuo, 2009.*

The prevalence of ADHD, and thus the need for psychostimulant medications in growing children, may be reduced if we create play sanctuaries for preschool children, where they can play naturally with each other, facilitating frontal lobe maturation and the healthy development of pro-social minds. *Panksepp, 2008.*

Youths who watched three or more hours of television per day were at a higher risk of developing attention problems later in life and were the least likely to pursue postsecondary education; in the association of television viewing with attention and learning difficulties, there was little evidence of bidirectionality. *Johnson, 2007.*

To see if effective therapy can minimize the onset, persistence, and severity of problems that co-occur with adult ADHD, more research is needed. *Kessler, 2006.*

In 2003, it was estimated that 4.4 million children aged 4 to 17 had been diagnosed with ADHD. *CDC, 2005.*

At the age of seven, early television exposure is linked to attentional issues; efforts to reduce early children television viewing may be warranted. *Christakis, 2004.*

ADHD symptoms are significantly reduced when people are exposed to "green space." *Kuo, 2004.*

Half of the diagnosis of ADHD was initially suggested by teachers. *Sax, 2003.*

"Attention Deficit Hyperactivity Disorder" brings together the leading experts in the field of ADHD to address the issues and controversies surrounding the disorder scientifically. *Jensen, 2002.*

"Scattered Minds" debunks the notion of Attention Deficit Disorder as a genetically determined condition, written from the inside out by someone who has ADD himself, with the wisdom obtained through years of medical practise and research. *Mate, 2000.*

"Attention inconsistency" is a better word for ADHD. The three tenets of Attention Restorative Theory are as follows: 1) The ability to pay attention is sensitive to exhaustion and restoration. 2) Those that are voluntary and exciting are less tiring than tasks that are involuntary and dull. 3) The ability to pay attention is affected by changes in the surroundings. *Kaplan S 1995.*

Brain injury

Patients (12-25 years) with concussion who refrained from screen time during the first 48 hours of recovery had a statistically significantly shorter duration of symptoms (3.5 days) than those allowed to screen time (8 days). *Macnow, 2021.*

'Covid Effect' reversal initiatives

Less than half of the estimated 52.9 million adults experienced mental illness in 2020 received mental health services. The COVID-19 pandemic made the problem worse. *Muñoz, 2022.*

International review of the impacts of school closures on the health and well-being of children during the first wave of the pandemic and urges a balance between measures to contain infectious disease and to bolster the physical and mental health of children. *Viner, 2022.*

The burden to reduce screen time cannot fall to parents and families alone. Policies are needed to avoid closures of schools and recreation and ensure alternatives to screen time for children and youth of all ages that promote socialization and physical activity. In addition, there are key equity considerations when it comes to accessibility of alternatives to screen time such as child care and community recreation. *Toombs, 2022.*

Education systems reaction and processes need to develop to reflect the expanding body of information and study on the negative effects of Covid closures on children's health, well-being, and life expectancy. *Dooley, 2022.*

Physical activity engagement and child movement behaviours such as sleep habits, and sedentary behaviour were significantly impacted by Covid-19. Participation in physical activity yields protective results and reduce the severity/prevalence of negative mental health outcomes associated with Covid-19 in children *Caldwell et al., 2022.*

Should Covid-19 pandemic restrictions persist in various jurisdictions, parents should consider incorporating more physical activities into their child's daily routines *Caldwell et al., 2022.*

Replacing sedentary learning activities with movement-based learning activities and replacing screen-based learning activities with non-screen-based learning activities, can support student's health and wellbeing *Sanders et al. 2022.*

To achieve the best health and educational outcomes, school districts should implement some or all of the AAP guidance measures and prioritize them based on local COVID-19 incidence, key stakeholder input, and budgetary constraints. *Wang, 2021.*

The incidence of depression and anxiety symptoms during COVID-19 has doubled compared to pre-pandemic estimates. *Racine, 2021.*

Study results suggest that virtual learning may pose a greater risk than personal learning related to the mental and emotional health of the child and parents. *Verlenden, 2021.*

Child and youth screen time has substantially increased during Covid-19. Research suggests that increased reliance on screen time during Covid-19 harms physical, cognitive and mental health for children and youth *Gilbert et al., 2021.*

Setting and monitoring screen time limits, discussing impacts of screen use, taking frequent breaks, incorporating movement throughout the day, encouraging adults to practice healthy screen use and tapering screen use are effective measures to reduce harmful effects on children and youth by decreasing screen time. *Gilbert et al., 2021.*

School closings during the COVID-19 pandemic impacted children's academic learning gains; in particular, mathematics performance was significantly lower than in the typical school year. *Northwest Evaluation Association (NWEA), 2020.*

The findings revealed that there was a significant increase in indicators of anxiety, post-traumatic stress disorder, depression, and behavioral challenges during COVID-19 and beyond when compared to indicators typically found in the general child population. *Waddell, 2020.*

Due to the unique combination of the public health crisis, social isolation, and economic recession, the COVID-19 pandemic may exacerbate existing mental health problems and lead to an increase in cases among children and adolescents. *Golberstein, 2020*.

Based on US data, this decision analysis model of years of life potentially lost under various scenarios of school closure; the findings favoured keeping schools open. *Christakis, 2020.*

Dementia

Study found that 55-60-year-olds who used greater than 4 hours of TV and computer time per day, had 28% incidence of dementia (compared to 0.5-1 hour per day. *Wu et al., 2023.*

Digital Therapy

Study author Dr. Sheryl Spithoff highlights that virtual care is often based on a business model that values money over client and reports she is concerned that care might not be designed to be the best care for patients, but rather might be designed to increase uptake of a drug or vaccine to meet the pharmaceutical company objectives. The direct-to-consumer virtual care industry views patient data as a revenue stream, raising concerns about privacy, autonomy, and care quality, and highlighting the need for enhanced privacy regulations and alternative oversight models. *Spithoff et al., 2024.*

Increased screen use in young children may pose cognitive risks, urging caution and further research before widespread adoption of digital therapeutics like Endeavor Rx. *Bryant, 2023.*

The FDA has authorized the marketing of Endeavor Rx, the first game-based digital therapeutic device designed to improve attention function in children aged 8-12 with ADHD. *FDA, 2020.*

The digital revolution in medicine brings new treatment opportunities for mental illness but raises ethical concerns about privacy, data misuse, and the risks of unvalidated digital tools, highlighting the need for better education for

physicians and patients. *Bauer et al., 2017.*

Executive function

Executive functioning was impaired in young children who were exposed to extensive periods of everyday background TV. *Nichols, 2022.*

Early-life threat and deprivation experiences were linked to lower executive functioning, but the link was higher for deprivation exposure. *Johnson, 2021*.

High screen time contributes to adverse cognitive, executive function, and behavior outcomes at ages 6 to 7 years in children born extremely premature. *Vohr, 2021.*

The executive function of four-year-old children was found to be significantly reduced after watching the Spongebob cartoon for nine minutes. *Christakis, 2011.*

High levels of exposure to adult-oriented television programming during infancy and at age four, as well as high levels of household television viewing at age four, were all linked to lower executive functioning at age four. *Barr, 2010.*

People with amnesia who played the Tetras video game, were able to describe Tetra's visual images at sleep onset, demonstrating that remote memories can influence the images from a recent awaking. *Stickgold, 2000.*

Learning disorders

Children 3-5 years of age who used screens longer than recommended had lower measures of microstructural organization and myelination of white matter pathways in the brain that support language skills and development of literacy and corresponding cognitive assessments. *Hutton, 2020.*

The language cues made it difficult for the infants to imitate activities at levels far above those observed when such language treatments were not used. *Zack, 2013.*

Ayres's eight articles (1965-1987) containing 10 multivariate analyzes based on her concept of sensory integration do not support her claim and are of no value for diagnostic procedures or remedial programs for children with learning disabilities. *Cummins, 1991.*

Multitasking stress

More than four out of five adults in the United States say they check their email, messages, and social media accounts frequently or continuously a decade after cellphones, Facebook, and Twitter were introduced, resulting in higher stress levels for these Americans. *APA, 2017*.

Multitasking on a laptop is a significant source of distraction for both users and fellow students, and it can make it difficult to understand class material. *Sana, 2013.*

The unique relationship between media multitasking and these measures of psychosocial dysfunction suggests that the growing trend of media multitasking may be a unique risk factor for anxiety and mood related mental health problems. *Becker, 2013*

People switched media at an extreme rate (about 4 switches per minute and 120 switches in 27.5 minutes) and recalled their switching behavior on average for only 12% of their actual switching rate. *Brasel & Gips, 2011.*

WIRELESS RADIATION AND HUMANS

Wireless controversy

Five of the six members of the Core Group in charge of the development of a Monograph on RF Fields and Health for public comment are involved with the International Commission on Non-Ionizing Radiation Protection (ICNIRP), an industry loyal NGO, creating a severe conflict of interest; the assessment of the non-thermal biological effects of RF radiation was rejected as scientific evidence of adverse health effects in the monograph which prompted many objections sent to the WHO. *Hardell, 2017.*

Wireless expansion

The number of satellites orbiting the globe has expanded from 2,000 to 4,800 in the last two years, and a wave of new projects has pushed the total number of operational, approved, and proposed satellites to at least 441,449. And that figure only covers satellites in low-earth orbit (LEO) that will be in the ionosphere. *Firstenberg, 2022.*

Wireless safety

The review found limited evidence on the effects of mobile phone EMF radiation on pregnancy, noting potential links to miscarriages and fetal changes but calling for more research and updated safety guidelines. *El Jarrah et al., 2022.*

Wireless technology has yet to be adequately assessed in the context of being a human and environmental hazard *Khan et al., 2022.*

Current Radiofrequency Radiation (RFR) exposure limits fail to account for "potential synergistic effects that reflect modern day exposures to multiple environmental agents," *Environmental Health, 2022.*

This essay by a prominent UK epidemiologist identifies four relevant sources of scientific uncertainty and concern and based on the precautionary principle, echoes the calls of others for a moratorium on the further roll-out of 5G systems globally, pending more conclusive research on their safety. *Frank, 2021.*

- Lack of clarity about precisely what technology is included in 5G;
- Rapidly accumulating body of laboratory studies documenting disruptive in vitro and in vivo effects of RF-EMFs-but one with many gaps in it;
- Almost total lack (as yet) of high-quality epidemiological studies of adverse human health effects from 5G EMF exposure specifically, but rapidly emerging epidemiological evidence of such effects from past generations of RF-EMF exposure;
- Persistent allegations that some national telecommunications regulatory authorities do not base their RF-EMF safety policies on the latest science, related to unmanaged conflicts of interest.

Radiation standards for cellphones, based on a binary distinction between thermal and nonthermal radiation, do not protect against the neurophysiological effects of cellphone radiation. *Marino, 2017.*

The article provides a non-exhaustive view of the effective measures that must be implemented in the field of non-ionizing electromagnetic radiation to protect future generations. *Markho, 2016.*

"Wireless Radiation Rescue" contains advice on how to make mobile phones and other wireless technology safer. *Crofton, 2011.*

This bibliography contains over 2300 references on biological responses to radio frequency and microwave radiation that were published up until April 1972. *Glaser, 1971.*

Experimental research

National Institute of Health – National Toxicology Program

EMR-2450 MHz induces stress and exacerbates anxiety-like symptoms in rats and causes the death of both necrotic and apoptotic cells. *Gupta, 2019.*

EMF interferes with neural stem cell production and differentiation during embryonic development, as well as the reproductive and neurological health of individuals who have been exposed prenatally. *Kaplan, 2016.*

The researchers concluded that RF EMFs are carcinogenic in male rats but not in female rats or mice (US National Toxicology Program only). *ICNIRP (pp. 525-532), 2020.*

Cell Phone Radio Frequency Radiation (nih.gov)

National Toxicology Program, National Institute of Health. NTP conducted two-year toxicology studies in rats and mice to help clarify potential health hazards, including cancer risk, from exposure to RFR like that used in 2G and 3G cell phones which operate within a range of frequencies from about 700–2700 megahertz (MHz). These were published as Technical Reports in November 2018. NTP uses a standard scale (graphic of NTP's Level of Evidence Rating System for Cancer Studies) to determine the strength of the evidence for an association between the exposure and findings in the tissues or organs studied. The scale ranges from the highest rating of "clear evidence," followed by "some evidence," then "equivocal evidence," and finally "no evidence." Different organs or tissues can have different conclusions.

The NTP studies found that high exposure to RFR (900 MHz) used by cell phones was associated with:

- **Clear evidence of an association with tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of an association with tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of an association with tumors in the adrenal glands of male rats.** The tumors were benign, malignant, or complex combined pheochromocytoma.

It was unclear if tumors observed in the studies were caused by exposure to RFR in female rats (900 MHz) and male and female mice (1900MHz).

As a follow-up, NTP published an article in October 2019 that evaluated DNA damage in three regions of the brain, the liver, and in blood cells in rats and mice that were removed at an earlier timepoint from the ongoing 2-year toxicology study. DNA damage, if not repaired, can potentially lead to tumors. This work was also included in NTP's published Technical Reports, but this study includes analyses of the data in the supporting information not included in the Technical Reports. NTP scientists found that RFR exposure was associated with an increase in DNA damage.

Specifically, they found RFR exposure was linked with significant increases in DNA damage in:

- the frontal cortex of the brain in male mice,
- the blood cells of female mice, and
- the hippocampus of male rats.

-

There are many factors that influence whether damaged DNA will lead to tumors. NTP plans to conduct additional studies to learn more about how RFR might cause DNA damage. Please see the FAQs below for more information about the specific studies and NTP's cell phone RFR program.

Epidemiological studies

Brain tumors

The risks of glioma from mobile phone are likely to be higher than published. *Morgan 2015*.

A study in France supporting previous finding concerning a possible association between heavy mobile phone use and brain tumors. *Coureau 2014*.

There is a link between mobile and cordless phone use and acoustic neuroma, according to this study. *Hardell, 2013.*

A study of prior cell phone use (up to 2004) discovered a 40% increase in the incidence of glioblastoma in the most heavy users (reported average: 30 minutes per day over 10 years). *WHO, 2011.*

The use of a cell phone for 50 minutes was linked to an increase in brain glucose metabolism. *Volkow, 2011.*

Cell phone use for more than or equal to ten years nearly doubles the risk of being diagnosed with a brain tumor on the same side of the head. *Khurana, 2009.*

Breast cancer

Excessive smartphone use significantly increased the risk of breast cancer, particularly for participants with smartphone addiction, a close distance between the breasts and smartphone, and the habit of smartphone use before bedtime. *Shih 2020.*

Cognition and behavior

The results suggest that 2400-MHz RF-EMR cell phone radiation damages the anatomical integrity of the hippocampus, resulting in behavioural alterations like anxiety; study raise awareness of the long-term dangers of RF-EMR exposure. *Hasan, 2021.*

When rats are exposed to microwave radiation at 2.45 GHz, their brains undergo negative changes, including a decrease in learning and memory, as well as the manifestation of anxious behaviour, as well as a decrease in brain antioxidant enzyme systems. *Varghese, 2018.*

In adolescent mice, exposure to radio frequency fields had no effect on depression-like behaviour, spatial memory, or brain histology, but it can increase anxiety levels. *Zhang, 2017.*

Research compilation on cell phone radiation, behavior and brain development. *Hugh, 2016.*

Children with early self-regulation issues watched more media by age 2, with persistent problems linked to even higher media use; this relationship was stronger in lower socioeconomic and English-speaking households. *Radesky et al, 2014.*

Physiological effects

The majority of research on the use of non-ionizing radiation cosmetic devices has concentrated on treatment efficacy rather than side effects or complications; mild and transient pain, erythema, swelling, and changes in pigmentation are all common side effects on the skin. *ICNIRP (pp.562-579), 2020.*

The potential for wireless technology radiation to cause serious biological effects has significant implications, necessitating a re-evaluation of its near-ubiquitous presence, particularly in hospitals and medical facilities. *Kleiber, 2017*.

Microwaves cause biological effects at non-thermal levels by activating voltage-gated calcium channels, supporting a paradigm shift in microwave/lower frequency electromagnetic field action. *Pall, 2015.*

Oxidative stress, single and double-strand breaks in cellular DNA, cancer, male and female infertility, lowered melatonin/sleep disruption, cardiac changes including tachycardia, arrhythmia, and sudden cardiac death, diverse neuropsychiatric effects including depression, and therapeutic effects are all biological responses to non-thermal exposures; pulsed fields are more active than non-pulsed fields in most circumstances and exposures within specified intensity windows have far more substantial biological impacts than exposures at lower or higher intensities. *Pall, 2015.*

The Biological Effects Chart was created using data from a comprehensive new evaluation of the medical research literature (which included 67 studies) on the biological effects of electromagnetic fields. *Bioinitiative Working Group, 2014.*

The data is strong enough to justify new public exposure guidelines based on low-intensity (non-thermal) exposure levels now recognized to be physiologically disruptive, as well as strong, interim preventative measures. *Herbert, 2013.*

The current research supports a biological action route of ultralow frequency and microwave EMFs, nanosecond pulses, and static electrical or magnetic fields: EMF activation of VGCCs leads to fast elevation of intracellular Ca2+, nitric oxide, and, in certain situations, peroxynitrite; the Ca2+/nitric oxide/cGMP/protein kinase G pathway could potentially mediate therapeutic benefits. *Pall, 2013.*

There may be a link between being exposed to a magnetic field and cell death. *Emre, 2011.*

Exposure of the whole body to pulse-modulated RF radiation, which is similar to that emitted by Global Systems for Mobile Communications (GSM) cell phones, can cause pathological changes in the thyroid gland. *Esmekaya, 2010.*

Time-varying electromagnetic waves have the potential to temporarily modulate the nervous system, especially when neuron populations are required to work together. *Thornton, 2006.*

Sperm DNA/motility

Fertility rates in the United States have dropped to new lows, and smartphone adoption is inversely related. *Franki, 2020.*

Wi-Fi causes oxidative stress, sperm/testicular damage, and neuropsychiatric effects such as EEG abnormalities, apoptosis, cellular DNA damage, endocrine alterations, and calcium excess. *Pall, 2018.*

Different non-thermal microwave EMF exposures produce a variety of neuropsychiatric effects. *Pall, 2015.*

RF-EMR enhances mitochondrial reactive oxygen species generation by human spermatozoa, decreasing the motility and vitality of these cells while stimulating DNA base adduct formation and, ultimately DNA fragmentation. These findings have clear implications for the safety of extensive mobile phone use by males of reproductive age, potentially affecting both their fertility and the health and wellbeing of their offspring. *De Illis 2013.*

Human sprm motility is reduced and sperm DNA breakage is increased when laptop computers are connected to the

internet via Wi-Fi. *Avendano, 2012.*

Statistical analysis of sperm head abnormality score showed that there was a significant ($p < 0.05$) difference in occurrence of sperm head abnormalities in test animals. The major abnormalities observed were knobbed hook, pin-head and banana-shaped sperm head. The occurrence of the sperm head abnormalities was also found to be dose dependent. *Otitoloju 2010.*

RF-EMR in cell phones reduces the motility and vitality of spermatozoa while stimulating the formation of basic DNA adducts and, ultimately DNA fragmentation. *De Iuliis, 2009*.

Vision

The shift to grayscale makes smartphones less satisfying and can help people control their smartphone use. *Holte, 2020.*

Several in vitro and animal studies have shown that blue and white LEDs can potentially cause retinal cell damage when exposed to high irradiance and for long periods of time; more research on the potential health effects of short- and long-term exposure to new and emerging lighting technologies is required. *ICNIRP (pp.549-561), 2020.*

Further research has supported amending the retinal thermal exposure limits in terms of spot size dependence, pulse duration dependence for short pulses, and wavelength dependence between 1,200 nm and 1,400 nm. *ICNIRP (pp.271-295), 2013.*

Cancer incidence statistics

Prenatal

Findings give new epidemiological evidence that high maternal magnetic field levels in pregnancy may raise the risk of asthma in offspring. *Li, 2011.*

Although the exact process is unknown, it is believed that pyramidal cell loss in the cornu ammonis could be caused by prenatal exposure to 900 megahertz electromagnetic fields. *Bas, 2009.*

Pediatric

A correlational relationship appears to exist between childhood exposure to extremely low frequency (ELF) magnetic fields (MFs) and melanoma during adulthood *Khan et al., 2022.*

Extremely low frequency (ELF) magnetic fields (MFs) re believed to yield carcinogenic effects; especially during childhood exposure *Khan et al., 2022.*

Review of scientific literature on effects of EMF on children concludes the following:

- The nervous systems of children are more vulnerable to the effects of electromagnetic waves than adults.
- The exposure to electromagnetic fields (EMFs) among children should be minimized.
- According to International Agency for Research on Cancer EMFs are possibly carcinogenic, it should not be overlooked or interpreted with bias. *Moon, 2020.*

Children's brains and eyes absorb higher doses of local radiation than adults and are therefore more susceptible to dangerous exposure. *Fernández, 2018.*

Autism Spectrum Disorders-related genes may have a role in not just basic aspects of ASD, but also vulnerability to

various chronic and systemic issues, such as cancer, metabolic abnormalities, and heart disease. *Wen, 2016.*

Exposure to electromagnetic radiation may trigger epigenetic changes in the neurological system, which can lead to neurodegenerative illnesses like autism. *Ahuja, 2013.*

The usage of cell phones by children is especially alarming since their thinner craniums allow RF waves from cell phones to reach brain tissue more easily than in adults. *Rosenberg, 2013.*

According to studies, children who used cell phones or were exposed to wireless radiation during the perinatal period were more likely to suffer from headaches. *Sudan, 2012.*

Teens

Research indicated that smartphone use significantly increases the risk of breast cancer and proximity of smartphone to breasts can lead to more negative effects *Shih et al., 2020.*

Mobile phones and other wireless devices have the potential to have negative health consequences for young people; wireless technology exposure has been linked to several neurodevelopmental and neurobehavioral abnormalities, with epigenetic drivers and genetic (DNA) damage presumably playing a role. *Sage, 2018.*

Wireless Expert Recommendations

American Academy of Pediatrics

American Academy of Pediatrics comment on the Proposed Rule "Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies" published in the Federal Register on June 4, 2013, requesting the FCC (Federal Communications Commission) to reassess impact of EMF radiation on children citing 3 reasons:

1) *Protect children's health and well-being*. Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.

2) *Reflect current use patterns*. The FCC has not assessed the standard for cell phone radiation since 1996. Approximately 44 million people had mobile phones when the standard was set; today, there are more than 300 million mobile phones in use in the United States. While the prevalence of wireless phones and other devices has skyrocketed, the behaviors around cell phone uses have changed as well. The number of mobile phone calls per day, the length of each call, and the amount of time people use mobile phones has increased, while cell phone and wireless technology has undergone substantial changes. Many children, adolescents and young adults, now use cell phones as their only phone line and they begin using wireless phones at much younger ages. Pregnant women may carry their phones for many hours per day in a pocket that keeps the phone close to their uterus. Children born today will experience a longer period of exposure to radio-frequency fields from cellular phone use than will adults, because they start using cellular phones at earlier ages and will have longer lifetime exposures. FCC regulations should reflect how people are using their phones today.

3) *Provide meaningful consumer disclosure*. The FCC has noted that it does not provide consumers with sufficient information about the RF exposure profile of individual phones to allow consumers to make informed purchasing decisions. The current metric of RF exposure available to consumers, the Specific

Absorption Rate, is not an accurate predictor of actual exposure. AAP is supportive of FCC developing standards that provide consumers with the information they need to make informed choices in selecting mobile phone purchases, and to help parents to better understand any potential risks for their children. To that end, we support the use of metrics that are specific to the exposure children will experience *AAP 2013*.

Government guidelines

International Commission on Non-Ionizing Radiation Protection

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) presents its principles for preventing adverse health effects from non-ionizing radiation exposure. *ICNIRP (pp.477–482), 2020.*

The radiofrequency EMF section of the 1998 Guidelines has been updated by ICNIRP; this document presents the revised Guidelines, which protect humans from EMF exposure ranging from 100 kHz to 300 GHz. *ICNIRP (pp.483-524), 2020.*

A review of the literature was conducted to identify potentially relevant knowledge gaps, and the goal of this statement is to describe data gaps in research that, if addressed, would aid ICNIRP in further developing guidelines and setting revised recommendations on limiting exposure to electric and magnetic fields; it is divided into two sections: the main document, which reviews the science of low frequency data gaps, and the annex, which explains the methodology used to identify the data gaps. *ICNIRP (pp.533-542), 2020.*

In 2013, The International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued guidelines on exposure limits for laser radiation with wavelengths ranging from 180 nm to 1,000 mm . Since then, the limits' application has revealed that some additional guidance is required for complex exposure cases. *ICNIRP (pp.543-548), 2020.*

BALANCED TECHNOLOGY MANAGEMENT INITIATIVES

Homes

Homes and families

Study showed life satisfaction and physical activity increased in both the reduction and abstinence group with effects stronger and lasting longer in the reduction group. *Brailovskaia et al., 2023.*

This paper reviews the impact of screen time on the development and cognition of children aged 6-12 years, highlighting discrepancies between current guidelines and recent research; it calls for updated policies and more effective management strategies to align with scientific findings and ensure balanced screen use. *Hastie, 2022.*

Adolescents in the intervention group did not show statistically significant changes in media rule engagement after completing a family media use plan. *Moreno, 2021*.

The *Media Sensory Curation Theory* considers media devices as instruments that humans employ to preserve sensory management by capturing and curbing sensory input in both constructed and natural surroundings; general sensory processing and media sensory curation have a moderate to strong relationship. *Harrison, 2019.*

30% of parents place at least one electronic device in their children's bedrooms associated with lower overall school readiness and social competence. Harmful effect was more prominent among lower socioeconomic families and could be partially alleviated with parental restriction. *Fu 2017.*

A four-week plan to reduce meltdowns, improve grades, and improve social skills by reversing the impacts of electronic screen usage. *Dunckley, 2015.*

Parental media monitoring has a protective effect on many different educational, social and physical outcomes of children. *Gentile, 2014.*

The *Fourth R Parent Media Violence Workshop* was created to teach parents about the need of setting boundaries for their children's media intake and to encourage parents to take care on their children's media consumption; following the training, parents implemented more stringent, appropriate restraints, and active monitoring methods. *Broll, 2013.*

Around 17% of teenagers had real-life interactions with online contacts, while 30% of their parents were unaware of it. *Van den Heuvel, 2012.*

This research examined the connections between information seeking, parental worries, threats children have faced, and access to connected devices, as well as the use and satisfaction with various digital safety tools. *Davis, 2012.*

Parental involvement

Parental communication about media use that supports autonomy is associated with fewer concealments of media use by young people. *Kroshus, 2021.*

When parents spend time with their children, smartphones can distract them from feeling a sense of social connection. According to these studies, having a constant Internet connection may have unnoticed consequences for the fabric of social life. *Kushlev, 2018.*

Parental media monitoring has protective effects on many different academic, social, and physical outcomes. *Gentile, 2014.*

Family Organization, Parental Support, and Parental Limiting were found to be significantly related to the dimensions of the children's executive functions. *Schroeder, 2010.*

Raising Parents book offers a systematic analysis of parental behavior as well as methods for recognizing and correcting poor parenting. *Crittenden, 2008.*

The amount of time parents spend linked to various forms of technology prevents them from building healthy, primary relationships with their children. *Flores, 2004.*

Support network

"Refuse to Use" is a global movement led by responsible and forward-thinking parents and teachers who want to ban all school-based technology for children under the age of 12 and replace it with tried-and-true teaching techniques. *Rowan, 2014.*

Schools

Schools of Tomorrow Edition XII conference titled A World of Tomorrow: From Darkness to Light. Session title:

Keeping Creativity Alive: A Tribute to Sir Ken Robinson. Panel discussion with Cris Rowan, Prof Dr Ger Graus, Lord Jim Knight, Lee Daley and Afshan Khalid. Date: 20 Nov 2020. *SOT Events, 2021.*

Screen management policies

In children and adolescents, screen time use has increased at an unprecedented rate, which has resulted in a variety of physical and psychological disorders that were virtually unheard of in previous generations; the time has come to actively challenge those systemic processes that initiate, encourage, and promote screen use in light of the vast body of scientific evidence demonstrating the wide range of pathology brought on by prolonged screen use. *Stolzer, Biocultural Analysys, 2021.*

This article on digital screens, apps and books is an invitation to further research into the role of digital content in the early development of literacy and provides "alerts" to further explore more the hidden potentials of new technologies and how routines such as book reading might change and become more effective in some respects. *Bus, 2020.*

With researchers advocating for increased services for children to address the rising prevalence of child mental illnesses, *McEwan, 2007*, and solid evidence that many of these disorders may be linked to technology overuse, it appears that routine technology screening and management programs should be implemented in the health and education sectors. *Rowan, 2010.*

"Below C Level" is a path for educational success from a veteran PBS and NPR reporter. The author describes the difficulties facing the American people and offers insightful analysis and solutions as he discusses teaching and learning from kindergarten to prison. *Merrow, 2010*.

Moderate use of digital technology for less than 2.5 hours a day is not inherently harmful and can be beneficial in a connected world. *Przybylski, 2017.*

Increased exposure to internet hazards was linked to children's online activity. *Lee SJ, 2012.*

Screens in schools

Technology's impact on education is mixed, with its effectiveness and adoption varying by context, and it may not address all educational challenges; policymakers should ensure technology use is equitable, evidence-based, and complementary to traditional teaching methods. *Global Education Monitoring Report, 2023.*

A survey of teens says that they receive a medium of 273 notifications in a day, with 23% arriving during school hours. *Common Sense Media. 2023.*

Many mothers are aware of AAP screen time guidelines but often do not adhere to them, with motivations including perceived educational benefits; increasing awareness and addressing misconceptions could enhance adherence. *Lammers et al., 2022.*

Study reports that school-related screen time should be meaningful, mentally or physically active, and service a specific pedagogical purpose that enhances learning. *Saunders et al., 2022.*

PISA 2022 reports 65% of U.S. students reported they get distracted by using digital devices and 59% said they get distracted by other students who are using those resources. These distractions show as strong correlation with lower academic performance (up to 15 points lower in math). *Program for International Student Assessment, 2022*.

According to a parent survey, children's behavioral outcomes were worse during distant schooling than in-person

schooling, with hybrid learning falling somewhere in the middle, i.e. better than remote but worse than in-person. *Hanno, 2022.*

NAEP study results showed from 2019-2022 for math: the largest deterioration in math achievement on record (5 points in grade 4, 8 points in grade 8) and for reading; 3-point reading slump same grades. "If left unaddressed, the life trajectories and opportunities of a whole cohort of young people could be permanently altered" NAEP. *National Assessment of Educational Progress, 2022.*

The study found that distance education has a detrimental influence on the mental health of students who exhibit depressive symptoms as well as difficulties with concentration and learning, which are the strongest predictors of poor academic achievement. *Giusti, 2021.*

Survey of 663 schools in all 50 states indicates that 96% of K-12 school apps share children's personal information with third parties, 78% of the time with advertising and data analytics entities without the knowledge or consent of the users or the schools, making them unsafe. *Internet Safety Labs, 2021.*

Results show that handwriting (compared with typing) produce faster learning and greater generalization to untrained tasks. Furthermore, only handwriting practice leads to learning of both motor and symbolic letter representations thus improving reading skill. *Wiley, 2021.*

Author highlights 5 areas of concerns regarding cell phone bans in schools: 1) technology addiction 2) digital distraction 3) cyberbullying 4) surveillance capitalism and 5) environmental sustainability of digital education. *Selwyn, 2020.*

It is high time to address why children spend too much time with screens in schools and how screen time use creates indirect media effects. *Montag, 2020.*

On average, edtech developer research showed improvements in test scores that were 70 percent greater than what independent studies found. *Barshay, 2019.*

The Canadian 24-Hour Movement Guidelines for Children and Youth recommend at least 60 min physical activity/day, < 2 hrs recreational screen time/day, and 9–11 hrs. sleep per night in children aged 8–11 years all associated with superior global cognition. *Walsh, 2018.*

Additional research is needed on the role of information processing in screen-based learning for young children. *Kirkorian, 2017.*

Research review showed better comprehension outcomes with print rather than with digital texts. The research attributes this to the disruptive effect of scrolling on screens. *Singer, 2017.*

In countries that have substantially invested in ICT for education, there have been no discernible gains in student achievement in reading, mathematics, or science. *OECD, 2015.*

Internet searches are performed more hastily with more difficulty recollecting search data in comparison to non-Internet-based searching e.g. encyclopedias. *Dong, 2015.*

Students who read texts in print scored significantly better on the reading comprehension test than students who read the texts digitally. *Mangen, 2013.*

Teachers on average teach handwriting 13 min. per day in primary grades. *Graham, 2008.*

Outdoor Schools

Free play, including risky play, is crucial for children's development but has decreased due to excessive safety measures; pediatricians are encouraged to advocate for balanced risk-taking to enhance physical, mental, and social growth, while ensuring all children benefit from safe play opportunities. *Beaulieu et al., 2024.*

Position statement by CPS states that free and risky play are essential for children's physical, mental and social development yet have declined recently due to safety measures; pediatricians are encouraged to think of outdoor risky play as one way to help prevent and manage common health problems such as obesity, anxiety and behavioural issues. *Beaulieu et al., 2024.*

This study examined playground equipment-related injuries in children from 1995 to 2019, revealing a decline in overall injury rates but a rise in concussions; climbing apparatuses were the most common cause, with injuries peaking in May and September. *Nabavizadeh et al., 2022.*

This paper outlines the creation of standardized terminology, taxonomy, and ontology for the field of play, learn, and teach outdoors (PLaTO) through the global PLaTO-Network (PLaTO-Net); the finalized model enhances interdisciplinary research and collaboration, supporting PLaTO's integration with environmental and health agendas while acknowledging ongoing evolution in the field. *Lee et al., 2022.*

Adventurous play, involving thrilling and risky activities, can help reduce childhood anxiety by teaching children to manage fear and uncertainty; by providing these learning opportunities, such play may decrease the risk of developing anxiety disorders over time. *Dodd et al., 2021.*

Study reports that children who play freely in the great outdoors are healthier in body and mind and active engagement with the natural environment reduces stress and relieves depression in all ages. Article recommends physicians prescribe outdoor play for children. *Bravender, 2020.*

Rural children are less sedentary and more physically active than urban children. *McCrorie, 2020.*

Covid-19 Outdoor Learning**.** Green Schoolyards America has put together a website for schools with focus on how to create outdoor schools to accommodate Covid-19 guidelines. Included are radio interviews, webinars, and handouts. *Green Schoolyards America.*

Exposure to green spaces can improve prosocial behavior in children and adolescents. *Putra, 2020.*

The toolkit helps Canadian practitioners promote safe, balanced outdoor play for children by providing tools to assess and manage risks. It emphasizes allowing kids to experience and navigate risks while ensuring legal and safety standards are met. *Gill et al., 2019.*

Nature exposure improves academic performance, personal growth, and environmental responsibility. *Kuo, 2019*.

Clinical report by AAP states "Children need to develop a variety of skill sets to optimize their development and manage toxic stress; research demonstrates that developmentally appropriate play with parents and peers is a singular opportunity to promote the social-emotional, cognitive, language and self-regulation skills that build executive function and a prosocial brain." *Yogman et al., 2018.*

Access to green spaces in or around workplaces increases work productivity as improves physical and mental health. Provision of structural and loose play equipment after a period of 6 months resulted in a 23.3% increase in children engaging in *moderate to vigorous* physical activity during recess and 26.2% increase in children engaged in *vigorous* physical activity. These increases were sustained at 1 year from baseline, with an increase of additional 17.2% for *moderate to vigorous* physical activity and 33.1% for *vigorous* physical activity. *Frost, 2018.*

Increasing risk and challenge in primary school playgrounds led to more peer interactions and greater happiness among children, with minimal negative outcomes except for increased pushing/shoving; this environment may foster resilience, as indicated by reduced reporting of bullying to teachers. *Farmer et al., 2017.*

The prevalence of ADHD, and thus the need for psychostimulant medications in growing children, may be reduced if we create play sanctuaries for preschool children, where they can play naturally with each other, facilitating frontal lobe maturation and the healthy development of pro-social minds. *Panksepp, 2008.*

Physical exercise is linked to seven different types of cognitive performance: perceptual skills, intelligence quotient, achievement, verbal tests, math tests, developmental level, and academic readiness. *Ratey, 2008.*

In both areas of impulse control and attention capacity, exposure to "green space" leads in a considerable reduction in ADHD. Nature not only helps with attention, but it also stimulates all of the senses, which helps with multi-sensory learning. *Taylor, 2001.*

Playground safety

More than 200,000 children are treated in hospital emergency rooms in the United States each year for injuries caused by playground equipment; the Public Playground Safety Checklist provides practical advice on how to make the local community or school playgrounds a safe place to play. *US Consumer Product Safety Commission.*

Environmental modifications minimize injuries by 50-75%, playgrounds can be built to be safe. *Howard, 2010.*

The Canadian Standards Association establishes playground guidelines and, if followed, reduce injury rates by half. *Howard, 2005.*

Falling from playground equipment is one of the risk factors for serious playground injuries; falling from a height of more than 1.5 meters onto an inadequate falling surface causes the majority of playground injuries. *Macarthur, 2000.*

Clinics

Mandatory screening for screen use

The author of this commentary recommends routine screening for abuse and neglect in children who present with mental illness. *Gordon, 2020.*

Parent education

Unplug – don't drug

Overuse of technology may result in child behavior diagnosis and subsequent use of psychiatric medication; the unique *"Unplug – don't drug"* policy initiative and routine technology screening highlights issues of concern for parents, family physicians, and offers a novel treatment approach. *Rowan, 2010.*

Government

Great need for more research demonstrating government initiatives to reverse the escalating trend of screen overuse.

Federal (educate, legislate, regulate tech giants; turn off internet for 8 hours during night)

Bill C-11: The Online Streaming Act became law on Apr. 27, 2023 and introduced Canadian content requirements for commercial streaming services and social media platforms to be implemented by the CRTC. *Government of Canada, 2023.*

Bill C-63: The Online Harms Act became law on Feb. 26, 2024 expanded Canada's hate speech laws and became one of NA's most rigid regulatory environments for media and social media companies. *Government of Canada, 2024.*

China gov't requires apps and app stores to build a "minor mode" into their products to restrict how long children can spend on their phones. *Zhuang et al., 2023.*

Municipal (subsidized pools, gyms, events)

Provincial/State (free access to parks, beaches, forests)

In an effort to resolve the problem of escalating child internet addictions, the South Korean government has initiated the Jump Up Internet Rescue School, a camp designed to treat Internet-addicted or online game-addicted children. *Koo, 2010.*

Researchers

Results showed that associations vary as a function of when digital technologies are used (i.e., weekday vs. weekend), suggesting that a full understanding of the impact of these recreational activities will require examining their functionality among other daily pursuits. Overall, the evidence indicated that moderate use of digital technology is not intrinsically harmful and may be advantageous in a connected world. *Prybylski, 2017*

Technology Production Corporations

Tech giants must be held accountable and make reparations for damage caused by screen overuse.

Age limit enforcement

Do no harm

Urgent need for Best Practice Guidelines for technology production to ensure children, youth and adult safety.

Funding provided for government initiatives for screen reduction

Warnings on products

Probable physical, social, emotional, mental and cognitive impairments.

WORKPLACE ERGONOMICS

Ergonomic Musculoskeletal Injury Prevention

WorkSafe BC. 2022. Handle with Care – Patient Handling and the Application of Ergonomic (MSI) Requirements. Free download retrieved from www.worksafebc.com, April 2023.

WorkSafe BC. 2022. Preventing Musculoskeletal Injury – A guide for employers and joint committees. Free download retrieved from www.worksafebc.com, April 2023.

WorkSafe BC. 2022. Understanding the Risk of Musculoskeletal Injury (MSI) – An educational guide for workers on sprains, strains and other MSI's. Free download retrieved from www.worksafebc.com, April 2023.

Exercise and Fitness

Canada 24-Hour Movement Guidelines. 2022. Retrieved from www.csepguidelines.ca on April 11, '23.

Mental Health

In any given year, 1 in 5 people in Canada will personally experience a mental health problem or illness and by age 40, about 50% of the population will have or have had a mental illness. *Canadian Mental Health Association* 2023.

Increased opportunities for interpersonal interactions at work through greater task interdependence are not enough to reverse the negative effects of workplace isolation on wellbeing. In contrast, an investment in a supportive environment may reverse the negative effects of workplace isolation on wellbeing, highlighting the importance of a supportive culture. *D'Oliveira 2023.*

Work-life balance was highest in the flexible standard and rigid standard schedules and lowest in schedules with high working time demands, namely the extended shift, rigid all-week, and rigid extended schedules. Employees with high working time demands and low control represent risk groups prone to impairments of well-being *Brauner C. 2019*.

Psychiatric Drugs informs law enforcement, legislators, policymakers, healthcare professionals, and educators about the risks of psychotropic drugs causing violent, illogical, and suicidal conduct, as well as the severe side effects of withdrawal. *Eastgate, 2018*.

Brain structural changes related to cognitive control and emotional regulation are associated with digital media addictive behavior. Screen time induced adhd-related behavior could be inaccurately diagnosed as adhd. Screen time reduction is effective in decreasing adhd-related behavior. *Lissak, 2018*.

More than four out of five adults in the United States say they check their email, messages, and social media accounts frequently or continuously a decade after cellphones, Facebook, and Twitter were introduced, resulting in higher stress levels for these Americans. *APA, 2017*.

Nature and Greenspace

Nature exposure improves academic performance, personal growth, and environmental responsibility. *Kuo, 2019*.

Synthesis suggested that passive nature exposure promotes positive changes in attention, memory and mood. *Norwood, 2019.*

It has been proven that spending at least 120 minutes per week in nature improves health and well-being. *White, 2019*.

These findings suggest that greenspace has a positive impact on a variety of health outcomes. *Twohig-Bennett, 2018*.

Access to green spaces in or around workplaces increases work productivity as improves physical and mental health. *Frost, 2018.*

Workers in green-certified buildings had 26.4% higher cognitive function scores and 30% fewer sick building symptoms than those in non-certified buildings, indicating that green certification provides extra health and productivity benefits. *MacNaughton et al., 2017.*

Posture

Single case of headache from using digital device resolved with deep breath and posture reset exercise. *Peper, 2021.*

Seventy-five percent of the participants reported some level of either chronic or acute back pain. Individuals with chronic LBP demonstrated a trend towards more static sitting behaviour compared to their pain-free counterparts. A greater association was found between sitting behaviour and chronic LBP than for acute pain/disability. *Bontrupa 2019*.

Study found that using a smartphone for more than 4 hours a day can have a negative impact on posture and lung function. *Jung, 2016.*

The forces on the cervical spine increase gradually as the neck is in forward flexion, as is often the case with the use of smartphones. *Hansraj, 2014.*

Postures utilized while holding mobile devices such as holding a phone vs texting are believed to impact muscle and thumb positions *Gustafsson, Johnson & Hagberg, 2010.*

When texting, female exhibit higher muscle activity in the extensor digitorum and the abductor pollicis longus; also having greater thumb abduction and fewer pauses in thumb movements *Gustafsson, Johnson & Hagberg, 2010.*

Productivity and Breaks

In order to preserve or improve upon employee well-being and work performance, breaks are necessary to recover from work demands, prevent burn-out and create a positive work-environment *Lyubykh et al., 2022.*

More frequent universal-type work breaks yield positive effects on both employee health and performance in stressful work environments and increase overall job satisfaction *Scholz et al., 2018*.

Building in frequent work breaks for highly demanding occupations have a significant impact on overall mood, cognitive performance and neurophysiological state when compared to those who also work in highly demanding work environments without frequent breaks *Scholz et al., 2018.*

Even when people manage to maintain constant attention - for example, avoiding the temptation to check phones – merely having these devices nearby diminishes available cognitive capacities; furthermore, people who are the most addicted to smartphones face the biggest cognitive consequences. *Ward, 2017*.

Within small worksite environments, frequent shorter work breaks and stretching exercises improved productivity, eye, leg and foot comfort *Henning et al., 1997.*

Technology Overuse

Gaming disorder is characterized by impaired control over gaming, increasing priority given to gaming over other activities to the extent that gaming takes precedence over other interests and daily activities, and continuation or escalation of gaming despite the occurrence of negative consequences. *WHO, 2022.*

Internet Use Disorder is a rapidly growing behavioral addiction; this condition has been linked to a number of structural and functional brain changes. *Darnai, 2022.*

Risky game users reported lower levels of happiness and satisfaction, as well as a significantly higher lifetime prevalence of major depressive disorder, alcohol dependence, and suicidal ideation; usual game players had a significantly higher lifetime prevalence of alcohol dependence and suicidal ideation. *Byeon, 2022.*

Short-term abstinence from gaming that is intentional and under control reduces Internet Gaming Disorder and improves mental health. *Brailovskaia, 2022.*

Among Internet Gaming Disorders, the five most commonly reported health-related variables are depression (67 times),

internet addiction (54 times), anxiety (48 times), impulsivity (37 times), and attention deficit hyperactivity disorder (24 times). *Darvesh, 2020.*

During the Covid-19 pandemic, Pornhub, one of the largest porn sites, saw porn use spike in many countries, with global traffic gaining more than 11%. *Mestre-Bach, 2020*.

Long-term internet pornography use resulted in erectile dysfunction and delayed ejaculation. *Park, 2016.*

Twitter usage leads to increased Twitter-related disagreements between intimate partners, which leads to infidelity, breakup, and divorce. *Clayton, 2014.*

A high amount of Facebook usage has been linked to poor relationship results. *Clayton, 2013.*

Communication quality in intimate relationships is significantly better in the Second-Life relationships than in 3D life and level of satisfaction is higher with virtual partners. *Gilbert, 2011.*

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