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Screen Use and Child and Adolescent Health in Canada: Triangulation of Evidence Assessing the State of the Effort

Mark S. Tremblay^{1,2,3} | Leigh M. Vanderloo^{1,4,5} | Travis J. Saunders⁶ | Sheri Madigan⁷ | Nicholas Kuzik¹ | Laura Heather⁴ | Nathan D. Zhang¹ | Madelyn Curle⁸  | Amanda Helleman¹ | Gary S. Goldfield^{1,2} | Alyssa Hall¹ | Kathleen Pajer^{1,9} | Michelle Ponti¹⁰ | Valerie Carson^{1,8} 

¹Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ontario, Canada | ²Department of Pediatrics, University of Ottawa, Ottawa, Ontario, Canada | ³Department of Health Sciences, Carleton University, Ottawa, Ontario, Canada | ⁴Research & Evaluation, ParticipACTION, Toronto, Ontario, Canada | ⁵School of Occupational Therapy, London, Ontario, Canada | ⁶Department of Applied Human Sciences, Charlottetown, Prince Edward Island, Canada | ⁷Department of Psychology, University of Calgary, Calgary, Alberta, Canada | ⁸Faculty of Kinesiology, Sport, and Recreation, University of Alberta, Edmonton, Alberta, Canada | ⁹Department of Psychiatry, University of Ottawa, Ottawa, Ontario, Canada | ¹⁰Department of Paediatrics, Western University, and Child and Parent Resource Institute, London, Ontario, Canada

Correspondence: Mark S. Tremblay (mtremblay@cheo.on.ca)

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ABSTRACT

Background: Excessive screen use in children and adolescents is an increasingly prevalent, pervasive and pressing public health issue in Canada. This project investigated the 'state of the effort' in relation to screen use and healthy development in children and adolescents in Canada.

Methods: Five investigations were employed to identify, describe, interpret and triangulate the current evidence, including a national opinion survey, environmental scan, school board policy scan, network analysis and text mining analysis of Canadian news headlines.

Results: Screen use and healthy child development is an important issue for Canadian parents ($n = 385$), and they believe schools (79%), governments (73%) and technology companies (71%) have a responsibility to promote safe use. Most policy documents found were relatively recent (2023+) with both provincial (e.g., educational settings with a focus on personal digital devices) and national scope (e.g., protecting children regarding online programming, content and privacy). Of the 38 largest school boards in Canada, 84% ban or restrict students' unnecessary use of mobile devices during classroom/instructional time and 42% block or restrict access to social media platforms. Linked network analysis clusters included health, research, advocacy, law, policy, education, environment and physical activity, with most partnerships being weak, indicating a suboptimal connection among these sectors. Dramatic increases in related media headlines were found in 2024 ($n = 1061$) compared with 2023 ($n = 400$), and most lexicon sentiments were negative.

Conclusion: Concerns over excessive and inappropriate digital screen use among Canadian children and adolescents have escalated recently. This work highlights that while there is much recent activity across sectors occurring in Canada, policy is lacking, and efforts lack coordination, cross-sectoral collaboration, and synergy, likely resulting in suboptimal impact.

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Summary

- Screen use and its potential impact on healthy child development is an important concern among parents in Canada.
- Many leaders, advocates and researchers across Canada are engaged with this issue.
- Evidence suggests that the amount of research, initiatives and policies is increasing.
- Media coverage of screen use and the healthy development of children and adolescents is increasing.
- School Boards across Canada are struggling with excessive and problematic small-screen (smartphone) use.
- Compared with some peer jurisdictions, Canada appears to be underachieving on responsible oversight of excessive and inappropriate screen use and related harms to children and adolescents.

1 | Introduction

Screen use has rapidly transformed how individuals interact with peers, family and society. The first mobile screen devices became publicly available in 2007 and by 2018, 42% of Canadian 0- to 4-year-olds and 77% of 14- to 15-year-olds owned their own smartphone (Brisson-Boivin 2018). Similarly, in 2010, when the iPad was introduced, only 1% of American children under 8 years of age owned their own tablet. By 2020, this number increased to 67% and continues to rise (Rideout and Robb 2020). Tablets and handheld devices have transformed screen use from a traditionally shared family activity (e.g., watching television together) into a predominantly solitary one, which can foster feelings of isolation in developing children and adolescents. The shift toward solitary screen use can also result in less parental supervision, which, in turn, may increase children's exposure to risks of harmful online exposures such as cyberbullying, viewing inappropriate content, sextortion and other harms (Berson 2003; Livingstone and Smith 2014; Khurana et al. 2015). These risks have amplified caregivers' concerns about the safety and well-being of children's and adolescents' online usage (Pew Research Center 2020).

Concurrent with pervasive shifts in device ownership are increases in screen use (referring to the quantity of time individuals spend on screen-based behaviours [e.g., smartphones, televisions, gaming consoles, computers and tablets]), concern about the quality and context of interactions with screens and an exponential increase in the amount of research studying the impacts of this increasingly ubiquitous behaviour (LeBlanc et al. 2017). Although countries around the world have developed or adopted screen use guidelines (Parrish et al. 2020; Tremblay et al. 2016; Chassiakos et al. 2016; Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019; Canadian Association of Optometrists, Canadian Ophthalmological Society 2018; Bull et al. 2020; Saunders et al. 2022), research shows that across all age groups, screen use far exceeds the recommended guidelines (Carson et al. 2017; McArthur et al. 2022). Recent studies

suggest that Canadian adolescents now average seven or more hours per day of screen use, almost four times higher than national recommendations (Poirier et al. 2024), with large and significant increases seen since 2018 (Poirier et al. 2024; Saunders and Colley 2024). For context, a widely cited systematic review published in 2016 used ≥ 5 h/day as the most excessive category for daily screen time (Liu et al. 2016), an amount that is now several hours per day below the average daily screen time reported in more recent Canadian samples (Poirier et al. 2024).

A growing body of research has documented associations and causal links between screen use and a variety of adverse health outcomes, such as poor sleep, increased risk of obesity and mental health problems (Fang et al. 2019; Eirich et al. 2022; Carter et al. 2016; Davis and Goldfield 2024; Hunt et al. 2018; Radesky and Christakis 2016). Moreover, high or excessive non-educational digital media exposure is associated with negative effects on early child development (Radesky and Christakis 2016), language and executive functioning (Anderson and Subrahmanyam 2017), cognition (Walsh et al. 2018), brain development (Hutton et al. 2024), weaker peer-to-peer connectedness (O'Day and Heimberg 2021; Zhang et al. 2022) and poorer parent-child relationships (Zhu et al. 2022). This collective evidence and related concerns have been reinforced with recent authoritative books (Haidt 2024), reports (Bennett 2024) and proclamations (Murthy 2024). While responsible digital media use has been associated with positive outcomes (e.g., digital literacy, peer connections among equity-denied individuals), the preponderance of evidence related to excessive digital media use calls for efforts to mitigate harm.

Recently, several initiatives led by advocacy groups such as Fairplay for Kids (United States), the Five Rights Foundation (United Kingdom), the Children and Screens Institute for Digital Media and Child Development (United States) and the Sedentary Behaviour Research Network (International) have gained momentum, attention and impact. These organizations advocate for children's rights in navigating the digital screen landscape and creating a safer online environment for youth by promoting digital awareness and citizenship. They also call on governments to enforce increased regulations protecting young users from online harms. Their collective actions are shaping policy discussions globally and raising awareness about the urgent need to safeguard children and adolescents in a rapidly evolving (and largely unregulated) digital world.

While substantive initiatives to coordinate and maximize impact are underway in other countries, such efforts in Canada still need to be made. Accordingly, in November 2023, a group of concerned researchers, practitioners, policymakers and advocates from Canada, as well as international representatives from Fairplay for Kids, the Five Rights Foundation, the Children and Screens Institute for Digital Media and Child Development, and the Sedentary Behaviour Research Network convened to discuss potential strategies for a more impactful path forward in Canada that could help protect Canadian children from online harms and related adverse health and developmental consequences of excessive and inappropriate digital screen use. This meeting highlighted the lack of action on this issue in Canada to date, and the insufficient readiness of policymakers and advocacy groups to respond

proactively to the harms of excessive and inappropriate screen use among Canadian children and adolescents. Despite notable Canadian leadership in this field (e.g., 24-Hour Movement Guidelines (Tremblay et al. 2016), International School-Related Sedentary Behaviour Recommendations (Saunders et al. 2022), Canadian Paediatric Society digital media recommendations (Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019)), there was a strong consensus that Canada must elevate its efforts. This shared realization served as the impetus for this manuscript.

The overall objective of this paper was to comprehensively investigate the ‘state of the effort’ as it relates to screen use and healthy development among children and adolescents in Canada. It is meant to serve as a foundational document propelling researchers and policymakers to action on this issue. To achieve this broader objective, we employed several strategies to gather evidence to understand, describe, and triangulate the state of the effort in Canada.

2 | Methods

This paper consolidates evidence from five related information-gathering initiatives (‘substudies’) as described below. The five substudies were employed to provide a holistic socioecological assessment of the state of the sector by examining multilevel and multisectoral evidence from Canadian adults and parents, influencers, governments, schools and media. We deliberately combined these into one paper to conduct an in-depth examination of the state of the effort from multiple angles. We included details of the substudies in Supplemental Files to keep the manuscript size manageable.

2.1 | National Opinion Survey

A total of 1600 adults (385 parents) living in Canada were recruited from the Angus Reid Forum by MARU/Matchbox (a global market research and data science firm) in May 2024. This forum included over 100 000 participants who had already consented to participate in survey research before joining the panel. The panel is comparable with the Canadian census regarding age, sex, regional representation, income, employment and language spoken. After completing a survey, panellists generally receive a small token of appreciation (\$0.50–\$3 CAD). Once enrolled in the Angus Reid Forum, recruited panellists consented to participate in invited surveys or panel discussions. Ethical approval was not needed according to articles 2.4 and 5.5 of the Tri-Council Policy Statement (TCPS2) regarding the ethical conduct of human research reporting on secondary analyses of minimal risk and anonymous data (Canadian Institutes of Health Research 2022). Respondents provided informed consent through participation. The survey was commissioned by ParticipACTION, a not-for-profit, charitable physical activity promotion organization (www.participaction.com).

This survey was administered to adults (including parents) living in Canada to solicit opinions on the recent release of the ParticipACTION Report Card on Physical Activity for Children

and Youth (ParticipACTION 2024). It included questions focused on awareness of the product and its key messages, and other questions related to children’s physical activity, sedentary behaviours and sleep. To get a ‘pulse check’ on the nation, a short module on screen use in children was also included in the survey. Respondents were informed that screen time refers to the time spent on screen-based behaviours and can be accumulated on large (e.g., TV), medium (e.g., computers, tablets) and small (e.g., smartphones) screens in various settings, such as home and school. The entire sample was asked about their level of agreement on a 5-point scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) with the three statements:

- I feel schools need to help children use screens safely and in moderation (e.g., no screens during lunch/snack and indoor recess).
- I feel governments need to help children use screens safely and in moderation (e.g., school cell phone bans and age restrictions on social media).
- I feel broadcasting (e.g., Netflix, YouTube) and tech companies (e.g., Facebook, TikTok) need to help children use screens safely and in moderation.

If the respondent was a parent, they were also asked their level of agreement on the following items:

- My child’s screen time use is a concern to me.
- I find it challenging to limit my child’s screen time.
- It is a priority for me to limit my child’s screen time.
- I feel limiting my child’s screen time is important to support optimal development.

2.2 | Environmental Scan

2.2.1 | Eligibility Criteria

An online environmental scan was completed to identify information surrounding screen use policies/regulations/legislation related to healthy child development. To be eligible for the environmental scan, documents had to be: (1) legislation, regulation, bill, or public policy created by a municipal, provincial, or national agency in Canada; (2) available in English or French; (3) inclusive of those <18 years; and 4) related to screen time, digital media, and/or social media. The following definitions were used:

- Legislation: “written law that provides rules of conduct” (<https://www.justice.gc.ca/eng/laws-lois/index.html#:~:text=Legislation%20is%20a%20written%20law,put%20new%20ones%20in%20place,n.d.-a>).
- Regulation: specific laws to “carry out the purposes of general laws or expand on them and have the force of a law” (<https://www.justice.gc.ca/eng/laws-lois/index.html#:~:text=Legislation%20is%20a%20written%20law,put%20new%20ones%20in%20place,n.d.-b>).
- Public policy: “a strategic action led by a public authority in order to limit or increase the presence of certain

phenomena within the population” (https://www.nchpp.ca/docs/Guide_framework_analyzing_policies_En.pdf, "n.d.).

- Screen time: “*time spent on screen-based behaviours* (Tremblay et al. 2017) or *time spent with any screen, including smartphones, tablets, television, video games, computers, or wearable technology*” (Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019).
- Digital media: “content transmitted over the Internet or computer networks on all devices, unless particular ones are specified” (Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019).
- Social media: “any online resource that is designed to facilitate engagement between individuals” (Bishop 2019).

2.2.2 | Information Sources and Search Strategy

A template for applying systematic review search methods to grey literature (Godin et al. 2015) and input from a librarian with systematic review expertise informed the search plan for this environmental scan. The plan included four search strategies: (1) grey literature database(s); (2) customized Google search engines; (3) targeted websites; and (4) consultation with experts. Searches were conducted between June 2024 and September 2024.

For the first search strategy, one relevant database, the Canadian Public Policy Collection, was searched between June and July 2024 by one researcher. See Table S1 for the specific search strings used. For the second search strategy, one researcher searched two customized Google search engines created by the librarian between June and July 2024. The first search engine captured websites of provincial and national capitals and other major cities (e.g., Vancouver, Calgary, Montreal, Toronto, Saskatoon). The second search engine captured provincial and territorial websites. See Table S2 for the specific search strings used. The first 20 pages or 100 results were screened for each search as recommended by the librarian. For the third search strategy, the co-author team identified relevant websites that would not have been identified in the second search strategy and these were manually searched by one researcher between July and September 2024. See Table S3 for a list of websites searched. For the fourth search strategy, one researcher contacted experts in July 2024 who were identified in the screen time network analysis outlined later in this section, to suggest related resources. The email included a brief overview of the project and the eligibility criteria for resources.

Initial screening for the first three search strategies involved reviewing titles and the short text underneath titles, where applicable. For search strategy three, initial screening sometimes led to additional searches (e.g., searching for a policy document noted on the initial website). This screening was completed by the researcher who completed the search. Potentially relevant records were bookmarked, and the title, organization and URL (if applicable) were recorded in Excel. Duplicates were removed after compiling all potentially pertinent records from

all four search strategies into Excel. Next, between August and September 2024, one researcher screened the table of contents, headings, summary or abstract of potentially relevant records. Reasons for exclusion were noted for records that did not meet eligibility criteria. Finally, the full text for each remaining record was screened and reasons for exclusion were noted. One researcher competed the screening because of timeline and budget constraints. A second researcher checked the final documents that were included.

2.2.3 | Data Extraction

One researcher extracted and recorded document characteristics in Excel in September 2024. These characteristics included the name, source, URL (if applicable), date or year, level of government, setting and focus.

2.3 | School Board Policy Scan

A policy scan of Canadian school boards was conducted between July and August of 2024 to identify board policies related to screen time, digital/social media or cell phone use within schools. An initial internet search of all school boards and districts within Canada yielded 383 boards. School boards were then ranked by size (i.e., number of schools within the board) where the top 10% ($n=38$) were selected for further scanning (see Table S4). Websites of the 38 school boards or related media releases were searched for policies relating to student (and if applicable, staff) cell phone usage or social media use. Relevant information that was extracted for each board is presented in Table S5. Because of recent policy changes across many provinces regarding mobile phone use and social media access in schools, an additional scan was conducted to include updated policies issued/published at the beginning of the school year (September 2024).

2.4 | Screen Use Network Analysis

A network analysis methodology was employed as a visual tool to identify and analyse the relationship between key players (organizations or individuals) in the field of screen use and children and adolescents in Canada. Gephi (version 10.1) was used for network visualization purposes, general analyses and measuring network properties (Bastian et al. 2009).

2.4.1 | Data Collection and Processing

A database of key players was created with members identified through word-of-mouth and current social and professional networks. The consolidation of the network is presented visually and consists of both nodes (circles) and edges (lines). Each node represents an organization or individual and is classified by sector. The sectors include health, research, law, education, policy, environment, advocacy, physical activity and others that do not fit into the above categories. While many key players fall into numerous sectors, for the purpose of this analysis, only the primary sector of each organization

or individual was included. Included in the dataset were the names (key players), locations, sector representation (type and attribution), strength of the relationship between players and level of reciprocity for each organization or individual contained in the list.

2.4.2 | Data Analysis

The network analyses were conducted between April and August 2024. Once the database was imported, Gephi extracted every unique player in the dataset to build a node list—an inventory of every node (circle) that appears on the network diagram. Every node was assigned a unique ID, which by default was the same as the node name. A bimodal network graph was created, whereby a node was created for each organization or individual. The edges represent the strength of the relationships between nodes based on their weight and determined by average contact frequency within the last year. The weights of the connections were assigned a number from one to five and ranged from very weak, weak, moderate, strong and very strong. New contacts or non-existent connections were included but not assigned a weight. The darker edges represent a greater weight, equating to a stronger partnership with the respective node, whereas the lighter-coloured lines demonstrate weaker partnerships. Solid lines indicate bi-directional relationships, whereas arrows demonstrate unidirectional relationships.

Modularity (using the Louvain method) was calculated to identify groupings of sector organizations that had the most or least in common (Lu et al. 2015). High modularity suggests there are dense connections between nodes in the same cluster and few connections to nodes in different clusters. Once modularity was calculated, nodes were coloured according to their clusters (i.e., communities), which permitted the visualization of the factors that bound them together into communities. In other words, organizations or individuals that had the most in common were assigned the same colour based on sector attribution/representation.

2.5 | Media Text Mining

A systematic review and text mining analyses were conducted to examine the major issues in Canadian news headlines related to children's screen use since 2020. Generally, text-based analyses consisted of sentiment analyses to examine the general sentiment and emotions associated with the news headlines, and results were visualized using word clouds.

2.5.1 | Systematic Review

Three databases were searched for relevant news headlines (ProQuest Canadian Major Dailies, Factiva, and Eureka) from 1 January 2020 to 1 August 2024 (see Table S6 for Search Strategy). Headlines were included if they were related to screen use issues, potential harms, benefits and usages for children, adolescents, parents, families, schools, communities, governments, policies or any domain that could influence children's or adolescents' screen use. Headlines also needed to be in English and from a Canadian publisher. Headlines not

explicitly discussing screen use issues, or not relevant to children and/or adolescents, were excluded (e.g., a headline about a new TV program without mentioning the program is targeted at children). All headlines were screened by two reviewers, and inclusion or exclusion discrepancies were resolved through discussion and agreement. Headlines were manually checked for duplicates. While some headlines were syndicated in multiple newspapers, these were not considered duplicates since syndicating an article could demonstrate more interest in a certain story or topic.

2.5.2 | Data Analysis

Data were imported into RStudio (R Core Team 2024) and manual de-duplication was confirmed using automatic de-duplication. Cleaning or transforming the text was conducted to standardize words into meaningful and common data points. Specifically, stopwords (e.g., conjugations) were removed, whitespace was trimmed, all words were converted to lowercase, alphanumeric numbers were removed, punctuation was removed and words were stemmed to their base using Porter's stemming algorithm (Feinerer 2024; Porter 1980). While stemming reduces words to their common base, the algorithm can produce meaningless (e.g., suing is stemmed to *su*) and erroneous stems (e.g., *busi* is the stem for business and busy). Thus, any stem with a frequency ≥ 10 was manually transformed to meaningful and distinct stems (e.g., *su* transformed to *sue*, *busi* transformed to *business* or *busy* depending on the original term). Sentiment analyses were conducted using two lexicons: Bing (Hu and Liu 2004) and the National Research Council (Mohammad and Turney 2013). The Bing lexicon classifies words into either negative or positive sentiments, while the NRC lexicon classifies words into 10 emotions (anger, anticipation, disgust, fear, joy, negative, positive, surprise, sadness, trust). Across all headlines, the total frequencies of sentiments were calculated based on the Bing and NRC lexicons. Finally, word clouds were generated as ungrouped and grouped by lexicon sentiments to visualize the most used words and their sentiments/emotions.

3 | Results

3.1 | National Opinion Survey

Results from the National Opinion Survey show that among the full sample ($n = 1600$, including adults with and without children) and parent sub-sample ($n = 385$), approximately three quarters agree or strongly agree that schools, governments and broadcasting/tech companies need to help children use screens safely and in moderation (Table 1). The level of support is generally consistent across parental gender and age groups (see Table 1). Results are the proportions of respondents who agreed or strongly agreed with each statement and clearly show that screen time-related issues are a concern, particularly among Canadian parents. More than 8 out of 10 parents believe that limiting their child's screen time is important to support optimal development and a similar proportion considers it a priority. Nearly two-thirds of parents report their child's screen time is a concern to them and a majority consider it a challenge to limit their child's screen time.

TABLE 1 | Results of the national opinion survey for parent respondents ($n = 385$). Percentages represent the weighted (by age, gender, region to ensure a representative sample) proportion of respondents who agreed or strongly agreed with each statement.

Statement	Overall $n = 1600$	Female $n = 877$	Male $n = 714$	18–34 years $n = 224$	35–54 years $n = 607$	55+ years $n = 769$	Parents only $n = 385$
I feel schools need to help children use screens safely and in moderation	78%	78%	78%	78%	75%	80%	79%
I feel governments need to help children use screens safely and in moderation	70%	70%	72%	72%	66%	73%	73%
I feel broadcasting and tech companies need to help children use screens safely and in moderation	70%	71%	70%	73%	64%	73%	71%
Parent sample	$n = 385$	$n = 218$	$n = 164$	$n = 87$	$n = 262$	$n = 36$	
I feel limiting my child's screen time is important to support optimal development	83%	83%	82%	80%	84%	83%	
It is a priority for me to limit my child's screen time	77%	80%	75%	82%	75%	77%	
My child's screen time use is a concern to me	63%	57%	68%	67%	59%	64%	
I find it challenging to limit my child's screen time	57%	53%	61%	57%	57%	65%	

3.2 | Environmental Scan

Figure 1 is a summary flow diagram of the identification, screening, eligibility and inclusion of documents. Through the four search strategies, a total of 144 potentially relevant records were identified once duplicates were removed. After reviewing tables of contents, headings, summaries or abstracts, 101 documents were excluded, leaving 43 documents for full text review. After the full text review was completed, 13 documents were found to meet the eligibility criteria.

Characteristics regarding the 13 included documents can be found in Table S7. Ten of the documents were released, including some amended versions, in 2023 or later. A total of six documents were from provincial governments (Newfoundland and Labrador, Nova Scotia, Prince Edward Island, Ontario, Saskatchewan, British Columbia) and the remaining seven were national in scope. The primary setting of provincial documents was schools or education with a focus on personal mobile or digital devices as well as digital citizenship/cyber-bullying. The primary focus of national documents was protecting children regarding online programming and news content, sexually explicit material, electronic data and personal device recording.

Overall, there was limited evidence of inter-jurisdictional collaboration or cooperation to enhance efficiency or create inter-jurisdictional synergy or avoid duplication of effort. There were directives from provincial governments (e.g., Ontario, British

Columbia, Saskatchewan) for schoolboards to create screen use policies, which coordinated, but did not avoid duplication of efforts. Notably, the Education Minister's directive from Prince Edward Island was more complete, with policy documents written up for use by all school boards. From the Environmental Scan, there were many similar documents (especially regarding policy recommendations) at municipal, provincial, and national levels with common themes but limited collaboration.

3.3 | School Board Policy Scan

Detailed results of the school board policy scan are presented in Table S5. A scan of the 38 school boards revealed that 84% of boards ban or restrict students' use of mobile devices during classroom/instructional time, unless otherwise permitted for educational or health reasons. Of these boards, 75% provide age/grade-related guidelines regarding using personal mobile devices outside of instructional time (i.e., lunch/breaks). Of the school boards without a ban/restriction on mobile devices, four delegated the decision regarding students' use of mobile devices to individual schools (i.e., principal or classroom teacher) and one board imposed students' self-regulated use of devices during instructional time. Two boards encouraged students to bring their own devices.

Regarding social media restrictions, 42% of boards block or restrict access to some or all social media platforms on school devices and Wi-Fi; 29% of boards promote students' responsible use of social

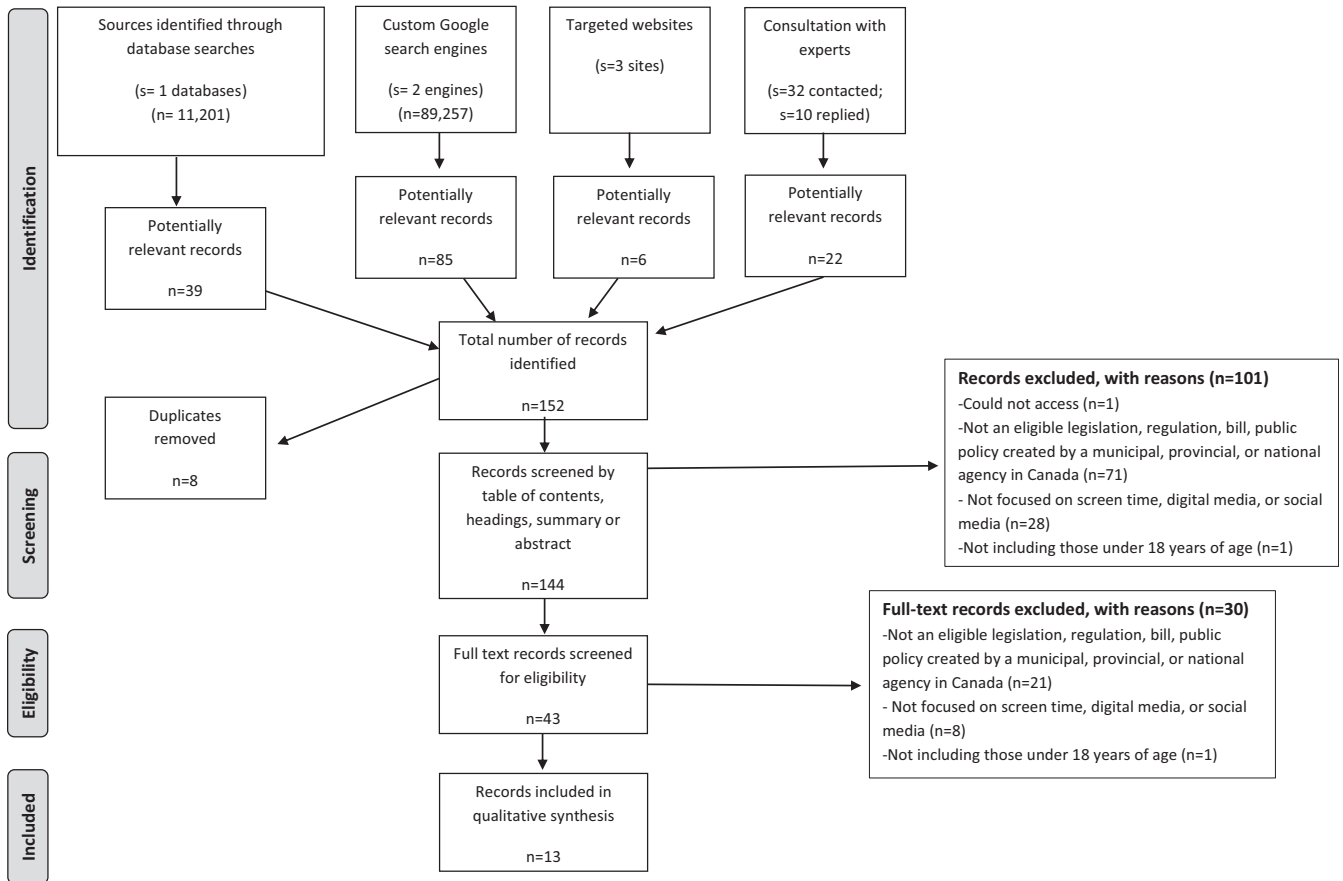


FIGURE 1 | Flow diagram for the identification, screening, eligibility and inclusion of environmental scan resources.

media or encourage the use of social media for educational purposes. Three boards delegated decisions regarding social media access to individual schools, and 10 boards did not provide any policy regarding social media access. Of the 38 school boards reviewed, it is notable that five Ontario boards included in this scan have joined the recent class-action lawsuit against tech giants Meta, Snapchat and TikTok (Schools for Social Media Change, *n.d.*).

3.4 | Screen Use Network Analysis

The results of the linked network analysis included 43 entries (organizations or individuals) identified through the convenient solicitation of key players through known networks and author contacts. The results highlight the strength of relationships among numerous organizations and individuals linked to children's screen use in Canada (Figure 2). The nodes represent the organizations or individuals and are classified by sector, which form clear clusters. At first glance, these clusters demonstrate that most partnerships are in the research and health sectors, representing 39% and 23% of all nodes, respectively. While the health sector makes up a significant portion of all nodes, 50% of the relationships can be categorized as weak, very weak or non-existent. This contrasts greatly in comparison with the research sector where 65% of all partnerships are either very strong, strong or moderate. The remaining sectors of advocacy, law, policy, education, environment, physical activity and others comprise 37% of all nodes, with 69% of all relationships categorized as weak, very weak or non-existent. This might indicate a possible underutilization in these sectors

in terms of current or future partnerships between key players. While most partnerships are in the research and health sectors, this network map allows us to see the other potential key players in the field of screen use and children in Canada. A focus on broadening the network in terms of the inclusion of various sectors could improve the expertise engaged in advancing programs, research and policies in the field of screen use and children in Canada.

The average degree for this network map is 7.9, which indicates the average number of relationships between two key players. Further, numerous isolated nodes can be seen on the network map, contributing to its density of 0.188. This illustrates an opportunity to re-evaluate the current partnerships among key players, their respective contributions toward one another and how impactful changing those partnerships would be moving forward. Modularity is another important aspect to include, as it helps identify the presence of community structures. The network analysis' modularity can be seen as poor to fair, with a score of 0.187, indicating that the network does not have a significant community structure.

3.5 | Media Text Mining

3.5.1 | Systematic Review

After searching the three databases, 6001 headlines were imported for screening. After the screening, 3450 headlines remained and de-duplication reduced the final number to 2458.

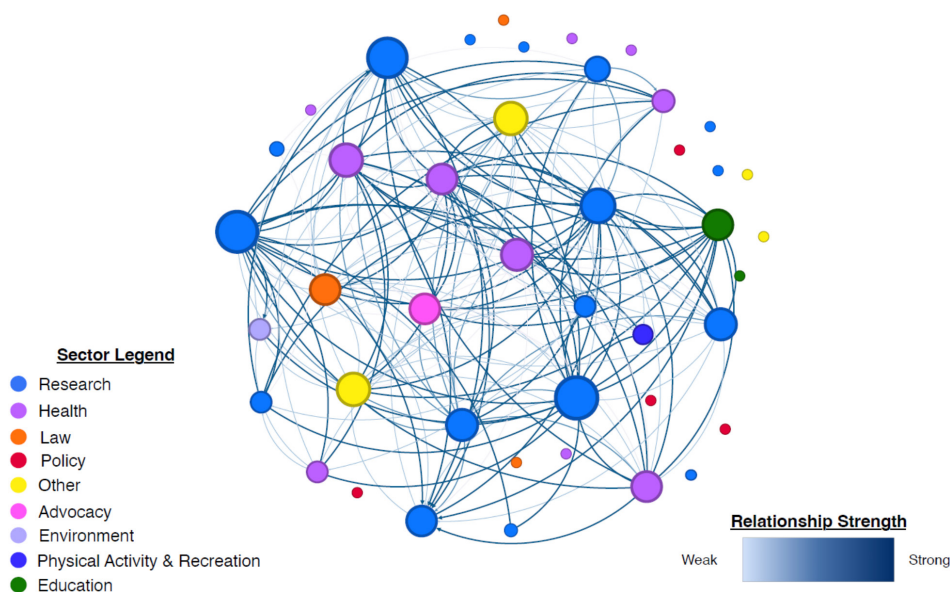


FIGURE 2 | Linked network map of key organizations/individuals (de-identified) involved in screen use and healthy development of children and adolescents in Canada. Nodes represent organizations/individuals (colour-coded by sector representation) and line density represents the strength of inter-node relationships.

Removing syndicated duplicates resulted in 1759 headlines, but 2458 headlines were used for further analyses. Two to three times more headlines were printed in 2024 ($n=1061$) compared with 2023 ($n=400$), 2022 ($n=292$), 2021 ($n=356$) and 2020 ($n=349$), suggesting a recent burst in interest and coverage of the issue.

3.5.2 | Data Analyses

After cleaning and transforming the data, there were 27680 total words (also called tokens) and 3103 unique words. The main sentiments according to the NRC lexicon were Trust (15.9%), Positive (15.3%) and Negative (14.5%). The Bing lexicon classified 75.8% of words as Negative (Table S8). The three most frequently classified words for the NRC lexicon were School (Sentiment: Trust), Board (Sentiment: Anticipation) and Youth (Sentiments: Anger, Anticipation, Fear, Joy, Positive, Surprise; Table S9). For the Bing lexicon, the three most frequently classified words had negative sentiment alone and consisted of Sue, Allege and Harm (Table S9). Word clouds without lexicon classification and classified with the Bing and NRC lexicons are presented in Figure 3.

The integration of findings from the five substudies provides reinforcing evidence from various levels of influence to triangulate concern and support urgent action as explained further in the discussion.

4 | Discussion

We employed five separate, complementary methodologies to create an informed overview of the state of the child and adolescent screen use effort in Canada as it relates to healthy development. In summary we found (i) that screen use and healthy child development is an important issue for Canadian parents and they believe schools, governments and technology companies have a responsibility to promote safe use, (ii) most government policy

documents found were relatively recent, (iii) most school boards in Canada ban or restrict students' unnecessary use of mobile digital devices during instructional time and many block access to social media platforms, (iv) leaders and influencers in this space cluster around health, research, advocacy, law, policy, education, environment and physical activity, but with suboptimal connections among these sectors, (v) dramatic recent increases in related media headlines with predominantly negative sentiments. These findings reinforce and support one another, providing compelling collective evidence that screen time and child and adolescent health is on the minds of Canadian adults reinforced by now omnipresent media coverage, is of interest to leaders across many isolated/disconnected sectors, is requiring school policies to manage, and is just starting to result in government policies, strategies and regulations.

We wove the findings together to triangulate the current evidence, as illustrated in Figure 4A, and generally found the situation illustrated in Figure 4B. That is, our results indicate there is strong converging evidence that groups and individuals within and across various sectors want to protect children and adolescents from the harms of excessive and inappropriate screen use. However, in Canada, the absence of coordination, leadership and unified strategies has resulted in isolated efforts, undermining the output and impact of the work. In line with the fundamental responsibility, *primum non nocere* (first, do no harm), we recognize the need for a more cohesive approach that helps to safeguard children's digital well-being.

Our results suggest that most parents in Canada see limiting screen time as important for children's health and development. This perspective is supported by a growing body of research evidence linking screen use with poorer health and functioning for children (Rideout and Robb 2020; Berson 2003; Livingstone and Smith 2014; Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019; Canadian Association of Optometrists, Canadian Ophthalmological Society 2018;

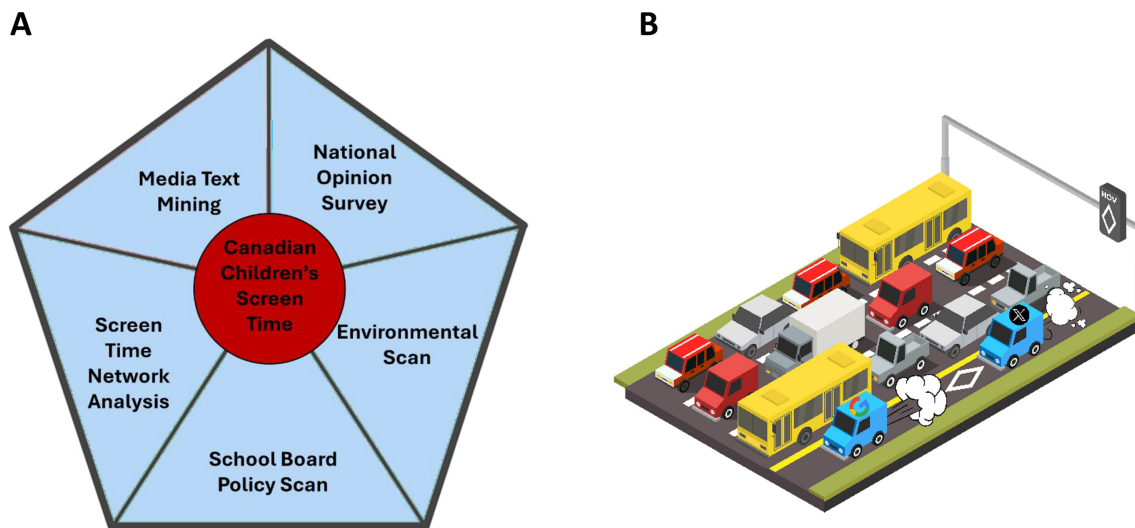


FIGURE 4 | (A) Illustration of the five sub-studies providing triangulated evidence related to Canadian children's screen use. (B) Traffic flow illustration of the state of the effort in Canada with respect to screen use and healthy child development. Grey cars (families), red SUVs (researchers), red vans (not for profit organizations), grey trucks (health authorities), grey moving truck (Federal Governments), and yellow school buses (school boards) all travelling separately and alone, stuck in traffic in the three general lanes—competing with each other for space and moving slowly and inefficiently. Blue vans (technology giants) moving quickly in the one high occupancy vehicle (HOV) express lane.

children through screen use guidance, policies, regulations, legislation and even litigation at the national, provincial, community and school board levels. Despite all the concern, passion and scattered efforts, our network analysis demonstrated a lack of coordination, centralized leadership and advocacy organization, leaving our isolated efforts underachieving in Canada.

Each level of government in Canada has specific areas of responsibility, with education and healthcare falling under provincial/territorial responsibility, and the federal government overseeing issues related to international relations and public safety. For this reason, the federal government should focus on issues that fall under these domains and set national policies to ensure that corporations that provide online services are doing so in a way that promotes health and public safety. Although education falls under provincial authority, provincial/territorial Departments of Education could enhance collaboration with one another to share successful approaches and promote consistency across jurisdictions. Additionally, working more closely with the Federal Government and national education associations (e.g., Canadian Association of Principals, Canadian School Boards Association) would facilitate better communication, increased awareness and support coordinated policy reform, resulting in a more unified approach to educational goals nationwide. The Joint Consortium for School Health (<https://www.jcsh-cces.ca/>), which includes representation from provincial/territorial and federal governments, may be an ideal group for this sharing to take place.

Many efforts and policies in Canada are implemented at a school board level, resulting in tremendous duplication of efforts. This is not only inefficient but also creates potential conflicts resulting from differing policies or policy implementation. Many provinces issued cellphone and other mobile device policies only at the start of the 2024–2025 school year, demonstrating the issue's timeliness in Canada. Because many school-based policies are new, it is currently unknown how effective these

mandate-informed school board policies will be in regulating students' screen use in school and beyond. In addition to variation in school board approaches to provincial mandates *within* a province, there are discrepancies in provincial mandates *between* provinces that can contribute to inefficiencies and redundancies, as well as conflicts and distractions related to different interpretations or applications of provincial mandates. Some provinces provide central support and guidance, while others do not (see Tables S5, S7).

An example of a successful approach may be taken from the province of Prince Edward Island, which used a Minister's Directive to update policies related to the use of cell phones in schools at all levels province-wide (Jameson N. Minister's Directive No. MD 2024-06 2024). This change was made prior to the start of the 2024–2025 school year, giving all stakeholders (students, parents and teachers) the ability to adapt and prepare for the changes. Although a new policy change, the initial rollout was well received by stakeholders (<https://www.cbc.ca/news/canada/prince-edward-island/pei-student-cellphone-ban-doran-1.7348392>, n.d.). An inter-sectoral conference is planned to develop guidelines for ensuring the greatest uptake and best use of other types of screens in the classroom, as well as and ways to minimize the harms of screen use outside of the classroom.

Variation in screen time policies and approaches is equally visible in the childcare environment. Canadian researchers conducted a review of provincial/territorial childcare legislation in Canada (Vanderloo et al., 2025). Only three provinces/territories stated requirements for sedentary behaviour/screen time (New Brunswick, British Columbia, Quebec). Quebec and British Columbia advised limiting screen time, with British Columbia providing a maximum duration of 30 min/day and limits to prolonged sedentary behaviour. British Columbia also prohibits the inclusion of screen time activities in two cases: daily programs that are less than 3 h and if children are younger than 2 years. While not the only solution to creating more supportive

childcare environments for young children with screen time in childcare, failing to ratify or amend these regulations to include behaviour-specific recommendations may be a missed opportunity to prioritize healthy behaviours for young children in care. Attention is warranted to prioritize this on the political agenda in Canada given the large proportion of children enrolled in childcare, coupled with the high volume of time they spend in this environment.

Compared with other countries, including the United States and the United Kingdom, Canada has shown relatively limited federal action on the important and evolving issue of online safety for children and youth. For example, in the US, extensive federal engagement has occurred, including Senate and Congressional hearings, multiple legislative efforts and prominent advocacy from the US Surgeon General (Murthy 2024; US Department of Health and Human Services, n.d.). In the United Kingdom, the Age Appropriate Design Code has led to changes across leading social media and digital platforms, including YouTube, TikTok, Snapchat, Instagram, Amazon Marketplace and Google Search. These changes, aimed at fostering a safer, more secure and age-appropriate online environment, underscore the crucial role of regulation in improving the digital landscape for children and teens” (Information Commissioner’s Office 2022; Mootz and Blocker 2024). As this manuscript was being prepared, the Australian Government passed legislation banning social media for those under 16 years of age (<https://www.cbc.ca/news/world/australia-social-media-ban-1.7395487>, n.d.).

There have been several legislative and policy changes at the provincial level within Canada, such as policies related to cell-phone use in schools, criminalizing non-consensual ‘deepfake pornography’ in some provinces (<https://policyoptions.irpp.org/magazines/march-2024/deepfake-law-urgent/>, n.d.), banning the use of professional athletes in gambling advertisements (<https://www.cbc.ca/news/canada/toronto/sports-betting-athlete-ban-advertising-ontario-1.6950541>, n.d.) and legal action taken by large school boards against social media companies (<https://globalnews.ca/news/10531229/ontario-school-board-s-social-media-lawsuit/>, n.d.). However, at the federal level, entities such as the Public Health Agency of Canada, the Chief Public Health Officer and Parliament have been relatively silent and inactive on this issue. Although the Government of Canada introduced Bill C-63: The Online Harms Act, legislation has been in development for nearly 4 years with no obvious progression. Since then, similar laws have been drafted, debated and passed in the European Union, United Kingdom and Australia. Bill C-63, with appropriate amendments, provides Canada with a much-needed framework to hold social media companies accountable to make online platforms safe, empowering and accessible for all. Unfortunately, its long delay in Committee has stalled opportunities for debate, refinement and enactment. This underscores the urgent need for federal leadership in online safety within Canadian jurisdiction.

To understand Canada’s limited ‘top-down’ action on online harms, examining processes that drove effective federal policy changes in other countries offers valuable insights. For example, in November 2023, our group convened with representatives from advocacy organizations, including Fairplay for Kids (United States), the Five Rights Foundation (United Kingdom)

and the Children and Screens Institute for Digital Media and Child Development (United States), to learn from their experiences with policy advocacy and explore ways to leverage and adapt these approaches for the Canadian policy context. We learned in this meeting, that ‘bottom up’ grassroots and community-led advocacy efforts have also been effective in the United States through a combination of litigation, public demonstrations in Washington DC and other direct and indirect sources of influence on the government. This collective advocacy seemingly resulted in a Surgeon General report (Murthy 2024; US Department of Health and Human Services, n.d.), which helped to catalyse Congressional hearings that led to the development of the US Kids Online Safety Act (which was sadly recently defeated). Similarly, in the United Kingdom, advocacy efforts by the 5 Rights Foundation in collaboration with the Age-Appropriate Design Code have led to protective policies for children and youth and encouraged technology giants to make changes to social media platforms reducing psychological harms.

In contrast, Canada lacks equivalent advocacy organizations with a unified voice, and the absence of such grassroots, bottom-up initiatives may contribute to the stalled progress of Bill C-63. This delay poses a growing risk to ensuring that children and youth are safe online. Therefore, we issue a clarion call for a coordinated and effective approach to advocacy around online harms to ensure meaningful policy changes can be successfully advanced in Canada. Recommendations to advance efforts in Canada to address issues related to screen use and child and adolescent health and wellbeing by sector are provided in Table 2.

4.1 | Strengths and Limitations

This study is the first to synthesize findings from multiple sources to determine the state of the effort on child and adolescent screen use in Canada. Validated and established methodological frameworks were used to search and synthesize results, strengthening the internal validity of the findings. The opinion survey was broadly representative of the Canadian population making the findings generalizable. For the environmental scan, an established template was followed (Godin et al. 2015) that was reviewed by an expert librarian. The schoolboard policy scan was thorough and included policy information as recent as September 2024. Both the network analysis and media text mining sub-studies are new and novel to this field of study.

The project also has its limitations. For example, the national opinion survey, although developed by content experts, a key limitation is that it was not psychometrically tested. Additionally, responses may be susceptible to social desirability bias. Stratified analyses by child age groupings or screen use (e.g., gaming vs. social media vs. educational) were also not possible from the survey results. The short timeline, created to ensure relevance of results in a quickly changing field and the available budget, necessitated that most of the environmental scan work be done by one researcher for each sub-project, thus eliminating the chance to measure agreement in data interpretation. In terms of the school board policy scan, a key limitation was only examining the top 10% of school boards in terms of size, once again because of timeline and budget restraints and

TABLE 2 | Recommendations for advancing efforts to address issues related to screen use and child and adolescent health and wellbeing in Canada, by sector.

Advocacy Organizations	<ul style="list-style-type: none"> • Canada's advocacy organizations should collaborate to create a central hub for education and advocacy on the impacts of screen use and digital media on children, strengthening efforts and streamlining resources.
Research	<ul style="list-style-type: none"> • Expand the network of individuals and organizations across diverse sectors to enhance expertise and advance programs, research, and policies on the impacts of screen-based digital media on children and adolescents in Canada. • Track school-related screen use in provincial or national surveys to assess the impact of updated cellphone policies. Baseline data and regional comparisons will enable natural experiments to identify effective strategies for broader adoption. • At the international level, researchers should assess whether the many different policy approaches taken across and within countries is having impacts on behaviours or health and academic outcomes.
Education	<ul style="list-style-type: none"> • Collaborate across all levels of the Canadian education system (federal, provincial, and school boards) which is essential for creating consistent policies. • Early childhood education leaders and organizations across Canada should also collaborate to avoid duplication, share best practices, and optimize synergy. • Parent groups should be used as allies when advocating for changes and/or reductions in school-related screen use. • Adopt the International School-Related Sedentary Recommendations (Saunders et al. 2022). • Coordinate provincial/territorial school-board policies while collaborating at the national level to share and avoid duplication of efforts.
Healthcare	<ul style="list-style-type: none"> • Continue to rely on guidance from the Canadian Paediatric Society while incorporating routine screen use and digital health counselling for every family member. Counselling can rely on the Canadian Paediatric Society 4M approach of: <i>Managing</i> screen use, encouraging <i>Meaningful</i> screen use, <i>Modelling</i> healthy screen use, and <i>Monitoring</i> for signs of problematic uses (Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario 2019). • Advocate for schools and childcare centres to develop and implement screen use policies that consider the health and developmental needs of all children. • Increase awareness of the risks and potential benefits of screen use across all ages and developmental stages.
Industry	<ul style="list-style-type: none"> • Implement healthy screen habit prompts to protect the well-being of young digital media users. • Develop industry standards for age-verification and content moderation to protect children from predators and inappropriate and harmful material. • Be transparent with the data collected on children and adolescents. • Prioritize child and youth health in the development and design of new social media programs.
Government	<ul style="list-style-type: none"> • Government leaders should prioritize legislation leading to the prompt passing of Bill C-63, the Online Harms Act. • Policymakers should prioritize the rights of all children and youth, ensuring the inclusion of diverse and marginalized voices to avoid unintended negative impacts when introducing new digital technology policies. • Fund efforts to coordinate screen use advocacy groups and individuals. • Implement legislation to restrict technology companies from targeting children's attention and harvesting their data. • Require that digital media literacy curricula are incorporated into all schools starting at the elementary level.

we do not know if the results would generalize to small and/or rural school boards. A key limitation of the network analysis is that it relies on accurate and reliable data to build and update the network diagram. It is likely that important organizations or individuals were missed during the database-building phase and consequently not captured in the visual output of this exercise. A key limitation of the media text mining analysis is that words considered neutral in our study context (e.g., school, board, youth) were classified as favorable in the NRC lexicon.

This could lead to bias in our results through inflation of the sentiment. Future analyses could focus more on non-neutral words (e.g., sue, ban, educate) or rely more heavily on the negative sentiment from the Bing lexicon. The media text mining analysis also only used the headlines of the news stories. Clickbaiting and headlines that evoke strong emotions, such as fear and urgency, are common practices to increase readership, resulting in potentially exaggerated and/or distorted narratives to grab the reader's attention and persuade them to read the full article.

The core contents of the article may not be as sensationalized as the headlines, leading to the misrepresentation and/or distortion of the sentiments expressed. Future work could involve text mining articles in full to grasp a more complete sentiment of the story. Finally, much of the cited research is associational in nature, limiting firm conclusions about causal relationships and directionality of findings. Furthermore, the evidence base would benefit from more research examining a better balance of both negative and positive outcomes and indicators, as well as more nuanced research dismantling digital media use into its contextual and content sub-components.

5 | Conclusions

This review of the state of the effort has demonstrated widespread multi-sectoral concerns over excessive and inappropriate digital screen use and its detrimental impacts on Canadian children and adolescents. The results of our five inter-related sub-studies highlight that despite recent increases in attention and activity across sectors occurring in Canada related to screen use and healthy child and youth development, there is converging evidence of a lack of both inter-sectoral and intra-sectoral coordination, collaboration and synergy, resulting in suboptimal impact. The result is that we are failing to “do no harm” to our children and adolescents regarding screen use.

Decisive action is needed now, and we call for a cohesive approach to safeguard the healthy development of Canadian children and adolescents. We hope this review is a timely “call to action” to all related sectors to promote more leadership, investment, awareness, advocacy, coordination, collaboration, and impact. This will involve developing and implementing evidence-informed policies and best practices to protect children and adolescents from excessive and inappropriate screen use and online harm. Developing a national centre devoted to studying digital media use on child development and wellbeing, with unified pillars of research and evidence-informed best practices, education and training, knowledge translation and coordinated advocacy, would have agency to bridge the identified gaps, as demonstrated in other countries.

Author Contributions

Mark S. Tremblay: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, supervision, validation, writing – original draft, writing – review and editing. **Leigh M. Vanderloo:** conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review and editing. **Travis J. Saunders:** data curation, validation, writing – original draft, writing – review and editing. **Sheri Madigan:** validation, writing – original draft, writing – review and editing. **Nicholas Kuzik:** data curation, formal analysis, investigation, methodology, software, supervision, visualization, writing – review and editing. **Laura Heather:** data curation, formal analysis, investigation, methodology, visualization, writing – review and editing. **Nathan D. Zhang:** data curation, formal analysis, investigation, software, visualization, writing – review and editing. **Madelyn Curle:** data curation, formal analysis, investigation, methodology, visualization, writing – original draft, writing – review and editing. **Amanda Helleman:** data curation, formal analysis, investigation, methodology, visualization, writing – original draft,

writing – review and editing. **Gary S. Goldfield:** data curation, formal analysis, investigation, resources, supervision, writing – original draft, writing – review and editing. **Alyssa Hall:** data curation, formal analysis, investigation, writing – review and editing. **Kathleen Pajer:** data curation, formal analysis, funding acquisition, investigation, resources, writing – review and editing. **Michelle Ponti:** data curation, validation, writing – review and editing. **Valerie Carson:** conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – original draft, writing – review and editing.

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Ethics Statement

All research was carried out in accordance with the Helsinki Declaration. Ethics approval and consent to participate were not required for the Environmental Scan, School Board Policy Scan, or Media Text Mining, as all information for these elements of the paper is in the public domain. Per Article 2.2 of the Canadian *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2* (TCPS 2, 2022), Research Ethics Board review/approval was not required for the linked network analysis as it relied exclusively on information that is in the public domain and the individuals and organizations to whom the information refers have no reasonable expectation of privacy. With respect to the National Opinion Survey, participants were recruited from a panel of consumers who agreed to answer research surveys in return for small compensation (see Methods). They are informed that their responses may be used for research purposes and provide informed consent through participation. These secondary data are anonymous (not anonymized) – no identifiers were collected. Because we cannot establish linkages to the participants, the Canadian research ethics guidelines in the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2* (TCPS 2, 2022) state that Research Ethics Board review and approval are not required.

Consent

No consent for publication was required.

Conflicts of Interest

MST (volunteer) and LMV (staff) are members of the ParticipACTION Research Advisory Group which advises ParticipACTION on aspects related to reducing excessive sedentary behaviour of people living in Canada. MST is the volunteer Chair and TJS is the volunteer Vice-Chair of the Sedentary Behaviour Research Network.

Data Availability Statement

All materials used in the preparation of this manuscript are available from the corresponding author upon reasonable request and the completion of a data-sharing agreement.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** Environmental Scan: Search strings used for grey literature database search. **Table S2:** Environmental Scan: Customized Google search engine search strings used. **Table S3:** Environmental Scan: Websites identified from targeted website searches. **Table S4:** List of top 10% of Canadian School Districts (by number of schools). **Table S5:** Cell phone and social media policies for the top 10% of Canadian School Districts (by number of schools) in descending order of size. **Table S6:** Screen time Media Text Mining systematic review search strategy. **Table S7:** Summary of characteristics of documents included from the four search strategies of the Environmental Scan. **Table S8:** Frequency and percent of classified sentiments from the NRC and Bing lexicons. **Table S9:** The 10 most frequently identified words from each of the NRC and Bing lexicons, presented in descending order.