



Is the Association Between Early Childhood Screen Media Use and Effortful Control Bidirectional? A Prospective Study During the COVID-19 Pandemic

Caroline Fitzpatrick^{1,2,3*}, Elizabeth Harvey^{3,4}, Emma Cristini^{1,3}, Angélique Laurent^{1,3}, Jean-Pascal Lemelin^{1,3} and Gabrielle Garon-Carrier^{1,3}

¹ Faculty of Education, Université de Sherbrooke, Sherbrooke, QC, Canada, ² Department of Childhood Education, University of Johannesburg, Johannesburg, South Africa, ³ Groupe de Recherche et d'Intervention sur les Adaptations Sociales de l'Enfance, Sherbrooke, QC, Canada, ⁴ Department of Education, Université Sainte-Anne, Church Point, NS, Canada

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*Correspondence:

Caroline Fitzpatrick
caroline.fitzpatrick@usherbrooke.ca

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Individual differences in effortful control, a component of temperament, reflecting the ability to use attention and other cognitive processes to self-regulate emotion and behavior, contribute to child academic adjustment, social competence, and wellbeing. Research has linked excessive screen time in early childhood to reduced self-regulation ability. Furthermore, research suggests that parents are more likely to use screens with children who have more challenging temperaments, such as low levels of effortful control. Since screen time by children between the ages of 0 and 18 has increased during the COVID-19 pandemic, it remains timely to investigate the developmental pattern of association between child screen media use and effortful control. We hypothesize that higher levels of screen media intake at age 3.5 will be associated with lower effortful control at age 4.5 and that lower effortful control at 3.5 will contribute to more screen media intake at age 4.5. This study draws on participants followed longitudinally over the span of 2-years for an investigation of Canadian preschoolers' screen media use during the pandemic ($N = 316$, Wave 1). A follow-up with this sample was completed in 2021 ($N = 265$, Wave 2). Analyses using a cross-lagged panel model revealed stability in child screen time and effortful control between the ages of 3.5 and 4.5. Child screen time at age 3.5 significantly contributed to decreased effortful control scores at the age of 4.5, whereas effortful control at age 3.5 did not contribute to screen time at age 4.5. Our results partially confirmed our hypothesis and indicated that higher levels of screen time intake were detrimental to the development of effortful control. These results suggest that screen media use, an exceedingly frequent activity, may play an enduring role in development by shaping young children's temperaments.

Keywords: screen media, screen time, effortful control, early childhood, temperament, family adversity

INTRODUCTION

Child effortful control is a core component of temperament composed of attentional (e.g., attention focusing and shifting) and other cognitive (e.g., planning) skills that allow for the voluntary regulation of emotions and behaviors that may interfere with personal goals or environmental demands (Rothbart and Bates, 2006; Rothbart, 2011; Morris et al., 2013). Before children begin school, around the age of 3 and 4, effortful control contributes to their ability to benefit from informal learning situations and activities in the home and daycare setting (Liew, 2012; Merz et al., 2014). As children transition to school, effortful control is likely to help children succeed through a cascade of effects. For one, effortful control provides a strong basis for cognitive and social dimensions of school readiness (Potmesilova and Potmesil, 2021). Furthermore, better effortful control also contributes to child academic achievement indirectly through improved learning behaviors (Blair and Razza, 2007; Sánchez-Pérez et al., 2018). More specifically, child effortful control is associated with better classroom engagement and social competence, which each make contributions to academic achievement (Valiente et al., 2008; Sánchez-Pérez et al., 2018).

In addition, decades of research support the hypothesis that higher levels of child effortful control benefits mental health and wellbeing. Lower levels of effortful control are related to increased risk of behavior problems and psychopathology including aggression and antisocial behavior (Murray and Kochanska, 2002; Olson et al., 2005; Eisenberg et al., 2009, 2015; Gartstein et al., 2012; Wang et al., 2016; Diaz et al., 2017; Jonas and Kochanska, 2018; Smith and Day, 2018; Wichstrøm et al., 2018). To a lesser degree, lower levels of child effortful control have also been linked to increased risk of experiencing internalizing problems such as anxiety and depression (Santens et al., 2020). The ability to deploy attentional and cognitive resources to effectively control one's behaviors and emotions during the preschool years may also foster benefits well beyond early childhood. In particular, research has found that higher levels of effortful control can provide children with long-term advantages including better health, financial successfulness, family stability, and lower risk of criminal conviction by adulthood, regardless of their IQ and parent's social status (Moffitt et al., 2011).

Effortful Control in the Context of Early Childhood Experience

Early childhood is a sensitive and foundational time for the strengthening of effortful control skills (Potmesilova and Potmesil, 2021). Between the ages of 3 and 4, child self-regulation skills evolve rapidly (Montroy et al., 2016). Individual differences in effortful control are in part driven by genetic differences and maturation (Diamond, 2002; Rothbart and Bates, 2006). Nevertheless, experiences and environments also play an essential and formative role in shaping children's self-regulation skills (Rothbart, 2011; Tiberio et al., 2016). Longitudinal and experimental research indicate that sensitive caregiving and exchanges help children build these skills (Diamond et al., 2007;

Blair and Raver, 2015; Landry et al., 2017; Nix et al., 2018; Warren and Barnett, 2020; Park et al., 2022). Raising children with low regulation skills can be especially challenging, even for the most sensitive, warm, and patient caregivers (Moffitt, 1993). Families that face higher levels of adversity in particular, are likely to experience challenges in providing the types of experiences that help build effortful control. As a result, disadvantaged children are more likely to develop lower levels of effortful control than their more advantaged peers (Lengua, 2012; Zalewski et al., 2012).

Preschool Screen Time and Child Effortful Control

Screen time by young children has been linked to negative developmental outcomes (Pagani et al., 2013; Madigan et al., 2019), yet research has yet to examine its contribution to effortful control. From a prevention perspective, a focus on preschool children is advantageous because screen time habits adopted early on are likely to be carried forward later in life (Jones et al., 2013). Even though pediatric and health organizations recommend limiting screen time with preschool-aged children to 1 h a day, screen media use with preschool-aged children is increasingly common (Rideout, 2020). According to two Canadian studies conducted prior to the pandemic, only 46–58% of preschool-aged children respect the recommendation of <1 h/day of screen media (Tamana et al., 2019; Madigan et al., 2020).

There is evidence that non-adherence to pediatric screen time recommendations between the ages of 3 and 5 is associated with suboptimal development in the frontal-occipital fasciculus, a brain area involved in cognitive control (Hutton et al., 2020). Furthermore, *real world* longitudinal research supports these findings by indicating that children who accumulate too much time in front of screens may experience developmental delays across cognitive, social, and motor domains and are more at risk of arriving less well prepared to learn in kindergarten (Pagani et al., 2013; Madigan et al., 2019). Research has also linked early childhood screen time to reduced executive function ability in preschoolers (Nathanson et al., 2014; Ribner et al., 2017; Konok et al., 2021). More specifically, according to one cross-sectional study, the negative association between preschooler screen time and school readiness appears to be partially mediated by reduction in child executive functions (Ribner et al., 2017). Executive functions and effortful control both represent key mechanisms of self-regulation that share much overlap in their underlying neurological circuitry, developmental trajectories, function in modulating emotions and behavior, and measurement (Zhou et al., 2012).

These studies are consistent with displacement hypotheses. That is, too much media intake during a sensitive time for the development of self-regulation may create a time debt for other important experiences and activities. That is, media use may take time away from self-regulation building pursuits such as imaginary play, storytelling, or games that present motor challenges (Diamond and Lee, 2011). Given the importance of the preschool period for building the foundations of effortful control, devoting too much time to screen media use at

the expense of other activities may be particularly costly at this age.

Family Distress, the COVID-19 Pandemic, and Preschooler Screen Time

Research has found that families facing higher levels of adversity and who have less personal, social, and financial resources, are likely to expose children to more screen time (Hartshorne et al., 2021). Indeed, parents are likely to use more screens with children that are less-well regulated (Thompson et al., 2013; Coyne et al., 2021; Parrish et al., 2022). In addition, children with a low level of effortful control may have greater difficulty regulating emotional and physiological responses to media as well as disengaging from media (Clifford et al., 2020). Furthermore, screen-based activities generally require minimal effortful attention focusing from young children (Goodrich et al., 2009). For this reason, engaging young children in screen-based activities may place less strain on parents, particularly in the context of increased distress during the pandemic. Indeed, toddlers' lower effortful control has been indirectly associated with greater screen use (Shin et al., 2021). Furthermore, research on 4–8-year-olds and older school-aged children has linked impulsivity and attention problems to more compulsive and problematic media use habits (Gentile et al., 2011; Paulus et al., 2018). The extent to which effortful control prospectively contributes to the development of screen time habits in young children during the pandemic remains to be examined.

In further support of the hypothesis that family distress contributes to child screen time, children in disadvantaged homes are more likely to spend time in front of screens, view developmentally inappropriate content, and view media without adult supervision (Wright et al., 2001; Asplund et al., 2015). Parent mental health may also contribute to parental practices surrounding child media use. For instance, parents who report being more stressed set less limits on their children's screen time (Walton et al., 2014). To help inform effective child and family level interventions, it is therefore important to consider how family distress contributes to child screen time.

Research suggests that screen time has increased for children between the ages of 0 and 18 during the pandemic (Hartshorne et al., 2021). Parents are likely to have used more screen media during this time to keep young children busy or provide them with a respite from parenting responsibilities. Recent work from our group suggests that the majority (63%) of preschoolers were exposed to more than 2 h of screen time daily during the pandemic (Fitzpatrick et al., 2022). Furthermore, according to another recent study with Spanish children, accelerometer measured sedentary behavior and self-regulation problems have increased among preschoolers during the pandemic (Alonso-Martínez et al., 2021).

The Current Study

The direction of the association between child screen time and effortful control, amidst increased screen media use by children during the pandemic remains unknown. Since early childhood represents a key developmental time for the strengthening

of effortful control and the shaping of screen media habits, it is important to examine longitudinal associations between these variables. Previous research using cross-sectional and longitudinal designs has been unable to account for the direction of influence when examining associations between screen time and child outcomes. The present study attempts to address this limitations by simultaneously examining both directions of influence and by accounting for stability in screen time habits and effortful control. We predict that screen time at age 3.5 will be prospectively associated with lower levels of child effortful control by age 4.5. In addition, we hypothesize a bidirectional effect by which child effortful control at age 3.5 will predict screen time at age 4.5. Given that family distress is likely to have contributed to child media use during the pandemic, parenting stress, maternal education, satisfaction with the division of childcare, and the use of daycare will be considered as control variables.

MATERIALS AND METHODS

Sample

This study focuses on Canadian preschool-aged children and their parents followed longitudinally at two-time points for an investigation of child digital media use during COVID-19 pandemic. Participants were recruited by distributing eye catching posters and flyers to preschools and pre-kindergarten classes, through sign-up sheets and presentations given at preschool and pre-kindergarten registration nights, a Facebook page, and newspaper and radio advertisements broadcast across Nova Scotia, Canada. At the initial assessment, the sample was composed of 316 children aged between the ages of 2 and 5 years (168 boys and 146 girls; M age = 3.45 years, SD = 0.85). This first assessment took place between April and August 2020 during a provincially declared state of emergency and lockdown. A follow-up with this sample was completed in 2021 between April and August (N = 266, M age = 4.33, SD = 0.86, 84% retention rate). Participants with missing data at age 4.5 did not differ from retained participants on their average screen time and effortful control scores at 3.5. Most parents were married (82%), born in Canada (91%), Caucasian (90.5%) and English-speaking (88.1%). Mothers were the primary respondents for 93.4% of the sample.

Procedure

Parents completed the web-based Media use Questionnaire when children were 3.5 and 4.5. This assessment has been described in detail elsewhere (Barr et al., 2020). This assessment includes questions on child sex, parent education, family income, parenting stress, childcare use, and parent satisfaction with the division of childcare. For the purpose of our study, we integrated questions on child temperament using the Children's Behavior Questionnaire – Short Form, described below. The present research was approved by Université Sainte-Anne (#0090.d) and Université de Sherbrooke's IRB (2021–2927). Informed consent to participate was obtained from parents.

Measures

Child Screen Time

Parents indicated the average amount of time children spent doing each of the following activities on weekdays and weekend days separately: (1) watching TV or DVDs; (2) using a computer; (3) playing video games on a console; (4) Using an iPad, tablet, LeapPad, iTouch, or similar mobile device (excluding smartphones); or (5) Using a smartphone. Response options included: (1) Never; (2) Less than 30 min; (3) 30 min to 1 h; (4) 1–2 h; (5) 2–3 h; (6) 4–5 h; and (7) more than 5 h. Each categorical answer was then converted to a numerical score variable reflecting the number of hours spent with each type of media. Our approach involved using the midpoint for each response range, with the exception of “5 or more hours a day” where a more conservative score of 5 was used. Weighted daily estimates were then estimated by multiplying weekday estimates by 5 and weekend day estimates by 2 and dividing the total by 7. Finally, we calculated an overall daily screen time estimate by summing average daily usage across media devices. The same procedure was used to estimate screen time at ages 3.5 and 4.5.

Effortful Control

Temperament was measured using the Children’s Behavior Questionnaire – Short Form (Putnam and Rothbart, 2006). This instrument measures several distinct dimensions of temperament that can be grouped into three factors: negative affectivity, surgency/extraversion, and effortful control. Effortful control was based on combined scores on the dimensions of attentional focusing (six items, i.e., Sometimes becomes absorbed in a picture book and looks at it for a long time) and inhibitory control (six items, i.e., Can wait before entering into new activities if s/he is asked to). The short version uses a 7-point Likert scale ranging from 1 (*extremely untrue of your child*) to 7 (*extremely true of your child*). Cronbach’s alphas were 0.79 and 0.79 at age 3.5 and 4.5, respectively.

Family Distress

Parents reported level of education, satisfaction with the division of childcare, use of childcare, and parenting stress. Education reflects the highest school grade completed by the parent. Responses were dichotomized as: (0) High school or college vocational or (1) Undergraduate or Graduate degree. Satisfaction with childcare was assessed with the following question: How satisfied are you with the division of childcare between you and your partner? Responses were recorded on a Likert scale ranging from: (1) Very satisfied; (2) Satisfied; (3) Not satisfied or unsatisfied; (4) Unsatisfied; and (5) Very unsatisfied. Parents completed the parenting distress subscale of the Parent Stress Index (Abidin, 2012). In total, parents completed 12 items (i.e., I find myself giving up more of my life to meet my child’s needs than I ever expected). Items were rated on a 5-point Likert scale as: 1 (strongly disagree); 2 (disagree); 3 (not sure); 4 (agree); or 5 (strongly agree), and were then summed to create a total score, Cronbach’s alpha = 0.85. Finally, parents reported whether or not their child was enrolled in daycare. Daycare closures were directly inferred based on the dates that daycares were ordered

to close and eventually allowed to reopen¹. Children were then categorized into three groups: (1) Daycare Non-user; (2) User daycare open; and (3) User daycare closed.

Data Analytic Strategy

Given that greater levels of family distress are likely to contribute to greater screen time, we first considered associations between indicators of family distress and child screen media use at age 3.5 and 4.5, respectively. We then retained significant predictors of child screen media habits. To simultaneously measure associations between screen time and effortful control between the ages of 3.5 and 4.5, we then estimate a cross-lagged panel model using Mplus (Muthen and Muthen, 2018). Kline (2015) recommends achieving a ratio of $N = 20/\text{estimated parameter}$ to ensure sufficient statistical power for detecting small to moderate effects in cross-lagged panel models. With a total of 15 parameter, and a sample size of 315, our study is sufficiently powered for detecting the hypothesized associations ($N = 315 > 20 \times 15$ parameters).

RESULTS

Descriptive Statistics

Descriptive statistics are presented in **Table 1**. Frequencies for categorical variables are presented in **Table 2**. Children spent on average $M = 3.46$ ($SD = 2.44$) and $M = 3.25$ ($SD = 2.38$) hours daily with screens at the ages of 3.5 and 4.5, respectively. As expected, child effortful control scores increased significantly between the ages of 3.5 and 4.5 [$M = 4.71$ vs 4.88] $t(263) = 4.31$, $p < 0.001$]. In total, 26% of parents had attained a high school or vocational degree. Finally, 22.3% ($n = 59$) of our sample reported not using daycare, 18.1% ($n = 48$) reported that their daycare was closed at the first assessment, and 59.6% ($n = 158$) reported that their daycare was open at the time of the first assessment.

Family Distress and Child Screen Media Habits

We conducted a multiple linear regression to estimate the contribution of indicators of family distress to child media habits. More specifically, we regressed screen time in hours at the ages of 3.5 and 4.5 on parental education, child sex, satisfaction

¹<https://novascotia.ca/news/release/?id=20200313009>

TABLE 1 | Descriptive statistics for continuous study measures.

Variables	<i>M (SD)</i>	<i>N</i>
Age 3.5		
Effortful control	4.70 (0.85)	315
Screen time (hours/day)	3.42 (2.44)	315
Parenting stress	27.14 (7.88)	315
Division of childcare	2.15 (1.04)	305
Age 4.5		
Effortful control	4.88 (0.82)	264
Screen time (hours/day)	3.25 (2.38)	265

TABLE 2 | Frequencies for categorical variables.

Variables	%	N
Child sex		296
Girls	46	
Maternal education		316
High school or vocational	26	
Daycare		265
Non-user	22	
Closed	18	
Open	60	

TABLE 3 | Associations between family characteristics and child screen time at Ages 3.5 and 4.5.

Independent variables	Screen time (in hours/day)			
	Age 3.5		Age 4.5	
	(95% CI)	β	B (95% CI)	β
Child sex				
Girls	0.27 (-0.33-0.86)	0.05	-0.21 (-0.84-0.42)	-0.04
Boys (ref)	-		-	
Parent education				
High school or vocational	1.37 (0.64-2.10)*	0.23*	1.76 (0.96-2.56)*	0.30*
University degree (ref)	-			
Parenting stress	0.01 (-0.03-0.05)	0.02	0.00 (-0.04-0.04)	0.01
Division of childcare	-0.42 (-1.09-0.26)	-0.08		0.00
Daycares				
Non-user	-0.30 (-1.04-0.45)	-0.05	-0.44 (-1.21-0.33)	-0.08
Closed	0.28 (-0.51-1.07)	0.05	-0.28 (-1.12-0.57)	-0.04
Open (ref)	-			
R-Square	0.04		0.06	

Ref, reference group. * $p \leq 0.05$.

with the division of childcare, parenting stress, and daycare use. Regression coefficients are reported in **Table 3**. Lower parental education contributed to more child screen time at the ages of 3.5 ($\beta = 1.37$, $p < 0.001$) and 4.5 ($\beta = 1.76$, $p < 0.001$), respectively. None of the other variables were significantly related to child screen time. As such, we did not retain these variables in our cross-lagged panel model.

Cross-Lagged Panel Model

Our model is presented in **Figure 1**. Our cross-lagged panel model provided good fit (CFI = 0.988; TLI = 0.965; RMSEA = 0.069 [0.000; 0.113]) and accounted for 49 and 54% of the variance in child screen time and effortful control at age 4.5, respectively. Analyses revealed considerable stability in child screen time ($\beta = 0.70$, SE = 0.031; $p < 0.001$) and effortful control ($\beta = 0.72$, SE = 0.030; $p < 0.001$) between the ages of 3.5 and 4.5. In terms of the cross-lagged associations, child screen

time at age 3.5 significantly contributed to decreased effortful control scores at age 4.5 ($\beta = -0.10$, SE = 0.042; $p = 0.023$) whereas effortful control at age 3.5 did not contribute to child screen time at age 4.5 ($\beta = 0.016$, SE = 0.046; $p = 0.729$). Parental education ($\beta = -0.24$, SE = 0.053; $p < 0.001$) was also significantly negatively associated with more child screen time at age 3.5. As indicated by the strength of the standardized coefficient, the effect size for the associations between child screen time at ages 3.5 and 4.5 ($\beta = 0.70$) and effortful control at 3.5 and 4.5 ($\beta = 0.72$), were large. The cross-lagged association between screen time at 3.5 and effortful control at 4.5 ($\beta = 0.10$) was small (Cohen, 1994).

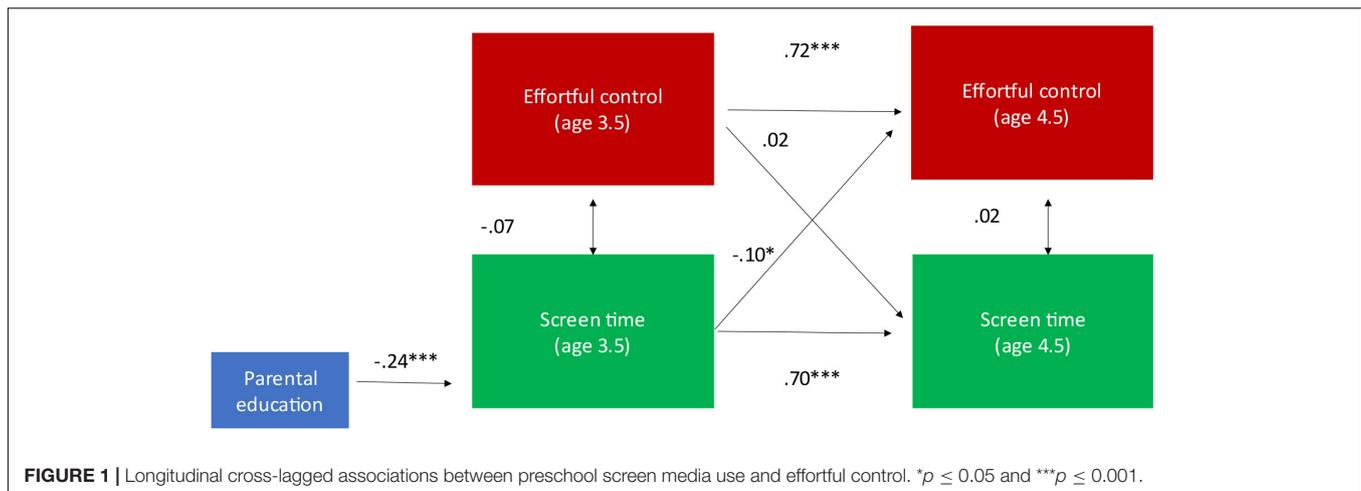
Practical Significance

Each hour of daily screen time contributed to 10% of a standard deviation decrease in effortful control scores. Despite its small size, this association is likely to be more clinically meaningful for heavy screen media exposure. That is, for children using screen media for 4 h or more per day (32% of our sample), the contribution of daily screen time would result in 40% of a standard deviation decrease in effortful control scores. Furthermore, some have argued that even small effect sizes in psychological and behavioral medicine research can be of real-world practical significance (Rutledge and Loh, 2004).

DISCUSSION

The purpose of our study was to examine associations between child screen time and effortful control during the COVID-19 pandemic. Our results partially confirmed our hypotheses by indicating that higher levels of screen media intake during the pandemic at age 3.5 are prospectively associated with lower levels of effortful control at age 4.5. In contrast, lower levels of child effortful control at age 3.5 did not contribute to more screen media intake at age 4.5. Furthermore, we found partial support for the family distress hypothesis in that lower parental education was associated with higher levels of screen media use by children. Though the strength of the observed association was small, our models suggest more clinically significant effects for children exposed to high levels of screen time. These findings suggest that too much screen time media in early childhood can undermine effortful control, a key building block of personality and personal success (Kochanska and Knaack, 2003; Moffitt et al., 2011).

Theory and research suggest that child media use displaces time for self-regulation building activities such as sensitive parent-child interactions or play (Diamond and Lee, 2011). Our results indicating a prospective association over time provide support for this pathway. Future longitudinal research can seek to clarify the extent to which the displacement of children's interactions and activities may account for the observed effects. For instance, according to one study, sedentary behavior increased among preschoolers during the pandemic whereas sleep and physical activity decreased (Alonso-Martínez et al., 2021). As such, research could examine the extent to which links between screen time and self-regulation may be accounted



for by the displacement of social interactions, play, sleep, and physical activity.

The impact of digital media on young children's development may also be driven by features of media content. The overstimulation hypothesis predicts that child media use is likely to undermine children's development of sustained attention and ability to inhibit distractors over time (Christakis et al., 2018). In particular, this is believed to be the case because media directed at young children features a high frequency of perceptually salient elements such as frequent camera cuts and quick pacing, which are effective in eliciting child engagement without cognitive effort (Goodrich et al., 2009). Experimental research has also found that preschooler's exposure to media content that is fantastical can deplete executive functions minutes after exposure (Lillard et al., 2015). This type of content is believed to mentally overwhelm young minds because it contradicts children's basic understanding of the world (Smith, 2020). This would be the case, for instance, when a program or movie depicts a human character that can fly. As such, frequent exposure to fast paced and unrealistic or fantastical elements may be especially harmful.

Finally, research could examine the extent to which media use contexts including joint media engagement with parents and timing of use may further contribute to and moderate children's development of effortful control. For instance, according to an experimental study, preschoolers assigned to view 10 episodes of the show *Daniel Tiger's Neighborhood*, showed more gains in their empathy and emotional regulation if their parents engaged them in conversations about the content (Rasmussen et al., 2016). Furthermore, other research suggests that using media before bedtime contributes to decreased sleep quality, which then contributes to reductions in effortful control (Nathanson and Beyens, 2018). However, these associations have yet to be explored longitudinally.

By the time children enter school, the foundations of their temperaments and media habits have been established (Rothbart, 2011; Jones et al., 2013). Furthermore, early childhood interventions aimed at helping children develop healthy media habits are more likely to be effective than those undertaken with older school-aged children and adolescents (Wahi et al., 2011). For this reason, it remains important to sensitize parents and

early childhood professionals that screen media can pose risks to the development of effortful control. In the context of increasing media use during the pandemic, supporting parents especially parents facing higher levels of socioeconomic vulnerability in their efforts to regulate young children's digital media habits is especially timely. Our results reaffirm the importance of encouraging parents to establish a family media plan and to provide children with ample opportunities to engage in play and literacy building activities which can strengthen effortful control. In particular, plans can help parents implement digital media use limits for children, as well as make provisions for which contents to favor and how to accompany children's use (Reid Chassiakos et al., 2016).

Child effortful control is narrowly linked to executive functions (Bridgett et al., 2013), school readiness (Gobeil-Bourdeau et al., 2021; Potmesilova and Potmesil, 2021), and academic competence (Liew, 2012). As such, early childhood professionals can also help support school readiness by implementing evidence-based intervention programs or strategies that benefit children's development of skills such as inhibitory and attentional control. Furthermore, school-based programs such as *INSIGHTS into Children's Temperament* (McClowry et al., 2005), which aim to sensitize children about their own temperaments and their challenges, have been found to be effective in reducing child behavior problems (O'Connor et al., 2014). Finally, screen time is common in childcare settings and likely to take time away from more developmentally enriching formal and informal learning opportunities (Christakis and Garrison, 2009). As such, we encourage early childhood professionals to limit their use of screen media in this setting.

Strengths and Limitations

Strengths of the present study include our ability to establish the direction of the association between screen media use and effortful control. Furthermore, our analytical strategy also allowed us to consider developmental continuity and stability in these variables. Finally, to our knowledge, there remains limited research on the association between young children's media habits during the COVID-19 pandemic and the development of self-regulation.

The present results are not without limitations. First, our correlational approach does not allow us to conclude that a causal association exists between child screen time and the development of effortful control. Even though we were able to provide evidence that changes in screen time habits are associated with changes in child effortful control and that changes in screen time precede changes in temperament, our design does not allow us to rule out third variable confounding. Second, as previously mentioned, we did not account for the content to which children were exposed nor did we account for the context (i.e., timing of use, adult accompaniment) in which media was used. Considering these features of media use in addition to screen time will be useful in better understanding multifinality in child outcomes. Third, both our measures of screen time and effortful control were parent reported which can introduce shared measurement bias. Fourth, our study only included two of the four possible subscales designed to measure effortful control. The inclusion of 2-year-olds in our study could also represent a limit as our temperament scale was designed for 3–7-year olds. Nevertheless, the observed Cronbach's alphas indicate good internal consistency. Another limit of our study is the use of a relatively homogenous, low risk convenience sample. As such, our findings may not be generalizable to the population of Canadian preschoolers. Despite this limitation, we detected a significant association between parent education and child screen time. Nonetheless, our inability to detect associations between child effortful control and later screen time habits could reflect the fact that our sample is relatively homogenous in terms of its demographic characteristics. Previous studies have found that child temperamental characteristics such as surgency and negative affectivity predict preschooler screen time in contexts of high social risks, defined by low maternal education, income, and higher levels of maternal depression (McArthur et al., 2022). Future research should seek to examine these associations in larger more diverse samples. Last, although our sample was sufficiently powered for our analyses, we were limited in our ability to detect small effects.

CONCLUSION

To our knowledge, this is the first study to examine how higher amounts of preschooler screen time are prospectively associated with decreases in effortful control in the context of a pandemic.

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Our results suggest that screen media use during early childhood, a sensitive period for the development of lifelong temperament, should be closely monitored by parents. Furthermore, our findings add to the literature suggesting that limiting screen time during the preschool period may benefit child socio-emotional and school readiness skills.

DATA AVAILABILITY STATEMENT

The data presented in this article are not readily available. As per the participant consent form, data are only available to the research team. Requests to access the data should be directed to caroline.fitzpatrick@usherbrooke.ca.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Comité d'Étique, Université Sainte-Anne; Comité d'Étique, Université de Sherbrooke. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

CF designed the study and drafted most of the manuscript. GG-C conducted the analyses and EC drafted the methods. EH, AL, J-PL provided critical theoretical feedback on the entire manuscript. All authors have read and approved the manuscript.

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