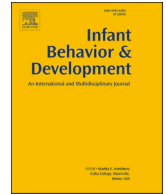




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Why do parents use screen media with toddlers? The role of child temperament and parenting stress in early screen use

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ABSTRACT

Considering child characteristics may be an important piece to understanding parental decision-making for children's screen use. The current cross-sectional study examined the mediating role of maternal parenting stress in the relation of child temperament to young children's screen use. Recognizing the multidimensional aspects of temperament, three mediated pathways for three temperament domains (i.e., negative affectivity, surgency, and effortful control) were tested. Mothers of toddlers, 18–36 months ($N = 296$), completed an online survey, reporting on child temperament, total parenting stress, and child screen use. The results showed that mother-child dynamics were related to toddlers' screen use. Toddlers' negative affectivity and effortful control were each associated with toddlers' screen use through maternal parenting stress. Higher negative affectivity was associated with higher maternal parenting stress, which in turn, was related to greater screen use in toddlers. Toddlers' lower effortful control was related to higher maternal parenting stress, which in turn, was associated with greater screen use. Toddlers' surgency was not related to either maternal parenting stress or toddlers' screen use. The findings from this study contribute to an understanding of media-related parenting in toddlerhood and may help with the development of strategies for supporting healthy media habits in families with young children.

1. Introduction

The American Academy of Pediatrics (AAP) has recommended no TV or entertainment screen media for children under two years of age (American Academy of Pediatrics AAP, 2016). This guideline is supported by the lack of evidence on educational benefits of non-interactive media in this age group (Anderson & Pempek, 2005) and evidence of harm from excessive media exposure in young children (Barr, Lauricella, Zack, & Calvert, 2010). Despite these concerns, infants and toddlers spend a considerable amount of their waking hours looking at screens. A recent report revealed that American children under two consume an average of 42 min of screen media per day, and the majority of the screen time (40 min) consisted of watching TV, DVDs, or videos on any device (Rideout, 2017). Thus, parents of young children rarely adhere to the AAP's guidance. Understanding why mothers allow their young children to use screen media is crucial to addressing the discrepancy between the guideline and real-world practice.

As early screen media use is often initiated and terminated by parents' media-related decisions (Nathanson & Beyens, 2018), parental factors have been studied to understand young children's screen media use. Parenting stress is one of the factors that has been associated with toddlers' screen use, supporting the importance of family contexts in parental decision-making for child screen use

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(Pempek & McDaniel, 2016). Parenting behaviors are influenced by dynamics between parents and children, and mothers interact differently with their children based on the children's characteristics and needs (Putnam, Sanson, & Rothbart, 2002). Indeed, prior work has revealed that child temperament is related to child screen time (Nabi & Kracmar, 2016; Radesky, Silverstein, Zuckerman, & Christakis, 2014). However, little research to date on young children's screen use has considered parenting stress as a mechanism underlying the association between child temperament and media exposure. In this study, we examined how children's temperament was related to their screen use through maternal parenting stress. Particularly, increased autonomy and noncompliance in toddlerhood, which is likely related to children's temperament, may lead to greater parenting demands (Chester & Blandon, 2016; Teti & Huang, 2005), which could be related to increased maternal parenting stress. Both of these factors are expected to be associated with mothers' media-related decisions potentially as ways to decrease stress and handle children's temper tantrums or acting out in this developmental period (Potegal & Davidson, 2003). Considering rapid growth in brain, cognition, and socioemotional development and prolonged effects of environmental factors during the early years of life (Diamond, 2002; Knickmeyer et al., 2008), creating a beneficial media environment is essential for children's healthy development.

1.1. Child temperament and screen use

Temperament is one primary characteristic beginning at birth and classically defined as "constitutionally based individual differences in reactivity and self-regulation" (Rothbart & Derryberry, 1981, p. 384). Reactivity refers to reactions to the environment, including emotional reactions (e.g., fear, anger, pleasure) and behavioral tendencies when children experience changes in the environment (Eisenberg et al., 2010). Regulation from a temperament perspective is often viewed as effortful control, which includes "the ability to willfully or voluntarily inhibit, activate, or change (modulate) attention and behavior" (Eisenberg, Smith, & Spinrad, 2016, p. 458). Temperament in early childhood is considered multidimensional, conceptualized into two dimensions of reactivity, which are negative affectivity and surgency and one for regulation, which is effortful control (Gartstein & Rothbart, 2003; Rothbart & Bates, 2006).

Although a growing body of research on young children's media use has documented that child temperament is related to children's use of media (Nathanson & Beyens, 2018; Radesky, Peacock-Chambers, Zuckerman, & Silverstein, 2016; Thompson, Adair, & Bentley, 2013; Zimmerman & Christakis, 2007), most of the work has not considered the multidimensional nature of temperament, focusing on either reactive or regulatory traits. Each dimension, however, reflects specific characteristics that distinguish it from other dimensions (Gartstein, Putnam, & Rothbart, 2012). Given research findings that each temperament dimension elicits different developmental outcomes and parenting behaviors (Molfese et al., 2010; Neppel, Jeon, Diggs, & Donnellan, 2020; Rothbart, 2007), there may be unique relations of each dimension to children's screen use.

The reactive dimensions of temperament include negative affectivity and surgency. Negative affectivity reflects the tendency to easily experience discomfort, anger, fear, sadness, and irritability (Gartstein & Rothbart, 2003). Children with high negative affectivity were more likely to be distressed, frustrated, and difficult to soothe (Oddi, Murdock, Vadnais, Bridgett, & Gartstein, 2013). Surgency is a tendency to actively engage with the environment (Oddi et al., 2013) and can be displayed through smiling, laughing, approaching novel stimuli, activity, and impulsivity (Gartstein & Rothbart, 2003). Thompson et al. (2013) reported that infants high in activity, crying, and distress had more exposure to television. Similarly, mothers who rated their toddlers higher in social-emotional difficulties such as frequent crying and irritability were more likely to provide mobile technologies to calm down children's tantrums and keep peace in the house (Radesky et al., 2016). These findings suggest that mothers may use media when their children are higher in reactivity, including negative emotionality or surgency, as a way to deal with the children's temperamental reactivity.

Effortful control, the regulatory dimension of temperament, helps children to control attention and inhibit behavior (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013). Since low effortful control has been linked to difficulties in self-soothing, sleeping, and feeding in early childhood (Egger & Emde, 2011), regulation has been the main temperament characteristic studied when predicting young children's screen use. Challenges in soothing or controlling toddlers' mood and behaviors may encourage parents to place a screen in front of their children to calm them down or keep them still by distracting toddlers' attention through fast-paced media contents (Lillard, Drell, Richey, Boguszewski, & Smith, 2015). There is evidence to suggest that parents use media to handle children's low effortful control (Cliff, Howard, Radesky, McNeill, & Vella, 2018; Linder, Potter, & Garrity, 2020; Radesky et al., 2014). Radesky et al. (2014) found a longitudinal association between children's regulatory temperament and their media use, indicating that children with self-regulation problems at 9 months were exposed to more TV and video at age 2.

Considering the multidimensional aspects of temperament, there may be unique relations of each dimension to children's screen use. Mothers may engage in parenting practices differently based on each dimension of temperament because each dimension has distinct characteristics and needs (Oddi et al., 2013). Thus, whereas most prior work has only focused on a specific aspect of temperament, the current study examined all three dimensions of temperament to disentangle specific links between temperament and screen media use. Being mindful of the critical role of the environment during the early years of life, it is crucial to understand how mothers of toddlers foster media environments that may be linked to children's temperament. In this regard, our work can provide practical guidelines for parents based on distinct characteristics of children.

1.2. Parenting stress and child screen use

Parenting stress is an important parental factor that has been shown to play a critical role in parenting behaviors, including mothers' decision-making in children's screen media use (Pempek & McDaniel, 2016). Parenting stress is conceptualized as negative perceptions or feelings about the demands of parenthood (Deater-Deckard, 1998), and parents who experience higher levels of

parenting stress often have less energy and motivation to deal with parenting roles and interactions with their children (Beyens, Eggermont, & Nathanson, 2016). Therefore, higher parenting stress has been related to less optimal parenting, such as a harsh parenting style (Huth-Bocks & Hughes, 2008) and emotional distance from children (Moreira & Canavarro, 2018). Given that parenting stress has been associated with a lack of resources to meet demands of parenting (Neece, Green, & Baker, 2012), mothers who experience higher levels of parenting stress are more likely to need resources to help them reduce the demands of parenting.

Screen media use is likely to provide parents with time to cope with parenting stress by occupying their children with media content and thus potentially lowering the demands of parenting. Indeed, prior research has found a positive association between stress that parents experience and children's screen media use (Pempek & McDaniel, 2016; Warren & Aloia, 2019). Mothers with greater concerns about parenting reported higher screen media use by their children (Warren & Aloia, 2019). Similarly, mothers with higher stress in personal and family situations tended to allow their children to use more mobile media (Pempek & McDaniel, 2016). Despite the link between stress and children's media use, little work has considered stress specific to parenting. Parenting stress is distinct from stress in other roles and situations (Deater-Deckard, 2008) and includes intricate processes, including parent-child relationship and resources around parenting (Deater-Deckard, 1998). Examining general stressors does not fully reflect the complex nature of parenting stress and its potential role in children's media use; therefore, in the current study, we examined relations between parenting stress and toddlers' screen time.

1.3. Child temperament and screen use: Indirect effects via parenting stress

Parenting behaviors are shaped within the context of interactions between mothers and children (Kiff, Lengua, & Zalewski, 2011). As a primary determinant of parenting (Belsky & Jaffee, 2006), child temperament may play a crucial role in mothers' media-related decisions through links with parenting stress. Previous research reveals that child temperament has been related to maternal parenting stress (Bayly & Gartstein, 2013; Hartman, Stage, & Webster-Stratton, 2003; Jonas & Kochanska, 2018; Scher & Sharabany, 2005). Children who displayed high negative affectivity and low effortful control had mothers reporting higher levels of parenting stress (Bayly and Gartstein, 2013; Scher & Sharabany, 2005). Surgency, exuberance (Nigg, 2006), sensation seeking (Jonas & Kochanska, 2018), and impulsivity (Hartman et al., 2003) have been positively linked to maternal parenting stress. However, the majority of research on parents' media-related decision-making (Cingel & Krcmar, 2013; Duch, Fisher, Ensari, & Harrington, 2013; Garrison, Liekweg, & Christakis, 2011; Thompson et al., 2013) has not examined the mediating role of parenting stress in the relation between child temperament and media use.

As parenting stress reflects challenging parent-child relationships and the lack of parenting resources (Akerman, 1995), temperament may be a source of parenting stress, which in turn relates to maternal decision-making on child media use. Given that mothers with greater parenting stress are more likely to have less resources for dealing with the parenting role (Neece et al., 2012), mothers who lack energy and motivation for parenting may utilize media as a parental tool. Indeed, the positive association between maternal parenting stress and children's media use has been found in prior research (McDaniel & Radesky, 2020; Pempek & McDaniel, 2016; Warren & Aloia, 2019). Thus, mothers of children rated high in negative affectivity and surgency and low in effortful control may experience greater parenting stress, which in turn, may predict more screen media use for their children.

1.4. Overview of the current study

Although prior research examined individual contributions of child temperament and parenting stress to children's screen media use (McDaniel & Radesky, 2020; Nabi & Krcmar, 2016; Radesky et al., 2014, 2016), it remains unclear whether child temperament is related to screen use through parenting stress. Considering the critical role of the environment during the early years of life, it is crucial to understand how mothers of toddlers foster a media environment that may be associated with their children's temperament as well as their own stress felt in their roles as parents. In the current study, we examined the extent to which the associations between child temperament and screen use was mediated by maternal parenting stress. Specifically, we tested a mediated pathway for each temperamental domain: negative affectivity, surgency, and effortful control. Based on the extant literature, we expected that children with high negative affectivity, high surgency, and low effortful control would have mothers with greater parenting stress, which would be associated with more screen use for children.

2. Method

2.1. Procedure

Participants were recruited through Qualtrics' Research Panel Service, which connects researchers with internet-based participant panels. Qualtrics' Panel Service sent a link to our online survey to their online panels and recruited participants if eligibility criteria were met. Informed consent was obtained from survey participants electronically prior to commencing the survey. The eligibility criteria for this study included being mothers of children between 18–36 months, being 18 years and older, and residing in the United States. To ensure the quality of survey responses, we included two attention check items, which instructed participants to select a specific response. Participants who provided incorrect responses to these items were closed out of the rest of the survey, and their responses were considered invalid. The final valid sample included 296 mothers.

2.2. Participants

A total of 296 mothers ($M_{age} = 31.8$ years, $SD_{age} = 5.7$) of children aged between 18 and 36 months (47.6 % girls, $M_{age} = 28.0$ months, $SD_{age} = 5.3$) completed the survey. When asked about ethnicity, 18.6 % of mothers reported that they were Hispanic or Latino and 81.4 % reported that they were not Hispanic or Latino. Participants identified themselves as White (63.2 %), Black or African American (12.2 %), Asian or Pacific Islander (7.4 %), Native American or Alaska Native (0.7 %), and other/mixed race (16.6 %). A large proportion of mothers were married (68.2 %), 11.8 % were single and living without a partner, 15.5 % were single or divorced and living with a partner, and 4.3 % were separated, divorced, or widowed. Mothers' average years of education was roughly equivalent to an associate's or 2-year college degree ($M = 15.3$ years, $SD = 3.3$, range = 10.0–39.0). Family income was varied, with 9.1 % less than \$15,000, 8.8 % \$15,000–\$30,000, 14.2 % \$30,000–\$45,000, 13.9 % \$45,000–\$65,000, 14.2 % \$60,000–\$75,000, 18.2 % \$75,000–\$100,000, 15.9 % \$100,000–\$150,000, and 5.7 % over \$150,000.

2.3. Measures

2.3.1. Child screen use

The child screen use question was created by combining and modifying questions included in the Common Sense Media survey (Rideout, 2011, 2013, 2017). We asked mothers to rate the frequency with which their child engaged in a variety of screen media activities on a 10-point Likert scale, measuring 0 (has never done this), 1 (less than once per month), 2 (less than once per week), 3 (once per week), 4 (several times per week), 5 (once per day), 6 (several times per day), 7 (once per hour), 8 (several times per hour), and 9 (all the time). This scale was modified from an existing 6-point scale (Rideout, 2011, 2013, 2017) to include additional response options (i.e., less than once per month, once per hour, several times per hour, and all the time). The screen media activities included in this study were as follows: (1) reading or being read to eBooks on a Kindle, Nook, or similar e-reader, (2) watching TV shows (including Netflix, Hulu) or videos (DVDs) on a TV set, on a handheld device (e.g., smartphone, iPad), or on a computer (laptop or desktop), (3) playing games on a console game player (e.g., X-box, PlayStation, Wii), on a handheld game player (e.g., Gameboy, Nintendo DS), or on a smartphone, tablet, or computer, (4) having a video chat on a smartphone, tablet, or computer, and (5) using other types of apps on a smartphone or tablet. The scores for these activities were summed to yield a total score, with higher scores indicating a greater frequency of screen media use.

2.3.2. Child temperament

Mothers rated their children's negative affectivity, surgency, and effortful control using the Early Child Behavior Questionnaire–Very Short Form (ECBQ–VSF; Putnam, Jacobs, Gartstein, & Rothbart, 2010) on a 7-point scale (1 = never, 7 = always, or not applicable). Negative affectivity consists of 12 items (e.g., “How often did your child get irritated?”; Cronbach's $\alpha = .87$). Surgency includes 12 items (e.g., “While participating in daily activities, how often did your child seem full of energy, even in the evening?”; $\alpha = .85$). Effortful control also consists of 12 items (e.g., “When playing alone, how often did your child play with a set of objects for 5 min or longer at a time?”; 12 items; $\alpha = .69$). For each construct, the ratings for all 12 items were averaged, with higher scores representing higher levels of the temperament dimension.

2.3.3. Maternal parenting stress

To assess mothers' parenting stress, the Parenting Stress Index–Short Form 4th edition (PSI–SF; Abidin, 2012) was used. Mothers rated the degree of stress in parenting, focusing on parenthood, parent-child relationship, and child characteristics on a 5-point scale (e.g., 1 = strongly disagree, 5 = strongly agree). The PSI–SF consists of 36 items ($\alpha = .97$) in the three subscales of parental distress, parent-child dysfunctional interaction, and difficult child. The subscale of parental distress reflects mothers' personal adjustment to parenthood, including community and peer support (e.g., “I feel alone and without friends”; 12 items; $\alpha = .92$). The parent-child dysfunctional interaction displays a lack of bonding with the child and a parent's disappointment and alienation from the child (e.g., “Sometimes I feel my child doesn't like me and doesn't want to be close to me”; 12 items; $\alpha = .93$). The difficult child subscale indicates the child's temperamental problems or parent's struggling with managing their children's behavior (e.g., “My child makes more demands on me than most children”; 12 items; $\alpha = .92$). Scores from the three subscales were summed to form a total score, with higher scores indicating greater stress.

2.4. Analytical approach

We ran descriptive statistics as well as bivariate and partial correlations among study variables using SPSS version 26. Our primary research question involved whether parenting stress mediated the relation between child temperament (i.e., negative affectivity, surgency, and effortful control) and child screen media use. Specifically, we hypothesized the following: (1) children with high negative affectivity would have mothers with greater parenting stress, which would be associated with more screen use for children; (2) children with high surgency would have mothers with greater parenting stress, which would be associated with more screen use for children; (3) children with low effortful control would have mothers with greater parenting stress, which would be associated with more screen use for children. To test these hypotheses, we used the SPSS macro PROCESS version 3.5 (Hayes, 2018) to run three mediation models, one for each aspect of child temperament. The mediation models were estimated based on 5000 bootstrapped samples using bias-corrected and accelerated 95 % confidence intervals (Preacher & Hayes, 2004).

3. Results

3.1. Preliminary analyses

Descriptive statistics and correlations between study variables are presented in Table 1. Using bivariate correlations, we examined whether child age and sex were significantly related to the study variables. Older children were reported higher in effortful control. Next, we used partial correlations to examine the associations among the variables of interest after controlling for child age and sex. Among the three child temperament dimensions, child surgency and child effortful control were positively correlated. Parenting stress was positively correlated with child negative affectivity and negatively correlated with child effortful control. Child screen use was positively related to child negative affectivity and parenting stress. All study variables were measured using forced-choice questions; therefore, no absent responses were present. However, the three child temperament dimensions had a “not applicable” response option, resulting in missing data (child negative affectivity: $n = 3$, child surgency: $n = 3$, child effortful control: $n = 3$) when participants chose the “not applicable” option for all questions.

3.2. Mediation analyses

3.2.1. Child negative affectivity and screen use: Testing for mediation by parenting stress

First, we examined the effect of child negative affectivity on screen use through parenting stress after controlling for children’s age and sex (see Fig. 1). The regression coefficients are shown in Table 2. Child negative affectivity positively predicted parenting stress. After controlling for child negative affectivity, parenting stress significantly predicted child screen media use. The mediation analysis showed a significant indirect effect of child negative affectivity on screen use through parenting stress. Thus, children who were higher in negative affectivity tended to have mothers with higher levels of parenting stress, which in turn, related to more screen use in children. The direct effect of child negative affectivity on child screen use was statistically significant. That is, after controlling for parenting stress, children with higher negative affectivity were more likely to have higher levels of screen use.

3.2.2. Child surgency and screen use: Testing for mediation by parenting stress

Next, we tested the effect of child surgency on screen use through parenting stress after controlling for children’s age and sex (see Fig. 2). The regression coefficients are shown in Table 3. Child surgency was a positive but non-significant predictor of parenting stress. After controlling for child surgency, parenting stress significantly predicted child screen use. The indirect effect of child surgency on child screen use via parenting stress was not significant. Thus, the level of child surgency did not significantly contribute to either mothers’ parenting stress or children’s screen use. The direct effect of child surgency on child screen use was not significant. That is, after controlling for parenting stress, child surgency was a positive but not significant predictor of child screen use.

3.2.3. Child effortful control and screen use: Testing for mediation by parenting stress

Lastly, we examined the effect of child effortful control on screen use through parenting stress after controlling for children’s age and sex (see Fig. 3). The regression coefficients are shown in Table 4. Child effortful control negatively predicted parenting stress. After controlling for child effortful control, parenting stress significantly predicted child screen media use. The mediational analysis revealed a significant indirect effect of child effortful control on screen use via parenting stress. Thus, mothers of children with lower effortful control reported higher levels of parenting stress, which was then related to greater screen use in children. The direct effect of child effortful control on child screen use was statistically significant. In other words, after accounting for parenting stress, children with higher effortful control were more likely to have greater screen use.

4. Discussion

The current study examined maternal parenting stress as a mediator in the relation of child temperament (i.e., negative affectivity,

Table 1

Descriptive Statistics, Zero-Order Bivariate Correlations Between Study Variables (Below Diagonal), and Partial Correlations Controlling for Child Age and Sex (Above Diagonal).

	Descriptives		Correlations						
	Mean (SD) or Freq. (%)	Range	1.	2.	3.	4.	5.	6.	7.
1. Child age (months)	28.0 (5.3)	18.3–36.9	–	–	–	–	–	–	–
2. Child sex	47.6 %	–	–.04	–	–	–	–	–	–
3. Child negative affectivity	3.7 (1.2)	1.1–6.7	<–.01	–.02	–	–.09	–.07	.59***	.52***
4. Child surgency	5.4 (0.9)	1.0–7.0	.10	–.06	.09	–	.53***	.01	.07
5. Child effortful control	4.9 (0.8)	1.7–7.0	.12*	.03	–.07	.53***	–	–.20***	.09
6. Parenting stress	84.5 (31.1)	36.0–173.0	–.07	.04	.59***	<–.01	–.21***	–	.42***
7. Child screen use	27.2 (19.5)	0.0–99.0	–.03	.03	.51***	.06	.09	.42***	–

Note. Variables included child age (months), child sex (0 = male, 1 = female), child negative affectivity, child surgency, child effortful control, parenting stress, and child screen use. The correlation matrix included Pearson correlations for continuous variable pairs (e.g., child age ~ child negative affectivity) and point-biserial correlations for continuous-dichotomous pairs (e.g., child age ~ child sex). * $p < .05$, *** $p < .001$.

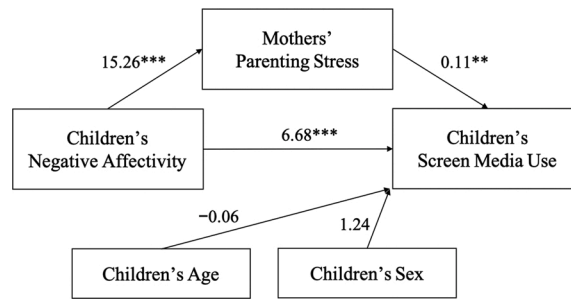


Fig. 1. Mediation Model with Parenting Stress as a Mediator Between Child Negative Affectivity and Screen Use.
 Note. ** $p < .01$, *** $p < .001$.

Table 2
 Mediation Analysis with Parenting Stress as a Mediator Between Child Negative Affectivity and Screen Use.

	B	SE	95 % CI
Parenting stress			
Child age	-0.37	0.28	[-0.92, 0.18]
Child sex	3.18	2.96	[-2.65, 9.01]
Negative affectivity	15.26***	1.23	[12.84, 17.67]
$R^2 = .35$			
$F = 52.38***$			
Child screen use			
Child age	-0.06	0.18	[-0.42, 0.30]
Child sex	1.24	1.95	[-2.60, 5.07]
Negative affectivity	6.68***	1.00	[4.72, 8.65]
Parenting stress	0.11**	0.04	[0.03, 0.18]
$R^2 = .29$			
$F = 28.88***$			
Indirect effect			
Negative affectivity → Parenting stress → Child screen use	1.66	0.79	[0.18, 3.29]

Note. ** $p < 0.01$, *** $p < .001$.

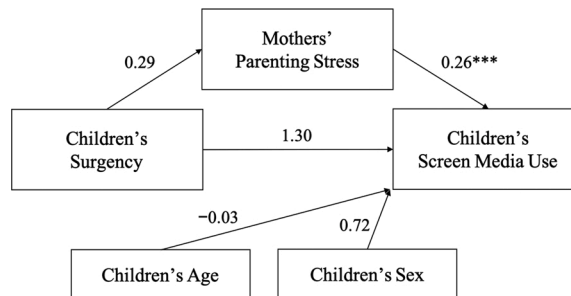


Fig. 2. Mediation Model with Parenting Stress as a Mediator Between Child Surgency and Screen Use.
 Note. *** $p < .001$.

surgency, and effortful control) to maternal decision-making around child screen use. The findings from this study demonstrated that mother-child dynamics were related to toddlers' screen use. Child negative affectivity and effortful control were associated with maternal parenting stress. Further, maternal parenting stress was related to children's screen use. Critically, children's negative affectivity and effortful control were each associated with children's screen use via maternal parenting stress. Children's surgency was not related to either maternal parenting stress or children's screen use.

4.1. Child temperament and screen use: Direct effects

Consistent with previous research (Nabi & Krcmar, 2016; Radesky et al., 2014; Tamana et al., 2019), children's temperament was associated with their screen use, but there were differences depending on the specific dimension of temperament. Children's negative affectivity and effortful control, but not surgency, had direct effects on child screen use, suggesting the unique relations of each dimension to children's screen use. In particular, child negative affectivity was positively associated with child screen use. Further,

Table 3
Mediation Analysis with Parenting Stress as a Mediator Between Child Surgency and Screen Use.

	B	SE	95 % CI
Parenting stress			
Child age	-0.39	0.35	[-1.07, 0.30]
Child sex	2.64	3.67	[-4.59, 9.87]
Surgency	0.29	1.95	[-3.56, 4.13]
$R^2 = .01$			
$F = 0.61$			
Child screen use			
Child age	-0.03	0.20	[-0.42, 0.36]
Child sex	0.72	2.09	[-3.39, 4.84]
Surgency	1.30	1.11	[-0.89, 3.48]
Parenting stress	0.26***	0.03	[0.19, 0.33]
$R^2 = .18$			
$F = 15.73***$			
Indirect effect			
Surgency → Parenting stress → Child screen use	0.08	0.53	[-0.89, 1.21]

Note. *** $p < .001$.

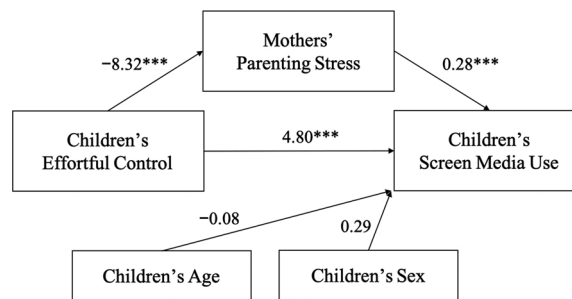


Fig. 3. Mediation Model with Parenting Stress as a Mediator Between Child Effortful Control and Screen Use.
Note. *** $p < .001$.

Table 4
Mediation Analysis with Parenting Stress as a Mediator Between Child Effortful Control and Screen Use.

	B	SE	95 % CI
Parenting stress			
Child age	-0.24	0.34	[-0.91, 0.43]
Child sex	3.01	3.59	[-4.06, 10.08]
Effortful control	-8.32***	2.36	[-12.97, -3.67]
$R^2 = .05$			
$F = 4.76**$			
Child screen use			
Child age	-0.08	0.19	[-0.46, 0.31]
Child sex	0.29	2.05	[-3.74, 4.33]
Effortful control	4.80***	1.38	[2.09, 7.51]
Parenting stress	0.28***	0.03	[0.22, 0.35]
$R^2 = .21$			
$F = 19.01***$			
Indirect effect			
Effortful control → Parenting stress → Child screen use	-2.37	0.70	[-3.81, -1.06]

Note. ** $p < .01$, *** $p < .001$.

there was a significant direct effect of child negative affectivity such that child negative affectivity was positively associated with child screen use after accounting for parenting stress. Children who were easily irritated and difficult to be soothed were more likely to be exposed to screen media. This result supports prior research that children's expression of negative emotionality may lead to greater media use (Radesky et al., 2016; Thompson et al., 2013).

Children's effortful control was not associated with their screen use. However, after controlling for parenting stress, there was a significant direct effect of child effortful control on screen use. Thus, when parenting stress was accounted for, children who had high effortful control were more likely to use screen media compared to those who had low effortful control. This result did not support previous research indicating a link between regulatory problems and greater screen use (Cliff et al., 2018; Linder et al., 2020; Radesky

et al., 2014). It may be related to how regulation was conceptualized and measured. The previous research used assessments to diagnose regulatory disorders such as Infant-Toddler Symptom Checklist (DeGangi, Poisson, SICKEL, & WIENER, 1995) or the Preschool Pediatric Symptom Checklist (Sheldrick et al., 2012), whereas the current study assessed the ability of attentional and behavioral control as measured and defined within the temperament literature (Eisenberg et al., 2010; Gartstein et al., 2012). Therefore, regulatory difficulties such as sleeping and feeding issues using clinical assessment may have reflected more specific regulatory issues, whereas effortful control is considered as a foundation of self-regulation. Given that effortful control includes modulating and controlling attention, toddlers high in effortful control may be more focused and engaged when in front of screens, which may lead to more use of screens after accounting for parenting stress. In addition, children with high effortful control tend to enjoy low-intensity stimulation and activities, including reading books (Gartstein & Rothbart, 2003). Thus, they may enjoy watching screens over approaching novel objects and activities when parental stress was accounted for.

Alternatively, the measurement of screen time could explain why the effortful control effect observed in the current study appears to contradict earlier studies in which effortful control was negatively related to toddlers' screen use (Cliff et al., 2018; Radesky et al., 2014). The current study measured various types of screen media, including TV, computers, and mobile devices. In contrast, prior work specifically focused on TV/video viewing (Radesky et al., 2014) or computer and video game use (Cliff et al., 2018). Interactive mobile media such as tablets and smartphones may provide opportunities for toddlers to exercise control, contributing to higher effortful control. A particular strength of the current study was the inclusion of multiple types of screen media. Future research would benefit from including a range of screen media activities to fully elucidate the link between children's effortful control and screen use.

On the other hand, children's surgency was not related to their screen use. Further, there was no significant indirect effect of child surgency on screen use after accounting for parenting stress. Thus, in our sample, toddlers' tendencies toward being active, approachable, and enjoying sensation seeking were not associated with their exposure to screen media. These findings are similar to Leppänen et al. (2020)'s finding that surgency and screen use were not associated in 4-year-old children. Children with higher surgency have a tendency to actively engage in their physical environment by seeking sensation activities or high-intensive stimulation (Putnam, Gartstein, & Rothbart, 2006). Perhaps children with higher surgency may be more likely to prefer interacting with people and intense physical activities than sitting and watching screens. More research is needed to provide more conclusive evidence on the association between child surgency and screen use.

4.2. Child temperament and parenting stress

Child temperament domains were differentially related to maternal parenting stress. Children's negative affectivity and effortful control, but not surgency, were linked to maternal parenting stress. Consistent with prior research demonstrating the link between children's negative affectivity and parenting stress (Bayly & Gartstein, 2013; Scher & Sharabany, 2005), mothers were more likely to report higher levels of parenting stress when their children were easily irritated and difficult to be soothed. This result suggests that mothers may experience greater difficulty in managing children's negative affectivity. Caring for children who tend to be easily distressed and cry may increase mothers' negative perceptions or feelings about parenting roles by depleting their emotional and physical resources for parenting (Deater-Deckard, 1998).

Along with negative affectivity, effortful control was associated with maternal parenting stress but in the opposite direction. Consistent with previous research demonstrating the relation between low effortful control and greater parenting stress in toddlerhood (Tsotsi et al., 2019; Voigt et al., 2013), mothers of toddlers who had low effortful control reported higher levels of parenting stress. This suggests that children's regulatory skills were associated with levels of maternal parenting stress. As the increased demands of parenting were more likely to be related to parenting stress (Neece et al., 2012), mothers of toddlers with low effortful control may experience more parenting stress because they had to make greater effort to manage attention, emotion, and behavior of their toddlers.

Contrary to our hypothesis, children's surgency was not related to maternal parenting stress. This finding is consistent with previous work reporting non-significant associations between surgency and parenting stress (Oddi et al., 2013). It is possible that children's intimating aspects of surgency, positive affectivity, and sociality were important to build attachment with mothers and may help to reduce distress in their parenting role. Pleasure in interactions with children may compensate for the demands of parenting coming from children's inclination to approach novelty and impulsivity. The link between higher surgency and lower parenting stress (Pesonen et al., 2008) supports the role of children's surgency in parent-child relationships. Since young children's temperament and parenting behavior are interrelated (Rubin, Burgess, Dwyer, & Hastings, 2003), mothers may interact differently with their children. The positive emotionality aspects of surgency may be differently associated with mothers' perceptions of parenting by interplaying with other factors such as mothers' personality or marital relationship. Further research is needed to examine which aspect of surgency is associated with parenting stress and other factors that moderate the relation of surgency to parenting stress.

4.3. Parenting stress and screen use

Parenting stress of mothers was related to their children's screen use in all three models. The more mothers perceived stress associated with parenting, the more their toddlers consumed screen media. The positive association between maternal parenting stress and child screen use aligns with previous research that explored the role of parents, such as maternal depression and mental health, in child screen media use (Bank et al., 2012; Beyens et al., 2016; Thompson & Christakis, 2007). Importantly, the current study demonstrated a link between mothers' parenting-specific stress and screen use in toddlerhood by assessing particular stress related to parenting, including mothers' perception of parental roles, parent-child relationships, and child's characteristics, rather than general stress of mothers. Because parenting stress is distinct from stress in other roles and situations (Deater-Deckard, 2008), stress associated

with parenting roles can be particularly important to understand parental decision-making on child screen use.

Given that common motivations in parents' decisions in their children's media use is satisfying parental needs (Beyens & Eggermont, 2014; Elias & Sulkin, 2019), mothers who experienced higher levels of parenting stress may be more likely to use the media to keep their children occupied because they may lack resources to meet the demands of parenting. In Hiniker et al.'s () qualitative research, parents mentioned how they utilize media for their parenting, saying that they gave a tablet or a smartphone in order for them to complete personal or family activities. Because greater parenting stress indicates parents' negative perception of parental roles and the lack of the parenting resources (Neece et al., 2012), mothers with higher parenting stress may have less motivation and energy to interact with their children, and thus they were more likely to allow their young children to consume media. In particular, toddlerhood is a crucial period for both children and mothers; foundations of cognition, socioemotional, and behavior significantly develop during toddlerhood (Diamond, 2002). Also, the demands of parenting are notably raised due to increased autonomy and noncompliance of toddlers (Chester & Blandon, 2016). Considering the unique demands of parenting toddlers, mothers of toddlers need to be mindful of the prolonged effects of media exposure on children. Further, parenting-related supports are needed to reduce parenting stress to help them create optimal media environments for toddlers.

4.4. Child temperament and screen use: Indirect effects via parenting stress

Maternal parenting stress mediated the relation of children's negative affectivity to screen use and the relation of children's effortful control to screen use. Children with higher negative affectivity were more likely to be associated with maternal parenting stress, which in turn, was related to mothers' decision-making on their children's screen use. These results support previous research that infants who were frequently crying and distressed tended to have greater exposure to television (Thompson et al., 2013). Young children's tantrums may be a child factor that influences parents to allow additional screen use. Although parents appears to be hesitant about this decision for their young children (Hiniker, Schoenebeck, & Kientz, 2016), recent research suggests that handheld digital media devices such as phones and tablets are becoming the new electronic babysitter (Beyens & Eggermont, 2014). Because toddlers who were higher in negative affectivity might be challenging for mothers to handle, mothers who lacked parenting resources may need an electronic babysitter to alleviate their parenting stress or have time for themselves (Nabi & Krcmar, 2016).

Children's effortful control also had an indirect effect on their screen use through maternal parenting stress. Children rated low in effortful control were more likely to have mothers reporting higher maternal parenting stress, which in turn, was related to higher screen media use in children. These results suggest that mothers with higher parenting stress related to children's effortful control may use media to calm or distract toddlers, supporting one of parental motivations of children's screen media use—calming the child (Beyens & Eggermont, 2014). Distress from children's low regulation may encourage mothers to allow more screen use for their young children.

Children's surgency and screen use, however, were neither related nor mediated by parenting stress. The absence of a mediating role of parenting stress in the relation between child surgency and screen use confirmed that surgency was not related to mothers' distress, parent-child dysfunctional relationship, or young children's consumption of screen media. As noted earlier, positive emotional aspects of surgency, including smiling and laughing, were more likely to elicit maternal pleasure in the interaction with their children (Tsotsi et al., 2019) and compensate for the fatigue of parenting. In addition, children's active, approachable, and sensation seeking characteristics may facilitate them to enjoy the physical activities rather than keeping them in front of the screen.

As parents are majorly in charge of the home media environment especially during the early years of life (Lauricella, Wartella, & Rideout, 2015), these findings have implications for parental guidelines on how to manage toddlers' screen use based on different dimensions of child temperament. Given the dynamics between children's temperament and mothers' parenting stress, targeted recommendations and support may be needed for parents who use screens to cope with parenting stress in families of children with different temperament characteristics. As Neumann (2015) suggested strategies for parents to take a mindful approach to their children's digital media use, providing parents with strategies to distinct temperamental characteristics may help to lessen parenting stress, and in turn, reduce child screen use. Further, by supporting parents of children with higher negative affectivity and lower effortful control, parenting stress may be reduced, leading to enhanced healthy media habits for young children.

4.5. Limitations and future directions

Although the current study examined the mediating role of parenting stress in the association between child temperament and screen use, one of the limitations of our work was the self-report nature of the measures. Given that self-report could be biased by social desirability and inaccurate recall, diverse assessments from multi-informants and direct observations would increase our understanding of these relations. Future work needs to consider electronic devices to more accurately measure media time or observational measurement for child temperament.

Because the results from this study were based on a correlational approach, we cannot infer that parental stress caused screen use with temperamentally difficult children. It might be possible that toddlers who were exposed to more screen media were less regulated and expressed more negative emotionality because of increased screen use. It could also be the case that parenting stress may dynamically interact with child temperament prior to the time point measured in this study. According to a developmental cascade framework, what occurs at one point in development can create a ripple effect by shifting the path of development and setting the stage for future experiences (Oakes & Rakison, 2019). Therefore, developmental outcomes, like children's screen use, are cumulative results of different trajectories of relations between child temperament and parenting stress, and longitudinal investigations have shown the cascade effects of cumulative interactions among parental factors and child temperament traits (Hentges, Graham, Plamondon, Tough,

& Madigan, 2019; Perry, Dollar, Calkins, & Bell, 2018). In regard to our findings, high levels of parenting stress may initiate developmental cascades that can exacerbate initial differences in child temperament over time. Further, parental personality such as neuroticism or anxiety may play a role in the interplay between parenting stress and child temperament (Clark, Kochanska, & Ready, 2000; Oddi et al., 2013). Alternative explanations involving these interacting trajectories should be acknowledged to address potential associations among parenting stress, child temperament, and screen use through future longitudinal examination of these relations, which may allow for causal interpretations that our cross-sectional study cannot address.

We also recognize that this measure of screen use accounts for the frequency of screen use and not the content or context of the screen media use, which are important factors to fully understand children's screen media. High-quality educational content or using screen use to connect with family members may show different patterns associated with child temperament and parenting stress than playing games alone or watching videos for entertainment. Considering the role of parental engagement with their children during screen use (Radesky, Schumacher, & Zuckerman, 2015), parental co-use of screen media with their young children may yield different results. Thus, future studies should consider the content and context of early media exposure to better understand how child and parenting characteristics contribute to young children's screen media use.

4.6. Conclusions

Understanding the family dynamics surrounding screen media use is crucial to our understanding of media effects, policy development, and interventions targeting individuals and families to benefit child health and development. This study examined the role of parenting stress as a mechanism through which temperament relates to parental influence on toddlers' screen use. Exploring children's unique characteristics, such as temperament, and their relation to parenting have not been fully integrated with children's media effects research (Valkenburg & Peter, 2013). The findings from this study allow us to understand media-related parenting in toddlerhood and help us to develop specific strategies to support families with young children to build healthy media habits. Given the mediating role of mothers' parenting stress in the association between child temperament and screen use, offering parenting classes or home visiting services designed to better understand children's temperament and thus decrease parenting stress may be particularly useful in reducing screen use in toddlers. This line of work can provide practical guidelines that are moving from whether or not parents should allow screens for their young children to how society or communities can support families to develop healthy habits for screen media use from early in life.

Author statements

Eunkyung Shin: Conceptualization, Methodology, Software, Investigation, Data Curation, Formal analysis, Writing - Original draft preparation. **Koeun Choi:** Conceptualization, Software, Validation, Resources, Data curation, Writing - Reviewing and Editing, Supervision, Project administration, Funding acquisition. **Jessica Resor:** Data curation, Validation, Visualization, Writing - Reviewing and Editing. **Cynthia L. Smith:** Conceptualization, Methodology, Resources, Writing - Reviewing and Editing, Supervision, Funding acquisition.

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Declaration of Competing Interest

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References

- Abidin, R. R. (2012). *Parenting stress Index-4th edition short form (PSI-4-SF)*. Psychological Assessment Resources.
- Akerman, A. B. (1995). Eight-year follow-up of cognitive development in 33 twin pairs. *Acta Geneticae Medicae et Gemellogiae*, 44, 179–188. <https://doi.org/10.1017/S000156600001598>.
- American Academy of Pediatrics [AAP]. (2016). Media and young minds. *Pediatrics*, 138(5), Article e20162591. <https://doi.org/10.1542/peds.2016-2591>.
- Anderson, D. R., & Pempek, T. A. (2005). Television and very young children. *American Behavioral Scientist*, 48(5), 505–522. <https://doi.org/10.1177/0002764204271506>.
- Bank, A. M., Barr, R., Calvert, S. L., Parrott, W. G., McDonough, S. C., & Rosenblum, K. (2012). Maternal depression and family media use: A questionnaire and diary analysis. *Journal of Child and Family Studies*, 21(2), 208–216. <https://doi.org/10.1007/s10826-011-9464-1>.
- Barr, R., Lauricella, A., Zack, E., & Calvert, S. L. (2010). Infant and early childhood exposure to adult-directed and child-directed television programming: Relations with cognitive skills at age four. *Merrill-Palmer Quarterly*, 56, 21–48. <https://doi.org/10.1542/peds.2016-2591>.
- Bayly, B., & Gartstein, M. (2013). Mother's and father's reports on their child's temperament: Does gender matter? *Infant Behavior and Development*, 36(1), 171–175. <https://doi.org/10.1016/j.infbeh.2012.10.008>.
- Belsky, J., & Jaffee, S. R. (2006). The multiple determinants of parenting. In D. Cicchetti, & D. J. Cohen (Eds.), *Developmental psychopathology: Risk, disorder, and adaptation* (pp. 38–85). New York, NY: Wiley.
- Beysens, I., & Eggermont, S. (2014). Putting young children in front of the television: Antecedents and outcomes of parents' use of television as a babysitter. *Communication Quarterly*, 62(1), 57–74. <https://doi.org/10.1080/01463373.2013.860904>.

- Beyens, I., Eggermont, S., & Nathanson, A. I. (2016). Understanding the relationship between mothers' attitudes toward television and children's television exposure: A longitudinal study of reciprocal patterns and the moderating role of maternal stress. *Media Psychology*, 19(4), 638–665. <https://doi.org/10.1080/15213269.2016.1142383>.
- Bridgett, D. J., Oddi, K. B., Laake, L. M., Murdock, K. W., & Bachmann, M. N. (2013). Integrating and differentiating aspects of self-regulation: effortful control, executive functioning, and links to negative affectivity. *Emotion*, 13(1), 47. <https://doi.org/10.1037/A0029536>.
- Chester, C. E., & Blandon, A. Y. (2016). Dual trajectories of maternal parenting stress and marital intimacy during toddlerhood. *Personal Relationships*, 23(2), 265–279. <https://doi.org/10.1111/per.12122>.
- Cingel, D. P., & Krcmar, M. (2013). Predicting media use in very young children: The role of demographics and parent attitudes. *Communication Studies*, 64(4), 374–394. <https://doi.org/10.1080/10510974.2013.770408>.
- Clark, L. A., Kochanska, G., & Ready, R. (2000). Mothers' personality and its interaction with child temperament as predictors of parenting behavior. *Journal of Personality and Social Psychology*, 79(2), 274. <https://doi.org/10.1037/0022-3514.79.2.274>.
- Cliff, D. P., Howard, S. J., Radesky, J. S., McNeill, J., & Vella, S. A. (2018). Early childhood media exposure and self-regulation: Bidirectional longitudinal associations. *Academic Pediatrics*, 18(7), 813–819. <https://doi.org/10.1016/j.acap.2018.04.012>.
- Deater-Deckard, K. (1998). Parenting stress and child adjustment: Some old hypotheses and new questions. *Clinical Psychology: Science and Practice*, 5(3), 314–332. <https://doi.org/10.1111/j.1468-2850.1998.tb00152.x>.
- Deater-Deckard, K. (2008). *Parenting stress*. New Haven, CT: Yale University Press.
- DeGangi, G., Poisson, S., Sichel, R., & Wiener, A. S. (1995). *Infant/toddler symptom checklist: A screening tool for parents*. Tucson, AZ: Therapy Skill Builders.
- Diamond, A. (2002). Normal development of prefrontal cortex from birth to young adulthood: Cognitive functions, anatomy, and biochemistry. In D. T. Stuss, & R. T. Knight (Eds.), *Principles of frontal lobe function* (pp. 466–503). London: Oxford University Press.
- Duch, H., Fisher, E. M., Ensari, I., & Harrington, A. (2013). Screen time use in children under 3 years old: A systematic review of correlates. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 102. <https://doi.org/10.1186/1479-5868-10-102>.
- Egger, H. L., & Emde, R. N. (2011). Developmentally sensitive diagnostic criteria for mental health disorders in early childhood: The diagnostic and statistical manual of mental disorders—IV, the research diagnostic criteria—Preschool age, and the Diagnostic Classification of Mental Health and Developmental Disorders of Infancy and Early Childhood—Revised. *American Psychologist*, 66(2), 95–106. <https://doi.org/10.1037/a0021026>.
- Eisenberg, N., Haugen, R., Spinrad, T. L., Hofer, C., Chassin, L., Zhou, Q., & Liew, J. (2010). Relations of temperament to maladjustment and ego resiliency in at-risk children. *Social Development*, 19(3), 577–600. <https://doi.org/10.1111/j.1467-9507.2009.00550.x>.
- Eisenberg, N., Smith, C. L., & Spinrad, T. L. (2016). Effortful control: Relations with emotion regulation, adjustment, and socialization in childhood. In K. D. Vohs, & R. F. Baumeister (Eds.), *Handbook of self-regulation: Research, theory, and applications* (3rd ed., pp. 458–478). New York, NY: Guilford.
- Elias, N., & Sulkin, I. (2019). Screen-assisted parenting: The relationship between toddlers' screen time and parents' use of media as a parenting tool. *Journal of Family Issues*, 40(18), 2801–2822. <https://doi.org/10.1177/0192513X19864983>.
- Garrison, M. M., Liekweg, K., & Christakis, D. A. (2011). Media use and child sleep: The impact of content, timing, and environment. *Pediatrics*, 128(1), 29–35. <https://doi.org/10.1542/peds.2010-3304>.
- Gartstein, M. A., & Rothbart, M. K. (2003). Studying infant temperament via the revised infant behavior questionnaire. *Infant Behavior and Development*, 26(1), 64–86. [https://doi.org/10.1016/S0163-6383\(02\)00169-8](https://doi.org/10.1016/S0163-6383(02)00169-8).
- Gartstein, M. A., Putnam, S. P., & Rothbart, M. K. (2012). Etiology of preschool behavior problems: Contributions of temperament attributes in early childhood. *Infant Mental Health Journal*, 33(2), 197–211. <https://doi.org/10.1002/imhj.21312>.
- Hartman, R. R., Stage, S. A., & Webster-Stratton, C. (2003). A growth curve analysis of parent training outcomes: Examining the influence of child risk factors (inattention, impulsivity, and hyperactivity problems), parental and family risk factors. *Journal of Child Psychology and Psychiatry*, 44(3), 388–398. <https://doi.org/10.1111/1469-7610.00129>.
- Hayes, A. F. (2018). Partial, conditional, and moderated mediation: Quantification, inference, and interpretation. *Communication Monographs*, 85(1), 4–40. <https://doi.org/10.1080/03637751.2017.1352100>.
- Hentges, R. F., Graham, S. A., Plamondon, A., Tough, S., & Madigan, S. (2019). A developmental cascade from prenatal stress to child internalizing and externalizing problems. *Journal of Pediatric Psychology*, 44(9), 1057–1067. <https://doi.org/10.1093/jpepsy/jsz044>.
- Hiniker, A., Schoenebeck, S. Y., & Kientz, J. A. (2016). Not at the dinner table: Parents' and children's perspectives on family technology rules. February. *Proceedings of the 19th ACM conference on computer-supported cooperative work & social computing* (pp. 1376–1389). New York, NY: Association for Computing Machinery.
- Huth-Bocks, A. C., & Hughes, H. M. (2008). Parenting stress, parenting behavior, and children's adjustment in families experiencing intimate partner violence. *Journal of Family Violence*, 23(4), 243–251. <https://doi.org/10.1007/s10896-007-9148-1>.
- Jonas, K., & Kochanska, G. (2018). An imbalance of approach and effortful control predicts externalizing problems: Support for extending the dual-systems model into early childhood. *Journal of Abnormal Child Psychology*, 46(8), 1573–1583. <https://doi.org/10.1007/s10802-018-0400-3>.
- Kiff, C. J., Lengua, L. J., & Zalewski, M. (2011). Nature and nurturing: Parenting in the context of child temperament. *Clinical Child and Family Psychology Review*, 14(3), 251. <https://doi.org/10.1007/s10567-011-0093-4>.
- Knickmeyer, R. C., Gouttard, S., Kang, C., Evans, D., Wilber, K., Smith, J. K., & Gilmore, J. H. (2008). A structural MRI study of human brain development from birth to 2 years. *Journal of Neuroscience*, 28, 12176–12182. <https://doi.org/10.1523/JNEUROSCI.3479-08.2008>.
- Lauricella, A. R., Wartella, E., & Rideout, V. J. (2015). Young children's screen time: The complex role of parent and child factors. *Journal of Applied Developmental Psychology*, 36, 11–17. <https://doi.org/10.1016/j.appdev.2014.12.001>.
- Leppänen, M. H., Sääksjärvi, K., Vepsäläinen, H., Ray, C., Hiltunen, P., Koivusilta, L., ... Roos, E. (2020). Association of screen time with long-term stress and temperament in preschoolers: Results from the DAGIS study. *European Journal of Pediatrics*. <https://doi.org/10.1007/s00431-020-03686-5>. Retrieved from
- Lillard, A. S., Drell, M. B., Richey, E. M., Boguszewski, K., & Smith, E. D. (2015). Further examination of the immediate impact of television on children's executive function. *Developmental Psychology*, 51(6), 792. <https://doi.org/10.1037/a0039097>.
- Linder, L., Potter, N. S., & Garrity, S. (2020). The moderating role of parental strain on the relationship between child media use and regulation. *Cyberpsychology, Behavior, and Social Networking*, 23(6), 392–399. <https://doi.org/10.1089/cyber.2019.0480>.
- McDaniel, B. T., & Radesky, J. S. (2020). Longitudinal associations between early childhood externalizing behavior, parenting stress, and child media use. *Cyberpsychology, Behavior, and Social Networking*, 23(6), 384–391. <https://doi.org/10.1089/cyber.2019.0478>.
- Molfese, V. J., Rudasill, K. M., Beswick, J. L., Jacobi-Vessels, J. L., Ferguson, M. C., & White, J. M. (2010). Infant temperament, maternal personality, and parenting stress as contributors to infant developmental outcomes. *Merrill-Palmer Quarterly*, 56(1), 49–79. www.jstor.org/stable/23098083.
- Moreira, H., & Canavarro, M. C. (2018). The association between self-critical rumination and parenting stress: The mediating role of mindful parenting. *Journal of Child and Family Studies*, 27(7), 2265–2275. <https://doi.org/10.1007/s10826-018-1072-x>.
- Nabi, R. L., & Krcmar, M. (2016). It takes two: The effect of child characteristics on US parents' motivations for allowing electronic media use. *Journal of Children and Media*, 10(3), 285–303. <https://doi.org/10.1080/17482798.2016.1162185>.
- Nathanson, A. I., & Beyens, I. (2018). The role of sleep in the relation between young children's mobile media use and effortful control. *British Journal of Developmental Psychology*, 36(1), 1–21. <https://doi.org/10.1111/bjdp.12196>.
- Neece, C. L., Green, S. A., & Baker, B. L. (2012). Parenting stress and child behavior problems: A transactional relationship across time. *American Journal on Intellectual and Developmental Disabilities*, 117(1), 48–66. <https://doi.org/10.1352/1944-7558-117.1.48>.
- Neppel, T. K., Jeon, S., Diggs, O., & Donnellan, M. B. (2020). Positive parenting, effortful control, and developmental outcomes across early childhood. *Developmental Psychology*, 56(3), 444–457. <https://doi.org/10.1037/dev0000874>.
- Neumann, M. (2015). Young children and screen time: Creating a mindful approach to digital technology. *Australian Educational Computing*, 30(2). Retrieved from <http://journal.acce.edu.au/index.php/AEC/article/view/67>.
- Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry*, 47(3-4), 395–422. <https://doi.org/10.1111/j.1469-7610.2006.01612.x>.

- Oakes, L. M., & Rakison, D. H. (2019). *Developmental cascades: Building the infant mind*. Oxford University Press.
- Oddi, K. B., Murdock, K. W., Vadnais, S., Bridgett, D. J., & Gartstein, M. A. (2013). Maternal and infant temperament characteristics as contributors to parenting stress in the first year postpartum. *Infant and Child Development*, 22(6), 553–579. <https://doi.org/10.1002/icd.1813>.
- Pempek, T. A., & McDaniel, B. T. (2016). Young children's tablet use and associations with maternal well-being. *Journal of Child and Family Studies*, 25(8), 2636–2647. <https://doi.org/10.1007/s10826-016-0413-x>.
- Perry, N. B., Dollar, J. M., Calkins, S. D., & Bell, M. A. (2018). Developmental cascade and transactional associations among biological and behavioral indicators of temperament and maternal behavior. *Child Development*, 89(5), 1735–1751. <https://doi.org/10.1111/cdev.12842>.
- Pesonen, A. K., Rääkkönen, K., Heinonen, K., Komi, N., Järvenpää, A. L., & Strandberg, T. (2008). A transactional model of temperamental development: Evidence of a relationship between child temperament and maternal stress over five years. *Social Development*, 17(2), 326–340. <https://doi.org/10.1111/j.1467-9507.2007.00427.x>.
- Potegal, M., & Davidson, R. J. (2003). Temper tantrums in young children: 1. Behavioral composition. *Journal of Developmental and Behavioral Pediatrics*, 24, 140–147. <https://doi.org/10.1097/00004703-200306000-00002>.
- Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, 36(4), 717–731. <https://doi.org/10.3758/BF03206553>.
- Putnam, S. P., Gartstein, M. A., & Rothbart, M. K. (2006). Measurement of fine-grained aspects of toddler temperament: The early childhood behavior questionnaire. *Infant Behavior and Development*, 29(3), 386–401. <https://doi.org/10.1016/j.infbeh.2006.01.004>.
- Putnam, S. P., Jacobs, J., Gartstein, M. A., & Rothbart, M. K. (2010). Development and assessment of short and very short forms of the Early Childhood Behavior Questionnaire. March Poster Presented at International Conference on Infant Studies, Baltimore, MD.
- Putnam, S. P., Sanson, A. V., & Rothbart, M. K. (2002). Child temperament and parenting. In M. H. Bornstein (Ed.), *Handbook of parenting: Children and parenting* (pp. 255–277). Lawrence Erlbaum Associates Publishers.
- Radesky, J. S., Silverstein, M., Zuckerman, B., & Christakis, D. A. (2014). Infant self-regulation and early childhood media exposure. *Pediatrics*, 133(5), 1172–1178. <https://doi.org/10.1542/peds.2013-2367>.
- Radesky, J. S., Schumacher, J., & Zuckerman, B. (2015). Mobile and interactive media use by young children: The good, the bad, and the unknown. *Pediatrics*, 135(1), 1–3. <https://doi.org/10.1542/peds.2014-2251>.
- Radesky, J. S., Peacock-Chambers, E., Zuckerman, B., & Silverstein, M. (2016). Use of mobile technology to calm upset children: Associations with social-emotional development. *Journal of American Medical Association Pediatrics*, 170(4), 397–399. <https://doi.org/10.1001/jamapediatrics.2015.4260>.
- Rideout, V. J. (2011). *Zero to eight: Children's media use in America*. San Francisco, CA: Common Sense Media.
- Rideout, V. J. (2013). *Zero to eight: Children's media use in America*. San Francisco, CA: Common Sense Media.
- Rideout, V. (2017). *The Common Sense census: Media use by kids age zero to eight*. San Francisco, CA: Common Sense Media.
- Rothbart, M. K. (2007). Temperament, development, and personality. *Current Directions in Psychological Science*, 16(4), 207–212. <https://doi.org/10.1111/j.1467-8721.2007.00505.x>.
- Rothbart, M. K., & Bates, J. E. (2006). Temperament. In N. Eisenberg (Vol. Ed.), W. Damon, & R. M. Lerner (Series Eds.), *Handbook of child psychology*. Vol. 3. Social, emotional, personality development (pp. 99–166). Wiley.
- Rothbart, M. K., & Derryberry, D. (1981). Theoretical issues in temperament. In M. E. Lamb, & A. Brown (Eds.), *Advances in developmental psychology* (Vol. 1, pp. 37–486). Hillsdale, NJ: Erlbaum.
- Rubin, K. H., Burgess, K. B., Dwyer, K. M., & Hastings, P. D. (2003). Predicting preschoolers' externalizing behaviors from toddler temperament, conflict, and maternal negativity. *Developmental Psychology*, 39(1), 164–176. <https://doi.org/10.1037/0012-1649.39.1.164>.
- Scher, A., & Sharabany, R. (2005). Parenting anxiety and stress: Does gender play a part at 3 months of age? *The Journal of Genetic Psychology*, 166(2), 203–214. <https://doi.org/10.3200/GNTP.166.2.203-214>.
- Sheldrick, R. C., Henson, B. S., Merchant, S., Neger, E. N., Murphy, J. M., & Perrin, E. C. (2012). The Preschool Pediatric Symptom Checklist (PPSC): Development and initial validation of a new social/emotional screening instrument. *Academic Pediatrics*, 12(5), 456–467. <https://doi.org/10.1016/j.acap.2012.06.008>.
- Tamana, S. K., Ezeugwu, V., Chikuma, J., Lefebvre, D. L., Azad, M. B., Moraes, T. J., ... Mandhane, P. J. (2019). Screen-time is associated with inattention problems in preschoolers: Results from the CHILDBIRTH cohort study. *PLoS One*, 14(4), Article e0213995. <https://doi.org/10.1016/j.acap.2012.06.008>.
- Teti, D. M., & Huang, K. Y. (2005). Developmental perspectives on parenting competence. In D. M. Teti (Ed.), *Handbook of research methods in developmental science* (pp. 161–182). Oxford, England: Blackwell.
- Thompson, D. A., & Christakis, D. A. (2007). The association of maternal mental distress with television viewing in children under 3 years old. *Ambulatory Pediatrics*, 7(1), 32–37. <https://doi.org/10.1016/j.ambp.2006.09.007>.
- Thompson, A. L., Adair, L. S., & Bentley, M. E. (2013). Maternal characteristics and perception of temperament associated with infant TV exposure. *Pediatrics*, 131, 390–397. <https://doi.org/10.1542/peds.2012-1224>.
- Tsotsi, S., Broekman, B. F., Shek, L. P., Tan, K. H., Chong, Y. S., Chen, H., ... Rifkin-Graboi, A. E. (2019). Maternal parenting stress, child exuberance, and preschoolers' behavior problems. *Child Development*, 90(1), 136–146. <https://doi.org/10.1111/cdev.13180>.
- Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication*, 63, 221–243. <https://doi.org/10.1111/jcom.12024>.
- Voigt, B., Brandl, A., Pietz, J., Pauen, S., Kliegel, M., & Reuner, G. (2013). Negative reactivity in toddlers born prematurely: Indirect and moderated pathways considering self-regulation, neonatal distress and parenting stress. *Infant Behavior and Development*, 36(1), 124–138. <https://doi.org/10.1016/j.infbeh.2012.11.002>.
- Warren, R., & Aloia, L. (2019). Parenting style, parental stress, and mediation of children's media use. *Western Journal of Communication*, 83(4), 483–500. <https://doi.org/10.1080/10570314.2019.1582087>.
- Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. *Pediatrics*, 120, 986–992. <https://doi.org/10.1542/peds.2006-3322>.