Children's Screen and Problematic Media Use in the United States Before and During the COVID-19 Pandemic

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Abstract

This mixed methods study examined parent-reported child screen media use before and during the COVID-19 pandemic by examining 2019-2020 changes in parent perceptions of media, screen media use (SMU), and problematic media use (PMU) in children ages 2-13 years (*N* =129; 64 boys, 64 girls, 1 nonbinary; 90.7% White, 4.6% Hispanic/Latino, .8% Black, 8.5% multiethnic; primarily middle-to-high income). Quantitative analyses showed a significant SMU and PMU increase (medium effect size). There was a steeper increase in PMU among school-age (older) children. Together, the qualitative and quantitative results suggest the PMU and SMU increase were influenced by distal, proximal, and maintaining factors including the COVID-19 pandemic, distance learning, child behaviors, other children, parental mediation, and positive media reinforcement.

Children's Screen and Problematic Media Use in the United States Before and During the COVID-19 Pandemic

The COVID-19 pandemic has caused marked changes across all layers of children's social ecologies, including family routines, schooling, media habits, and the broader economy. Cross-national studies in the early months of the pandemic identified patterns of self-reported lifestyle changes among adolescents and adults, including more time spent physically inactive and using screens (Dutta et al., 2020; Pišot et al., 2020). The most striking change in children's daily lives and routines was the rapid closure of schools to reduce transmission of the virus. In the spring of 2020, nearly 93% of respondents in U.S. households with children reported that their children were engaging in some form of "distance learning" via online resources (80%) or paper materials (20%) sent home by the school (U.S. Census Bureau, 2020). Additionally, roughly 40% of Americans are working from home full time during the pandemic (Smith, 2020), creating new demands on parents who are simultaneously working and monitoring their children during the day (Eales et al., in press). Such cross-cutting changes in daily life have reinvigorated debates about screen media usage among children and adolescents, both within the academic literature (Nagata et al., 2020) and within the popular press (Kamenetz, 2020; Wartella, 2020). Prior to the pandemic, 66% of all U.S. parents reported that they believe parenting is harder today than it was 20 years ago; most citing technology as the main reason for this change (Auxier et al., 2020). Additionally, 71% of parents of children under 12 years old reported that they were somewhat or very concerned that their child spends too much time in front of screens, even though the majority also reported confidence in knowing appropriate limits (Auxier et al., 2020). The disruptions to daily life and family routines necessitate efforts to understand how to minimize the risks and maximize the potential benefits of screen media use for children and

families during this pandemic.

Child screen media use has changed since the COVID-19 pandemic began, with research emerging on its correlates and new patterns of use. The World Health Organization (WHO) and American Academy of Pediatrics (AAP) generally recommended a maximum of one hour of screen time for children under 5 and consistent, family-specific limits for older children (AAP, 2016; WHO, 2019). However, parents have felt many tensions of parenting in the age of screens since before the pandemic began, with qualitative work revealing cognitive and emotional tensions in parents of 0 to 8-year-old children (Radesky et al., 2016). In light of the pandemic, parents and researchers have recognized the infeasibility for most families to meet the screen media guidelines offered by these entities, while others have highlighted the potential benefits that screen-based socialization and educational programming may have for children and adolescents during this time (Nagata et al., 2020). Parents are seeking new guidance on children's screen time use in light of distance learning and changes to family routines and work situations (Kamenetz, 2020). Preliminary, cross-sectional data from families around the world have documented concerning trends in media use and other relevant health behaviors. Online schooling has been associated with increased usage of electronic devices without parental supervision during class (Lau & Lee, 2020). Among adolescents in India, an increase in screen exposure was associated with disruptions in sleep behavior and more sedentary time (Dutta et al., 2020). In Portugal, parents retrospectively reported an increase in screen time and family activities, but also a decrease in physical activity (Pombo et al., 2020). Parents in Turkey reported that they instituted ground rules related to screen time by May, 2020 and had observed an increase in screen time in their children (Eyimaya & Irmark, 2021). The current study aims to extend the extant cross-sectional research on screen media use during the pandemic to examine

screen media use and problematic media use at two time points (hereafter referred to as "pre-pandemic" [February-April, 2019] and "post-onset" [May-June, 2020]) in a group of U.S. families.

Screen Media Use: Risks and Buffers

Research on screen media use during COVID-19 stems from known risks and buffers of screen media use for child development. Weight gain, sleep disruption, inattention problems, and developmental delays are all associated with increased screen media use early in life (AAP, 2016; Tamana et al., 2019). During the COVID-19 pandemic, children's social, intellectual, and self-regulatory development are potentially at risk due to home confinement (Goldschmidt, 2020). Of course, while there is not a perfect association between media use and risks, specific types of media use are associated with these risks. For example, using screen media at night is associated with shorter sleep times for children because of the light emitted by the electronic devices close to bedtime (LeBourgeois et al., 2017). Additionally, poor executive functioning skills are associated with non-PBS television content and a young age of beginning screen media in preschoolers (Nathanson et al., 2014), though other researchers have found no association between screen time and executive functioning skills in preschoolers (Jusienė et al., 2020). Other studies have found that poorer self-regulation abilities are cross-sectionally linked to more media use in children, and parents using media to regulate their child's distress is longitudinally linked to increased negative emotionality in some children (Linder et al., 2020; Gordon-Hacker & Gueron-Sela, 2020). During the COVID-19 pandemic, the bidirectional associations between poorer child self-regulation and screen media use may have become more pronounced. While schools were closed, parents may have increasingly felt the need to occupy children, particularly those with self-regulation difficulties, with media use (Radesky, 2020).

While there are certainly risks of screen media use in childhood, screen media use can also serve as a buffer for adjustment, particularly during the COVID-19 pandemic. Screen media use can foster social development in online spaces and connections with distant family members, which is of particular relevance when children may not be able to see older family members like grandparents during the pandemic (Chassiakos et al., 2016; Eales et al., in press; Grose, 2021). In a sample of Chinese children and adolescents, media use – above and beyond reading and physical activity – helped alleviate pandemic-related distress (Jiao et al., 2020). Parents can also promote adaptive screen media behavior and regulate child media use during the pandemic by watching screen media with their children and explaining or guiding them through what they are seeing (Coyne et al., 2017; Király et al., 2020; Vanderloo et al., 2020). A month after COVID-19 was declared a pandemic, a UNICEF article encouraged parents to "rethink" their assumptions on screen time, focusing on what it can do for their children instead of how it can harm them. The authors recommended parents have their children stay in touch with friends, engage with their children through video games and online experiences, and encourage their children to stay physically active in front of screens (Winther & Byrne, 2020). Taken together, these findings suggest that although there are risks of screen media use for children, parents can find ways to use media to their child's advantage during the pandemic.

Problematic Media Use

Given the rise in screen media adoption in U.S. families and around the world, identifying *problematic* media use (PMU) in childhood is becoming more and more pressing (Domoff et al., 2019 & 2020). Problematic media use is conceptualized as a form of dependence on media use for children aged 12 and under, which distinguishes excessive media use that interferes with a child's functioning from benign media use (Domoff et al., 2019 & 2020). As

mentioned previously, there is not a simple cause and effect relation between increased screen media use and unwanted outcomes in children. Rather, these negative effects and associations stem from various factors: how the media is used, what the media is, the characteristics of the child using the media, and so on. Domoff and colleagues (2020) recently elucidated an Interactional Theory of Childhood Problematic Media Use (IT-CPU), an extension of Bronfenbrenner's bioecological model that emphasizes the proximal, distal, and maintaining factors that can lead to the emergence of problematic media use. Distal factors, such as household chaos and digital environmental design, can exert their influence on proximal factors like a child's characteristics, parent media use and beliefs, and peer technology access. Maintaining factors keep problematic media use in play for the child through factors like positive reinforcement of media use for the child, using media to cope, and peer influences to play video games or engage online together. Domoff and colleagues' conceptualization of problematic media use also urges researchers to not consider simple screen time metrics as an indicator of problematic use, echoing calls from other researchers advocating to use more nuanced ways of assessing media use in children and adolescents (e.g., Kaye et al., 2020). Given the changes the COVID-19 pandemic has exerted across many areas of family life, a rise in problematic media use could be a concern for families.

Potential Moderators

When considering screen media use and problematic media use for children before and during the COVID-19 pandemic, what factors can moderate this trajectory? Given the well-established differences in media use across age groups in childhood (Rideout & Robb, 2020), it stands to reason that older children in our sample are more likely to use more screen media, and could have a larger increase in screen media use post-onset. Additionally, the proximal, distal,

and maintaining factors of PMU in Domoff and colleagues' (2020) IT-CPU are likely to change across the years (e.g., using more media to cope, more peer influence), potentially leading to higher problematic media use among older children than their younger peers. The ways in which parents perceive media use, engage with their child's media use, and use their own media use can also impact how a child uses screen media (e.g., Lauricella et al., 2015). Policymakers and researchers advocate for parents to watch and engage in media with their child, which can teach them how to regulate their own media and potentially buffer a reliance on media use (e.g., Coyne et al., 2017; Kiraly et al., 2020). Therefore, a parent's lower engagement with their child's media use pre-pandemic could lead to a steeper increase in screen media use and problematic media use post-onset, as the "proximal" and "maintaining" factors of the IT-CPU model could be present (i.e., the parent is not modeling or teaching their child how to use screen media adaptively). This engagement with media can also be seen as a form of parental mediation of media (active mediation [watching with discussion; also called instructive mediation]; Valkenburg et al., 1999), which is linked with positive child outcomes and healthier screen media habits (e.g., Coyne et al., 2017; Griffiths et al., 2016; Mendoza, 2009). Other forms of parental media mediation are coviewing, where a parent watches media with their child without discussion, and restrictive mediation, where a parent sets specific rules or prohibits certain media content for their child (Barkin et al., 2006; Valkenburg et al., 1999). Relevant to the COVID-19 pandemic, increased parental stress pre-pandemic has also been linked to increased restrictive and active mediation, as well as coviewing (Warren & Aloia, 2019). The ways in which a parent uses screen media as a regulation tool or a virtual "babysitter" could also certainly lead to steeper increases in benign or problematic screen media use post-onset, as these also contribute to the dyadic factors of maintaining problematic media use as per the IT-CPU. Giving a child a device

for calming (regulator) or to keep them occupied while a parent has to work (babysitter) is theorized to strengthen the maintenance of problematic media use (Domoff et al., 2020).

Parents clearly play a large role in their child's screen media and problematic media use. From a young age, parents help decide what screen to turn on, when to turn it on, and when to turn it off (Nikken & Schols, 2015). How parents mediate their child's media, parent's use of their own media, and their attitudes surrounding media are all related to a child's media use (Coyne et al., 2017). Parents who use their own devices during parent-child interactions are less likely to respond to their child's bids for attention, and in response, children may engage in more attention-seeking behaviors (Kildcare & Middlemiss, 2017). A parent's attitudes about screen media can also influence how their family uses screen media: families with media-focused parents are more likely to have children who use more media (Wartella et al., 2013). Therefore, how parents perceive screen media use for their own children could moderate the change between pre-pandemic and post-onset for screen media use and problematic media use.

Current Study

The current study explores how children are using screen media differently pre-pandemic vs. post-COVID-19 onset using data from U.S. parents collected at two time points (February-April 2019, May-July 2020). Our first aim was to describe how children were using screen media differently pre-pandemic vs. post-onset and parent perceptions of their child's media use. This was a confirmatory aim based on international observations of changing screen media habits in children and adolescents (Dutta et al., 2020; Eyimaya & Irmark, 2021; Lau & Lee, 2020; Pombo et al., 2020). We hypothesized that in our qualitative data parents would express more concern about their child's media use post-onset and there would be a shift in how they were talking about their child's media use. We also hypothesized that in our post-onset quantitative data: a)

children would use more screen media than pre-pandemic, b) children would be using screens in more problematic ways than pre-pandemic, and c) parents would have more negative perceptions of media use.

Our second aim (primarily exploratory) was to examine the parent and child factors that moderate the trajectories of change in screen media use and problematic media use pre-pandemic to post-onset. We hypothesized that being an older child, having a parent with more positive perceptions of media use, having a parent with lower participation with children during media activities, and greater parental use of screens as a regulation tool would lead to a steeper increase in non-school-related screen media use and problematic media use post-onset.

Method

We utilized a mixed method approach to capture strengths of qualitative and quantitative approaches by 1) qualitatively capturing differences in how parents perceived their child's media use pre-pandemic versus post-onset and 2) quantitatively assessing change in screen media use and problematic media use over time as well as moderators of these changes (Creswell & Plano Clark, 2018). This study collected the qualitative and quantitative data simultaneously, the analyses were conducted separately, and then the results were synthesized in the interpretation process (convergent design, questionnaire variant; Creswell & Plano Clark, 2018).

Participants

Participants were recruited via a university-managed participant pool of families in a major U.S. city. In February – April 2019 (T1 or pre-pandemic), parents of children aged 2 to 11 years were randomly selected from this pool to receive an email inviting them to complete an online survey. Two-hundred and forty-six of these participants indicated they would be willing to be contacted for a follow-up study. In May – July 2020 (T2 or post-onset), after the COVID-19

pandemic hit, these participants were contacted again via email with a link to a new survey. Altogether, 169 participants responded to the survey again, two of whom took the survey twice, and only 131 of those participants responded for the same child (deduced by date of birth and parent initials). One participant was removed because they lived in a different country and one was removed because they had over 35% missing data, resulting in a final sample size of 129. The original 246 participants, 169 re-responders, and final 129 sample did not differ in terms of parent education, family income, child age, or child gender. Only families meeting the age criteria were sent the e-mail link, and there were no exclusion criteria.

Parents included 127 mothers and 2 fathers ($M_{2020\ Age}$ = 39.4, $SD_{2020\ Age}$ = 4.34, *Range* = 29 – 50) of children described in 2020 as 64 girls, 64 boys, and 1 nonbinary child ($M_{2020\ Age}$ = 6.14, $SD_{2020\ Age}$ = 2.21, *Range* = 2.33 – 12.75). One participant indicated a different gender for their child in 2020 – given that gender is not an integral part of our analyses, they were kept in the sample. Descriptions of age ranges at both time points are provided in Table 1. The average participant family income at T1 was $125,000 - $149,999 (*Min* = < $25,000, *Max* = $200,000+), which is relevant to the types of devices available to children and stressors faced by the family during the pandemic (Cluver et al., 2020). For 86.8% of the families, both parent and child were mono-ethnically White and non-Hispanic/Latino. Of the children, 90.7% were White; 4.6% were Hispanic/Latino; 0.8% were Black/African-American; and 8.5% were multiethnic (combinations of Black/African-American, White, and Asian ethnicities). At T1, there were between 1 and 4 children in the home (average = 2), and 95.3% of participating parents were married to the target child's other parent. At T1, 58.1% of the parents had at least some graduate school; 34.9% had a Bachelor's degree; 5.4% had some college; and 1.6% had "other." The sample demographic characteristics are largely due to convenience sampling and the demographics of the university-

managed participant pool, which we note as a limitation of the study's generalizability. See Table 1 for full descriptive statistics of relevant study variables (and see Supp. B for correlations between all variables).n Additionally, most children were enrolled in school at the time of data collection and their use of media for distance learning was assessed: in May or June 2020, six (4.7%) were not in virtual school; 30 (23.3%) participated in virtual schooling for less than an hour/day; 27 (20.9%) participated between 1-2 hours/day; 23 (17.8%) participated for 3-4 hours/day; five (3.9%) participated for 5-6 hours per day; and one (0.8%) participated for 9+ hours/day.

Procedure

Following Institutional Review Board approval, the researchers received a randomly selected participant list from the city-wide participant pool of parents of children aged 2 to 11 years old. This participant pool recruits participants from across Minnesota (United States). These participants received a survey link via email between February - April, 2019 where they were eligible to receive a $100 e-gift card through a raffle for their participation. At this time, participants also indicated if they would be willing to be recontacted for another survey in the future. After further IRB approval, these participants were recontacted via email in May –July, 2020 with an invitation to complete another 30-40 minute survey, shortly after the state Governor began to dial back stay-at-home-orders. Each participant could elect to receive a $10 e-gift card, informational resources, both, or neither for the 2020 data collection. Participants were identified via a unique participant-created ID (same ID at both timepoints).

Measures

Qualitative: Parent Perceptions of Child Media Use

Open-ended questions developed for this survey allowed parents to report on other

elements of their child's media use or pandemic-related experiences that they found important or concerning. At T1, the prompt read "If you have any final thoughts regarding your child's media use, please write them out here. Is there anything we didn't ask that you think is important?" At T2, this prompt also invited them to comment on the impact of the COVID-19 pandemic and a second prompt asked: "Is there anything we didn't ask that you think is important such as other current events that are impacting you and/or your family right now?" Only responses pertaining to children's screen media use were included in analyses; "N/A" responses were excluded.

Quantitative: Screen Media Use (SMU)

Adapted versions of items from the Common Sense Census (CSC) of children's media use (Rideout, 2017) were used to measure children's total screen media use across common non-school-related activities at both T1 and T2. Parents reported the average time per day that the child spent using screen media for eight *non-school-related activities* (e.g., watching shows or movies on a computer or laptop, watching shows or movies on a TV, playing games on a handheld game player, doing anything not school-related on a smartphone or tablet). Very small wording changes were made between T1 and T2 (see Supp. A). Responses were anchored to a 7-point Likert scale that included never, 15 minutes or less, 15-45 minutes, 45-60 minutes, 1-1.5 hours, 1.5-2 hours, 2 hours or more. Quantities were given for the midpoint of each response: never (0), 15 minutes or less (7.5), 15-45 minutes (30), 45-60 minutes (52), 1-1.5 hours (75), 1.5-2 hours (105), 2 hours or more (130). The original Rideout (2017) measure asks first about days spent on these activities, then hours/minutes. We adapted the questionnaire at T1 for length and made the time options multiple choice to ensure individuals did not erroneously type in the incorrect amount of time spent on an activity (e.g., typing in "20" when asked how many hours their child spent doing an activity, when they really meant 20 minutes). Any quantities that were

over 2 standard deviations over the mean were restricted to 2 standard deviations over the mean (T1 n = 9; T2 n = 6).

Quantitative: Problematic Media Use (PMU)

The 9-item Problematic Media Use Measure – Short Form (Domoff et al., 2019) was used to capture screen media use that is disruptive to family functioning (e.g., my child's screen media use interferes with family activities) or obsessive in nature (e.g., screen media is all that my child seems to think about). The measure demonstrated convergent validity with total daily screen time and parent-rated concern about the child's media use and showed incremental validity for predicting the child's overall functioning above total daily screen time (Domoff et al., 2019). Parents rated how true these statements were for their child on a 5-point Likert scale from "1 = Never" to "5 = Always." A mean score was computed at each timepoint, with higher scores indicating more problematic media use (possible range: 1 – 5). The scale showed acceptable internal consistency at both timepoints (Time 1 α = .91; Time 2 α = .94).

Quantitative: Parental Participation with Child Screen Media

Parents reported how often they participate in media with their child during four different activities (e.g., watching their TV shows, watching online videos, playing console video games, and using games or apps on a smartphone or tablet). All four items from the CSC scale were used (Rideout, 2017). Responses were rated on a 4-point Likert scale from "1 = All of the time" to "4 = Never." A fifth option allowed them to respond that the item was not applicable if their child does not do an activity. Allowing for "not applicable," the measure had good reliability (α =.74). The mean of all four items was computed (allowing for N/As) to result in a score from 1-4, a higher score meaning they do activities with their child a small amount of the time.

Quantitative: Parent Perceptions of Screen Media

Using items drawn from the CSC (Rideout, 2017), parents reported their attitudes about the effect of children's media use across six different domains of their child's life: social skills, learning, ability to focus, behavior, physical activity, and creativity. For each domain, they responded to the question "Overall, do you think your child's media use helps, hurts, or makes no difference to his/her [domain]" using a 5-point Likert scale anchored to "1 = Helps a lot," "3 = Makes no difference," and "5 = Hurts a lot." The mean of each time point was calculated to yield two scores in year 1 and year 2, range = 1 – 5 (Time 1 α = .78 ; Time 2 α =.70).

Quantitative: Screen Media as Regulation and Babysitter

Two items were created for this study to assess how parents use screen media to regulate children's emotions or behavior. On a 4-point Likert scale from "1 = Strongly agree" to "4 = Strongly disagree," parents reported their agreement with the statements: "When my child is upset, giving my child a device with a screen is the easiest way to have them calm down" (regulation tool) and "When I need to get work done at home, I often give my child a mobile device to play with, let them watch TV, or play video games to keep them occupied" (screen as babysitter). A fifth option allowed them to say that the items were not applicable to them.

Quantitative: Social Desirability (Covariate).

Social desirability bias in the parents' reporting was assessed with a brief version of the Marlowe-Crowne Social Desirability Scale that included true or false ratings of the three highest-loading items of the scale (Reynolds, 1982). Higher score indicated a more socially desirable response, and the average of the sum of these dichotomous items at each timepoint was used as a covariate in regression analyses (possible range = 0 – 3; α = .75).

Data Analyses

Qualitative Analyses

In line with Braun and Clarke's thematic analysis methodology (2006), coders read participant responses multiple times and independently generated initial codes. The third author served as the primary coder for T1 and the second author served as the primary coder for T2. These two coders read participant responses and independently generated initial codes using both analyst-driven values coding and emotion coding techniques (beliefs and values, attitudes including concerns, practices, and emotions), and data-driven coding (any other themes present in the data) (Braun & Clarke, 2006; Saldaña, 2015). The first author then organized codes into potential themes and the entire coding team met on multiple occasions to resolve discrepancies, establish consensus, and agree on final themes, after which a thematic diagram was created and illustrative quotes were selected for each code (Braun & Clarke, 2006; Hill et al., 2005).

Quantitative Analyses

Aim 1. To address our first question of how SMU, PMU, and parent perceptions of media have changed from pre-pandemic to post-onset, we conducted Wilcoxon signed ranks tests to compare the means across both years, given the non-normal distribution of our data (assessed via visual inspection and the Shapiro-Wilk's test). The Wilcoxon test effect size *r* was used.

Aim 2. To address our second question – what moderates the change of SMU and PMU pre-pandemic to post-onset – we conducted two hierarchical regressions, using T1 SMU and PMU to predict T2 SMU and PMU, respectively. Covariates (social desirability and income) and main effects (T1 SMU and PMU, T1 child age, T1 participation with child media, and T1 perceptions of media) were entered into the first step, followed by two-way interactions between T1 SMU and PMU and the main effects. Because we still wanted to examine the associations of using media as a regulation tool or babysitter, while accounting for those that indicated "not applicable" (meaning they did not believe the item applied to their child), those two main effects

and their interactions with T1 SMU and PMU were entered into a third step with the acknowledgement that this would be a smaller sample size. Additionally, post-hoc analyses were conducted treating age as a dichotomous variable, with "1 = age 5 or older." This was to examine whether or not the child being school-aged during the pandemic (i.e., around 6 years or older) would be associated with their screen media use.

In both models, variables included in the interaction analyses (i.e., all variables other than covariates) were mean-centered to reduce collinearity (Aiken & West, 1991). Main effects and moderations were considered significant if the *p*-value was less than 0.05; effect sizes were determined by the regression coefficients and ΔR^2.

Missing Data. The proportion of missing data was very minimal across variables: one participant was missing 1 item from the Problematic Media Use scale at T1, one participant was missing items across the participation with child media items, and one participant was missing one screen media use item from 2019. Given this very small amount of missingness, the PMU score for the participant whose problematic media use item was missing was simply averaged across all other 8 items for that participant, and the participants missing participation with child media items and one SMU item were given the sample mean. Mean substitution is an appropriate method to address missing data at such low levels of missingness (Parent, 2013). Analyses were run both with and without this strategy and the results stayed the same. Additionally, many participants chose "N/A" for items related to media as a regulation tool and as a babysitter. Given that we did not want to assume why they indicated "N/A" and imputation was not the best strategy, they were instead removed from the final step of the regression analysis.

Results

Aim 1: Qualitative and Quantitative Analyses (Pre-Pandemic to Post-Onset Change)

Qualitative Analysis

In total, 57% (73) of the sample responded to the open-ended questions at one or both time points (prompts are described above, "*Qualitative: Parent Perceptions of Child Media Use"*). Fifty-one participants responded to the pre-pandemic (T1 or 2019) prompt and 42 participants responded to a post-onset (T2 or 2020) prompt. Twenty participants responded to the prompts at both time points. Supp. C shows a diagram of the emotions in parents' response regarding their children's media in each year, with the overlapping section representing emotions present in both years. A wider array of emotions was observed post-onset, spanning a larger affective range than pre-pandemic. Pre-pandemic emotions were primarily negatively valenced, including unhappy, concerned, and confused (although there is one positively valenced emotion captured in both years: grateful). Post-onset emotions included both negatively valenced emotions *and* more neutral or positively valenced emotions like relieved, mindful, ambivalent, and bored. Additionally, the unique emotions seen post-onset also include loss, stressed, distracted, fear, sad, relieved, dislike, uncertain, dissatisfied, and isolated.

Thematic analysis of parent responses revealed eight major themes related to screen media use before and during the COVID-19 pandemic. Themes and codes are displayed in Figure 1, and themes are organized within three broad domains: beliefs and values (2 themes), practices (3), and attitudes (3). Additionally, illustrative participant quotes for each code can be found in Supp. D. All eight themes were present both pre-pandemic and post-onset (in italics below), with some identical codes across the timepoints (17 codes) and others codes unique to one timepoint (15 pre-pandemic, 10 post-onset).

Beliefs and Values. Within the theme of *positives and negatives of screen media*, across both years parents believed media can have negative consequences for children (e.g., poor child

behaviors). However, pre-pandemic only, parents also expressed that there is an educational value for media and that media skills are important for a child's future. As one parent of a 3-year-old stated, "it is important for kids to become digitally intelligent" (ID111). Only pre-pandemic parents saw a tradeoff of media, including believing too much screen time takes away from other activities, like playing. Within another theme of *monitoring screen time*, parents across both years believed it is important for media to be monitored and limited, even mentioning specific software to be used to send materials safely to children. Parents across both years also believed that context plays a large role in how easy it is to manage screens, mentioning that screen time is easier to manage with one child, when it is not winter, and when both parents do not work full time. However, only pre-pandemic did parents believe media use was a privilege for their children, and that other families around them also struggle with device use. As one mother of a 5-year-old stated pre-pandemic, "I have a lot of 'mom guilt' about [not enforcing stricter screen time limits], and I'm certain other caregivers feel guilt around this issue as well" (ID53).

Practices. *Parental mediation* of their child's media was a theme in parents' discussion of their practices. Across both years, parents were aware of how they were limiting and monitoring screen content, if they were using screens as a way to occupy their child when they were busy, and how they were participating in coviewing with their child (e.g., watching shows together as a family). However, pre-pandemic only, they were trying to use screen media as an educational tool, occasionally using it as a reward, and tended to view specific reasons and times for media use (e.g., using the Wii for exercise, or using media as a "brain break" [ID72]). On the other hand, post-onset only, parents were using mediation in much more specific ways related to COVID-19. They were allowing more screen time for at-home distance learning. Also, because

of increased screen time, post-onset parents were more mindful of their child's media use, including avoiding its use as a babysitter or attempting healthy media use. Post-onset parents also said they were less able to monitor their child's screen media during the pandemic and were less restrictive with screen time and content. For example, "My husband's and my remote workload increased dramatically and we were not able to support or monitor [screen time] almost not at all. Eventually we realized that our children got addicted to screen time" (ID46, parent of 9-year-old).

Another theme was parents discussing their child's *screen time* practices. Across both years, parents mentioned their child's screen use differed based on context (e.g., less in the summer, more when they communicate with family). However, only pre-pandemic parents mentioned their child's screen time quantity in relation to when they purchased devices (e.g., purchase an Xbox for a child's birthday) and where they are in the home (e.g., not keeping a television in the main living space). Only post-onset parents mentioned their children were using more screen media since the pandemic began and explicitly mentioned increased iPad and tablet use daily and not just as a reward. As one parent of a 4-year-old stated, "Pre COVID-19 we only used ipads on plane rides… now they are used daily" (ID104). Finally, parents discussed their *child's activities and behavior* surrounding screen time. Parents across both years mentioned the ways in which their children were both influencing and responding to screen media limits (e.g., child is receptive to screen time limits, children find workaround of screen media limits, undesirable child behavior leads to screens getting taken away). Parents in both years also mentioned other children were influencing their child's screen media use, including friends and older siblings. For example, one parent of a 5-year-old at T1 stated, "My youngest is more interested in screen media because of his older brother's interest" (ID62). Parents at both years

also described non-screen time activities their children participate in, such as family game nights and other activities with siblings. However, only pre-pandemic parents explicitly mentioned behavior changes they observe in their child due to screen media (e.g., increased swear words, becoming irritable, imitating what they see on the screen).

Attitudes. Parents expressed attitudes about the *factors influencing their child's media*. Across both years, parents listed reasons they believed their children's media use fluctuated (e.g., being an only child, having a stay-at-home parent). Parents also thought siblings and peers influence their child's screen media use (e.g., thinks their child's media use is higher because their friend's screen media use is not monitored). However, pre-pandemic only, parents perceived that child age influenced such that their child would use more media as they get older. However, post-onset only, parents tended to view their child's screen media use as influenced by distance learning (e.g., inevitable screen time increase due to virtual schooling). Additionally, post-onset parents said they thought their child's screen use was changing (or not changing) due to COVID-19. A parent of a 3-year-old said they "have tried to keep media use similar to pre pandemic. Some increase was [inevitable]" (ID88).

Within another theme, parents expressed different *thoughts and strategies regarding media*. Across both years, parents expressed opinions of screen time and challenges with media use and monitoring (e.g., finding it challenging to monitor child media use, not knowing how to monitor media use, thinking their child is getting too much screen time). In addition, pre-pandemic only, parents said they and their co-parent had different opinions regarding screen time and expressed more parental guilt around their child's screen media use. Pre-pandemic parents also thought their parental mediation strategies (e.g., being strict with limits, not placing a television in a living room) were effective. However, post-onset parents were concerned their

child was getting too much screen time because of COVID-19: as one parent of a 4-year-old stated regarding the pandemic, “Screentime has SKYROCKETED, never in a million years would I imagine we would be using screens this much” (ID104). Post-onset, parents also expressed concerns about their child’s expected screen media use after COVID-19 such as concerns about the high amount of screen time becoming a new norm and anticipation of difficulty reducing screen time after COVID-19 resolves.

Finally, parents expressed their thoughts about *outcomes of screen media use* – and for this theme, all codes were present in both years. Parents in both years expressed concerns surrounding negative behavioral effects of media on their child (e.g., irritability or aggressiveness, rage, wetting themselves). For example, one parent of a 7-year-old stated their son would “love to have all the game time in the world – but his behavior gets off track when he gets too much screen time” (ID103). Parents in both years also thought their children could become addicted to or dependent on media, explicitly mentioning dependence on the iPad and television and noticing how their child’s relationship to media had changed since the pandemic began. Parents also thought there were some positives of media, including helping keep their child quiet, being educational, and helping with hand-eye coordination.

Quantitative Analyses

Screen media use (SMU), problematic media use (PMU), and parent perceptions of media use were independently compared across the two years. A Wilcoxon signed ranks test indicated T2 SMU per day (in minutes) (M = 199.29, SD = 109.26, *Median* = 186) was significantly higher than T1 SMU (M =149.33, SD = 88.32, *Median* = 127), Z = -5.01, $p < .001$, r = -0.44. T2 PMU (M = 2.20, SD = 0.91, *Median* = 2) was also significantly higher than T1 PMU (M = 1.91, SD = 0.75, *Median* = 1.78), Z = -4.25, $p < .001$, r = -0.37. However, parent

perceptions of media use as helpful vs. hurtful were not significantly different across the years (T2: M = 3.21, SD = 0.60, $Median$ = 3.17; T1: M = 3.19, SD = 0.51, $Median$ = 3.17; Z = -0.03, p = .98). Figure 2 shows the overlapping distributions of these three variables across the two years.

Aim 2: Quantitative Analyses (Moderators of Change Trajectories)

T2 screen SMU and then PMU were regressed on their T1 counterparts, covariates, and potential moderators. When regressing T2 SMU on all main effects and interactions in step 2, T2 SMU was significantly associated with T1 SMU ($\beta = 0.45$, $p < .001$) and child age ($\beta = 13.13$, $p < .01$). Thus, a one-year age increase was associated with a 13.13-minute increase in T2 SMU. Parent perceptions of media use, parent participation with media, and covariates were not significant, nor were any interactions (Supp. E). Media as a regulation tool and babysitter were not significant as main effects nor interactions. When regressing T2 problematic media use (PMU) on all main effects and interactions in step 2, T2 PMU was significantly associated with T1 PMU ($\beta = 0.66$, $p < .001$), child age ($\beta = 0.11$, $p < .01$), and parent perceptions of media as hurting their child ($\beta = 0.27$, $p < .05$). A one-year increase in child age was associated with a .11-unit higher T2 PMU, and a one-unit increase in parental perceptions of media was associated with a .27-unit higher T2 PMU. Parent participation with media and the covariates were not significant, nor were any interactions (see Supp. F). Media as a regulation tool and a babysitter were not significant as main effects or interactions (Model 3).

Given our hypothesis that these associations might differ for preschool and school-age children, we also ran the same analyses using a dichotomous age variable, such that 1= 5 and older (Supps. G and H). With this, being 5 years or older at T1 was associated with a 65.16-minute higher SMU at T2. Additionally, a PMU x age interaction was now present, such that for older children, a one-unit change in PMU at T1 was associated with a .41-unit higher difference

in T2 PMU than for younger children ($\beta = 0.41$, $p < .05$).

Discussion

Screen media use has become an increasingly hot-button issue for families, researchers, and educators across the United States and globally since the COVID-19 pandemic began (e.g., Király et al., 2020; Nagata et al., 2020). The present study utilized a mixed methods approach to understand *how* and *how much* a sample of children in the United States were using media pre-pandemic versus post-onset, utilizing parent-report data collected at two time points (2019 and 2020). We utilized both qualitative analysis to investigate the nuances of how parents were discussing screen media, and quantitative analysis to investigate how parents were perceiving media and rating their child's general screen media use (SMU) and problematic media use (PMU) across years (and what might moderate that trajectory). By understanding how media use shifted pre-pandemic to post-onset, we can better know what to expect regarding media throughout the pandemic's course, through future COVID-19 and other pandemic waves, and how to talk to families about their child's media use. Below, we provide an integrative discussion of the quantitative and qualitative findings (themes are italicized).

COVID-19-Related Increased Screen Media Use

Both the quantitative and qualitative results demonstrated that there was a shift in non-school related SMU pre-pandemic to post-onset; children went from using an average of 149 minutes per day (2.48 hours) to an average of 199 minutes per day (3.32 hours) post-onset (medium effect size change; see Figure 2a). This increase held even after age, income, and social desirability were accounted for. Pre-pandemic SMU also significantly predicted post-onset SMU, suggesting stability in rank order compared to other families, even as all families tended to see a rise in SMU. Qualitative findings supported those conclusions as parents discussed their children

using more screen media and having more access to screen media devices like iPads (see Figure 1 and Supp. D theme *Screen time:* "More screen media use during COVID-19" and "More access to iPad/tablet during COVID-19"). Post-onset, parents tended to attribute this rise in SMU to either the pandemic or a change in their child's learning situation (see Figure 1 and Supp. D theme *Factors influencing screen media*). While the quantitative results did *not* specifically take school-related media use into account, these qualitative findings clearly suggest parents were also seeing an inherent increase in screen time due to distance learning, as seen in other studies (Lau & Lee, 2020; Pombo et al., 2020).

COVID-19-Related Increased Problematic Media Use

PMU also increased from pre-pandemic to post-onset quantitatively. Although the median of PMU only increased by 0.22 on a scale from 1-5, this change was still a medium effect size (see Figure 2b for a graphic representation of the distribution). As with screen media use, the finding that pre-pandemic PMU predicted post-onset PMU suggests that there was rank order stability between families, even as all families saw a rise in PMU. Qualitative results reflected parent concerns about their child's media use. Regarding *child activities and behavior* surrounding media that could theoretically include problematic behaviors, parents did not express much difference across the two years. In both years, parents observed that their children were influencing screen media limits, as were other children; interestingly, behavior changes due to screen media were only brought up pre-pandemic (see Figure 1 and Supp. D: *Child activities and behavior*). Additionally, in both years, parents perceived their child could be addicted to screen media use and there were negative behavioral effects related to it (see Figure 2 and Supp. D: *Outcomes of screen media use*).

When examining the distal, proximal, and maintaining factors of PMU in the IT-CPU

model, qualitative analyses yielded many factors that could influence PMU in early-mid childhood. Distal factors, in this case, relate to the new digital learning space and challenges that COVID-19 were bringing to the family environment that could result in more PMU (see Figure 1 and Supp. D: *Factors influencing screen media* and *Parent thoughts and strategies regarding media*). This is also validated by other studies, showing that 93% of respondents in U.S. households had children engaging in some form of "distance learning," the majority via online materials (U.S. Census Bureau, 2020). However, as described in our Methods section, most of our sample that was in school was only using media for virtual learning less than four hours per day (93%). SES is also a distal influence on PMU; thus, family income was included as a covariate in all analyses. Other distal influences of PMU, including digital environmental design and parent's PMU, were not measured in the current study. Proximal factors in the IT-CPU model include challenging child behaviors, which we saw qualitatively in the *Child activities and behavior* and *Outcomes of screen media use* themes. Proximal *and* maintaining influences of problematic media use also include social factors, which were evident here with parents discussing how their child's media use is influenced by their peers or siblings, and how they think their child's media use increases because of their peers (Figure 1 and Supp. D: *Child activities and behavior:* "Other children influence media use"; *Factors influencing screen* media: "Siblings and peers").

Parent and family proximal factors can also influence PMU, including parental stress, parental media beliefs, and inconsistent or limited parenting practices, all of which were apparent in our analyses (Domoff et al., 2020; Lauricella et al., 2015). Parental stress was seen in our emotional content analysis, where there was a wider array of emotions post-onset and the word "stress" was present post-onset, but not pre-pandemic (see Supp. C). Interestingly, "guilty" was

only mentioned pre-pandemic. It is possible that while parents were expressing more concerns about their child's media, they were more accepting of it and no longer felt as much guilt given other pandemic-related stressors.

Parental media beliefs were both qualitatively seen and quantitatively related to problematic media use. Parents expressed specific *beliefs* about screen media use both at both time points, seeing negative consequences at both time points and believing screen media use should be limited and monitored (see Figure 1 and Supp. D: *Positives and negatives of screen media* and *Monitoring screen time*). There were more codes expressing positives of screen media pre-pandemic than post-onset, though the quantitative analysis did not result in a significant quantitative difference in perceptions of child screen media use between years. Additionally, within *attitudes,* parents did see positive outcomes from media for their children at both time points (see Figure 1 and Supp. D: *Outcomes of screen media use:* "Media can be positive"). Parents also expressed specific concerns about screen time both during COVID-19 and after the pandemic ends, wondering how they would get back to a "normal" amount of screen time (see Figure 1 and Supp. D). A less positive view of child media use was quantitatively associated with *more* PMU post-onset, even after controlling for pre-pandemic PMU. Though we did not specifically hypothesize about the direction of the main effect, this is contrary to the hypothesis that a positive perception of media would be associated with a steeper increase in PMU. It is possible that these parents with more negative perceptions of media use pre-pandemic were also more likely to become overwhelmed by the increased media use when the pandemic hit, therefore leading to reduced parental mediation strategies. Additionally, perhaps children with parents who had a worse perception of media pre-pandemic were simply "catching up" with the other children's problematic media use post-onset. Future longitudinal research should aim to

further tease out why negative perceptions of media could result in a steeper increase of problematic media use over time.

Media parenting practices can also influence PMU, and this was certainly borne out in our qualitative analysis, though not in the regression analysis. When including parent participation with their child's media use in our models, it was not associated with SMU nor PMU. However, the *parental mediation* theme contained many codes relevant to media parenting practices at both time points. As defined previously, parental mediation strategies can encompass active mediation (discussing media content with children), coviewing (watching media together without any discussion), and restrictive mediation (prohibiting certain media content and setting specific rules; Barkin et al., 2006; Valkenburg et al., 1999). Parents were engaging in restrictive mediation at both time points and coviewing; additionally, parents expressed that they were *less* able to restrict and monitor screen time during COVID-19, reflecting the limited media parenting practices Domoff and colleagues (2020) refer to (see Figure 1 and Supp. D). With the qualitative data, we cannot speak to whether these differing parental mediation strategies led to increased post-onset PMU; however, taken together, these results suggest that parents were concerned with their mediation strategies post-onset and felt they were less able to engage in them than before. Our regression analyses differ from our qualitative analyses perhaps due to the nature of the questions we used for parent participation with media. These quantitative items mostly related to coviewing (e.g., watching television together), not necessarily engaging in active or restrictive mediation. Though quantitative data with parents in Turkey around the same time period as this data collection revealed most parents said they were instituting screen time rules (Eyimaya & Irmark, 2021), our qualitative analysis shows that parents do not feel as *capable* to do so as pre-pandemic. Additionally, these results show that, while parents are engaging in increased

monitoring of their child's media use to avoid problematic behaviors during the pandemic (consistent with Király et al., 2020; Vanderloo et al., 2020), they are struggling to meet this goal with the many other demands the pandemic is bringing to their lives.

Finally, we also saw some maintaining factors of the PMU from the IT-PCU model (Domoff et al., 2020), though these results were more mixed. As mentioned previously, another maintaining factor of problematic media use is screen media influence – at both time points, parents mentioned that a sibling or peer's higher SMU can result in an increase their child's SMU (see Figure 1 and Supp. D). Another maintaining factor of PMU could be positive reinforcement for the child, and in this study, we conceptualized this as parents using media as a regulation tool. However, when including this in our regression analyses, it was not related to problematic media use. Given the variety of ways in which screen media use relates to self-regulation (Gordon-Hacker & Gueron-Sela, 2020; Linder et al., 2020), future research on media as a regulation tool during the pandemic should aim to use a larger sample and more nuanced measurement (i.e., not a one-item measure) to capture this potential association. Media as a babysitter was also not quantitatively associated with PMU nor SMU (potentially due to the smaller sample size used for that analysis at $n = 106$), but it was a prominent code in the *parental mediation* theme: parents were using screens to keep their child occupied, and post-onset parents said this was especially needed because of working and schooling from home (see Figure 1 and Supp. D). This is consistent with samples of parents before COVID-19 as well, where samples of Dutch and U.S. parents viewed media as a potential babysitter (Nikken, 2019; Wartella et al., 2013). The small differences between the qualitative and quantitative analyses (e.g., parental mediation being prominent in the qualitative analyses but not the quantitative analyses) speaks to both the added nuance qualitative analyses provided in this study and the fact that parents might

be conceptualizing parental mediation in different ways than our brief quantitative items could measure.

Together, the qualitative and quantitative results suggest that there was an increase in PMU between pre-pandemic and post-onset, and this increase was possibly influenced by a variety of distal, proximal, and maintaining factors including the COVID-19 pandemic, distance learning, other children, child behaviors, parental mediation, and positive media reinforcement.

Age as Main Effect and Moderator

As hypothesized, age was significantly related to post-onset PMU and SMU; additionally, when treated as a dichotomous variable, we saw a PMU X Age interaction such that for children aged 5 and older, there was a steeper increase in PMU. A year increase in age pre-pandemic was associated with a 13-minute increase in post-onset SMU and a 0.11-unit increase in PMU. With our dichotomous analysis, being a child 5 years or older pre-pandemic was associated with a 65.12-minute higher SMU post-onset than their younger counterparts. These results speak to the importance of age and school-age categorization when considering the widespread challenges children face during the COVID-19 pandemic, and how media use might factor into their lives. Children at different developmental stages face different challenges during the pandemic, including different social demands. While a younger child might not necessarily need to engage with friends virtually, older children have more out-of-family connections that they might be trying to maintain (Masten & Motti-Stefanidi, 2020). The items of the Problematic Media Use Measure – Short Form (Domoff et al., 2019) include screen media use interfering with family activities; screen media causing problems; child becoming frustrated when they do not use screens media; and it being difficult to stop the child from using screen media. It follows that this would be more difficult for older and school-age children versus their younger

counterparts – especially as parents are more pre-occupied with work and childcare demands at home. Older children, who are seen as more independent, are (quite literally) more likely to be left to their own devices.

Limitations, Future Research, and Implications

While our study has many strengths, including its mixed methods approach, data collection at two time points, and the inclusion of both screen media use *and* problematic media use, it is not without limitations. The first is that our sample was primarily White, middle-to upper-class, and highly-educated due to the convenience sampling approach that was used. This could affect the type of devices these children had access to and the types of jobs their parents had during the pandemic: if their parents had a job that enabled them to work from home, they would have a different ability to monitor their child's media use than parents who had to go out and work. Additionally, our sample was primarily comprised of two-parent households, which would also affect the ways in which they could monitor media. Parents at different income levels were also facing different levels of stress during the pandemic, which could affect the family and media environments (Cluver et al., 2020). One of the distal factors in Domoff et al.'s IT-CPU is SES/poverty, and so families at lower levels of SES could have much different experiences of problematic media use compared to the families in the current sample given higher economic stress during the pandemic. These factors, taken together, mean that the findings are limited in generalizability due to the demographics and convenience nature of the sample. Second, the two measures that assessed media as a regulation tool and media as a babysitter were one-item measures that were created for this sample, and many parents selected "N/A," meaning that they could not be included in the quantitative analysis. Additionally, there was a negative correlation between these items and problematic media use, indicating further psychometric analysis is

needed. Future research should utilize more in-depth measures of how parents are using media (as a regulation tool, as a babysitter, etc.) with larger samples to uncover potential associations with screen media use and problematic media use. Third, due to the nature of this global pandemic, it was not possible to have a control group. Thus, it is possible our results could, in part, reflect normative increases in SMU and PMU with age. Our qualitative analysis revealed that pre-pandemic parents thought their child's SMU would increase with age, introducing an important confound. Previous research evidenced a 35-minute increase in daily SMU between children ages 2 to 4 years and 5 to 8 years (Rideout & Robb, 2020); our dichotomous regression analysis showed that for children 5 and older, there was a 65-minute increase in SMU, much larger than previous normative research. Additionally, our qualitative analyses suggested that these changes were, in fact, COVID-19-specific.

Importantly, this survey was parent-report, meaning that we did not have objective measures of screen media use nor clinical observations of problematic media use. Although the PMUM-SF measure used for PMU in the study is meant for parent-report, clinical observations of a child's PMU behaviors would be ideal. However, due to the nature of the pandemic, and the fact that the construct of child PMU is still in its nascent stages, parent-report was the only available methodology for this sample. Parent's own PMU is another potential distal influence on child PMU that was not assessed in this study. Parents tend to under-report their child's media use (Wood et al., 2019) – while we tried to take this into account by including social desirability in our models and still saw an increase in PMU and SMU, it is possible we underestimated actual SMU. We also limited the top item of the SMU scale at "two hours or more," which could have resulted in underestimated SMU. Future research could use more objective measures of screen media use (e.g., utilizing screenshots of app use, media device trackers; Kaye et al., 2020). We

also did not obtain data on *what* the children were watching, just how much. However, our inclusion of problematic media use as a focal construct in this study at least addresses *how* children are using media, as well as *how much.* Finally, our qualitative analyses were limited to thematic analysis of open-ended questions that were optional for parents to answer; as such, only a select subset of our sample provided responses we analyzed qualitatively. There are different and more comprehensive qualitative data collection methodologies that can be employed in the future to study this phenomenon, including observations, focus groups, and interviews (Creswell & Creswell, 2018). Future work should aim to analyze longitudinal trajectories of SMU and PMU through more in-depth qualitative methodologies.

Our findings regarding increased problematic and screen media use, age differences, and increased emotionality of parents and concerns about their child's media use have several implications. First, as researchers are already doing (e.g., Vanderloo et al., 2020), they can provide advice for parents about how to monitor their child's media use during a time when they are stuck at home. Additionally, researchers should consider the unique challenges the COVID-19 pandemic places on school-age children and their parents relative to younger children. As well, parents are clearly experiencing many more emotions during the pandemic relative to pre-pandemic, including stress, loss, and isolation. A focus on parental mental health during and after the pandemic will be important moving forward, especially as their mental health has implications for their child's well-being during this time (e.g., Daks et al., 2020). Finally, our thematic analyses clearly show that parents are concerned about their child's screen media use not only during the COVID-19 pandemic, but also once the pandemic is over. As schools begin to open up more and vaccines are distributed, guiding parents in how to help their child adjust to "back to normal" routines will be of the utmost importance, especially as there were already high

levels of stress around children's screen media use pre-pandemic (Radesky et al., 2016).

Conclusion

The COVID-19 pandemic provided a unique challenge for parents around the world, including in the United States, regarding their children's media use. There are increased concerns about too much screen use and its developmental implications (e.g., Nagata et al., 2020). The findings of our mixed methods study show both an increase in screen media use and problematic screen media use between pre-pandemic and post-onset, as well as an age moderation such that school age children on average had a steeper increase in problematic media use than preschool age children. Additionally, the qualitative findings support the increase in screen media use and distal, proximal, and maintaining factors of problematic media use. Significant events and changes to family life are reflected in children's media use as well as parents' attitudes and behaviors surrounding it. Future research will be needed to trace the post-pandemic changes in the amount, content, and parental mediation of children's media use.

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Table 1

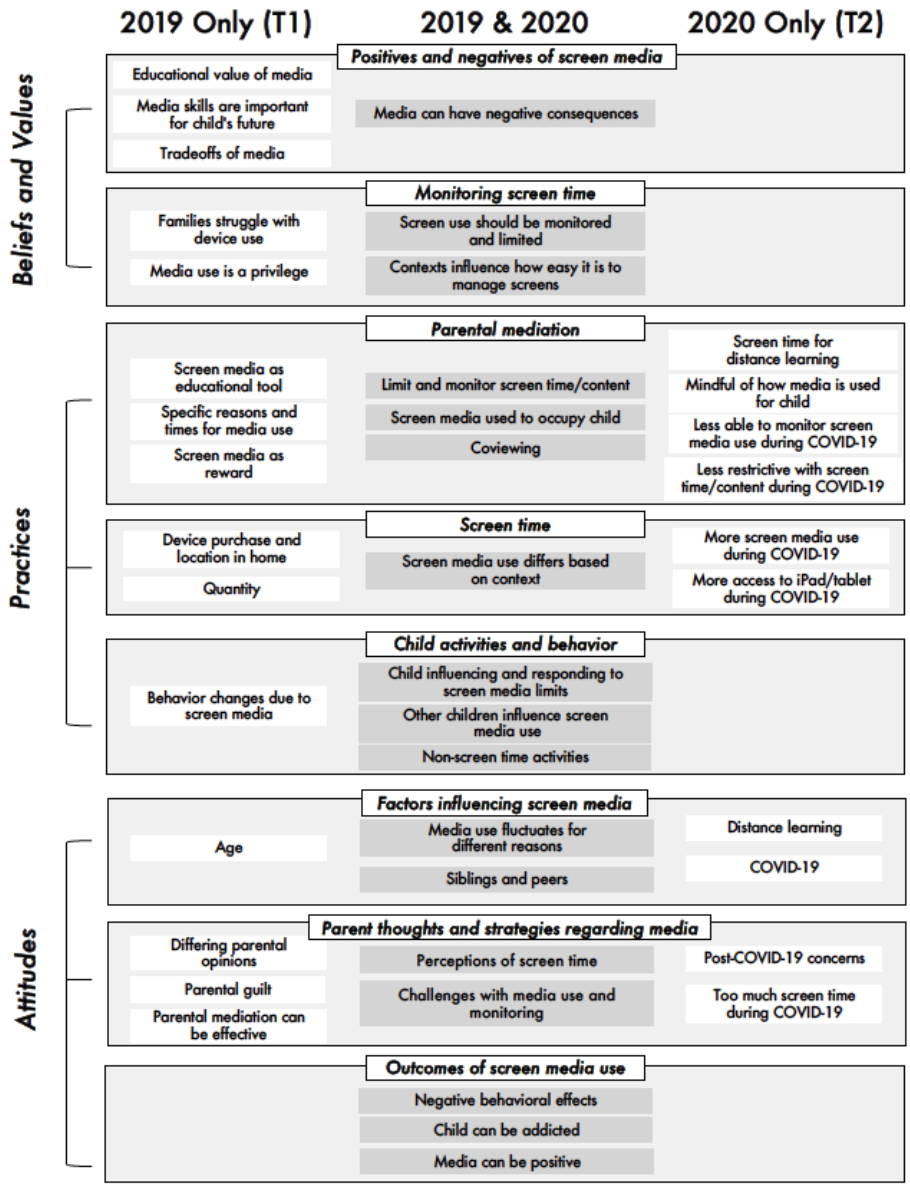
Descriptive Statistics of Sample Characteristics and Variables Included in Analyses (N = 129)

Variable	*M* (*SD*)	*Observed range*
Non-model study variables		
2020 (T2) Child age in years	6.12 (2.22)	2.33 – 12.75
Covariates		
2019 (T1) Family income [a]	5.79 (2.27)	<$25,000 - $200,000+
Social desirability [b]	1.57 (0.97)	0 – 3
Substantive study variables		
2019 (T1) Screen media use (average minutes per day)	149.33 (88.32)	22.5 – 346.04
2020 (T2) Screen media use (average minutes per day)	199.29 (109.26)	7.5 – 453.52
2019 (T1) Problematic media use [c]	1.91 (0.75)	1 – 4.11
2020 (T2) Problematic media use [c]	2.20 (0.91)	1 – 4.78
2019 (T1) Child age in years	4.86 (2.21)	1.17 – 11.42
2019 (T1) Parent perceptions of media hurting child [d]	3.19 (0.51)	1.67 – 4.5
2020 (T2) Parent perceptions of media hurting child [d]	3.21 (0.60)	1 – 4.83
2019 (T1) Parent participation with child media [e]	2.07 (0.66)	1 – 3.75
2019 (T1) Media as regulator [f]	3.56 (0.74)	1 – 4
2019 (T1) Media as babysitter [g]	2.31 (0.98)	1 – 4

Note. [a] Family income: 1 = Less than $25,000; 2 = $25,000-$49,999; 3 = $50,000-74,999; 4 = $75,000-$99,000; 5 = $100,000-$124,999; 6 = $125,000-$149,999; 7 = $150,000-$174,999; 8 = $175,000-$199,999; 9 = $200,000 or more. [b] Possible range: 0 – 3. [c] Possible range: 1 – 5. [d] Possible range: 1 – 5. [e] Possible range: 1 – 4. [f] n = 106. Possible range: 1 = Strongly agree to 4 = Strongly disagree. [g] n = 126. Possible range: 1 “Strongly agree” to 4 “Strongly disagree.”

Figure 1

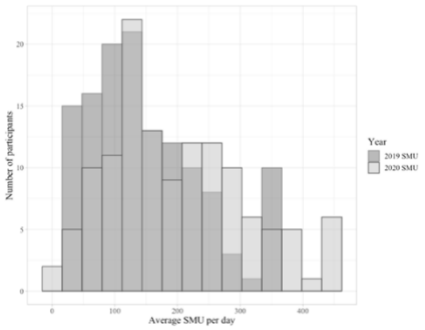
Thematic Diagram of Parent Beliefs and Values, Practices, and Attitudes About Screen Media Use Before and During the COVID-19 Pandemic



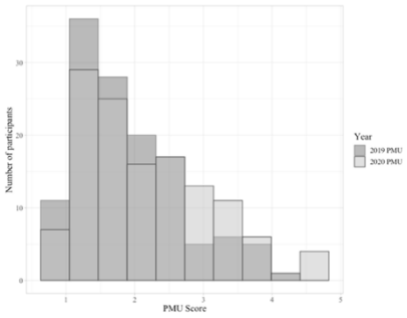
Note. Themes (centered, bolded at the top of each box) and codes (phrases within each box) are organized within three broad domains (written out on the left: Beliefs and Values, Practices, and Attitudes). When codes were consistent across both 2019 and 2020 (both pre-pandemic and post-onset), they are centered and in gray. When codes were present only in 2019 or 2020, they are depicted on the appropriate side of the chart (left: 2019/pre-pandemic and right: 2020/post-onset) and are surrounded by white.

Figure 2

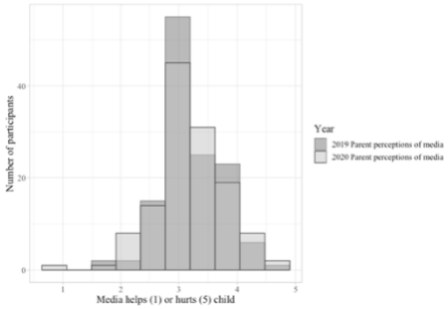
a) Average screen media use (SMU) per day in 2019 and 2020 (light grey bars indicate T2)



b) Average problematic media use (PMU) in 2019 and 2020 (light grey bars indicate T2)



c) Average parent perceptions of child media use (scale from 1 = helpful to 5 = hurtful) in 2019 and 2020 (light grey bars indicate T2)



Supplement A

Screen Media Use Questions: Exact Wording in 2019 And 2020

Items for 2019	**Items for 2020**	**Rating scale**
*We're interested in how much time your child spent doing various activities on an **AVERAGE DAY** over the last week. Some of these may be things your child is too young to do or never does. If that's the case, just mark "didn't do" and move on.*	*We're interested in how much time your child spent doing the following **non-school related activities** on an **AVERAGE DAY** over the last two weeks. We recognize that your child may be spending more or less time than usual on these activities because of the COVID-19 pandemic. So, please give us your assessment of your child's average use **for the last 2 weeks.*** *Some of these may be things your child is too young to do or never does. If that's the case, just mark "didn't do" and move on.*	1 = Didn't do 2 = 15 minutes or less 3 = 15 to 45 minutes 4 = 45 to 60 minutes 5 = 1 hour to 1.5 hours 6 = 1.5 hours to 2 hours 7 = 2 hours or more
Reading or being read to from a book, tablet, phone, or e-reader	Reading or being read to from a book, tablet, phone, or e-reader	
Watching DVDs, videotapes, or TV on a TV set	Watching shows or movies via streaming services (e.g., Netflix, Hulu), YouTube, DVDs, videotapes, or TV on a TV set	
Watching videos or TV shows on a mobile device like a smartphone or tablet	Watching shows or movies via streaming services (e.g., Netflix, Hulu), YouTube, DVDs, videotapes, or TV on a mobile device like a smartphone or tablet	
Watching videos or TV shows on a computer	Watching shows or movies via streaming services (e.g., Netflix, Hulu), YouTube, DVDs, videotapes, or TV on a computer or laptop	
Playing games on a console video game player like an Xbox, PlayStation, or Wii	Playing games on a console video game player like an Xbox, PlayStation, or Wii	
Playing games on a handheld game player like a Game Boy, PSP, or Nintendo DS	Playing games on a handheld game player like a Game Boy, PSP, Nintendo DS, or Nintendo Switch	
Doing anything else on a smartphone or tablet, such as taking or looking at pictures or videos, looking up things, social networking, or using other types of apps not already covered	Doing anything else not school-related on a smartphone or tablet, such as taking or looking at pictures or videos, looking up things, social networking, or using other types of apps not already covered	

Supplement B

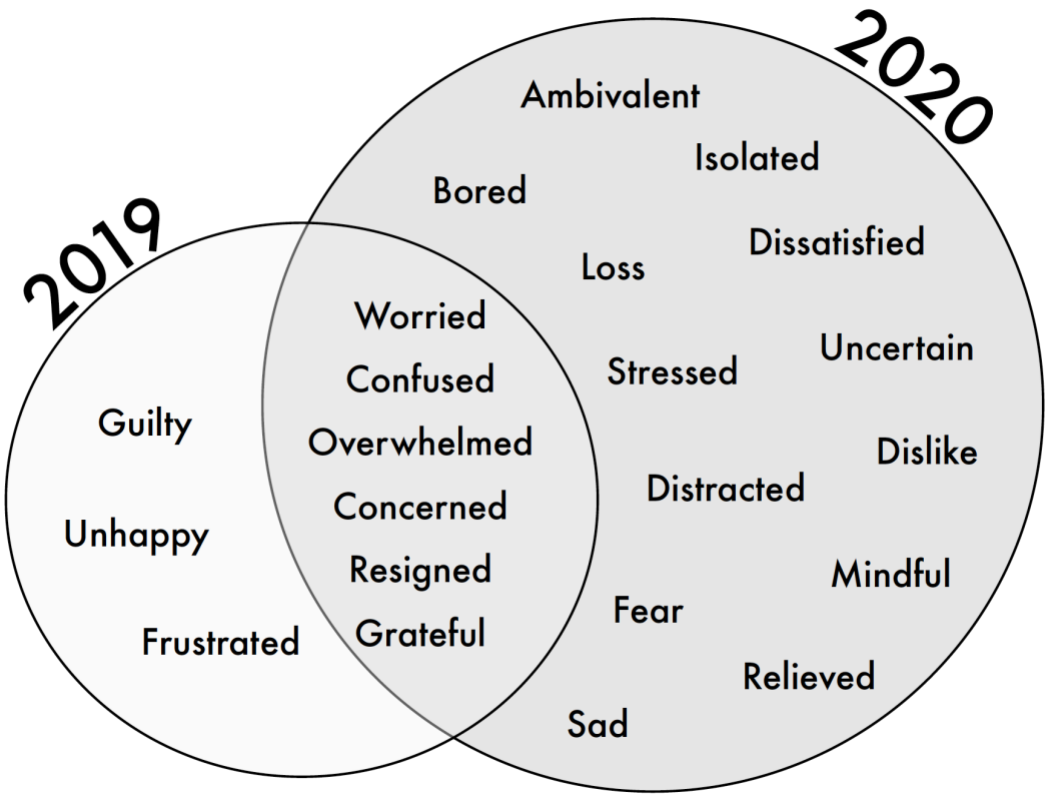
Correlations Between All Study Variables in 2019 and 2020 (N = 129 Unless Otherwise Noted)

	Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1.	Family income [a]	1											
2.	Social desirability [b]	0.13	1										
3.	2019 (T1) Screen media use (average minutes per day)	-0.07	-0.04	1									
4.	2020 (T2) Screen media use (average minutes per day)	0.001	-0.02	.46**	1								
5.	2019 (T1) Problematic media use [c]	0.05	-.18*	.43**	.50**	1							
6.	2020 (T2) Problematic media use [c]	0.02	-.19*	.23*	.45**	.68**	1						
7.	2019 (T1) Child age	0.13	-0.04	.31**	.41**	.40**	.48**						
8.	2019 (T1) Parent perceptions of media hurting child [d]	-0.06	-.18*	0.06	0.13	.36**	.41**	.31**	1				
9.	2020 (T2) Parent perceptions of media hurting child [d]	0.03	-.21*	-0.03	0.11	.37**	.53**	.33**	.64**	1			
10.	2019 (T1) Parent participation with child media [e]	.19*	-0.06	0.16	.24**	.31**	.21*	.51**	.27**	0.14	1		
11.	2019 (T1) Media as regulator [f]	-0.06	0.16	-.20*	-0.09	-.37**	-.28**	0.102	-0.09	-0.17	-0.03	1	
12.	2019 (T1) Media as babysitter [g]	-0.16	0.11	-0.15	-0.14	-.32**	-0.15	-0.09	-0.09	-0.07	-.38**	.20*	1

Note. * $p < .05$; ** $p < .01$. [a] Family income: 1 = Less than $25,000; 2 = $25,000-$49,999; 3 = $50,000-74,999; 4 = $75,000-$99,000; 5 = $100,000-$124,999; 6 = $125,000-$149,999; 7 = $150,000-$174,999; 8 = $175,000-$199,999; 9 = $200,000 or more. [b] Possible range: 0 – 3. [c] Possible range: 1 – 5. [d] Possible range: 1 – 5. [e] Possible range: 1 – 4. [f] $n = 106$. Possible range: 1 = Strongly agree to 4 = Strongly disagree. [g] $n = 126$. Possible range: 1 = Strongly agree to 4 = Strongly disagree.

Supplement C

Diagram of Emotions in Participant Responses Pre-Pandemic (2019) and Post-Onset (2020)



Note. Emotions from participant responses were placed in three categories: present only in 2019 (pre-pandemic), present only in 2020 (post-onset), or present in both years. If the emotion was present in both years, it is in the overlapping section of the two circles.

Supplement D

Themes and Codes From Open-Ended Participant Responses Pre-Pandemic (2019) And Post-Onset (2020)

Domain	Theme	2019 (T1) Codes (in bold) & Illustrative Quotes	Cross-cutting Codes (in bold) & Illustrative Quotes	2020 (T2) Codes (in bold) & Illustrative Quotes
Beliefs and Values	*Positives and negatives of screen media*	**Educational value of media** **"**They really like [virtual] puzzle solving games like Lego games and I see value in those." ID130 (5 yo) **Media skills are important for child's future** "I think technology is an important piece of learning for the future so I don't believe in no screen time at all." ID130 (5 yo) **Tradeoffs of media** "I think it is important for kids to become digitally intelligent and it would be a disadvantage for children not to have access to the technology." ID111 (7 yo)	**Media can have negative consequences** *2019:* "I am a middle school teacher, and my husband is a high school teacher. We have seen many negative effects of technology and screen time, and students seem to be more addicted each year." ID1 (11 yo) *2020:* "I think distance learning that is heavily media based is the wrong direction to go with children in an elementary setting." ID129 (5 yo)	

Beliefs and Values	*Monitoring screen time*	**Families struggle with device use** "I have a lot of "mom guilt" about [not enforcing stricter screen time limits], and I'm certain other caregivers feel guilt around this issue as well." ID53 (5 yo) **Media use is a privilege** **"**We communicate that being on electronics is a privilege." ID110 (10 yo)	**Screen use should be monitored and limited** *2019:* "It is important that [access to technology] is monitored and limited. Kids need to be playing!" ID111 (7 yo) *2020:* "I would have liked the YouTube videos shared through the distance learning platform to all have been sent through the Safe Share option." ID42 (6 yo) **Contexts influence how easy it is to manage screens** *2019:* "We probably have an easier time with monitoring/limiting my son's screen time since we only have one child!" ID82 (9 yo) *2020:* "I am working fewer hours right now, so our kids have been fortunate not to have 2 parents trying to work full time at home while daycare is closed. Our 1 hour a week has been a challenge to keep them interested in non screen activities. I don't know how families would be able to do 40 hours a week with kids at home and 2 parents working." ID88 (3 yo)	

Practices	*Parent mediation*	**Specific reasons and times for media uses** "We often use media for a short time before dinner, or another time to allow a "brain break" or some relaxation between activities" ID72 (6 yo) **Screen media as educational tool** "I try to make sure the cartoons/videos my child watches are educational in some way. He shares things he learns or remembers from the cartoons he watches." ID95 (2 yo) **Screen media as reward** "My kids use a decent amount of screen media and I do struggle to find a balance, so I try not to use it like a crutch, I try to make it a reward for good behavior at school." ID130 (5 yo)	**Limit and monitor screen time/content** *2019:* "We are very aware of screen time. Two months ago I started limiting iPad time to 1 hour either before or after school." ID80 (7 yo) *2020:* "We kept our expectation for media use about the same when we started staying home." ID30 (6 yo) **Screen media used to occupy child** *2019:* "My two year old doesn't have the attention span to watch media for too long. I homeschool my kids so he watches storybots for educational purposes and then we use videos to distract him while I teach the others. It doesn't always hold his attention as long as I'd like!" ID29 (2 yo) *2020:* "We are on more technology while we are home but mostly realated (sic) to school or the need for mom and dad to work and then kids need to be quiet (ie. during conference calls)." ID47 (6 yo) **Coviewing** *2019:* "There is no screen time during the week unless we watch a show as a family (ex. America's Got Talent, or a Nature Show)." ID114 (7 yo) *2020*: "Finally, with fewer evening activities, we've been spending more family time watching TV (mostly educational documentaries and mini-series, since we all like them)." ID52 (10 yo)	**Mindful of how media is used for child** "He uses a more-than-average amount of tablet time but now I am more mindful and have deleted apps that offer no significant value. 80% of the time he is on the tablet, it is for educational (but not for school) purposes." ID127 (5 yo) **Less able to monitor screen media use during COVID-19** "My husband's and my remote workload increased dramatically and we were not able to support or monitor almost not at all. Eventually we realized that our children got addicted to screen time. We couldn't monitor them, and they were watching YouTube or playing a video game during their school work time." ID46 (9 yo) **Less restrictive with screen time/content during COVID-19** "We have let a lot of our normal 'can't's' slide during the stay at home order. It will be difficult to go back to less screen time I anticipate when kid activities open back up again." ID76 (6 yo)

Practices	*Screen time*	**Device purchase and location in home** "We purposefully don't have a screen in our main living areas. My girls don't ask for a lot of tv, because our main space doesn't a have a TV or computer to remind them of use." ID128 (3 yo) **Quantity** "Our first child had zero screen time until she was two years old." ID69 (3 yo)	**Screen media use differs based on context** *2019:* "The amount of time spent on screens and his feelings about it can vary greatly throughout the year. When the weather is nice, he spends less time with screens and more time playing outside. When we're "stuck" inside, he tends to spend more time on screens." ID26 (8 yo) *2020:* "My kids seem to be bouncing back easily and spend very little time on screens now that summer is here and we have been able to secure childcare in our home while we continue to work from home." ID18 (3 yo)	**More screen media use during COVID-19** "Definitely have had more screen time [since COVID-19]" ID108 (7 yo) **More access to iPad/tablet during COVID-19** "Pre COVID-19 we only used ipads on plane rides... now they are used daily" ID104 (4 yo)

Practices	*Child activities and behavior*	**Behavior changes due to screen media** "I'd really like to understand why my child flies into an all out rage when he's watched too much tv, seems like pure addiction. If he wants to watch and we say 'no' without explanation, he's totally fine... Moves on. But if he watches tv (& really only tv) over an hour and he turns psycho." ID54 (5 yo)	**Child influencing and responding to screen media limits** *2019:* "My kids each get 10 media "sticks" each week. Each stick (cocktail stirrer) is worth 15 minutes of screen time . . . It works pretty well in resolving conflict around media, but they are getting better at finding loopholes and pushing the limits." ID30 (8 yo) *2020:* "My child does ask for [screen time] once in awhile but is receptive to our decisions of when and how long." ID69 (3 yo) **Other children influence screen media use** *2019:* "My youngest is more interested in screen media because of his older brother's interest." ID62 (5 yo) *2020:*"Much bigger increase in older siblings' screen use in order to keep in touch with friends." ID115 (4 yo) **Non-screen time activities** *2019:* "My daughter is not allowed to use her iPad during the week, only on weekends. If she gets bored I tell her to play with her dolls and/or toys. We also have game night on Thursday that minimizes screen time." ID74 (9 yo) *2020:* "It's important to note that my child will sometimes make her own decision to get up from watching TV with her siblings to play with toys." ID69 (3 yo)	

Attitudes	*Factors influencing screen media*	**Age** "My kids haven't started grade school yet and I expect technology use and exposure will be forced to increase with homework at that time." ID88 (2 yo)	**Media use fluctuates for different reasons** *2019:* "I find [my child's media use] is something that I struggle with. I feel largely due to the fact that my daughter is an only child." ID14 (7 yo) "Yes screen time went up slightly because of virtual learning for his preschool. But it would have gone up more by necessity if I was a working parent, but I stayed at home with them even before this." ID61 (4 yo) **Siblings and peers** *2019:* "Her younger sister sees the problems it causes and uses less media because she doesn't want to cause problems like her sister." ID44 (8 yo) *2020:* "[CHILD] has continued to play with one friend during the pandemic. His friend is often the one that initiates use of the tablet for them to play games together. It have been very difficult to control tablet use since his friend has no limits access to his tablet." ID48 (7 yo)	**Distance learning** "More media due to virtual school necessity. I don't like that as it's a slippery slope to want to use even more media." ID17 (9 yo) **COVID-19** "We have tried to keep media use similar to pre pandemic. Some increase was [inevitable]." ID88 (3 yo)

Attitudes	*Parent thoughts and strategies regarding media*	**Differing parental opinions** "If my spouse was not in the picture our children would have even less screen time but we have compromised." ID70 (2 yo) **Parental guilt** "Do I feel guilty about the amount of time my child uses media? Yes. Would I feel guilty about any amount of time he uses media? Yes." ID2 (4 yo) **Parental mediation can be effective** "We are very strict with our media use with the kids. The amount they use isn't a problem because we are in control and don't let it be a problem." ID17 (8 yo)	**Challenges with media use and monitoring** *2019:* "It is so hard to balance how much my child wants to have screen time, and how easy it is for me to give it to him, with how bad I know it is for him to use it and how many other things we should be doing instead...it is overwhelming." ID100 (5 yo) *2020:* "With all this extra time at home, we've really struggled with media use and screen time. We've tried more, we've tried none. It's a delicate balance." ID103 (8 yo) **Perceptions of screen time** *2019:* "I am not happy with how much screen time my son uses but we have gotten into a pattern that has been hard to change." ID3 (8 yo) *2020:* "We are very strict on screen time with our children. I think it's important for them to learn how to use but not more important than family and play." ID69 (3 yo)	**Too much screen time during COVID-19** "Screentime has SKYROCKETED, never in a million years would I imagine we would be using screens this much." ID104 (4 yo) **Post-COVID-19 concerns** "I am worried [high screen time] is going to be hard to reverse when things go back to 'normal'" ID104 (4 yo)

Attitudes	*Outcomes of screen media use*		**Negative behavioral effects** *2019:* "My son is a HUGE game fan. And would love to have all the game time in the world- but his behavior gets off track when he gets too much screen time." ID103 (7 yo) *2020:* "When he gets irritable, aggressive, or inconsiderate, we cut off his choice and use of screen time." ID132 (7 yo) **Child can be addicted** *2019:* "We have seen many negative effects of technology and screen time, and students seem to be more addicted each year." ID1 (11 yo) *2020:* "… We realized that our children got addicted to screen time." ID46 (9 yo) **Media can be positive** *2019:* "I feel that he has too much screen time but he will often play with his toys with what is happening on the TV (while watching or after) so I do feel it has helped his imagination." ID73 (5 yo) *2020:* "80% of the time he is on the tablet, it is for educational (but not for school) purposes" ID127 (5 yo)	

Note. Illustrative quotes were selected for each code. The age of the target child at the time of the survey is indicated in parentheses.

Supplement E

Hierarchical Linear Regression Predicting 2020 (T2) Screen Media Use with Unstandardized Coefficients and Standard Errors in Parentheses

Variable	**Model 1**	**Model 2**	**Model 3**
Social desirability	0.95 (8.79)	1.42 (9.13)	1.58 (11.23)
Family income	-0.90 (3.83)	-0.75 (3.90)	-2.10 (4.58)
2019 (T1) Screen media use (SMU)	0.45** (0.10)	0.45** (0.10)	0.39** (0.12)
Parent perception of media hurting child	1.00 (17.81)	2.36 (18.18)	-11.11 (21.12)
Child age	13.71** (4.64)	13.13** (4.87)	16.58** (5.86)
Parent participation with child media	7.45 (14.98)	7.83 (15.23)	-6.30 (18.34)
SMU x Parent perception of media hurting child		-0.10 (0.21)	-0.00 (0.24)
SMU x Age		0.02 (0.05)	-0.01 (0.06)
SMU x Participation with child media		-0.03 (0.16)	0.04 (0.21)
Media as regulator			-3.49 (14.60)
Media as babysitter			-6.09 (11.69)
SMU x Media as regulator			-0.31 (0.16)
SMU x Media as babysitter			0.08 (0.13)
Constant	202.92** (25.76)	200.53** (26.63)	210.88** (31.34)
Model *N*	129	129	105
R^2	0.29	0.30	0.34
F Statistic	8.50**	5.58**	3.55**

*Note: * $p<0.05$; **$p<0.1$*

Supplement F

Hierarchical Linear Regression Predicting 2020 (T2) Problematic Media Use with Unstandardized Coefficients and Standard Errors in Parentheses

Variable	**Model 1**	**Model 2**	**Model 3**
Social desirability	-0.05 (0.06)	-0.06 (0.06)	-0.03 (0.07)
Family income	-0.00 (0.03)	0.00 (0.03)	0.01 (0.03)
2019 (T1) Problematic media use (PMU)	0.66** (0.09)	0.66** (0.09)	0.73** (0.13)
Parent perception of media hurting child	0.27* (0.12)	0.27* (0.12)	0.28* (0.13)
Child age	0.12** (0.03)	0.11** (0.03)	0.10* (0.04)
Parent participation with child media	-0.19 (0.10)	-0.15 (0.10)	-0.20 (0.12)
PMU x Parent perception of media hurting child		-0.01 (0.15)	-0.10 (0.16)
PMU x Age		0.04 (0.04)	0.01 (0.05)
PMU x Participation with child media		-0.16 (0.13)	-0.21 (0.14)
Media as regulator			-0.12 (0.10)
Media as babysitter			0.09 (0.08)
PMU x Media as regulator			-0.05 (0.10)
PMU x Media as babysitter			0.03 (0.09)
Constant	2.30** (0.17)	2.28** (0.18)	2.24** (0.20)
Model *N*	129	129	105
R^2	0.55	0.55	0.61
F Statistic	24.52**	16.45**	10.93**

Note: * $p<0.05$; ** $p<0.1$

Supplement G

Hierarchical Linear Regression Predicting 2020 (T2) Screen Media Use with Unstandardized Coefficients and Standard Errors in Parentheses Using a Dichotomous Age Variable

Variable	**Model 1**	**Model 2**	**Model 3**
Social desirability	1.53 (8.68)	2.57 (9.03)	2.23 (11.05)
Family income	-1.00 (3.78)	-0.95 (3.84)	-1.58 (4.50)
2019 (T1) Screen media use (SMU)	0.49** (0.10)	0.43** (0.14)	0.42* (0.16)
Parent perception of media hurting child	-0.73 (17.59)	-0.16 (17.85)	-9.90 (20.37)
Child age (1 = 5 years or older)	64.50** (18.71)	65.16** (18.92)	72.69** (21.32)
Parent participation with child media	10.96 (14.13)	10.53 (14.34)	-1.67 (17.30)
SMU x Parent perception of media hurting child		-0.14 (0.20)	-0.13 (0.24)
SMU x Age		0.12 (0.23)	0.12 (0.27)
SMU x Participation with child media		-0.02 (0.15)	-0.00 (0.19)
Media as regulator			2.87 (13.82)
Media as babysitter			-5.87 (11.39)
SMU x Media as regulator			-0.32* (0.16)
SMU x Media as babysitter			0.12 (0.12)
Constant	174.57** (26.08)	171.99** (26.72)	174.83** (31.31)
Model *N*	129	129	105
R^2	0.31	0.32	0.36
F Statistic	9.20**	6.09**	3.88**

Note: * $p<0.05$; ** $p<0.1$

Supplement H

Hierarchical Linear Regression Predicting 2020 (T2) Problematic Media Use with Unstandardized Coefficients and Standard Errors in Parentheses Using a Dichotomous Age Variable

Variable	**Model 1**	**Model 2**	**Model 3**
Social desirability	-0.05 (0.06)	-0.04 (0.06)	-0.01 (0.07)
Family income	-0.00 (0.03)	0.01 (0.03)	0.01 (0.03)
2019 (T1) Problematic media use (PMU)	0.67** (0.09)	0.47** (0.13)	0.61** (0.16)
Parent perception of media hurting child	0.26* (0.12)	0.24 (0.12)	0.26 (0.13)
Child age (1 = 5 years or older)	0.50** (0.13)	0.48** (0.13)	0.41** (0.15)
Parent participation with child media	-0.14 (0.10)	-0.10 (0.10)	-0.14 (0.11)
PMU x Parent perception of media hurting child		-0.14 (0.16)	-0.20 (0.17)
PMU x Age		0.41* (0.19)	0.31 (0.21)
PMU x Participation with child media		-0.17 (0.12)	-0.19 (0.14)
Media as regulator			-0.08 (0.10)
Media as babysitter			0.10 (0.07)
PMU x Media as regulator			-0.04 (0.09)
PMU x Media as babysitter			0.07 (0.08)
Constant	2.08** (0.18)	2.01** (0.18)	2.00** (0.20)
Model *N*	129	129	105
R^2	0.55	0.57	0.63
F Statistic	24.83**	17.68**	11.67**

Note: * $p<0.05$; ** $p<0.1$