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Parental Recreational Screen Media Practices and Behavioral Difficulties Among Danish 7-Year-Old Children

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The authors have no conflicts of interest to disclose.

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ABSTRACT

OBJECTIVE: This study aimed to investigate the association of parental recreational screen media practices, including time use and level of smartphone addiction, with behavioral difficulties in 7-year-old children.

METHODS: The study was based on cross-sectional data from the Odense Child Cohort, a community-based birth-cohort study. A total of 1152 parent-child dyads with complete data were included based on data from the 7-year examination conducted in 2018–21. Parental recreational screen use was self-reported as hours/day using the SCREENS-questionnaire, and their smartphone addiction was self-reported using the Smartphone Addiction Scale Short Version. Child behavioral difficulties were assessed by the parent-reported version of the Strengths and Difficulties Questionnaire (SDQ).

RESULTS: Parental recreational screen time was not consistently associated with behavioral difficulty SDQ subscales and total difficulty scores when adjusted for other determinants of child mental well-being such as sociodemographic factors,

parental well-being, and number of siblings. Children had higher total behavioral difficulty scores (adjusted mean difference 2.12 (95% CI, 1.19–3.05)) when comparing fourth quartile versus first quartile of maternal smartphone addiction score. Also, higher maternal smartphone addiction scores were associated with more externalizing and internalizing behavioral problems of their child (adjusted mean difference 1.61 points (95% CI, 0.95–2.27), and 0.81 points (95% CI, 0.19–1.43)) for fourth quartile versus first quartile, respectively.

CONCLUSIONS: No cross-sectional association was found between total parental recreational screen use and behavioral difficulties in their 7-year-old children, but an association between maternal obsessive smartphone use and behavioral difficulties of their children was found.

KEYWORDS: children; cohort study; mental health; parents; screen time

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WHAT'S NEW

This study showed no cross-sectional association between total parental recreational screen use and behavioral difficulties in Danish 7-year-old children. However, an association between maternal obsessive use of a smartphone and behavioral difficulties of their children was found.

RECREATIONAL SCREEN MEDIA use is an integrated part of the everyday lives of many families with children. Most parents have a personal smartphone that provides access to entertainment, communication, information, and a variety of functions that may benefit tasks of everyday life. The ubiquity of parental smartphone use in

combination with use of other screen media such as the television or game consoles may negatively impact parents' attention toward their children. Recent studies have found that screen media multitasking and spontaneous screen media use during daily family activities, such as meals and playtime, are common in the environment in families with young children.^{1,2} Smartphone use has been associated with negative changes in eye contact, conversations, relationship satisfaction and the perceived psychological availability to other people.^{3,4} Parental screen media use in the presence of the child has also been found to reduce the attention and responsiveness to the child.^{5,6} Another study found that parents experience difficulties multitasking between their child and the screen devices, by which they find it problematic to read and respond to

the cues and manage their child's needs and behavior.⁷ A potential consequence is that the parent-child interactions may change and cause more conflicts, fewer conversations and fewer verbal and nonverbal interactions with the child,^{5,6} which in turn, may impact the child's behavior.⁸

Few population-based studies have investigated the association between parental screen media use and children's behavior. A cross-sectional study in 533 children found that higher maternal screen media use was associated with more behavioral difficulties on the SDQ scale in 2- to 9-year-old children.⁹ Another cross-sectional study including parents of children below 5 years of age from 170 families found that screen media interruptions during parent-child interactions were associated with more child behavior problems.⁸ To further investigate the relationship between parental recreational screen media use practices and child mental health, the aim of the present study was to investigate associations of parental screen media use and parental smartphone addiction with behavioral difficulties among Danish 7-year-old children.

METHODS

STUDY SETTING, ENROLLMENT, AND POPULATION

The Odense Child Cohort study (OCC-study) is an ongoing prospective cohort study.

Pregnant women were recruited from January 1st, 2010 to December 31st, 2012. A total of 2874 women were

enrolled during pregnancy, and after giving birth a total of 2664 children were enrolled.

The present study used data from the initial enrollment questionnaire (during pregnancy) and from the child examination and parent-reported questionnaires when the child was 7 years of age.

A total of 1713 children participated in clinical examinations and/or parent questionnaire at 7 years of age between January 1st, 2018 and March 31st, 2021. A total of 1152 (42.9% of the initial cohort) participants (child and parent) had complete data on the outcome, exposure, and confounder variables, and were considered eligible for the present study.

Further details on the enrollment process are available in the [Figure](#) and Kyhl et al.¹⁰ The OCC-study and the subproject for screen use were approved by the Regional Committees on Health Research Ethics for Southern Denmark (S-20090130 and S-20170033).

EXPOSURES

Parents' individual recreational screen time was obtained through the SCREENS-Questionnaire (SCREENS-Q), which have reported good validity and reliability properties in terms of child's screen media use (intraclass correlation coefficient [ICC] = 0.67–0.90) and parental screen media use (ICC = 0.69–0.75).¹¹ Parents were asked to quantify their daily amount of screen time during leisure time on a typical

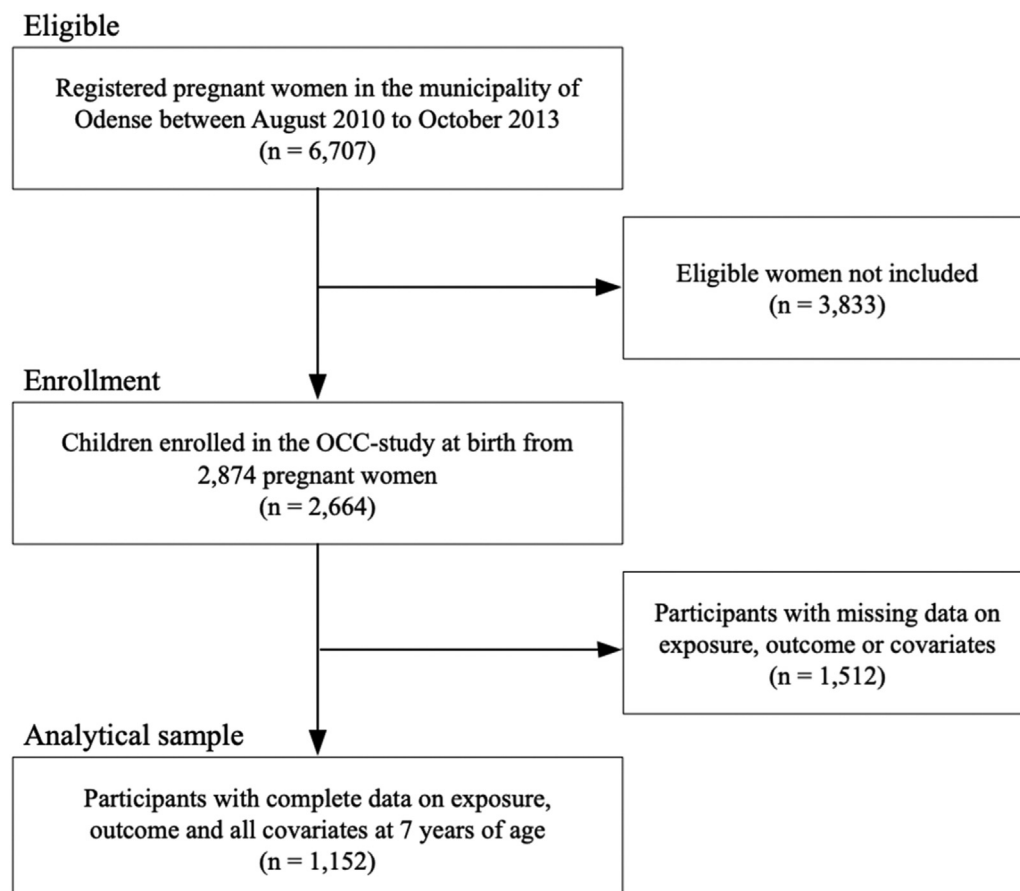


Figure. Flowchart of participants eligible for the analytical sample in the primary analysis.

weekday and weekend day (none, 1–29 minutes, 30–59 minutes, 1–2 hours, 2–3 hours, 3–4 hours, 4–5 hours, and ≥ 5 hours) across 6 different categories: 1) Movies, TV-series, YouTube videos, entertainment programs, 2) Games, 3) Social media or other types of communication, 4) Video conversation, 5) Surfing on the internet, and 6) Other types. These categorical variables were transformed to continuous variables using the median (in minutes) of each category (eg, 1–29 minutes = 15 minutes).¹² The highest category (≥ 5 hours) had no upper limit and was assumed to have the same minute range in terms of screen time as the preceding category (eg, ≥ 5 hours = 5.5 hours). Weekday screen time and weekend screen time were weighted equally ((weekday screen time + weekend screen time)/2) to avoid that weekday screen time accounted for the majority of the total screen time. Total screen time (hours/day) was calculated by adding the amounts of the 6 categories. Self-reported maternal and paternal smartphone addiction was obtained through the Smartphone Addiction Scale Short Version (SAS-SV) consisting of 10 items with a 6-point Likert scale (from 1 “strongly disagree” to 6 “strongly agree”).¹³ The SAS-SV contains items within 5 out of 6 subscales from the original SAS. The following subscales are included in the SAS-SV: Daily-Life Disturbance, Withdrawal, Cyberspace-Oriented Relationship, Overuse, and Tolerance. Internal consistency and concurrent validity of the SAS-SV were verified with a Cronbach’s alpha of 0.911.¹³ Total smartphone addiction score was presented in quartiles.

OUTCOME

Children’s behavior was assessed with the parent-reported version of the Strengths and Difficulties Questionnaire (SDQ).¹⁴ The SDQ consist of 25 items divided into 5 subscales (emotional symptoms, conduct problems, hyperactivity, peer problems, and prosocial behavior) each including 5 items.^{14,15} The SDQ items are rated on a Likert scale: 0 points for “Not true,” 1 point for “Somewhat true,” and 2 points for “Certainly true.” However, 5 questions were scored in reverse (ie, 2 points for “Not true”) according to the scoring manual. The score for each subscale was generated by summing the scores for each of the 5 items, thereby generating a score that ranges from 0 to 10. A total difficulties score ranging from 0 to 40 was calculated by summing the 4 problem scales (all scales except for the prosocial scale), where a high total difficulties score indicates more difficulties.¹⁴ We calculated the internalizing difficulty score (0–20 points) as the sum of the emotional and the peer subscales, and the externalizing difficulty score (0–20 points) as the sum of the conduct and the hyperactivity subscales.¹⁶ The SDQ has been translated into Danish and has been validated in the general population.^{15,17} The Danish version was revised in 2014.¹⁸ The psychometric properties of the SDQ have been reported to be good.^{19–21}

COVARIATES

Potential covariates were identified by drawing a directed acyclic graph based on existing literature and our assumptions of the directions of the paths (Supplementary Figure). Maternal age at birth and education (according to the International Standard Classification of Education²² [ISCED]) were obtained from the enrollment questionnaire. Maternal education was categorized into 3: 1) ISCED 1 to 3, 2) ISCED 4 to 6, and 3) ISCED 7 to 8. The WHO-5 Well-Being Index was used to assess parental well-being.²³ Biological sex of the child, number of siblings, and parental relation (eg, mother/father/stepmother) to the child were obtained from the 7-year examination and the parent-reported questionnaire. Parents reported their child’s physical activity level compared to peers with the following categories: Much less, Some less, Around the same, Somewhat more, and Much more. Due to few observations in the lowest and highest categories, the variable was dichotomized into 1) Much less, somewhat less or around the same, and 2) Somewhat more or much more. Height and weight of the child were measured at the 7-year examination and used to generate age- and sex-adjusted body mass index categories based on International Obesity Task Force growth charts using the Stata egen function `zbmcat()`.^{24,25}

Children’s recreational screen time was considered as a possible intermediate factor in the analyses. Parents reported the amount of their child’s screen time during leisure on typical weekdays and weekend days across 6 different categories: 1) movies, TV-series, YouTube videos, entertainment programs, 2) games, 3) school-related assignments by use of screen media, 4) video conversation, 5) social media or other types of communication, and 6) other types. Children’s total screen time was calculated the same way as for parental screen time. Maternal marital status (categorized as: 1) married, 2) nonmarital relationship/civil partnership, and 3) separated, single, or divorced) and ethnicity (categorized as: 1) born in Western countries (European Union member states and Andorra, Iceland, Liechtenstein, Monaco, Norway, San Marino, Switzerland, Vatican City, Canada, the USA, Australia, and New Zealand) and 2) born in non-Western countries (all other countries)) were obtained from the enrollment questionnaire and used to describe the sample, but they were not included in the analyses due to lack of variance in the study sample. Maternal marital status was collected during pregnancy, where most participants were expected to be in a relationship.

STATISTICAL ANALYSIS

Differences in characteristics among participants across quartiles of parental recreational screen time were tested with chi-square test for categorical variables and one-way analyses of variance or Kruskal-Wallis equality-of-populations rank test for continuous variables.

The cross-sectional associations of parental recreational screen time and parental smartphone addiction (continuous and in quartiles) with behavioral difficulties in children

were examined using multiple linear Tobit regression due to a floor effect of the SDQ score (11%, 20%, and 4% of participants had a score of 0 for the externalizing, internalizing, and total difficulties score respectively). All models were adjusted for maternal education, parental well-being, siblings, maternal age at birth, gender of the responding parent, and parent self-reported physical activity level of the child, which were suggested to be potential biasing paths according to the directed acyclic graph (Supplementary Figure). Crude and adjusted models were performed to assess the confounding effect of the covariates. We additionally adjusted for child recreational screen time to investigate the possibility of confounding or mediation of the association between parental recreational screen use practices and child behavioral difficulties.

There was a significant amount of missing data for mothers, fathers, or children, and inverse probability weighting was applied to account for the possible impact of the missing data. These weights were computed based on the following baseline information: sex of the child, maternal ethnicity, and maternal education. All statistical analyses were performed in STATA/BE 17.0 using a 2-sided α level of 0.05.

RESULTS

Characteristics of participants (children) with complete data and participants with missing data are shown in Table 1. The proportion of participants whose mothers had completed an education above short/medium length and were born in Western countries was greater among participants with complete data compared to participants with missing data (Table 1).

Table 2 shows the characteristics of the 1152 participants in the primary analysis presented in quartiles of parental recreational screen time. Parents with lower recreational screen time (first quartile) were higher educated (ISCED 7–8) (30.7%) compared to parents with higher

recreational screen time (fourth quartile) (18.9%). Participants whose parents had higher recreational screen time (fourth quartile) were less physically active and had more recreational screen time compared to participants, whose parents had lower recreational screen time. Lower self-reported well-being was present among parents with higher recreational screen time (third and fourth quartile) compared to parents with lower recreational screen time (first and second quartile). Additionally, participants whose parents had higher recreational screen time (third and fourth quartile) had higher recreational screen time (2.0 h/d and 2.5 h/d, respectively) compared to participants whose parents had lower recreational screen time (first and second quartile) (Table 2).

Table 3 shows the association between parental recreational screen time and the various SDQ scores in children. On the continuous scale of parental recreational screen time, crude analyses showed significant associations between parental screen time and externalizing difficulties (0.21, 95% CI, 0.09–0.32), internalizing difficulties (0.11, 95% CI, 0.01–0.22), and total difficulties (0.28, 95% CI, 0.12–0.45). After adjustments, the association only remained significant on the externalizing scale (0.12, 95% CI, 0.004–0.23).

In crude analyses, children in the fourth quartile of parental recreational screen time had significantly higher total difficulties scores compared to those in the first quartile (1.07, 95% CI, 0.20–1.93). After adjustments, children of parents with recreational screen media use in the second quartile, had significantly lower scores for externalizing difficulties (–0.61, 95% CI, –1.13 to –0.06) compared to children of parents with recreational screen time in the first quartile.

No other significant associations were found in the adjusted analyses. The inclusion of child recreational screen time in the multivariable adjusted analysis showed similar results regarding the level of significance. For more details on results of the SDQ subscales and the

Table 1. Characteristics at Enrollment (During Pregnancy and Up To the Postnatal Age of 2.5 Months) Among Participants With Complete Data and Missing Data

Characteristics, n (%)	Participants With Complete Data (n = 1152)	Participants With Missing Data (n = 1512)	Total (n = 2664)	P Value
Gender				.936
Boys	606 (52.6)	793 (52.5)	1399 (52.5)	
Girls	546 (47.4)	719 (47.5)	1265 (47.5)	
Maternal marital status				.001*
Married	422 (45.7)	413 (36.4)	835 (40.5)	
Nonmarital relationship/civil partnership	475 (51.4)	689 (60.6)	1164 (56.5)	
Separated, single, or divorced	27 (2.9)	34 (3.0)	61 (3.0)	
Maternal ethnicity				.001*
Born in Western countries	1130 (98.1)	1660 (93.5)	2790 (95.3)	
Born in non-Western countries	22 (1.9)	116 (6.5)	138 (4.7)	
Maternal education				.001*
ISCED 1–3	294 (25.5)	604 (36.0)	898 (31.7)	
ISCED 4–6	584 (50.7)	793 (47.3)	1377 (48.7)	
ISCED 7–8	274 (23.8)	280 (16.7)	554 (19.6)	

Data are presented as numbers (%). Significant differences between participants with complete data and participants with missing data. Significant differences ($P < .05$) are marked with*.

Categorical variables were compared using the chi-square test. Continuous parametric variables were compared using a 2-sample *t* test.

Table 2. Characteristics of the Study Population by Parental Recreational Screen Time Presented in Quartiles

Participant Characteristics	Parental Recreational Screen Time					P Value
	First n = 303	Second n = 314	Third n = 281	Fourth n = 254	Total n = 1,152	
	1.4 (1.0–1.6)	2.3 (2.2–2.4)	3.1 (2.8–3.5)	4.8 (4.3–5.9)	2.5 (1.8–3.6)	
Gender (child)						
Boys, n (%)	160 (52.8)	157 (50.0)	146 (52.0)	143 (56.3)	606 (52.6)	.513
Girls	143 (47.2)	157 (50.0)	135 (48.0)	111 (43.7)	546 (47.4)	
BMI (child)						
Grade 1–3 thinness	38 (13.0)	38 (12.6)	28 (10.4)	42 (17.4)	146 (13.2)	.162
Normal weight	227 (77.7)	243 (80.5)	210 (78.1)	180 (77.7)	860 (77.9)	
Overweight/obese	27 (9.3)	21 (6.9)	31 (11.5)	19 (7.9)	98 (8.9)	
Physical activity level compared to peers (child)						
Much less, some less or much the same	219 (72.3)	225 (71.7)	221 (78.6)	201 (79.1)	866 (75.2)	.060
Some more or much more	84 (27.7)	89 (28.3)	60 (21.4)	53 (20.9)	286 (24.8)	
Maternal age at birth	31.5 ± 4.3	31.0 ± 4.2	31.1 ± 4.1	31.1 ± 4.2	31.1 ± 4.2	.2529
Maternal ethnicity						
Born in Western countries	298 (98.4)	309 (98.4)	274 (97.5)	249 (98.0)	1,130 (98.0)	.852
Born in non-Western countries	5 (1.7)	5 (1.6)	7 (2.5)	5 (2.0)	22 (2.0)	
Maternal education						
ISCED 1–3	68 (22.4)	69 (22.0)	74 (26.3)	83 (32.7)	294 (25.5)	.003*
ISCED 4–6	142 (46.9)	173 (55.1)	146 (52.0)	123 (48.4)	584 (50.7)	
ISCED 7–8	93 (30.7)	72 (22.9)	61 (21.7)	48 (18.9)	274 (23.8)	
Parental WHO-5 Well-Being Index	18 (15–20)	18 (15–20)	17 (14–20)	17 (13–20)	18 (15–20)	.0019*
Maternal marital status						
Married	114 (47.3)	127 (50.0)	95 (43.0)	86 (41.4)	422 (45.7)	.211
Nonmarital relationship/civil partnership	119 (49.4)	122 (48.0)	122 (55.2)	112 (53.8)	475 (51.4)	
Separated, single, or divorced	8 (3.3)	5 (2.0)	4 (1.8)	10 (4.8)	27 (2.9)	
Have siblings	286 (94.4)	291 (92.7)	260 (92.5)	229 (90.2)	1066 (92.5)	.309
Child recreational screen time h/d	1.3 (0.8–1.8)	1.6 (1.1–2.1)	2.0 (1.5–2.8)	2.5 (1.9–3.5)	1.8 (1.1–2.5)	.0001*

BMI indicates body mass index.

Parametric data are presented as number and proportions (%) or mean ± SD values of the group. Nonparametric data are represented with median and interquartile range (IQR). Categorical variables were compared using the chi-square test. Continuous parametric variables were compared using one-way analyses of variance, and nonparametric variables were compared using Kruskal-Wallis equality-of-populations rank test. Significant differences (<.05) are marked with *.

distribution between maternal and paternal recreational screen time, see [Supplementary Tables 1 and 2](#).

[Table 4](#) represents associations between maternal smartphone addiction scores and child behavioral

difficulties. On the continuous scale, crude analyses showed significant associations between maternal smartphone addiction and externalizing difficulties (0.11, 95% CI, 0.07–0.15), internalizing difficulties (0.07, 95% CI,

Table 3. Cross-Sectional Associations Between Parental Recreational Screen Time and Child Behavioral Difficulties

	Median Time (h/d)	Child Behavioral Difficulties (Strength and Difficulties Questionnaire)					
		Externalizing Difficulties		Internalizing Difficulties		Total Difficulties Score	
		β [95% CI]	P Value	β [95% CI]	P Value	β [95% CI]	P Value
Parental screen time							
Crude							
Continuous		0.21 [0.09; 0.32]	.001*	0.11 [0.01; 0.22]	.040*	0.28 [0.12; 0.45]	.001*
First quartile (n = 303)	1.4	(Reference)		(Reference)		(Reference)	
Second quartile (n = 314)	2.3	−0.41 [−1.1; 0.14]	.145	0.04 [−0.48; 0.56]	.870	−0.44 [−1.21; 0.33]	.264
Third quartile (n = 281)	3.1	0.30 [−0.31; 0.88]	.346	0.09 [−0.46; 0.64]	.749	0.27 [−0.56; 1.10]	.517
Fourth quartile (n = 254)	4.8	0.63 [−0.0003; 1.26]	.050	0.64 [0.09; 1.12]	.023*	1.07 [0.20; 1.93]	.016*
Multivariable adjusted							
Continuous		0.12 [0.004; 0.23]	.043*	0.03 [−0.07; 0.14]	.528	0.14 [−0.02; 0.31]	.082
First quartile (n = 303)	1.4	(Reference)		(Reference)		(Reference)	
Second quartile (n = 314)	2.3	−0.61 [−1.13; −0.06]	.028*	−0.08 [0.58; 0.42]	.752	−0.71 [−1.44; 0.03]	.058
Third quartile (n = 281)	3.1	−0.0002 [−0.56; 0.56]	.999	−0.14 [−0.66; 0.38]	.599	−0.18 [−0.96; 0.61]	.653
Fourth quartile (n = 254)	4.8	0.14 [−0.46; 0.75]	.639	0.25 [−0.28; 0.77]	.357	0.31 [−0.50; 1.13]	.454

CI indicates confidence interval.

Coefficients (95% CI) represent mean difference in the Strengths and Difficulties Questionnaire (SDQ) score of the child per 1 h/d increase in parental recreational screen time (continuous) or mean difference in SDQ score of the child in second, third, or fourth quartile versus the first quartile of parental recreational screen time. Multivariable models were adjusted for maternal education, parental well-being, siblings, maternal age at birth, gender of responding parent and physical activity level of the child. Significant results (p<0.05) are marked with *.

Table 4. Cross-Sectional Associations Between Maternal Smartphone Addiction and Behavioral Difficulties in Children

	Median Score	Child Behavioral Difficulties (Strength and Difficulties Questionnaire)					
		Externalizing Difficulties		Internalizing Difficulties		Total Difficulties Score	
		β [95% CI]	P Value	β [95% CI]	P Value	β [95% CI]	P Value
Maternal smartphone addiction							
Crude							
Continuous		0.11 [0.07; 0.15]	.001*	0.07 [0.03; 0.10]	.001*	0.16 [0.10; 0.21]	.001*
First quartile (n = 238)	11	(Reference)		(Reference)		(Reference)	
Second quartile (n = 222)	15	0.66 [0.03; 1.29]	.039*	0.54 [−0.07; 1.15]	.082	0.97 [0.09; 1.86]	.032*
Third quartile (n = 221)	20	0.69 [0.13; 1.27]	.016*	0.77 [0.15; 1.39]	.015*	1.14 [0.28; 1.99]	.009*
Fourth quartile (n = 216)	26	2.04 [1.36; 2.72]	.001*	1.31 [0.68; 1.95]	.001*	2.94 [1.96; 3.92]	.001*
Multivariable adjusted							
Continuous		0.08 [0.05; 0.12]	.001*	0.04 [0.01; 0.07]	.019*	0.11 [0.06; 0.16]	.001*
First quartile (n = 238)	11	(Reference)		(Reference)		(Reference)	
Second quartile (n = 222)	15	0.51 [−0.11; 1.13]	.105	0.30 [−0.29; 0.89]	.314	0.64 [−0.19; 1.48]	.135
Third quartile (n = 221)	20	0.42 [−0.15; 0.99]	.150	0.41 [−0.19; 1.02]	.184	0.58 [−0.27; 1.42]	.182
Fourth quartile (n = 216)	26	1.61 [0.95; 2.27]	.001*	0.81 [0.19; 1.43]	.009*	2.12 [1.19; 3.05]	.001*

CI indicates confidence interval.

Coefficients (95% CI) represent mean difference in the Strengths and Difficulties Questionnaire (SDQ) score of the child per 1 point increase in maternal smartphone addiction score (continuous) or mean difference in SDQ score of the child in second, third, or fourth quartile versus the first quartile of maternal smartphone addiction score. Multivariable models were adjusted for maternal education, parental well-being, siblings, maternal age at birth, and physical activity level of the child. Significant results ($p < 0.05$) are marked with *.

0.03–0.10), and total difficulties (0.16, 95% CI, 0.10–0.21). The associations remained significant after adjustments.

Crude analyses of the quartiles of the maternal SAS showed significantly higher SDQ scores of children in the fourth quartile of maternal smartphone addiction score in both externalizing difficulties (2.04, 95% CI, 1.36–2.72), internalizing difficulties (1.31, 95% CI, 0.68–1.95), and total difficulties (2.94, 95% CI, 1.96–3.92). Multivariable adjusted analyses also showed significantly higher SDQ scores of children in the fourth quartile of maternal smartphone addiction score in both externalizing difficulties (1.61, 95% CI, 0.95–2.27), internalizing difficulties (0.81, 95% CI, 0.19–1.43), and total difficulties (2.12, 95% CI, 1.19–3.05) after adjustments. [Supplementary Table 3](#) shows more details on results of the SDQ subscales.

No significant associations between paternal SAS and child behavioral difficulties were found ([Supplementary Table 4](#)).

DISCUSSION

Based on recently collected data from a population-based sample of Danish 7-year-old children, no association between total parental recreational screen time and child behavioral difficulties was observed after adjustment for a range of other potential determinants of child mental health. For parental smartphone addiction, an indicator of excessive use of a smartphone, we found a consistent dose-dependent association of higher maternal smartphone addiction score with more externalizing and internalizing behavioral problems and total behavioral difficulties of their child.

The relationship between parental screen time and child mental health have been investigated in different ways in a few studies. A cross-sectional study by Poulain et al⁹ from 2019 found that high maternal screen time was

significantly associated with higher total difficulties scores in children measured with SDQ. The study had a smaller sample size ($n = 553$), and adjustments were only made for child age and sex, maternal age and socioeconomic status. One plausible explanation for this difference could be that mothers in Poulain et al had a much higher mean maternal screen time (4.33 h/d) compared to the mean of parental screen time (2.5 h/d) in the present study. Another explanation could be different ways of measuring screen time. A cross-sectional study in a modest sample size of 168 mothers and 165 fathers from 170 families by McDaniel et al⁸ from 2018 investigated whether parental problematic technology use was associated with technology-based interruptions in parent-child interactions, and whether technology-based interruptions were associated with behavioral problems in children. The study found significant associations between parents' self-perceptions of problematic digital technology use, perceived technology-based interruptions in parenting, and reported behavioral difficulties in children. The study supports the findings of our secondary analyses, which suggest that maternal excessive smartphone use may have negative impacts on children's mental health, although the 2 studies are not directly comparable.

A study by Goodman et al²⁶ compared the SDQ scores to clinical relevance and found that the odds of child mental health disorder increased monotonically with increasing difficulties score (odds ratios between 1.14 and 1.28 for every one-point increase in the total difficulties scale). In our study, the adjusted mean difference in total difficulties comparing the fourth and first quartile of maternal smartphone addiction score was 2.12 points, which corresponds to a standardized effect size of 0.45 and indicates that the difference is of clinical relevance. Higher maternal smartphone addiction appeared more strongly associated to externalizing difficulties as compared to internalizing difficulties. This may be due to the fact that

multitasking between smartphones and interactions with children during everyday situations may lead to an increase in conflicts and a decrease in positive and constructive interactions between parents and children. As a response to the parents' screen use, the child may particularly respond with externalizing behavior such as disobedience, tantrums, and restlessness^{5–7} and less so with internalizing behavior. Including child screen time in the multivariable adjusted analysis showed almost no differences in estimates, which indicates that children's screen time does not explain the association of maternal smartphone addiction with child behavioral difficulties. Yet, the relationship between child screen time, parental screen time, and child mental health is likely complex and requires further investigation in other samples. Also, it cannot be ruled out that mothers of children with more behavioral difficulties immerse themselves into the smartphone due to their children's difficulties.

The results from our primary and secondary analyses appear to be contradictory. The primary analyses included all types of screen time of the parents, which potentially could include screen time spent together with their children, such as watching a movie or playing video games. The secondary analyses were based on parents' smartphone addiction characterized by an excessive use and a difficulty in controlling the impulse to use a smartphone, which is likely screen time spent alone. Previous studies have found that smartphone use is associated with negative changes in social interactions with other people,^{3,4} which could explain why the association was found in the secondary analyses and not in the primary analyses. These findings suggest that the relationship between parental screen time and children's behavioral difficulties may depend on the type of device being used. Future studies may benefit from using objectively measured screen time on various devices as a way to further understand this issue.

STRENGTHS AND LIMITATIONS

The present study has several strengths. The study population is relatively large and from a well-defined source population, and data have been collected recently. In addition, the recently published SCREENS-Q, which was used to collect data on the exposure, was developed to capture today's use of screen media devices.¹¹ However, the present study is also limited by several factors and the results must be interpreted with these in mind. First, cross-sectional data were used in the present study and considerations about causal relationships remain speculative. Second, several measures were collected by parent-reported or self-reported questionnaires which can cause an increased risk of measurement bias. Screen time was self-reported by parents and might be affected by social desirability bias in addition to random measurement error. If parents with children having behavioral difficulties are more likely to underreport their own screen media use and extent of smartphone addiction, there is a risk that the estimated associations were underestimated. Also, the expected random measurement error in self-reported

screen time will bias the results toward the null hypothesis. Generally, there was little difference in the results when we modeled screen time categorically or continuously, indicating that the lack of association or weak association seen in the continuous analyses may be due to nonlinearity in the association. Third, although adjustments were made to address potential confounders, residual and unknown confounding cannot be ruled out. For example, adjustment for educational status was collected at the enrollment and not at the 7-year examination, and it is possible that educational status have changed since pregnancy (enrollment). In addition, this study lacks information about household income levels. Finally, dropouts and missing data from the enrollment of the OCC-study to the analytic sample may have introduced selection bias.

CONCLUSIONS

No evidence was found for a cross-sectional association between total parental recreational screen use and behavioral difficulties in 7-year-old children, but results showed a significant association between maternal excessive use of a smartphone and more behavioral difficulties of their children. Prospective observational and experimental studies are needed to confirm these findings. Future studies may consider assessment of parental recreational screen media use in the presence of the child and measures of parent-child-interactions to further corroborate the findings of this study.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at <https://doi.org/10.1016/j.acap.2023.01.004>.

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