Technoference in Parents of Primary School-Aged Children and its Associations with Parental Problematic Screen Use and Sociodemographic Characteristics

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INTRODUCTION: Parental technoference (PTF) refers to the behaviour of a parent who looks at the screen of their smartphone (or other electronic device) instead of their child's face during parent-child interaction. The parent's inattention to the child disrupts adult–child reciprocal trust and warmth, negatively affecting the parent-child relationship. The parent may also unconsciously convey to the child that they are of low importance. Additionally, given that children lack awareness about what is right and wrong in relation to screen use, frequent PTF may lead to the establishment of bad habits and a lack of self-regulation in the child's own screen use. This study aimed to explore the prevalence and severity of technoference in parents of elementary school children and the associations between PTF and sociodemographic variables and parental problematic screen use.

METHODS: We analyzed survey data from 1915 parents of primary school children (mean age: 8.4 years) from Czechia, Slovakia, and Finland. **RESULTS:** The frequency of self-reported PTF differed based on sociodemographic characteristics. We found a positive association between PTF and the parent's education, family income, child's position among siblings, child's year of study, size of the city where the family lived, and parent's self-reported problematic digital use. No association was found between PTF and the child's sex, parent's sex, parent's age and family intactness. **CONCLUSIONS:** Parents with a university degree, those with higher incomes and those living in large cities were found to be at greater risk for PTF. Further studies that analyze potential moderators, such as parenting stress and work-related screen use are warranted to better understand the dynamics of PTF.

Keywords | Technoference – Problematic Screen Use – Parents – Children

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1 INTRODUCTION

In 2015, Brandon McDaniel defined the term technoference as "everyday interruptions in interpersonal interactions or time spent together that occur due to digital and mobile technology devices" (McDaniel, n.d.). With an increasing volume of research focused on digital media, some similar new terms have emerged. Some authors have referred to technoference as phubbing (Chotpitayasunondh & Douglas, 2018), parallel communication (Kneidinger-Müller, 2017), and absent presence (Gergen, 2002). Technoference can be observed in all personal interactions, but investigation of this phenomenon between parents and children (parental technoference – PTF) is the most prevalent.

In their review, Knitter & Zemp (2020) summarized that PTF negatively affected parent-child relationships due to reduced parental attention, impaired quality of parent-child interactions and decreased parental warmth (as perceived by children). Previous research also found associations between PTF and low infant vocabulary (Corkin et al., 2021), low child prosocial behaviour (Sundqvist et al., 2020), children's externalizing and internalizing behavioural problems (McDaniel & Radesky, 2018b), parental inattentiveness to children's safety and emotional needs (Elias et al., 2021), adolescent depression (Bai, Lei, et al., 2020) and increased preadolescent mobile device use (Meeus et al., 2021). It may be concluded that PTF can seriously affect the child's healthy development and well-being. The question is how often PTF occurs and which parent-child dyads are most at-risk of this phenomenon.

Previous studies on the prevalence of PTF (Bai, Bai, et al., 2020; Krogh et al., 2021; McDaniel, 2021; McDaniel & Radesky, 2018a; McDaniel & Radesky, 2018b; Meeus et al., 2021; Merkaš et al., 2021; Stockdale et al., 2018; (Sundqvist et al., 2020); Wang et al., 2020) have shown high heterogeneity with respect to measurement instruments, the studied population and the source of reporting (child/parent). In addition, even raw averages of PTF reported by previous studies are difficult to compare due to the varying number of points (and types of anchors) in the Likert scales used for reporting. After recalculation of the studies' results using Cattell's interactive scoring (i.e., recomputing raw scores into percentages with 50% being the neutral point reflecting that PTF was on average neither present nor not present), we found that most studies reported averages that were lower than the middle (neutral) point (*Supplementary Table 1*), which suggested that the prevalence of PTF in the population was rather low. On the other hand, two studies which did not use Likert scale but rather asked parents to report the number of times per day when PTF occurred showed that it occurred on average five times per day (Krogh et al., 2021), two times per day, respectively (Sundqvist et al., 2020). No other meaningful patterns (e.g., lower PTF in the case of parental reports compared to child reports) were observed (*Supplementary Table 1*).

The occurrence of PTF has been previously found to vary widely from parent to parent. The presumed correlates of PTF were mostly low parental emotional stability (Merkaš et al., 2021) and parenting stress (McDaniel, 2021). Although the link between PTF and emotional stability/parenting stress has been evidenced only by singular studies, it is plausible. It has been found that some parents might use screen devices for coping with parental stress, namely for seeking information, self-distraction, and emotional and instrumental support (Wolfers, 2021). It should be noted that the alternative (or perhaps complementary) strategy to relieve parental stress via screens could include providing screen media to children. This strategy has been evidenced by a few studies. A study conducted during COVID-19 pandemic lockdown argued that screen time in children increased when parenting caretaker capacities were limited (Hartshorne et al., 2021). Similar to that, Munzer et al. (2022) suggested that giving children screen media could decrease parental stress during the COVID-19 pandemic. McDaniel & Radesky (2020) found that parenting stress mediated the relationship between parenting a difficult child and this child's increased screen time. Finally, a study by Bellagamba et al. (2021) found a positive correlation between parental stress and tendency of parents to provide screen devices for busying and calming child. Although such parental behavior could have some risks (e.g., excessive screen use in children), it however would not lead to PTF, as child's screen use prevents parent-child interaction and creates a space for a parent to engage in other than parenting behavior (including screen use).

Despite some parents have acknowledged using screen media for stress relief via self-distraction, a majority of parents expressed having rather strong norms against the use of screen media during parenting (Wolfers, 2021), i.e., expressing rather anti-PTF attitudes. These attitudes may, however, diverge from the actual behavior, especially in parents struggling to maintain their screen use under the control. A study by Zurcher et al. (2020) suggested that parental screen media use was higher when they had difficulties in executive functions independent of their (negative) attitudes towards PTF. Sundqvist et al. (2020b) identified a moderately strong positive correlation between PTF and parental problematic screen media use, which can be defined as a compulsive use which is beyond the user's voluntary control, is being prioritized over other hobbies and which excessiveness causes problems in relationships and everyday functioning of the user (Hawi et al., 2019). The above-mentioned study, however, had a rather small and convenient sample and measured problematic use only by three self-designed items reflecting the loss of control over screen media use. Therefore, the association should be further analyzed on a larger and more representative sample of parents.

Most studies on PTF have not examined the effect of sociodemographic variables on PTF prevalence and frequency. However, in her dissertation research, Alixandra Blackman found that parent/caregiver education level and income significantly moderated the relationship between parental screen time and parental screen distraction (Blackman, 2005). Similarly, Bai et al. found a weak positive relationship between education and PTF (Bai, Bai, et al., 2020). On the other hand, neither Krogh et al. (2021) nor McDaniel & Radesky (2018a) found any significant association between PTF and parental education or family income. Thus, the evidence on the relationships between PTF and family sociodemographic characteristics is inconclusive. Current evidence also does not suggest any effect of child age on the frequency of PTF, as studies have shown no correlations between PTF and child age (McDaniel & Radesky, 2018a;

Stockdale et al., 2018), except one study (Krogh et al., 2021) that found an increase in PTF between the second and seventh month of the child's life.

To summarize, PTF does not seem to be very frequent (at least from the perspective of parents), although the measurement method may be important. The frequency could differ based on the sociodemographic characteristics of parents/children/families, but research on these associations is largely lacking. As argued previously, PTF can negatively impact children's development and mental health, and researchers need to know which children (parents/families) are especially prone to experience PTF. Additionally, parental problematic use may be an important correlate of PTF, but the association needs to be confirmed on a less biased sample.

1.1 Current study

The primary aim of this explorative survey study was to examine the relations among PTF, parental problematic screen use (PPU), and sociodemographic variables. Specifically, we aimed (i) to estimate the prevalence of PTF among parents of young elementary school-aged children; (ii) to examine the associations between PTF and sociodemographic variables, including the child's sex, child's grade, child's position among siblings, family intactness, family income, family residence in rural/urban areas (size of city, number of inhabitants), parental sex, and parental education; and (iii) to examine associations between PTF and PPU. Given the limited previous knowledge, our study was mostly explorative. However, based on previous evidence, we expected PTF to be positively associated with PPU.

2 METHODS

2.1 Design and procedure

This survey study utilized baseline data from a larger ongoing longitudinal project on media parenting and children's use of screen-based devices (The effect of parenting on the use of digital technologies (screens/media) in children, https://osf.io/8nec4/). To collect data, online questionnaires were distributed to parents of children attending grades 1–3 of participating elementary schools in three European countries – Czechia, Slovakia and Finland. Alongside the two Central European countries, we included Finland for the sake of higher generalizability outside Central Europe. Three included countries share some important characteristics such as size, strong social welfare system, well-regarded educational system, and relatively homogeneous populations with most people having the same ethnicity and language. However, there are some differences reflected e.g. by the human development index (HDI); Finland belongs to the most developed European countries (11th place worldwide, 9th in Europe), while Czechia is around average (22nd in Europe) and Slovakia slightly below the average (29th in Europe) (Conceição et al., 2022). The rather special trait of Finland is the strong tradition of digital technology development, e.g., in the area of portable devices (Dunnewijk & Hultén, 2007) and gaming (Saarikoski & Suominen, 2009).

To ensure representativity of the sample, the cooperating schools were selected randomly from quotas based on sociodemographic characteristics (department, city, number of pupils in class, school size). The platform Limesurvey.net was used for online data collection. Czech schools could choose between online and offline data collection methods. For offline data collection, printed questionnaires were sent in opaque envelopes to the schools. The offline questionnaire had the equivalent content as online questionnaire. Only a minority of schools used the offline option. Completion of the survey took 15–30 min. Data collection ran from April 2021 to June 2021. Our data collection partially overlapped with Czechia's COVID-19 lockdown. As a result, some Czech data were collected when schools were closed (during distanced online schooling). We treated these data separately as a "Czechia at-home schooling sample" as we believed that the lockdown situation might play a role in the examined variables. The parents of first-, second- and third graders were invited to participate because the project focused on young elementary school-aged children (pre-adolescents), which were expected to constitute a specific category in respect to their screen media use (American Academy of Pediatrics, 2024).

2.2 Participants

The sample consisted of parents of children attending grades 1–3 of the participating elementary schools in Czechia, Slovakia and Finland. In the entire sample, most respondents were women (85.7%). Approximately half of the participants (48.5%) had a university degree, and more than half of the participants came from middle- to high-income families (61.7%). The mean age of the children was 8.4 years (SD = 1.016). On average, the families had two children. All sociodemographic characteristics are shown in *Table 1*.

Data from participants who completed the informed consent form (N = 2836) were checked for validity, and some participants were excluded for the following reasons:

- Participants completed less than 75% of the whole survey (N = 871).
- Participants reported that their children were not in the age cohort (6–11 years) (N = 7).
- Participants reported that their children were currently out of school due to illness, quarantine or other reasons (N = 32), or participants did not report whether their children were currently out of school or not (N = 11) (the reason for these exclusion criteria was that the questionnaire aimed to investigate the child's and parent's behaviour during a regular week, not e.g., in the situation when a child is sick).
- Participants had more than 25% missing values in variables of interest, i.e., PTF and PPU (N = 51).

The final sample included in the data analysis consisted of 1864 participants (Ncze = 511, Ncze-home = 552, Nsvk = 440, Nfin = 361).

2.3 Measures

Sociodemographic data included the child's sex (girl, boy), child's grade (1st, 2nd, 3rd), child's position among siblings (only child (no sibling/s), oldest child (only younger sibling/s), middle child (both younger and older siblings), youngest child (only older sibling/s)), family intactness (yes, no), family income (4 levels: low income, middle low income, middle-high income, high income), family rural/urban place of residence (5 levels: up to 999 inhabitants, 1000–4999 inhabitants, 5000–19999 inhabitants, 100 thousands or more inhabitants), parental sex (female, male), parental education (3 levels: elementary or practical school without graduation, high school or college with graduation, university).

Parental technoference (PTF) was measured with a questionnaire developed by Barr et al. (2020), which consisted of 6 items asking about how frequently parents used digital devices (for calling, texting, checking email, or watching video) while in contact with their children (during meals, when sending the child to school, when playing with the child, when preparing the child for sleep, when transporting the child to leisure activities or travelling by public transport, and when at the playground). Responses were recorded on a 5-point Likert scale (1 = never – 5 = very likely, almost always). The internal consistency was acceptable but borderline (McDonald's $\omega = 0.68$, Cronbach's $\alpha = 0.67$).

Parental problematic screen use (PPU) was measured with 9 items asking how frequently parents were unable to control device usage, were unable to sleep because of device usage, had conflicts with loved ones about device usage, preferred device usage to other hobbies, preferred device usage to spending time with loved ones, etc. Responses were recorded on a 5-point Likert scale (1 = never – 5 = always). Items were selected from the Digital Addiction Scale for Children (Hawi et al., 2019). The selection of items was guided by diagnostic criteria specified for internet gaming disorder in DSM-V (American Psychiatric Association, 2013). The internal consistency was acceptable (McDonald's $\omega = 0.79$, Cronbach's $\alpha = 0.78$). We considered this variable as an interval variable reflecting more or less problematic use of screen media, and did not use any cut-off to label participants as problematic or non-problematic. All variables were measured through parent reports.

This study was approved by the Ethical Committee of the Faculty of Education, Charles University, Prague, Czech Republic.

2.4 Statistical analysis

First, we estimated the mean and median values of PTF within the sample and national subsamples. We also assessed the distribution of PTF.

Second, the associations between PTF and the sociodemographic variables as well as between PTF and PPU were analyzed. Nonparametric tests (Spearman's correlation test, the Mann-Whitney U test, and nonparametric Kruskal-Wallis ANOVA with Dwass-Steel-Critchlow-Fligner pairwise comparisons controlled for Type I Error; Hollander, Wolfe, & Chicken, 2014) were used because PTF did not show a normal distribution.

We used the computing software Jamovi to conduct analyses (Jamovi version 2.3, 2022). Dataset is available upon request. The significance level was set to $p < .05$.

3 RESULTS

The mean PTF value in the whole sample was relatively low (M = 1.60 on a 5-point Likert scale; $M_{CZE} = 1.62$, $M_{CZE\text{-at-home schooling}} = 1.59$, $M_{FIN} = 1.70$, $M_{SVK} = 1.49$). The differences among the country subsamples were significant: (χ^2 (3) = 46.1, $p < .001$, $\varepsilon 2 = 0.0248$), with the highest amount of PTF found in Finland and the lowest in Slovakia. Significant post hoc differences were found between the Slovak sample and all other samples and between the Czech at-home schooling sample and the Finnish sample (*Table 2*).

3.1 Correlates of parental differences

Parental problematic use

Using the whole sample, we found a significant moderate positive correlation between PTF and PPU: Spearman $\rho = 0.45$, $p < .001$, N = 1849.

Sociodemographic characteristics

In the case of the child's sex, the parent's sex and family intactness, we did not find a significant relationship with PTF based on Welch's *t* test and the Mann-Whitney *U* test ($p > .05$). For other sociodemographic variables, significant relationships were found. The omnibus differences based on child's grade were significant ($p < .001$). Parents of first graders showed significantly higher PTF than parents of third graders, but the difference between second and third graders' parents and between second and first graders' parents were not significant (*Table 2*). The omnibus differences based on the child's position among siblings were again significant ($p < .001$), and PTF was significantly higher for parents of oldest children than for parents in all other groups (*Table 2*). Differences based on family income were also significant ($p < .001$) – parents from families with the highest income (N = 435) showed the highest amount of PTF (M = 1.71, SD = 0.457), and their PTF significantly differed from that all other income groups (*Table 2*). However, notably, most Finnish participants (86%) were in the two highest income groups (groups 3 or 4), while in the Czech and Slovak samples, the proportion of these participants was lower (approximately 57%); therefore, the effects of country and income could overlap. The place of residence (rural/urban area) showed a strong relation to PTF (omnibus differences were significant ($p < .001$) – the parents living in the largest cities with more than 100 000 inhabitants (N = 429) reported the highest amount of PTF (M = 1.73, SD = 0.481), and their PTF significantly differed from that all other groups (*Table 2*). Finally, we found significant omnibus differences based on parent education ($p < .001$); parents with a university degree (N = 896) reported more technoference than those with lower education (M = 1.66, SD = 0.453). All effects were rather small as none exceeded $\varepsilon 2$ higher than 0.06, which would suggest moderate effect.

Table 1 | Participants' characteristics in country samples

Variable (groups)	The whole sample (n = 1864)	The whole sample %	Czechia (n)	Czechia %	Czechia (at-home schooling) (n)	Czechia (at-home schooling) %	Slovakia (n)	Slovakia %	Finland (n)	Finland %
Child's sex										
Girls	904	48.90	233	12.61	269	14.56	233	12.61	169	9.15
Boys	944	51.10	275	14.88	276	14.94	204	11.04	189	10.23
Sum	**1848**									
Child's grade (year of study)										
first grade	662	35.50	203	10.89	171	9.17	158	8.48	130	6.97
second grade	640	34.30	157	8.42	208	11.16	142	7.62	133	7.14
third grade	562	30.20	151	8.10	173	9.28	140	7.51	98	5.26
Sum	**1864**									
Child's age (mean in months)	M=101.013 (SD=12.12)		M=99.26 (SD=12.82)		M=100.30 (SD=11.60)		M=99.99 (SD=13.80)		M=104.50 (SD=10.25)	
Child's position among siblings										
the only child	350	19.50	106	5.89	97	5.39	88	4.89	59	3.28
the youngest child	640	35.60	180	10.01	197	10.95	138	7.67	125	6.95
the middle child	201	11.20	51	2.83	63	3.50	34	1.89	53	2.95
the oldest child	608	33.80	157	8.73	175	9.73	167	9.28	109	6.06
Sum	**1799**									
Family intactness										
intact family	399	21.50	116	6.25	136	7.32	65	3.50	82	4.42
no-intact family	1458	78.50	391	21.06	414	22.29	374	20.14	279	15.02
Sum	**1857**									
Family income										
Less than 1200 EUR	219	13.20	71	4.28	82	4.94	54	3.25	12	0.72
1200 - 1800 EUR	416	25.10	121	7.29	125	7.53	128	7.72	42	2.53
1800 - 2400 EUR	589	35.50	122	7.35	129	7.78	174	10.49	164	9.89
more than 2400 EUR	435	26.20	136	8.20	125	7.53	56	3.38	118	7.11
Sum	**1659**									
Family living in rural/urban area										
up to 999 inhabitants	181	10	76	4,23	55	3.06	49	2.73	1	0.06
1.000 - 4.999 inhabitants	335	18.80	69	3.84	83	4.62	141	7.84	42	2.34
5.000 - 19.999 inhabitants	353	19.60	60	3.34	60	3.34	100	5.56	133	7.40
2.0000 - 99.999 inhabitants	500	27.80	127	7.06	164	9.12	85	4.73	124	6.90
100 thousand or more inhabitants.	429	23.80	156	59.09	177	9.84	51	2.84	45	2.50
Sum	**1798**									
Parental age in years			M=39.39(SD=5.56)		M=39.4 (SD=5.98)		M=38.5 (SD=5.33)		M=39.2 (SD=5.57)	
Parental sex										
Female	1588	85.70	445	24.03	476	25.70	365	19.71	302	16.31
Male	264	14.30	64	3.46	71	3.83	74	4.00	55	2.97
Sum	**1852**									
Parental education										
elementary/practical	279	15.10	87	4.71	126	6.83	43	2.33	23	1.25
high school	671	36.30	206	11.16	207	11.21	143	7.75	115	6.23
university	896	48.50	215	11.65	215	11.65	251	13.60	215	11.65
Sum	**1846**									
Parental problematic use			M=1.49 (SD=0.46)		M=1.47 (SD=0.46)		M=1.45 (SD=0.45)		M=1.7 (SD=0.49)	

Table 2 | The relationship between PTF, sociodemographic characteristics and PPU

Predictor	Mean	Median	SD	Test (r, ρ, χ2, U, BF_{10}) and Effect size (ε^2, r_rb)
Parental Technoference	1.60	1.50	0.46	
Country samples				$\chi^2(3) = 46.1$, $p < .001$, $\varepsilon^2 = 0.0248$
Czechia	1.62	1.50	0.47	
Czechia-home	1.59	1.50	0.46	sig: Svk vs. all others, Cze vs. Fin, Cze-home vs. Fin
Slovakia	1.49	1.33	0.38	
Finland	1.70	1.67	0.49	
Child's sex				$U = 421390$, $p = .641$, r_rb = 0.0124, BF10 = 0.0605
girls	1.59	1.50	0.45	
boys	1.60	1.50	0.46	
Child's grade (year of study)				$\chi^2(2) = 9.6$, $p = .008$, $\varepsilon^2 = 0.00515$
first grade	1.65	1.50	0.50	
second grade	1.58	1.50	0.45	sig: first grade vs. third grade
third grade	1.55	1.50	0.40	
Child's age (mean in months)				$r = -0{,}061$, $p = .009$
				$\rho = -0.050$, $p = .030$
Child's position among siblings				$\chi^2(3) = 27.2$, $p < .001$, $\varepsilon^2 = 0.0151$
the only child	1.58	1.50	0.45	
the youngest child	1.55	1.50	0.44	sig: the oldest child vs. all others
the middle child	1.58	1.50	0.51	
the oldest child	1.66	1.67	0.44	
Family intactness				$U = 289194$, $p = .859$, r_rb = 0.00577, BF10 = 0.0634
intact family	1.59	1.50	0.47	
no-intact family	1.59	1.50	0.45	
Family income				$\chi^2(3) = 48.1$, $p < .001$, $\varepsilon^2 = 0.0290$
Less than 1200 EUR	1.57	1.50	0.59	
1200 - 1800 EUR	1.52	1.50	0.40	sig: more than 2400 EUR vs. all others, 1200–1800 EUR vs. 1800–2400 EUR
1800 - 2400 EUR	1.60	1.50	0.42	
more than 2400 EUR	1.71	1.67	0.46	
Family living in rural/urban area				$\chi^2(4) = 55.3$, $p < .001$, $\varepsilon^2 = 0.0307$
up to 999 inhabitants	1.50	1.50	0.37	
1.000 - 4.999 inhabitants	1.55	1.50	0.45	
5.000 - 19.999 inhabitants	1.59	1.50	0.46	sig: 100 000 and more inh. vs. all others
2.0000 - 99.999 inhabitants	1.56	1.50	0.44	
100 thousand or more inhabitants.	1.73	1.67	0.48	
Parental age in years				$r = -0.025$, $p = .30$
				$\rho = -0.036$, $p = .126$
Parental sex				U = 194715, $p = .062$
female	1.59	1.50	0.45	
male	1.65	1.50	0.49	
Parental education				$\chi2(2) = 48.5$, $p < .001$, $\varepsilon^2 = 0.0263$
elementary/practical	1.53	1.33	0.59	
high school	1.54	1.50	0.37	sig: university vs. all others, elemen./prac. vs. high school
university	1.66	1.67	0.45	
Parental problematic use				$r = 0.47$, $p < .001$
				$\rho = 0.45$, $p < .001$

r = Pearson correlation, ρ = Spearman correlation, χ2 = non-parametric ANOVA (Kruskal-Wallis), *U* = Mann-Whitney test, r_rb = Rank biserial correlation (effect size for Mann-Whitney test), ε2 = effect size measure for non-parametric ANOVA, BF_{10} = Bayes Factor. Degrees of freedom for Kruskal-Wallis test are in parentheses.

4 DISCUSSION

The reported PTF was relatively low. Using our recalculation into interactive scores (percentage), our sample mean equaled to 15%, which meant those participants on average reported the occurrence of PTF to be very unlikely. In this respect, we obtained similar results as studies by McDaniel & Radesky (2018a, 2018b) and Meeus et al. (2021). All other studies showed higher values (*Supplementary table 1*). The results between country subsamples were significant but the mean did not drop below 12% or exceed 18% in any country. A moderate association was found between PTF and parents' problematic use of electronic devices. The frequency of PTF differed based on country, child's grade, child's position among siblings, family income, family place of residence (rural/urban area), and parental education.

Parental problematic screen use

In our study, the moderate correlation between PPU and PTF suggested that PPU may trigger PTF, or vice versa. This is consistent with findings from previous studies (McDaniel & Radesky, 2018b; McDaniel, 2021; Sundqvist et al., 2020). Previous research has also shown an association between PPU and less parental monitoring/mediation and poorer parental relationships (Bleakley et al., 2016).

Sociodemographic associates of PTF

High parental education was previously found to predict better coping with digital overuse (Gui & Büchi, 2021). However, our results suggested the opposite: parents with university degrees scored higher on the PTF scale than parents without such degrees. Our finding is consistent with previous studies that also found a weak positive correlation between parental education and PTF (Bai, Bai, et al., 2020), (Merkaš et al., 2021). The reason could be attributed to a higher focus among highly educated parents on child rearing (Radey & Randolph, 2009), which leads to more frequent contact with their children. Notably, the most common strategy to measure PTF is to ask parents/children report in which parent-child situations (e.g., during meals or playtime) parents tend to use their electronic devices. Highly educated parents may more frequently experience these situations with their children and thus have more opportunities for PTF. An additional explanation could be the higher exposure to work-related screen use in highly educated parents.

To the best of our knowledge, no previous study has analyzed the association between PTF and children's position among siblings. The highest level of PTF was reported for parents of oldest children in the family. The presence of a young child (or children) in the family may increase parental stress due to higher requirements. It has been found that increased parental stress is associated with increased consumption of digital media in parents (McDaniel & Radesky, 2018b). It is possible that the oldest child in the family bears the consequences of increased parental stress, but further research is necessary to analyze this hypothesis. Additionally, the positive relationship between the size of villages, towns or cities and PTF may be attributed to a higher level of stress in urban environments (Lederbogen et al., 2011; Peen et al., 2010), which may result in frequent use of digital media as a coping strategy (McDaniel & Radesky, 2018b). At the same time, large cities may have a higher concentration of highly educated and high-income families, which has been found to be associated with a higher prevalence of PTF.

We found PTF to decrease with the child's school year. This may be because younger children (first and second graders) are not as independent as older children and require more parental supervision. As previously mentioned, when contact between the child and the parent increases, the likelihood of PTF also increases. This finding is partly consistent with results from Krogh et al., who found a positive effect between PTF and the presence of children from 2 to 7 months of age (Krogh et al., 2021). On the other hand, most previous studies did not find a relationship between child age or school grade and PTF (Bai, Bai, et al., 2020; McDaniel & Radesky, 2018a; Stockdale et al., 2018).

Based on our results, we would like to emphasize that PTF endangers an atypical group of parents and families, i.e., highly educated parents with higher income who live in large cities. Alternatively, our findings might be attributed to a higher frequency of parent-child contact in these types of families, which increases the likelihood of PTF occurrence. The frequency of parent-child interaction can be a confounding variable, which is not assessed by currently available measures of PTF. Further research should address this important limitation.

Furthermore, the oldest sibling in the family is the most exposed to PTF, which suggests that parental stress may play a specific role in PTF. However, further studies are warranted to confirm this association. Finally, we confirmed the relationship between PTF and PPU, which is consistent with prior studies (McDaniel and Radesky, 2018a, McDaniel & Radesky, 2018b).

As PTF has been shown to be associated with a variety of negative child and family outcomes, parents should be instructed on how to prevent intrusive screen use in themselves as well as in their children. The American Academy of Pediatrics recommends creating a family plan for digital media use (https://www.aap.org/en/patient-care/media-and-children/), and the American Academy of Child and Adolescent Psychiatry (https://www.aacap.org/AACAP/Families_and_Youth/Facts_for_Families/FFF-Guide/Children-And-Watching-TV-054.aspx) and the Canadian Paediatric Society (Canadian Paediatric Society, Digital Health Task Force, Ottawa, Ontario, 2019) have published guidelines for healthy digital media use. The main common recommendations are as follows: 1) encourage daily 'screen-free' times, especially for family meals and socializing; 2) turn off screens and remove them from bedrooms 60 minutes before bedtime; 3) avoid using screens as pacifiers or babysitters or to stop tantrums; and 4) for children aged 6 and older, encourage healthy habits and limit activities that include screens. Recent pediatric recommendations for parenting regarding screen media use also include guidelines for parental use such as to avoid screen use during family mealtimes, during bedtime and while driving (American Academy of Pediatrics, 2024). Problematic use of digital media in parents should not be underestimated, as it substantially increases the risk of PTF and decreases the quality of parental communication and care provided to children.

4.1 Strengths and limitations

The major limitation of this study is that PTF was self-reported. Parents might respond in socially desirable ways due to social pressure. For this reason, we designed the questions to not follow a "true or false" format, and we included a note that there were no true or false responses.

The scale we used to measure PTF was developed for parents of younger children (Barr et al., 2020); therefore, some of the included situations might not have been appropriate for our age cohort (mean age 8.4 years), while some parent-child situations that would have been appropriate for this age cohort might have been missing from the questionnaire. On the other hand, previous studies used the same scale for very broad age groups (e.g., 3–14 years in the case of Merkaš et al., 2021 and 10–20 years in the case of Stockdale et al., 2018). Nevertheless, we would like to encourage the development of a PTF scale for primary school-age children.

Finally, as we emphasized earlier, the frequency of parent-child interaction, a potentially confounding variable, was not examined. The same can be said for family regulation of screen media use, parenting stress, parental occupation and other factors. For instance, the higher education can be associated with a type of a job requiring work-related screen use and flexible/remote work schedule and thus create more opportunities for PTF. Given the anecdotal evidence on the relationship between parental stress, using screens for self-relief, and providing children with screen media, it would be interesting to further analyze PTF within the broader context of family-related variables, preferably using qualitative designs such as ethnography or case studies.

5 CONCLUSIONS

PTF was the most frequent in parents showing symptoms of problematic use of electronic devices, highly educated parents, high-income families, and families living in big cities. In addition, the children most at risk of PTF seemed to be the oldest children in the family (i.e., those with younger siblings). Further studies are necessary to better understand the causes and dynamics of PTF. Highly educated and high-income parents should be informed about the detrimental role of PTF on parent-child relationships. Prevention programs for adult users to help them find a balanced use of screen media, which would not interfere with parenting and other important life tasks, are warranted.

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