

A Longitudinal Study on the Effects of Parental Mental Health and Handheld Devices on Child Outcomes

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Abstract: Children have been thrust into a “portable age” where handheld devices, such as smartphones, tablets or iPads, have become a part of the daily norm. Parental factors and early life experiences, such as engaging in screen devices, have been widely established as major influences on children’s outcomes. This study aimed to investigate the relationships between the mental health of parents, parental and child screen time (ST), and child outcomes. A longitudinal study of mothers and fathers ($N = 214$) were recruited at two time points (T1, April 2019-February 2020; T2, September 2020-February 2021). Due to loss to follow-up, the final sample consisted of 101 participants (97 mothers, 4 fathers) with a mean age of 37.55 ($SD = 4.14$). Children of participants had a mean age of T1 = 5.25 ($SD = .44$) and T2=6.51 ($SD = .52$). Participants completed a battery of self-report questionnaires regarding their own mental health, their child’s and their own engagement with handheld devices, as well as their child’s internalising and externalising behaviour. The study demonstrated that parental anxiety significantly predicted child internalising symptoms, whereas both parental anxiety and depression significantly predicted child externalising symptoms, across time. These findings suggest that after controlling for ST, parental mental health is predictive of temporal child outcomes. Future studies should consider early intervention programs that target parents with mental health concerns, examining children who engage in excessive ST, and consider context and content of ST amongst these trends.

Keywords: Parental Mental Health, Screen Time, Handheld Devices, Internalising Problems, Externalising Problems, Handheld Devices, Children’s Outcomes

1. Introduction

A tsunami of handheld devices has impacted on the current generation of young children whose world is far removed from the sand pits and the butterflies of the pre-digital age and children are now key players in this cultural and digital era. A nationally representative household survey of Australian children conducted by The Royal Children's Hospital Melbourne found that around two-thirds of primary-school aged children and over a third of preschoolers own a handheld device [47]. Approximately 17% of primary-school aged children and 13% of children under the age of six reportedly use a smartphone daily. For daily tablet use, this equated to 31% of primary-school aged children and 17% of children under the age of six [47]. Kabali et al. found that majority of children begun using mobile devices within their

first year of life, and this was allowed by parents who gave their children a device to use or own. With this rise of the “portable age”, further exploration regarding the implications of the use of handheld devices among young children warrants attention.

The young child brain is developing and early experiences are fundamental to moulding and shaping a healthy growing brain and subsequent wellbeing [18, 31]. Children’s exposure to screens may become habitual and early exposure increases the likelihood of increased use in later childhood [16]. ST habits tend to also increase over time to include entertainment rather than educational viewing [29]. The learning of young children is highly malleable, particularly from parental influence. They require considerable support from their parents to develop skills and behaviours that form the basis for good health habits, meaningful relationships and friendships, and adjustment to school, family and community

life [18, 21]. A study by Lee *et al.* identified that several parental cognitions and behaviours, as well as the home environment, was associated with toddler ST [27]. These included: negative outcome expectations for limiting ST, parental self-efficacy to limit ST, parental limit-setting practices, parental modelling of ST, and presence of devices in the bedroom [27]. These findings suggest that parents who spend more time in front of a screen may facilitate a home environment that is conducive to screen use among children. It is imperative that parents model healthy screen habits and behaviours to their children, as they are among one of the greatest, if not the most, influences in the early years for children.

1.1. Parental Factors and Screen Time

Young children are curious learners of the world, where they may absorb the surrounding media environment through imitating modelled ST behaviour from their parents [3]. Several studies have shown that children are more likely to engage in ST when parents are also engaging in similar behaviours [19, 26, 40]. As there is an increasing access to multiple devices in the home, it is now even easier for children to access a device, such as a tablet, whilst their parent is on their smartphone [26]. The effects of COVID-19 may have led to increased screen use among children, where children are staying indoors more often, keeping connected to family/friends or for online learning. In addition, public health orders to stay at home due to the pandemic have also led to potentially increased screen use among adults and children, time spent on electronic media was considered to displace quality interactions between parent and child. These interactions include quality time spent together playing with toys, reading, learning activities, and reduced opportunities for verbal parent-child interaction [36, 48]. Whilst Radesky *et al.* highlighted the impact of parent's use of mobile devices reduced quality parent-child interactions [37], Beyens and Beullens confirmed that children's use also had a role within these interactions [5]. That is, children who spent more on their tablet devices were more likely to engage in conflict with their parents [5]. Therefore, parents spending more time on screens may reduce such meaningful interactions with their child, and vice versa. As a consequence, decreased parent-child interactions has been shown to be associated with negative developmental outcomes, such as poor self-regulation and academic achievement [25, 33].

The naïve nature of young children lead them to be developmentally dependent on their caregivers. Early attachment theorists proposed that children require consistent attention and available caregiving in order meet their developmental needs [7, 50]. Outcomes for children are sensitive to parental attentiveness, responsivity, modelled behaviour and family/cultural environment [41]. A meta-analysis of 193 studies identified that maternal depression is a risk factor for adverse child outcomes, such as associations with child internalising and externalising problems [15]. Other longitudinal studies have also observed these effects, in both a younger cohort of 2-3 year olds [6], and an older

cohort of 10-15 year olds [14]. Moreover, a longitudinal family intervention study, the *Strengthening Families Program*, concluded that when parental mental health is considered, a reduction of child emotional and behavioural difficulties was observed in Australian children aged 8-12 years old [8].

Parents form the building blocks to encourage children's ST behaviours. These include factors such as the amount of parental ST [19], their attitudes towards ST [26], limit-setting [20], and self-efficacy [9], however parental mental health as a predictor of ST has not been extensively investigated or findings have been ambiguous. One study examining children aged two to five found a positive association between maternal depression and television (TV) use, however did not find this relationship with smartphones or tablet use [34]. A systematic review of 29 studies of correlates of ST in children under three years old revealed that five studies found maternal depression was positively associated with TV, computer and gaming console use, however the mechanisms behind this were unclear [12]. ST has been a common source of conflict and tension in the family home [47], where parents with mental health concerns may have increased difficulty to self-regulate as well as manage their child's ST habits and behaviours, particularly due to their limits in emotion regulation. Parents with greater symptoms of parental mental health may have increased difficulty with meeting the needs of their child, and therefore this may have consequences for their subsequent outcomes [13, 38]. Parental mental health considered in the context of ST is an area of research that requires more attention and may be a worthwhile target for early intervention.

1.2. Screen Time and Child Outcomes

The portable nature of handheld devices may have a greater impact on children's outcomes given their accessibility, interactivity and solitary use. Previous research has identified that ST has several implications for child outcomes, particularly the development of internalising and externalising symptoms, although the majority of the research has focused on adolescent samples [11, 35] and findings have been conflicting. Internalising problems refers to symptoms of anxiety and depression, whilst externalising problems are characterised by aggression, defiant behaviours, and attention difficulties [49]. A systematic review of school-aged children and adolescents identified that there was a positive association between ST and hyperactivity/inattention problems, as well as internalising problems [44]. However, findings regarding symptoms of depression were inconsistent, as some studies identified an association with ST whilst others did not. A recent global study of 11-15 year olds revealed that higher levels of recreational ST was associated with poorer mental health, and this data was collected before the COVID-19 pandemic [22]. Interestingly, a meta-analysis reported greater levels of ST was associated with increased symptoms of depression in children and adolescents, however this association was non-linear [30]. Previous research with similar findings observed adolescents engaging

in excessive ST had greater risk of symptoms of depression compared to groups with occasional or regular ST [23, 28]. These results indicated that an appropriate level of ST may not lead to the development of such symptoms. These findings were predominantly reported in adolescent samples, and hence it is unclear whether these results are applicable to younger children, especially given the hours of use among this cohort. This could provide important implications for early prevention of later internalising and externalising problems in adolescence.

Studies have reported a dose-response relationship exists between ST and externalising problems in preschool children, such as conduct problems, hyperactivity, and inattention [17, 45]. Although, this relationship was not found with internalising child behaviour, such as emotional symptoms and peer problems [17]. Potential exposure to violent or aggressive content in ST may encourage such externalising problems [17]. Moreover, ST may impact children's capacity to maintain attention due to numerous mechanisms, such as sleep disturbance. Screen use during bedtime is associated with greater arousal and interrupted melatonin production due to the brightness of screens [24]. Interestingly, Tansriratanawong et al. did not observe a significant relationship between ST and externalising problems in children, however a dose-response was found [46]. Tansriratanawong et al. explained that this may be due to the cross-sectional nature of the study, where ST may not have an immediate effect on child behaviour [46]. Longitudinal studies are potentially more appropriate to gauge temporal relations between these variables and relationships between the mental health of parents, and parent and child ST use.

1.3. Aim of Present Research

The present study aimed to investigate the relationships between parental mental health, parental and child ST and child outcomes, which include internalising and externalising problems. To the best of the author's knowledge, this is the first study to examine specific parental mental health factors, which include symptoms of depression, anxiety and stress, and ST as predictors of child outcomes. In addition, this study observed these relationships longitudinally.

It is hypothesised that:

- 1) Increased symptoms of parental mental health significantly predicts child internalising and externalising symptoms across time.
- 2) Greater child and parental ST significantly predicts child internalising and externalising symptoms across time.

2. Method

2.1. Participants

A community sample of 214 participants was recruited through government, Catholic and private schools; childcare agencies; children services, social media community groups, and GP family practices. Eligible participants were parents of

children aged 4.5 up to 6 years old at the initial time point (T1) (134 boys, 80 girls, $M = 5.23$, $SD = .44$). Follow-up data (T2), in which parents were contacted via email on multiple occasions, was collected approximately 18 months later between September 2020 to February 2021. T1 data was collected pre-COVID-19, whereas T2 data was collected during COVID-19 restrictions. Approximately 51% responded (ie. 109) and completed the follow-up survey. However, data from eight participants were removed due to inappropriate completion of the survey, such as participant codes did not match up and reporting on the incorrect child.

The final sample consisted of 101 participants (97 mothers, 4 fathers) with a mean age of 37.55 ($SD = 4.14$, range = 29-50). Children of participants had a mean age of T1=5.25 ($SD = .44$) and T2=6.51 ($SD = .52$). Most children were males (65.3%). Ethnicity was wide ranging with majority of parents identifying as Anglo-Australian (74.3%), followed by Other European (5.9%), British (5%), Asian (5%), Aboriginal (3%); Indian, Sri Lankan, Pakistani & Bangladeshi (2%), Other ethnicity (2%), North American (1%), Middle-Eastern (1%), or American (1%). Marital status of parents included married (81.2%), partnered (10.9%), separated (4%), divorced (2%), widowed (1%) and single (1%). The highest level of education completed by the majority of parents was a university-level of education (72.3%), followed by Diploma/TAFE or equivalent (18.8%) and Year 12 completion with certificate (8.9%). Most participants were employed part-time (41.6%) or full-time (26.7%), completed household duties (15.8%), employed casually (9.9%), and were a student (4%) or unemployed (1%). In addition, the annual household income for parents was similar across the thresholds with those earning less than \$100,000 (26.7%); \$100,000-150,000 (27.7%); \$150,000-200,000 (22.8%) and more than \$200,000 (22.8%).

2.2. Measures

2.2.1. Demographic Variables

Parents reported on child age and gender, parental age, parental ethnicity, relationship status, annual household income, employment status and highest education level achieved of parent. In addition, parents reported child's age and gender.

2.2.2. Symptoms of Anxiety

The Beck Anxiety Inventory (BAI) is a 21-item self-report measure of anxiety [4]. Examples of items include: "Fear of worst happening" and "Dizzy or lightheaded". Responses were rated on a 4-point Likert-scale (0 = *not at all*; 4 = *severely – it bothered me a lot*) over the past month. Higher scores indicated greater severity of anxiety (i.e. score of 0-21 = low anxiety; 22-35 = moderate anxiety; ≥ 36 = potentially concerning levels of anxiety). The present sample demonstrated high internal consistency ($\alpha = .95$).

2.2.3. Symptoms of Depression

The Patient Health Questionnaire (PHQ-9) is a 9-item self-report screener for the presence and severity of depression [42]. Examples of items include: "Feeling down, depressed

or hopeless” and “Poor appetite or overeating”. Responses were rated on a 4-point Likert-scale (0 = *not at all*; 4 = *nearly everyday*) over the past two weeks. A score of 10 or above is indicative of the presence of depression. In the present sample, this measure showed high internal consistency ($\alpha = .90$).

2.2.4. Symptoms of Stress

The Perceived Stress Scales (PSS) is a 10-item measure that assesses for stress [10]. Examples of items include: “In the last month, how often have you been able to control irritations in your life?” and “In the last month, how often have you felt that things were going your way?”. Responses were rated on a 5-point Likert-scale (1 = *never*; 5 = *very often*) over the past month. Higher scores indicated higher levels of perceived stress (i.e. score of 0-13 = low stress; 14-26 = moderate stress; 27-40 = high perceived stress). Internal consistency was low in the current sample ($\alpha = .38$).

2.2.5. Screen Time

Adapted from the Common Sense Media’s Screen Time survey [39], parents were asked how much time in hours they spend with handheld devices (iPad, tablet, smartphones and/or similar) on a typical weekday and weekend day. Parents were then asked a similar question to report on their child’s ST. To calculate ST for parents and children, weekday times were multiplied by 5 and weekend day times were multiplied by 2, and thus summed together. This amount of was divided by 7 in order to calculate the average daily ST use. In addition, the survey consisted of three additional binary questions relating to the impacts of COVID-19 on the amount of ST, children’s wellbeing and activities/content viewed on ST.

2.2.6. Internalising and Externalising Symptoms

The Child Behaviour Checklist, 1-4.5 and 6-18 years old, (CBCL) is a parent-completed questionnaire regarding emotional, social, and behavioural difficulties within the last six months [1, 2]. The form for younger children contains 99 items, whereas the older children form consists of 118 items. It consists of three main scales: internalising (e.g. “whining”, “sulks a lot”), externalising (“restless”, “easily frustrated”), and other problems (e.g. “cruel to animals”, “overeating”). In addition, six syndrome subscales can also be calculated (i.e. emotionally reactive, anxious/depressed, somatic complaints, withdrawn, sleep problems, attention problems aggressive problems). A total problems score can be computed by summing the internalising and externalising problems score. In the present study, two subscales were produced, one for internalising symptoms and one for externalising problems. Parents responded to items on a 3-point Likert-scale (0 = *not true*; 2 = *very true*) over the past six months. A higher score represents higher severity on each subscale. Internal consistency was high in the present sample ($\alpha = .98$).

2.3. Procedure

The study protocol was approved by an ethical review board under the Australian NHMRC (National Health and Medical Research Council) Guidelines for the Conduct of

Research with Humans [32]. Informed consent was obtained from participants prior to completing the study. Participants completed a battery of questionnaires administered online via Qualtrics, which took approximately 20 minutes to complete. Approximately 18 months later, participants completed a follow-up questionnaire consisting of similar questions.

2.4. Analysis Plan

Within the final sample, six cases (5.9%) were missing on both child internalising and externalising symptoms at T2, as parents did not complete this part of the survey. SPSS statistical software was used to impute the missing data. Thirty imputations were performed on the current dataset in order to reduce sampling variability from the imputation process [43]. Predictive mean matching was used to impute data. All variables in the main analysis model as well as three auxiliary variables pertaining to the impacts of COVID-19 were included in the imputed dataset. Non-normal distributed data was dealt with using predictive mean matching in the imputation process. A bivariate correlation analysis was conducted to examine initial associations between interested variables in the model.

A linear regression model was conducted to test whether parental mental health and parental and child ST predicted child outcomes across time. Independent variables measured at the initial timepoint (i.e. T1) consisted of: parental anxiety, parental depression, parental stress, parental ST and child ST child internalising symptoms and child externalising symptoms. Dependent variables were measured at follow-up (i.e. T2) which included: child internalising and child externalising symptoms. Covariates, also measured at T1, were: parental age, child gender, employment status, relationship status, annual household income and highest education level of parent. Two separate models were conducted where both models included all independent variables and covariates. The first model contained child internalising symptoms at T2 as a dependent variable, whereas the second model consisted of child externalising symptoms at T2 as a dependent variable.

3. Results

Table 1 demonstrates the descriptive statistics of parental mental health, parental and child ST and child outcomes. To examine the relationships of the key variables, we undertook bivariate correlation analyses, as shown in Table 2. There were strong correlations between measures at T1 and T2. At T1, all parental mental health measures and child ST were significantly and positively associated with child internalising and externalising problems at T2. That is, the more symptoms of depression, anxiety and stress experienced by the parent, as well as increased child ST at T1, the more internalising and externalising symptoms were present in children at T2. In addition, child internalising problems at T1 was positively and strongly associated with child externalising problems at T1, and this relationship was the same at T2. Specific to T1, parental anxiety showed a significant and positive association

with parental depression, parental stress, parental ST and child ST. At T1, parental depression was also significantly and positively associated with both parental stress and parental ST,

as well, parental stress was significantly and positively associated with parental ST.

Table 1. Descriptive Statistics of Key Study Variables.

Study Variable	N	%
Parental anxiety T1		
Low	31	30.7
Moderate	64	63.4
Concerning	6	5.9
Parental depression T1		
Minimal or none	16	15.8
Mild	85	84.2
Moderate	0	0
Moderately severe	0	0
Severe	0	0
Parental stress T1		
Low	0	0
Moderate	56	55.4
High	45	44.6
Parental ST T1		
>2 hrs	36	35.6
<2 hrs	65	64.4
Child ST T1		
>1 hr	23	22.8
<1 hr	78	77.2
Child internalising problems T1		
Normal	95	94.1
Borderline	2	2
Clinical	4	4
Child externalising problems T1		
Normal	95	94.1
Borderline	2	2
Clinical	4	4
Study Variable	N	%
Child internalising problems T1		
Normal	78	77.2
Borderline	6	5.9
Clinical	11	10.9
Child externalising problems T1		
Normal	94	93.1
Borderline	0	0
Clinical	1	1

Key. For symptoms of anxiety, a score of 0-21 = low anxiety, 22-35 = moderate anxiety, and ≥ 36 = potentially concerning levels of anxiety. For symptoms of depression, a score of 0-4 = minimal or none, 5-9 = mild, 10-14 = moderate, 15-19 = moderately severe, and 20-27 = severe. For symptoms of stress, a score of 0-13 = low stress, 14-26 = moderate stress, and 27-40 = high perceived stress. For internalising problems, a score of 0-13 = normal, 14-17 = borderline, and >18 = clinical. For externalising problems, a score of 0-20 = normal, 21-24 = borderline, and >25 = clinical. Six cases were missing for each of these variables: child internalising and externalising symptoms at T2.

In regard to covariates, parental age was significantly and negatively associated with both parental ST at T1 and child externalising problems at T2. That is, the younger the parent the more likely the parent was engaging in ST at T1 and increased child externalising problems were present at T2. Child female gender was significantly and positively associated with child internalising problems at T2, which indicated that females were more likely to exhibit such problems. Annual household income showed a significant and positive association with highest education level obtained by the parent. As annual household income increases, it was more likely that the parent held a higher level of education level, such as university qualifications. Employment status was significantly and positively

associated with child internalising and externalising problems at T1 and was significantly and negatively associated with highest educational level obtained by the parent and annual household income. Lastly, relationship status had a significant and positive association with employment status.

Tables 3 and 4 demonstrate the results from the linear regression models. In the first model (See Table 3), parental anxiety at T1 significantly predicted child internalising symptoms at T2 ($B=0.551$, $t(1)=3.89$, $p < .001$). This indicated that for every unit of increase in parental anxiety at T1, child internalising symptoms at T2 increased by 0.551 units. Interestingly, parental depression at T1 achieved close to statistical significance in predicting child internalising

symptoms at T2 ($B = 0.521$, $t(1) = 1.90$, $p = .057$). In addition, symptoms, and all of the covariates at T1 did not significantly predict child internalising symptoms at T2.

Table 2. Bivariate Correlations among Key Study Variables and Covariates ($N = 101$).

Variable	Mean (SD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
T1 Parental Anxiety	25.17 (7.49)	1														
T1 Parental Depression	12.52 (3.91)	.78**	1													
T1 Parental Stress	25.87 (3.82)	.47**	.47**	1												
T1 Parental Screen Time	2.62 (1.74)	.33**	.39**	.30**	1											
T1 Child Screen Time	1.41 (.86)	.29**	.17	.07	.25*	1										
T1 Child Internalising Problems	5.54 (10.53)	.07	.17	.01	-.04	.13	1									
T1 Child Externalising Problems	6.2 (9.04)	.09	.16	.12	-.03	.10	.86**	1								
T2 Child Internalising Problems	10.48 (8.13)	.69**	.58**	.26*	.19	.27**	.00	-.02	1							
T2 Child Externalising Problems	5.36 (7.71)	.72**	.67**	.26**	.20*	.26**	.11	.16	.80**	1						
Parent Age	37.55 (4.14)	-.12	-.13	-.03	-.22*	-.04	-.10	-.11	-.16	-.25*	1					
Child Gender		.14	.18	.03	.05	-.05	-.05	-.10	.23*	.10	.02	1				
Highest Education Level		.00	.01	.04	-.19	-.05	.05	.05	-.04	-.03	.03	.01	1			
Annual Household Income		-.12	-.08	-.05	-.15	-.05	-.05	-.02	-.10	-.20	.19	.05	.22**	1		
Employment Status		.11	.08	.10	-.01	-.01	.23*	.24*	.08	.04	-.03	.04	-.26**	-.22*	1	
Relationship Status		-.04	.07	.05	-.11	.03	-.19	-.17	-.09	.01	.02	-.09	.02	.17	.20*	1

Note. Correlations between ordinal variables, and ordinal variables with continuous variables are Spearman rank correlation.

* $p < 0.05$ ** $p < 0.01$.

Table 3. Results from Linear Regression with Internalising Symptoms as the Dependent Variable.

Variable	B	SE	t	p
Child Gender	0.67	1.29	0.51	.61
Parent Age	-0.15	0.16	-0.97	.33
Employed vs. Unemployed	-2.14	1.62	-1.32	.19
Currently Married vs Unmarried	2.17	1.80	1.21	.23
Parent Education Level (Completed university-level education)*				
Parent Education Level (Completed Y12 Cert)	-3.11	2.21	-1.41	.16
Parent Education Level (Completed Diploma/TAFE)	-1.38	1.77	-0.78	.44
Annual Household Income (<\$100,000)*				
Annual Household Income (\$100,000-\$150,000)	-0.29	1.82	-0.16	.87
Annual Household Income (\$150,000-\$200,000)	-1.16	1.73	-0.67	.50
Annual Household Income (>\$200,000)	0.31	2.00	0.16	.88
Parental Screen Time	-0.56	0.43	-1.30	.20
Child Screen Time	1.08	0.77	1.41	.16
Parental Anxiety	0.55	0.14	3.89	.00
Parental Depression	0.53	0.28	1.90	.06
Parental Stress	-0.17	0.19	-0.88	.38
Child Internalising Symptoms	-0.10	0.06	-1.58	.11

Key. Y12 Cert = Year 12 Certificate.

*Reference category.

In the second model (See Table 4), parental anxiety and parental depression at T1 significantly predicted child internalising symptoms at T2 ($B = 0.481$, $t(1) = 4.31$, $p < .001$; $B = 0.654$, $t(1) = 3.21$, $p = .001$, respectively). These results suggested that for every unit of increase in parental anxiety and depression at T1, child internalising symptoms at T2 increases by 0.481 and 0.654 units, respectively. Similarly, to

the previous model, parental stress, parental ST, child ST, child externalising symptoms, did not significantly predict child internalising symptoms at T2. However, only one covariate, parent age, significantly predicted child internalising symptoms at T2 ($B = -0.317$, $t(1) = -2.61$, $p = .024$). That is, for every unit of increase in parental age, child internalising symptoms at T2 decreases by 0.317 units.

Table 4. Results from Linear Regression with Externalising Symptoms as the Dependent Variable.

Variable	B	SE	t	p
Child Gender	.41	1.13	.36	.72
Parent Age	-.32	.14	-2.26	.02
Employed vs. Unemployed	.92	1.40	.66	.51
Currently Married vs Unmarried	.21	1.54	.14	.89
Parent Education Level (Completed university-level education)*				
Parent Education Level (Completed Y12 Cert)	-2.89	1.95	-1.48	.14
Parent Education Level (Completed Diploma/TAFE)	-.62	1.55	-.40	.69

Variable	B	SE	t	p
Annual Household Income (<\$100,000)*				
Annual Household Income (\$100,000-\$150,000)	-.86	1.69	-.51	.61
Annual Household Income (\$150,000-\$200,000)	-.79	1.62	-.48	.63
Annual Household Income (>\$200,000)	.79	1.62	-.49	.63
Parental Screen Time	-.43	.35	-1.22	.22
Child Screen Time	.67	.64	1.04	.30
Parental Anxiety	.50	.12	4.31	.00
Parental Depression	.73	.23	3.21	.00
Parental Stress	-.23	.16	-1.43	.15
Child Externalising Symptoms	.00	.06	.07	.94

Key. Y12 Cert = Year 12 Certificate.

*Reference category.

4. Discussion

This study aimed to investigate the relationships between parental mental health, parental and child ST and child internalising and externalising problems. The findings provided partial support for the initial hypothesis where increased symptoms of parental mental health and greater parental ST predicted child internalising and externalising symptoms across time. Specifically, parental anxiety at T1 predicted child internalising symptoms at T2. Furthermore, both parental anxiety and depression at T1 significantly predicted child externalising symptoms at T2. However, the study did not provide support for the second hypothesis, in which greater child ST did not predict child internalising and externalising symptoms across time.

Taken together, the findings indicated that parental mental health was significantly associated with poorer temporal child outcomes. This supported findings in previous longitudinal studies in various age samples [6, 14, 15]. Bouvette-Turcot et al. examined parental mental health by assessing for perceived stress and psychiatric symptoms [6], whereas Elgar et al. and Goodman et al. solely explored depressive symptoms [14, 15]. A strength of the present study is that the effects of parental mental health on child outcomes was accounted by distinct categories, which included symptoms of depression, anxiety and perceived stress. Interestingly, when parental mental health was accounted for in the same model, ST was not predictive of such temporal child outcomes. These findings were in contradiction to previous studies of adolescent samples [11, 35] that have found negative associations between ST and temporal child outcomes. The results from the present study further reflect the current ambiguous findings within in the field, particularly studies that have examined primary-school children [17, 30, 44]. These conflicting findings illustrate that more research needs to be conducted to ensure consistency and clarity regarding the emotional and behavioural changes in children's development across time. However, it is worth highlighting that these previous studies did not consider parental mental health as a predictor, and this is a notable strength of the current study.

These present results represent a timely finding, as potential attitudes and use of ST has changed dramatically within the past several years. ST has been increasingly part of

the norm, where children without a screen is rare. The use of handheld devices have been adopted into educational settings, used for a variety of purposes to assist parents with running errands and household chores [21], and has been necessary for those transitioning to online learning during the COVID-19 pandemic, as well as maintaining connections with others during these isolated periods. Therefore, children have been thrust into a world where handheld devices have become a necessary and normal part of everyday life. Although this study did not find ST as a significant predictor of child outcomes, it may be a representation of the evolving change of the use and adoption of technology within this "portable era". Attitudes and norms regarding screen usage have potentially changed given its daily presence in our lives, and therefore this may increase the normality of its use.

The present study was able to consider the simultaneous effect of parental mental health and ST on child outcomes. Indeed, it was anticipated that parents who present with mental health difficulties and had high levels of ST were more likely to have children who present with greater internalising and externalising symptoms. This may be because these parents may have limited capacity to attend to their child's needs and ST may displace these crucial parent-child interactions, which is already difficult for this population of parents. However, this study could not provide evidence for both parental health and ST as significant predictors of child outcomes. One explanation for these conflicting results is that there may not have been adequate power to detect an effect of this size, particularly as only half of participants responded for the follow-up study. Another interesting finding was that the majority of parents, and more so children, were meeting ST recommendations. Most children in this sample also fell within the "normal" range for both internalising and externalising symptoms at T1 and T2. Therefore, it is difficult to gauge if such effects exist for those on extreme ends of the spectrum.

This study solely examined handheld devices in order to extrapolate specific findings regarding these contemporary forms of ST. Handheld devices first appeared approximately ten years ago in our lives, and at this time, they have become normalised and ingrained into children's lives. Because of this, and particularly the age group considered in this study, parents are consistently concerned about the benefits and risks of engagement with handheld devices and exposed to recommended guidelines for the use of these devices.

Moreover, it may be useful for parents to have mobile applications that details screen guidelines and strategies to meet those guidelines relevant to a child's age and stage of development. The results suggest that although it is unclear of the benefits of these devices, it appears that when children are adhering to ST guidelines, there is a less likelihood for adverse outcomes. In fact, parental anxiety and depression were a more concerning factor to children's outcomes and should be considered as targets for early intervention. Parenting programs that address stressors or issues relevant to young parents and that can be easily accessed from a handheld device may mean that screens are utilised for beneficial purposes.

Limitations of the present research should be considered. Given the longitudinal nature of the study, it would have benefited from an increased initial sample to compensate for attrition. Although the researchers attempted to recruit from several sources, the follow-up data was collected during the first year of the COVID-19 pandemic, and so was inevitably out of the control of the researchers. Because of this, parents may have had other stressors and strains to be able to participate at T2. In addition, as all participants were from an Australian context, covariates related to COVID-19 were considered, however did not show any difference to primary analyses. This may be because follow-up data was initially collected when Australia was no longer in formal lockdown. Furthermore, a broader sample of the population may have captured children who were not meeting ST guidelines and those of borderline/clinical range for internalising and externalising symptoms. Interestingly, it may be that certain parents who express interest to participate in these studies may have children with less emotional or behavioural difficulties or less competing demands.

5. Conclusion

Early life experiences and parental influences are key contributors towards shaping and moulding temporal outcomes for children. Children thrive when they receive positive nurturance, warmth and supportive parenting, alongside developmentally appropriate activities and healthy lifestyle habits. This study has demonstrated that parental mental health has a significant influence towards children's longer term outcomes, after controlling for the effects of ST in both parents and children. Future studies should consider establishing early intervention programs directed towards improving the mental health of parents of young children, particularly given that the period of entering formal school is sensitive to development. Although this study did not find harmful effects of ST on child outcomes, future studies could benefit from examining a wider pool of young children and capturing those who do engage in excessive ST. These studies could also consider the context and content of ST viewed on children's outcomes, as this still represents a gap in the literature. Furthermore, this study has highlighted that current health recommendations regarding ST is helpful in minimising harm to children's development. Children learn

rapidly from their parents, and thus it is vital that parents have positive mental health in order to model healthy habits, such as ST, in order to give their children the best outcomes in life.

References

- [1] Achenbach T and Rescorla L (2000) Manual for the ASEBA Preschool forms & profiles. *Burlington: University of Vermont, Research Center for Children, Youth & Families*.
- [2] Achenbach TM and Rescorla L (2001) *Manual for the ASEBA School-age Forms & Profiles: An Integrated System of Multi-informant Assessment*. ASEBA.
- [3] Bandura A and Walters RH (1977) *Social learning theory*. Prentice-hall Englewood Cliffs, NJ.
- [4] Beck AT, Epstein N, Brown G, et al. (1988) An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology* 56 (6): 893-897.
- [5] Beyens I and Beullens K (2016) Parent-child conflict about children's tablet use: The role of parental mediation. *New Media & Society* 19 (12): 2075-2093.
- [6] Bouvette-Turcot A-A, Bernier A and Leblanc É (2017) Maternal Psychosocial Maladjustment and Child Internalizing Symptoms: Investigating the Modulating Role of Maternal Sensitivity. *Journal of abnormal child psychology* 45 (1): 157-170.
- [7] Bowlby J (1969) *Attachment and loss: Vol. 1. Attachment*. New York: NY: Basic books.
- [8] Burn M, Lewis A, McDonald L, et al. (2019) An Australian adaptation of the Strengthening Families Program: Parent and child mental health outcomes from a pilot study. *Australian psychologist* 54 (4): 261-271.
- [9] Campbell K (2010) Maternal self-efficacy regarding children's eating and sedentary behaviours in the early years: Associations with children's food intake and sedentary behaviours. *International Journal of Pediatric Obesity* 5: 501-508.
- [10] Cohen S, Kamarck T and Mermelstein R (1983) A Global Measure of Perceived Stress. *Journal of Health and Social Behavior* 24 (4): 385-396.
- [11] Costigan SA, Barnett L, Plotnikoff RC, et al. (2013) The Health Indicators Associated With Screen-Based Sedentary Behavior Among Adolescent Girls: A Systematic Review. *Journal of Adolescent Health* 52 (4): 382-392.
- [12] Duch H, Fisher EM, Ensari I, et al. (2013) Screen time use in children under 3 years old: a systematic review of correlates. *International Journal of Behavioral Nutrition and Physical Activity* 10 (1): 102-102.
- [13] Eckshtain D, Marchette LK, Schleider J, et al. (2018) Parental Depressive Symptoms as a Predictor of Outcome in the Treatment of Child Depression. *Journal of abnormal child psychology* 46 (4): 825-837.
- [14] Elgar FJ, Mills RSL, McGrath PJ, et al. (2007) Maternal and Paternal Depressive Symptoms and Child Maladjustment: The Mediating Role of Parental Behavior. *Journal of Abnormal Child Psychology* 35 (6): 943-955.

- [15] Goodman SH, Rouse MH, Connell AM, et al. (2011) Maternal Depression and Child Psychopathology: A Meta-Analytic Review. *Clinical Child and Family Psychology Review* 14 (1): 1-27.
- [16] Hamilton K, Spinks T, White KM, et al. (2016) A psychosocial analysis of parents' decisions for limiting their young child's screen time: An examination of attitudes, social norms and roles, and control perceptions. *British Journal of Health Psychology* 21 (2): 285-301.
- [17] Hosokawa R (2018) Association between mobile technology use and child adjustment in early elementary school age. *PLoS One* 13 (7): e0199959.
- [18] Huang K-Y, Bornheimer LA, Dankyi E, et al. (2018) Parental Wellbeing, Parenting and Child Development in Ghanaian Families with Young Children. *Child psychiatry and human development* 49 (5): 833-841.
- [19] Jago R, Stamatakis E, Gama A, et al. (2012) Parent and child screen-viewing time and home media environment. *American Journal of Preventive Medicine* 43 (2): 150-158.
- [20] Jago R, Zahra J, Edwards MJ, et al. (2016) Managing the screen-viewing behaviours of children aged 5-6 years: a qualitative analysis of parental strategies. *BMJ open* 6 (3): e010355-e010355.
- [21] Kabali HK, Irigoyen MM, Nunez-Davis R, et al. (2015) Exposure and Use of Mobile Media Devices by Young Children. *Pediatrics* 136: 1044-1050.
- [22] Khan A, Lee E-Y, Rosenbaum S, et al. (2021) Dose-dependent and joint associations between screen time, physical activity, and mental wellbeing in adolescents: an international observational study. *The Lancet Child & Adolescent Health*. DOI: 10.1016/S2352-4642 (21)00200-5.
- [23] Kim JY (2012) The Nonlinear Association Between Internet Using Time for Non-Educational Purposes and Adolescent Health. *Journal of preventive medicine and public health* 45 (1): 37-46.
- [24] Kubota T, Uchiyama M, Suzuki H, et al. (2002) Effects of nocturnal bright light on saliva melatonin, core body temperature and sleep propensity rhythms in human subjects. *Neurosci Res* 42 (2): 115-122.
- [25] Landry SH, Miller-Loncar CL, Smith KE, et al. (2002) The role of early parenting in children's development of executive processes. *Developmental neuropsychology* 21 (1): 15-41.
- [26] Lauricella AR, Wartella E and Rideout VJ (2015) Young children's screen time: The complex role of parent and child factors. *Journal of Applied Developmental Psychology* 36 (Supplement C): 11-17.
- [27] Lee E-Y, Hesketh KD, Rhodes RE, et al. (2018) Role of parental and environmental characteristics in toddlers' physical activity and screen time: Bayesian analysis of structural equation models. *The international journal of behavioral nutrition and physical activity* 15 (1): 17-17.
- [28] Liang Y, Tse L, Xu F, et al. (2009) Physical activity inversely associated with the presence of depression among urban adolescents in regional China. *BMC public health* 9 (1): 148.
- [29] Linebarger DL, Barr R, Lapierre MA, et al. (2014) Associations Between Parenting, Media Use, Cumulative Risk, and Children's Executive Functioning. *Journal of Developmental & Behavioral Pediatrics* 35 (6): 367-377.
- [30] Liu M, Wu L and Yao S (2016) Dose-response association of screen time-based sedentary behaviour in children and adolescents and depression: a meta-analysis of observational studies. *British Journal of Sports Medicine* 50 (20): 1252.
- [31] Murgatroyd C and Spengler D (2011) Epigenetics of Early Child Development. *Frontiers in Psychiatry* 2.
- [32] National Health and Medical Research Council (2018) *National Statement on Ethical Conduct in Human Research 2007 (Updated 2018)*. Available at: www.nhmrc.gov.au/guidelines/publications/e72.
- [33] NICHD Early Child Care Research Network (2005) Predicting individual differences in attention, memory, and planning in first graders from experiences at home, child care, and school. *Developmental Psychology* 41 (1): 99-114.
- [34] Park S, Chang HY, Park E-J, et al. (2018) Maternal Depression and Children's Screen Overuse. *Journal of Korean medical science* 33 (34): e219-e219.
- [35] Perrino T, Brincks A, Lee TK, et al. (2019) Screen-based sedentary behaviors and internalizing symptoms across time among U.S. Hispanic adolescents. *Journal of adolescence (London, England.)* 72: 91-100.
- [36] Plowman L, McPake J and Stephen C (2010) The technologisation of childhood? Young children and technology in the home. *Children & Society* 24 (1): 63-74.
- [37] Radesky JS, Kistin CJ, Zuckerman B, et al. (2014) Patterns of mobile device use by caregivers and children during meals in fast food restaurants. *Pediatrics* 133 (4): e843-e849.
- [38] Reising MM, Watson KH, Hardcastle EJ, et al. (2013) Parental Depression and Economic Disadvantage: The Role of Parenting in Associations with Internalizing and Externalizing Symptoms in Children and Adolescents. *Journal of Child and Family Studies* 22 (3): 335-343.
- [39] Rideout V (2013) *Zero to Eight: Children's Media Use in America 2013*. Available at: <https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013>.
- [40] Rideout VJ and Hamel E (2006) *The media family: Electronic media in the lives of infants, toddlers, preschoolers and their parents*. Henry J. Kaiser Family Foundation.
- [41] Shonkoff JP and Phillips DA (2000) *From neurons to neighborhoods: The science of early childhood development*. National Academy Press.
- [42] Spitzer RL, Kroenke K and Williams JB (1999) Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. *JAMA* 282 (18): 1737-1744.
- [43] Sterne JAC, White IR, Carlin JB, et al. (2009) Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. *BMJ* 338: b2393.
- [44] Suchert V, Hanewinkel R and Isensee B (2015) Sedentary behavior and indicators of mental health in school-aged children and adolescents: A systematic review. *Preventive Medicine* 76: 48-57.

- [45] Tamana S, Ezeugwu V, Chikuma J, et al. (2019) Screen-time is associated with inattention problems in preschoolers: Results from the CHILD birth cohort study. *PLoS One* 14 (4): e0213995.
- [46] Tansriratanawong S, Louthrenoo O, Chonchaiya W, et al. (2017) Screen viewing time and externalising problems in preschool children in Northern Thailand. *Journal of Child & Adolescent Mental Health* 29 (3): 245-252.
- [47] The Royal Children's Hospital Melbourne (2017) Screen time and kids: What's happening in our homes? Melbourne.
- [48] Tomopoulos S, Valdez PT, Dreyer BP, et al. (2007) Is exposure to media intended for preschool children associated with less parent-child shared reading aloud and teaching activities? *Ambulatory pediatrics: the official journal of the Ambulatory Pediatric Association* 7 (1): 18-24.
- [49] van Lier PAC, Vitaro F, Barker ED, et al. (2012) Peer Victimization, Poor Academic Achievement, and the Link Between Childhood Externalizing and Internalizing Problems. *Child Development* 83 (5): 1775-1788.
- [50] Winnicott DW (1986) *The theory of the parent-infant relationship*. New York, NY, US: New York University Press.