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## FACTORS ASSOCIATED WITH EXCESSIVE SCREEN TIME USAGE AMONG PRESCHOOL CHILDREN AND RISKS FOR BEHAVIOUR PROBLEMS

Husna Musa<sup>1</sup>, Aneesa Abdul Rashid<sup>2</sup>, Sultan Farvin Mohamed Sadik<sup>3</sup>, Goh Jun Xi<sup>3</sup>, Geeta Vaani Kesavan<sup>3</sup>, Nurdiyana Nasrudin<sup>4</sup>

### ABSTRACT

**Introduction:** Children spend a significant amount of screen time despite recommendations by the relevant bodies. Increased screen time in young children has been linked to an increased risk for behaviour issues. This study aims to determine behaviour problems and factors associated with excessive screen time usage among preschool children. **Methods:** A cross-sectional study was conducted among the parents of children aged 18-60 months in local parenting Facebook groups. Parents responded to an online questionnaire and Preschool Pediatric Symptom Checklist (PPSC) was used to screen risk for behaviour problems. **Results:** Over two-thirds (77%) of children spent more than one hour of screen time daily. There were significant associations between more than 1 hour of screen time daily and age  $\geq 2$  years old (OR 1.045, 95% CI 1.021 to 1.070), lesser among females (OR 0.345, 95% CI 0.178 to 0.671) and without gadget ownership (OR 0.74, 95% CI 0.010 to 0.565). Most children had PPSC total scores of less than 9 (75.8%) and there were no significant associations between excessive daily screen time usage with risks for behaviour problems among preschoolers in our study ( $p= 0.324$ ). **Conclusion:** We report factors associated with excessive screen time to be; the age of more than 2 years old, the male gender, and children with gadget ownership. We found no significant association with risk for behaviour problems. Longitudinal studies are recommended to investigate the causal relationship between the effects of screen time on children's behaviour.

**Keywords:** Screen Time, Factors, Behaviour problems, Preschool children  
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### Introduction

The way the younger generations live, learn and interact has changed tremendously over the years as childhood has been gradually saturated by technology. Screen-based media are now embedded in the daily lives of children. Excessive screen time usage among preschool children has been a growing problem in today's society. The World Health Organization (WHO) significantly mentions that screen time should be less than 1 hour for those who are 2-4 years of age [1]. Similarly, the American Academy of Pediatrics (AAP) recommends no screen time for children under two years old, while for three- to five-year-olds it is restricted to one hour a day [2]. Locally, screen-based media usage is not recommended for children below two years of age. On the other hand, for children aged two to five,

screen time should not exceed an hour per day [3]. Unfortunately, many studies have shown low adherence to these guidelines. A study conducted in the USA reported half (53%) of the children aged 0-5 met AAP guidelines on screen time limits [4]. A Malaysian study found that 40% of preschoolers exceeded daily screen time limits, even worrying a

<sup>1</sup> Paediatric Department, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 UPM Serdang, Malaysia

<sup>2</sup> Family Medicine Department, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia

<sup>3</sup> Second year medical student, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia

<sup>4</sup> Department of Paediatrics, Faculty of Medicine, Universiti Teknologi MARA (UITM), Sungai Buloh Campus, Malaysia

#### Corresponding Author:

Dr. Husna Musa, Paediatric Department, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Malaysia

**Tel:** 603-97692610 **Email:** husnamusa@upm.edu.my

recent study in Selangor reported that 90% of children below five years exceeded the WHO age-appropriate screen time limit [5, 6].

Unfortunately, due to the Coronavirus 2019 (COVID-19) pandemic, many studies proved that there were reduced physical activity and increased screen time among children across the globe. A recent Dutch study revealed that in both subject arms; self-reported screen time increased to  $34 \pm 105$  min/day in Cohort A and  $59 \pm 112$  min/day in Cohort B during the lockdown [7]. Similarly, another clinical trial in Germany in 2020 also showed decreasing sports activity and an increase in recreational screen time among children and adolescents compared to before the pandemic. The duration of watching TV increased to 21.5 min/day, gaming increased to 21.2 min/day and recreational internet usage increased to 18.5min/day; total duration of 61.2 min/day [8].

Risk factors for excessive screen time in children are not well established. A previous study reported that males spent more time on electronic devices [9]. A systemic review done showed demographic variables most correlated with high screen time among children less than 3-year-old are child's age (older) and race/ethnicity (minority) [10]. Another large-scale national survey showed child's age, race, parental education, and marital status had significant effects across most types of media [11]. Maternal education, employment, household income and type of care provider were also among the significant predictors quoted in previous studies [12, 13]. Environmental factors significantly associated with excessive screen time among younger children were less number of outings and households with no outdoor equipment [14]. However, there has been no clear study on the association of parental age, number of siblings, and household income.

Excess screen time is associated with adverse physical health effects as well as higher rates of behavioural problems which have been well-studied in teenagers and adolescents. A Canadian study reported pre-school children with more than 2-hours of screen time/day had a 7.7-fold increased risk of meeting the criteria for attention-deficit/hyperactivity disorder (ADHD) and were 5.9 times more likely to report clinically significant inattention problems [15]. A European study has shown a 1.2 to 2.0-fold higher risk of emotional problems and poorer family functioning in children aged 2-6 for each additional hour of media use [16]. An alarming finding in a previous study showed that

each hour of television viewed daily at 4 years old was a higher risk of bullying during primary schooling years [15, 17].

Understanding the correlations for this age group within our local context will help the adoption of effective clinical and educational practices in the development of early effective intervention strategies to prevent further adverse behavioural effects. Thus, this study aims to determine factors associated with excessive screen time usage and screening risk for behaviour problems among preschool children.

## Methods

### Study design and sample

A cross-sectional study was conducted from March to May 2021. The questionnaire was produced in a Google Form format and distributed online by posting in suitable local parenting Facebook groups identified. The local parenting Facebook groups chosen were Mama Tiyah Magical Parenting, Parents and Kids, Malaysian Early Childhood Education MYDIDIK, Malaysian Parent Discussion Children Education, Malaysia Education Info (And Homeschooling Too), Sarawak Parents Community and Malaysian-Preschools and Early Childhood Enrichment Programmes. Parents with children aged 18-60 months who can read English were invited to answer the questionnaire anonymously and voluntarily. Participants were provided informed consent to participate in this study via the Google form. We excluded parents with children with prior behaviour problems diagnoses by stating it in the recruiting poster. Non-probability sampling technique was used. The sample size was calculated to compare the proportion of screen time in two groups by Chandra et al (14). After accounting for a 30% attrition rate, 80% power, and 0.05% significance level, the estimated sample size was 252.

### Study instrument

The respondents were required to complete the online questionnaire which was prepared in English. It was assessed for content validity by an expert panel in both paediatrics and family medicine respectively. Face validation was done with 10% of the required participants that were not included in the final analysis. The screening for preschoolers' behaviour problems questionnaire was taken from a tool developed to assess behaviour of children aged 18-60 months which was the Preschool Pediatric

Symptom Checklist (PPSC) that is readily available on the Survey of Wellbeing of Young Children (SWYC) website. The questionnaire was divided into 3 parts. The first part of the questionnaire consists of 18 items on child's sociodemographic information (age, gender, birth order, race, number of siblings), parent's sociodemographic information (age, educational level, marital status, employment, household income) and household characteristics (language spoken in the household, number of outdoor equipment at home, number of outings, stories read per week, types of childcare). The second part consists of 6 questions regarding the child's screen time information (number and types of electronic gadgets at home; types of gadgets often used such as television, mobile phone, computer/laptop, Ipad/tablet, video game console; types of gadgets owned; total daily screen time; and types of screen time such as watching educational or non-educational TV programs/ films/ Youtube videos, video chat, playing video games or educational games). The third is the Preschool Pediatric Symptom Checklist (PPSC) which consists of 4 domains; externalizing, internalizing, attention problems, and parenting challenges. This checklist screens for the risk of behaviour problems among preschool children. A PPSC total score of  $\geq 9$  would indicate that a child is "at-risk" and further evaluation will be needed. Cronbach's alpha for this tool was 0.88 with adequate retest reliability was adequate (ICC = 0.75) [13].

### Ethics

Ethical approval was obtained from the Ethics Committee for Study involving Human subjects of University Putra Malaysia (JKEUPM-2021-073). All the respondents provided written informed consent.

### Data Analysis

The results were analyzed using IBM Statistical Package for the Social Sciences (SPSS) Statistics Software version 27. Sociodemographic and household data were presented in frequencies and percentages. The associations between categorical variables were established using the Pearson  $\chi^2$  test. The independent sample t-test was used for continuous variables. Multiple logistic regression analyses were used to determine independent

factors associated with screen time. Variables with a  $p$ -value of  $<0.20$  in the univariable logistic regression models were included in the initial multivariable logistic regression model as it was deemed sufficient to identify all the important variables which were more likely to contribute to excessive screen time and the same  $p$ -value was used based on a previous study [14, 19]. The forward selection method was used to determine the final model. Effect estimates are presented as adjusted odds ratios (OR) with associated 95% confidence intervals (CI). The statistically significant value was set at  $p < 0.05$ .

## Results

### Child's and parents' sociodemographic factors and household characteristics

Table 1 presents the sociodemographic and household characteristics of the participants. The majority of the children are more than 2-year-old (77.8%) with mean age (in months) of 40.21 ( $\pm 15.169$ ). There are almost an equal number of males and females in this study (48.8%, 51.2%) with a mixed percentage of races; Malay: 34.1%, Chinese: 35.3%, Indian: 25%, others: 7.5%. More than half of the children are firstborn (57.5%) and have 1-2 siblings (51.6%). The majority of parents are married, more than 30 years old, studied in universities, working full time and household income of more than RM 5000 per month. In terms of gadget ownership (Table 1), most of the preschoolers did not have their own gadgets (81.3%). More than two-thirds of the children (77%) spent a total of  $\geq 1$  hour of screen time daily (Table 1). Most of the respondents had 4 and more electronic gadgets at home (64.1%) with television being the most popular electronic gadget (48.8%) followed by mobile phones (25.4%) as shown in Figures 1 and 2.

Table 1. Sociodemographic and household characteristics by daily screen time (N = 252)

Variable	N (%)	<1 hour/day of screen time N %	≥1 hour/day of screen time N %
<b>Age</b>			
≤ 2 years old	56 (22.2)	26 (46.4)	30 (53.6)
> 2years old	196 (77.8)	32 (16.3)	164 (83.7)
<b>Gender</b>			
Male	123 (48.8)	18 (14.6)	40 (85.4)
Female	129 (51.2)	105 (31)	89 (69)
<b>Birth order</b>			
First	145 (57.5)	40 (27.6)	105 (72.4)
Middle	36 (14.3)	5 (13.9)	31 (86.1)
Youngest	71 (28.2)	13 (18.3)	58 (81.7)
<b>Number of siblings</b>			
No siblings	81 (32.1)	28 (34.6)	53 (65.4)
1-2	130 (51.6)	26 (20)	104 (80)
>3	41 (16.3)	4 (9.8)	37 (90.2)
<b>Race</b>			
Malay	86 (34.1)	13 (15.1)	73 (84.9)
Chinese	89 (35.3)	28 (31.5)	61 (68.5)
Indian	58 (23)	14 (24.1)	44 (75.9)
Others	19 (7.5)	3 (15.8)	16 (84.2)
<b>Mother's age</b>			
≤ 30 years old	80 (31.7)	28 (35)	52 (65)
> 30 years old	172 (68.3)	30 (17.4)	142 (82.6)
<b>Marital status</b>			
Single	5 (2)	0 (0)	5 (100)
Married	241 (95.6)	55 (22.8)	186 (77.2)
Divorced	6 (2.4)	3 (50)	3 (50)
<b>Mother's education level</b>			
High school	190 (75.4)	46 (24.2)	144 (75.8)
University	17 (6.7)	5 (29.4)	12 (70.6)
Others	45 (17.9)	7 (15.6)	38 (84.4)
<b>Mother's employment status</b>			
Full time	156 (61.9)	35 (22.4)	121 (77.6)
Part-time	28 (11.1)	12 (42.9)	16 (57.1)
Not working	68 (27)	11 (16.2)	57 (83.8)
<b>Father's age</b>			
≤ 30 years old	49 (19.4)	22 (44.9)	27 (55.1)
> 30 years old	203 (80.6)	36 (17.7)	167 (82.3)

<b>Father's education</b>			
<b>level</b>	49 (19.4)	7 (14.3)	42 (85.7)
High school	187 (74.2)	47 (25.1)	140 (74.9)
University	16 (6.3)	4 (25)	12 (75)
Others			
<b>Father's employment status</b>			
Full time	236 (93.7)	54 (22.9)	182 (77.1)
Part-time	12 (4.8)	4 (33.3)	8 (66.7)
Not working	4 (1.6)	0 (0)	4 (100)
<b>Household income</b>			
Less than RM2000	8 (3.2)	1 (12.5)	7 (87.5)
RM2000-RM5000	77 (30.6)	22 (28.6)	55 (71.4)
>RM5000	167 (66.3)	35 (21)	132 (79)
<b>Language spoken at home</b>			
English	77 (30.6)	20 (26)	57 (74)
Malay	67 (26.6)	9 (13.4)	58 (86.6)
Chinese	51 (20.2)	17 (33.3)	34 (66.7)
Tamil	44 (17.5)	10 (22.7)	34 (77.3)
Others	13 (5.2)	2 (15.4)	11(84.6)
<b>Outdoor equipment at home</b>			
Yes	129 (51.2)	29 (22.5)	100 (77.5)
No	123 (48.8)	29 (23.6)	94 (76.4)
<b>Number of outings per week</b>			
Less than 5	188 (74.6)	41 (21.8)	147 (78.2)
More than 5	44 (17.5)	7 (15.9)	37 (84.1)
0	20 (7.9)	10 (50)	10 (50)
<b>Stories read per week</b>			
Less than 3	117 (46.4)	23 (19.7)	94 (80.3)
More than 3	103 (40.9)	27 (26.2)	76 (73.8)
0	32 (12.7)	8 (25)	24 (75)
<b>Childcare</b>			
Centre-based	43 (17.1)	12 (27.9)	31 (72.1)
Home-based	118 (46.8)	29 (24.6)	89 (75.4)
Mixed	49 (19.4)	16 (32.7)	33 (67.3)
No care	31 (12.3)	1 (3.2)	30 (96.8)
Others	11 (4.4)	0 (0)	11 (100)
<b>Gadget ownership</b>			
Yes	47 (18.7)	1 (2.1)	46 (97.9)
No	205 (81.3)	57 (27.8)	148 (72.2)
<b>Screen time</b>		58 (23)	164 (77)

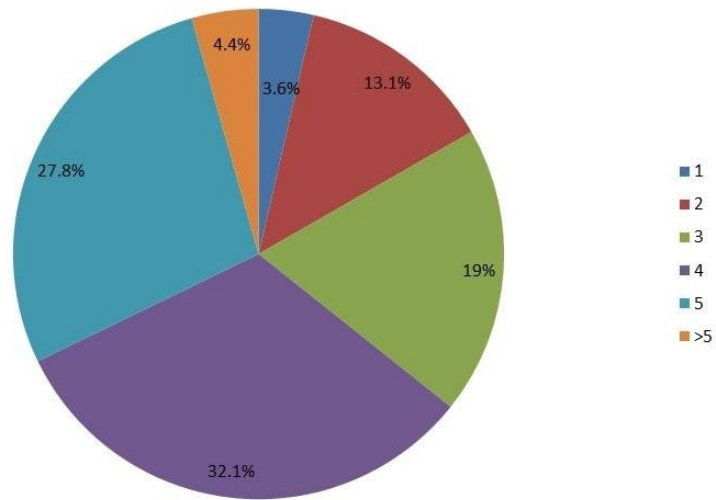


Figure 1. Percentage of number of electronic gadgets at home

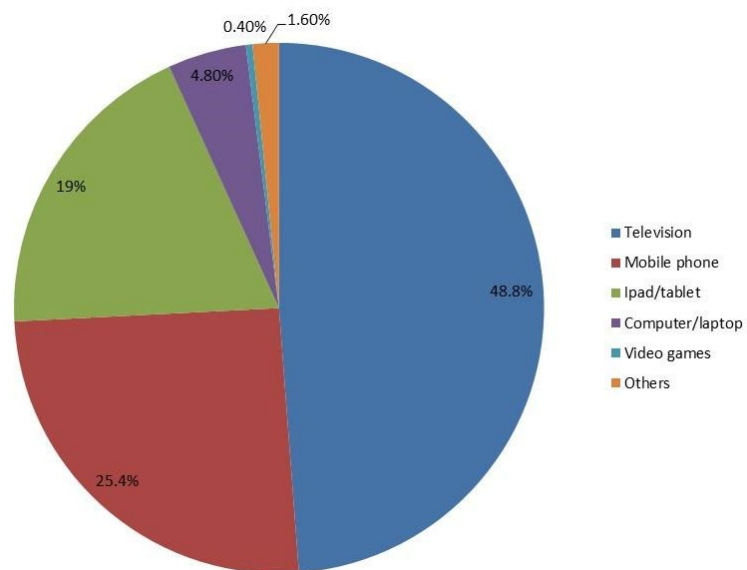


Figure 2. Percentage of electronic gadgets frequently used at home

**Preschool Pediatrics Symptom Checklist (PPSC) and its association with screen time**

The majority of the PPSC total scores were less than nine in 192 (76.2%) with a mean for the PPSC total score of 5.09 ( $\pm 4.781$ ). There was no significant association between daily screen time use with the risks of behaviour problems among preschool children ( $p=0.324$ , where  $p>0.05$ ).

**Factors associated with daily screen time use among preschool children**

In the univariable logistic regression analysis, age, gender, mother’s age, father’s age and gadgets ownership had significant associations with

increased screen time among children as summarised in Table 2.

In the final model of multivariable logistic regression analysis, there was no multicollinearity or interaction found. There was significant association between more than 1 hour of screen time daily and age  $\geq 2$  years old (AOR 1.045, 95% CI 1.021 to 1.070;  $p<0.0001$ ). The incidence of daily screen time is less likely to occur among females (AOR 0.345, 95% CI 0.178 to 0.671;  $p= 0.002$ ) and if the child does not own his/her gadgets (AOR 0.74, 95% CI 0.010 to 0.565;  $p = 0.012$ ) as depicted in Table 3.

Table 2. Factors associated with increased screen time and univariable logistic regression analysis

Variable	n	Crude $\beta$	Crude OR (95% CI)	p-value
<b>Age</b>				
$\leq 2$ years old	56	0	1	
$> 2$ years old	196	-1.491	0.225 (0.118, 0.430)	$<0.0001$
<b>Gender</b>				
Male	123	0	1	
Female	129	0.964	2.622 (1.405, 4.892)	0.002
<b>Birth order</b>				
First	145	0	1	
Middle	36	0.859	2.362 (0.858, 6.5)	0.096
Youngest	71	0.53	1.7 (0.841, 3.433)	0.139
<b>Number of siblings</b>				
No siblings	81	0	1	
1-2	130	-1.587	0.205 (0.066, 0.633)	0.06
$>3$	41	-0.838	0.432 (0.141, 1.322)	0.141
<b>Race</b>				
Malay	86	0	1	
Chinese	89	0.052	1.053 (0.268, 4.131)	0.941
Indian	58	-0.895	0.408 (0.110, 1.517)	0.181
Others	19	-0.529	0.589 (0.149, 2.324)	0.45
<b>Mother’s age</b>				
$\leq 30$ years old	80	0	1	
$> 30$ years old	172	-0.936	0.392 (0.214, 0.719)	0.002
<b>Marital status</b>				

Single	5	0	1	
Married	241	21.203	1615474843 (0.000)	0.999
Divorced	6	1.218	3.382 (0.664, 17.232)	0.142
<b>Mother's education level</b>				
High school	45	0	1	
University	190	0.816	2.262 (0.605, 8.454)	0.225
Others	17	0.266	1.304 (0.436, 3.898)	0.634
<b>Mother's employment status</b>				
Full time	156	0	1	
Part-time	28	-0.405	0.667 (0.316, 1.408)	0.288
Not working	68	-1.357	0.257 (0.096, 0.691)	0.007
<b>Father's age</b>				
≤ 30 years old	49	0	1	
> 30 years old	203	-1.33	0.265 (0.136, 0.516)	<0.0001
<b>Father's education level</b>				
High school	49	0	1	
University	187	-0.7	0.496 (0.209, 1.180)	0.113
Others	16	-0.693	0.5 (0.125, 1.999)	0.327
<b>Father's employment status</b>				
Full time	236	0	1	
Part-time	12	-19.988	0 (0)	0.999
Not working	4	-20.51	0 (0)	0.999
<b>Household income</b>				
Less than RM2000	8	0	1	
RM2000-RM5000	77	0.618	1.856 (0.221, 15.590)	0.569
>RM5000	167	-0.411	0.663 (0.357, 1.231)	0.193
<b>Language spoken at home</b>				
English	77	0	1	
Malay	67	0.816	2.261 (0.950, 5.384)	0.065
Chinese	51	-0.354	0.702 (0.324, 1.521)	0.37
Tamil	44	0.176	1.193 (0.5, 2.847)	0.691
Others	13	0.657	1.93 (0.393, 9.467)	0.418
<b>Outdoor equipment at home</b>				
Yes	129	0	1	
No	123	-0.062	0.94 (0.523, 1.69)	0.836
<b>Number of outings per week</b>				



Less than 5	188	0	1	
More than 5	44	-1.665	0.189 (0.057, 0.623)	0.006
0	20	-0.388	0.678 (0.282, 1.634)	0.387
<b>Stories read per week</b>				
Less than 3	117	0	1	
More than 3	103	-0.373	0.689 (0.366, 1.297)	0.248
0	32	-0.309	0.734 (0.292, 1.844)	0.511
<b>Childcare</b>				
Centre-based	43	0	1	
Home-based	118	0.172	1.188 (0.541, 2.610)	0.668
Mixed	49	-0.225	0.798 (0.326, 1.953)	0.622
No care	31	2.452	11.613 (1.421, 94.913)	0.022
Others	11	20.254	625345100.5 (0)	0.999
<b>Number of electronic gadgets at home</b>				
1	9	0	1	
2	33	-0.357	0.7 (0.071, 6.897)	0.76
3	48	-1.291	0.275 (0.032, 2.4)	0.243
4	81	-1.154	0.315 (0.037, 2.664)	0.289
5	70	-0.693	0.5 (0.058, 4.335)	0.529
>5	11	19.123	2019343355.4 (0)	0.999
<b>Types of electronic gadgets at home</b>				
Television	123	0	1	
Mobile phones	64	-0.349	0.705 (0.348, 1.431)	0.333
Computer/Laptop	12	1.032	2.806 (0.346, 22.771)	0.334
Ipad/Tablet	48	-0.153	0.858 (0.384, 1.917)	0.709
Video game console	1	19.837	412110929.3 (0)	1
Others	4	-22.569	0 (0)	0.999
<b>Gadget ownership</b>				
Yes	47	0	1	
No	205	-2.874	0.056 (0.008, 0.419)	0.005

Table 3: Factors associated with increased screen time (> 1 hour), simple logistic regression and multivariable logistic regression

Variables	Univariable Logistic Regression			Multivariable Logistic Regression		
	Crude $\beta$	Crude OR (95% CI)	p-value	Adj. $\beta$	Adj. OR (95% CI)	p-value
Age	<2 years old	0	1	0	1	
	$\geq 2$ years old	-1.491	0.225 (0.118, 0.430)	<0.001	0.044	1.045 (1.021 to 1.070)
Gender	Male	0	1	0	1	
	Female	0.964	2.622 (1.405, 4.892)	0.002	-1.064	0.345 (0.178 to 0.671)
Gadget owned by the child	Yes	0	1	0	1	
	No	-2.874	0.056 (0.008, 0.419)	0.005	-2.6	0.74 (0.010 to 0.565)

\*Constant: 2.557

No Multicollinearity, No Interaction

Hosmer-Lemeshow Test, p = 0.302

Overall Percentage 78.6% correctly classify

Area under ROC = 22.5% (95% CI = 16%, 28.9%)

**Discussion**

Our study highlighted an alarming proportion of preschoolers engaging in excessive daily screen time exceeding current recommendation guidelines. [2]. Similar trends were reported in both Australia, and the USA, and even higher compared to a previous local study conducted [4, 5, 20]. The study was undertaken during the first phase of the COVID-19 pandemic whereby our country was under a nationwide movement control order, hence most children being contained at home contributing to the excessive screen time reported. The sociodemographic characteristics of our respondents were comparable with other studies [14, 21]. However, a striking difference found that most of the households had fewer outings compared to a previous study which could be contributed by the ongoing restriction movement control order imposed during the study period [14]. Children over 2 years of age have higher daily screen time due to greater access to screen media with an increasing ability to process and manipulate complex information from electronic media as it has been reported in a study that nearly all kids (96.6%) have begun using them before the age of one [11, 20, 22]. Concerning that, gadget ownership has

been shown in our study as a significant factor in excessive screen time among preschoolers. Although a very small proportion of the preschoolers in our study owned gadgets, another study has shown otherwise with three-quarters of children owning their mobile device at the age of four [20]. Boys were found to be engaging in more screen time, in agreement with previous studies in the northern state, China and Australia indicating that sex-specific strategies should be adopted when advocating healthy screen time usage among preschool children [9, 23-24]. Particularly, video games are more tailored to the activity tastes of boys than girls [7]. In our study, household income was a non-significant risk factor for increased screen time in contrast to a recent local study which reported the predicted parental barrier to the reduction of screen time in children was due to limited financial access to substitute activities for screen time [25]. Our screening using the PPSC showed less than a quarter of the preschool children were ‘at-risk’ for behaviour problems which was comparable to other studies that used a similar tool [26, 27]. However, there was no association between excessive screen time usage and the risk of behaviour problems in contrast to previous larger longitudinal studies [15,

28]. The lack of a significant association could be due to the utilization of screening tools that may under detected in such a cross-sectional study as the scoring is based on parents' responses and is not a diagnostic tool. Our study is limited by the study population selected through only local parenting Facebook groups hence the results cannot be generalized to the whole population. Moreover, this was a prospective cross-sectional study thus causal relationship cannot be demonstrated.

### Conclusions

We report factors associated with excessive screen time to be; the age of more than 2 years old, the male gender, and children with gadget ownership. We found no significant association with risk for behaviour problems.

We suggest high impact awareness programs targeting preschool children to promote healthy screen time practices according to the appropriate recommendations. Future longitudinal studies are recommended to investigate the causal relationship between the effects of screen time on children's behaviour.

### Acknowledgements

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### Conflict of interests

The authors declare that they have no competing interests.

### Funding

Nil.

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