



Association between screen time and health-related quality of life: Testing the displacement and relational hypotheses in a prospective cohort study

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ABSTRACT

Previous studies showed a significant association between screen time and health-related quality of life (HRQoL) in children. However, the mechanisms underlying the association are unclear. This study aimed to examine the extent to which displacement (physical activities and sleep) and relationship factors (dysfunctional parent-child interaction and peer problems) mediate such association. A population-representative sample of 1428 parents of primary school children (49.3 % female; $M_{\text{age}} = 8.5 \pm 1.9$) in Hong Kong participated in the study over the course of one year (two waves). Children's screen time was reported by parents. The study outcome, children's HRQoL, was assessed using the Pediatrics Quality of Life Inventory Parent-Proxy Report (PedsQL). Mediators, including dysfunctional parent-child interaction (PCDI), peer problems (SDQ-PP), weighted daily time spent in moderate-to-vigorous physical activity (MVPA), and sleep-related quality of life (QoL), were assessed to test the displacement and relational hypotheses. Multilevel structural equation modeling showed a statistically significant total effect ($\beta = -0.12$, 95 % CI -0.16 to -0.08) of screen time on PedsQL. The association was partially mediated by sleep QoL (28.9 %; $\beta = -0.03$, 95 % CI -0.05 to -0.02), followed by PCDI (10.5 %; $\beta = -0.01$, 95 % CI -0.02 to -0.002), SDQ-PP (7.5 %; $\beta = -0.01$, 95 % CI -0.02 to -0.003), and MVPA (1.5 %; $\beta = -0.002$, 95 % CI -0.01 - 0.001). Intervention strategies that enhance children's sleep health and strengthen parent-child and peer relationships may mitigate the negative impacts of increased screen time on children's functioning. However, given the very small effect of screen time on PedsQL, it is probably not a major factor influencing children's HRQoL.

1. Introduction

Children and adolescents' increasing access to screen-based media, including television viewing, recreational computer use, video gaming, and use of mobile devices such as smartphones and tablets, has resulted in widespread concern about health problems and potential development of addiction associated with over-exposure to screen time (World Health Organization, 2015). While there are potential benefits of screen-based activities on children's development (Chassiakos et al., 2016), a large body of research suggests consistent associations between excessive screen time and a vast array of adverse health consequences and impaired psychological well-being in children (Zhang et al., 2022). In recent years, health-related quality of life (HRQoL), a

multidimensional construct that considers physical, emotional, and social aspects of one's life (Centers for Disease Control and Prevention, 2001), has emerged to be an important indicator of children's health and functioning (Wong et al., 2021). A systematic review provides supporting evidence of the negative effects of screen time on children's HRQoL (Wu et al., 2017).

Despite the research efforts to investigate the impacts of screen time on detrimental health outcomes, the mechanisms that underlie this association remain unclear. As many studies have suggested, increased screen time is unlikely to be directly harmful to children (Paulich et al., 2021). A better understanding of the pathways through which screen time affects children's health could contribute to the development of appropriate preventive and remedial responses to adverse health

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impacts arising from screen time. Screen time may influence different aspects of children's health via different pathways. The most commonly suggested mechanism is the displacement hypothesis (Neuman, 1991), which proposes that increased screen time displaces children's health-promoting activities, such as physical activities and sleep, which in turn, reduce children's physical and mental well-being. However, existing empirical evidence supporting this hypothesis has remained inconclusive. In terms of the displacement of physical activity, a cross-sectional study suggested that time spent in physical activity mediates the relationship between screen time and physical fitness in children (Cabanas-Sánchez et al., 2019). In contrast, a longitudinal study found no evidence supporting the displacement hypothesis, as time spent in physical activity did not correlate with screen time and depressive symptoms (Boers et al., 2019).

Regarding sleep displacement, Barlett et al. (2012) provided one of the first pieces of longitudinal evidence that sleep problems mediated the effect of screen time on adolescents' body mass index. Additionally, several cross-sectional studies have identified sleep duration as a significant mediator in the associations between screen time and social-emotional functioning among youth, including depressive symptoms (Wang et al., 2021) and psychological distress (Vandendriessche et al., 2019). However, data collected from a large-scale cross-sectional survey suggested that the impacts of screen time on anxiety and depressive symptoms are independent of sleep duration among adolescents (Leung & Torres, 2021).

These mixed findings underscore the need for additional research to verify the displacement hypothesis. Moreover, while the original concept of sleep displacement posits that screen media use replaces time that might otherwise be spent sleeping, a recent study proposes an update to the hypothesis, indicating that screen time may displace sleep in multiple ways, including by affecting sleep quality (Hökby et al., 2025). Given that sleep quality is an important dimension of sleep that can impact children's health and development (Chaput et al., 2018; Schlieber & Han, 2021), it warrants further investigation.

Another potential mechanism is the relational hypothesis concerning the impairment of screen time on parent-child and peer relationships, which are closely related to children's health and development. Based on this hypothesis, it was found that adolescents' satisfaction with social relationships mediated the amount of screen time on their self-rated health (Werneck et al., 2018). Furthermore, parent-child interaction was found to mediate the effect of screen time on psychosocial difficulties and prosocial behaviors in preschool children (Zhao et al., 2018). Similarly, results from a more recent study demonstrated the mediating role of parent-child conflict on the relationship between children's overuse of screen media and internalizing problems (Geng et al., 2023). Whereas these efforts have preliminarily validated the relational hypothesis, the evidence is derived from cross-sectional data and it is unclear whether impairments in both relationships with peers and parents mediate the association between the duration of screen time and health.

The present study aimed at testing the extent to which the potential mediators explain the association between screen time and children's HRQoL. According to the displacement and relational hypotheses, displacement (i.e., physical activity and sleep quality) and relationship factors (i.e., dysfunctional parent-child relationship and peer problems) would at least partly explain the influence of screen time on children's HRQoL.

2. Methods

2.1. Study design and sampling

This was a population-based survey study involving two assessment time points over the course of 1 year. The study involved 1428 parents with children attending Grades 1 to 6 (aged 6–11 years) of primary schools in Hong Kong at baseline.

2.2. Study procedures

The study was conducted between June 2021 and August 2022. We recruited the participants via randomly selected landline and mobile phone numbers using random digit dialing method. A total of 20,907 telephone numbers were randomly sampled, and after excluding 18,552 invalid cases (i.e., no target respondents, office numbers, inactive numbers), 2355 cases were found to be valid. When contact was successfully established with a target parent, after seeking their verbal and written consent, they were instructed to complete the questionnaire online. A total of 1428 target parents completed the survey successfully and the response rate was 60.6 % for the baseline questionnaire (conducted during June and August 2021) and a follow-up retention rate of 72.3 %. The sample size was estimated based on the estimates reported in previous studies. Screen time has been found to be associated with worse health-related quality of life ($\beta = -0.49$, $p < .05$) (Motamed-Gorji et al., 2019). A sample of 1428 would provide 99.5 % power to detect the mediated effect on depression, assuming that the mediated effect is at least 50 % of the total effect. Details of the data collection procedures have been described elsewhere (Lo, Chan, Chan, Ho, & Ip, 2024).

2.3. Ethics

Ethical approval for the study was obtained from the first author's affiliated institution (Reference number: HSEARS20191204001). Written consent was sought from participants before data collection.

2.4. Measures

2.4.1. Outcome

Children's Health-Related Quality of Life (HRQoL). Comprising both physical health (viz., physical functioning subscale) and psychosocial health (viz., emotional, social, and school functioning subscales) measures, the 23-item Pediatrics Quality of Life Inventory Parent-Proxy Report (PedsQL) is a widely used psychometric instrument for children's HRQoL. Parents reported various aspects of their children's functioning using the Chinese version of the PedsQL (Lau et al., 2010), with higher scores indicating better HRQoL. In the current study, we measured both physical and psychosocial health domains in children because we believed exposure to electronic screens could, either directly or indirectly, affect both these domains. Our baseline data showed good to excellent Cronbach's alphas for the physical functioning (0.90), emotional functioning (0.86), social functioning (0.91), and school functioning (0.79) subscales, with an overall scale $\alpha = .95$.

2.4.2. Exposure

Children's Screen Time. Parents were asked to report the time their children spent on any electronic screen utilization activities daily, regardless of whether the content was online or offline. They reported their children's screen time both on a typical weekday and weekend day, separately. A weighted average of daily screen time and daily screen time for each type of screen time content and context was computed as $((\text{Screentime}_{\text{weekday}} \times 5 + \text{Screentime}_{\text{weekend}} \times 2)/7)$.

2.4.3. Mediators – displacement factors

Sleep-related Quality of Life (QoL). Parents were asked to report their children's sleep habit on the 23-item Childhood Sleep Quality Index. The measure was adapted from two validated measures, the Children's Sleep Habits Questionnaire (Owens et al., 2000) and the Hong Kong Children Sleep Questionnaire (Li et al., 2006). The sleep-related QoL subscale consists of 5 items and was used in the current study, which had an internal consistency reliability of 0.71 in this study.

Physical Activities. Parents reported their children's time spent in physical activity on the Children's Leisure Activities Study Survey Questionnaire-Chinese version (CLASS-C). The scale had been validated

in a previous study of Chinese children in Hong Kong (Liang et al., 2014). The questionnaire captures the frequency and duration of children's engagement in physical activity during the past week with a checklist of 31 physical activities and screen-based behaviors. Weighted daily time spent in moderate-to-vigorous physical activity (MVPA) was calculated $((MVPA_{\text{weekday}} \times 5 + MVPA_{\text{weekend}} \times 2)/7)$.

2.4.4. Mediators – relational factors

Parent-Child Relationship. The 12-item Parent-Child Dysfunctional Interaction (PCDI) subscale of the Chinese version of the Parenting Stress Index-Short Form (PSI-SF; Abidin, 1995; Lam, 1999) was used to measure the extent to which the parent perceived their child as a disappointment, felt rejected by their child, or perceived a lack of proper bonding with their child. A previous study has confirmed that the 3-factor structure of the Chinese PSI-SF is consistent with the factors suggested by Abidin (Lam, 1999). The Cronbach's alpha of the Chinese PSI-SF in the current administration was 0.85.

Child's Peer Relationship. Parents reported their children's peer relationships on the 5-item Peer Problems subscale of the Chinese version of the Strengths and Difficulties Questionnaire (SDQ-PP), which has been validated with the Hong Kong children population (Lai et al., 2010). Higher scores of SDQ-PP indicate more peer problems in the target children. The internal consistency reliability of the Peer Problem subscale in the current study was 0.83.

2.5. Data analysis

We constructed a multilevel structural equation model (MSEM) using the two-wave panel data to examine the mediation effects (Hu et al., 2020; Preacher, Zhang, & Zyphur, 2011). We used a 1-1-1 mediation framework because all variables – exposure (screen time), mediators (sleep QoL, MVPA, PCDI, and SDQ-PP), and outcome (PedsQL) – were state variables, and our focus was on the mediating effects at the within-person level. All mediators were included in a single model to account for potential interacting causal relations among the examined mediators (VanderWeele & Vansteelandt, 2014). The exposure and mediator variables were person-mean centered, in which the raw scores for each measure subtracted the participant-centered mean scores, such that within-person variances could be obtained to fit the regression models (Wang & Maxwell, 2015).

We used propensity score weighting method to adjust for confounding impact due to covariate imbalance in exposure distribution (Jo et al., 2011). Weights were computed using linear regression fitted with all between-person covariates, including child's gender and age, parent's age, education attainment, employment status, chronic conditions, parental marital status, household size, household income, social security assistance status, and time variable, all of which were also included in the regression models used in the MSEM. Missing data were handled by using full information maximum likelihood procedures with sensitivity analysis performed on complete data with random imputation. Confidence intervals were obtained by bootstrapping with 10,000 iterates. As such, the multiple-mediator MSEM could help us uncover (a) the effect of time variations from a child's mean level of screen time exposure on their HRQoL; and (b) the extent and proportion to which this relationship is mediated by the set of mediators at the within-person level, while simultaneously accounting for mutual relationships among the mediators. Results were considered statistically significant at an alpha level of < 0.05 . All data manipulations and analyses were performed using R version 4.3.3. Data and R code are available on the data repository of the first author's institution (Lo, 2025).

3. Results

3.1. Descriptive analysis

In this study we recruited $N = 1428$ households' parents and

achieved a 72.3 % 1-year follow-up rate, among which 690 children were girls (48.3 %; total $M_{\text{age}} = 8.5 \pm 1.9$). The median household size was 4 (IQR 3–4). Most of families (52.2 %) had less than ~ USD3,850 monthly household income, and 69 (4.8 %) of the sampled households were receiving social security assistance. Less than 4 % of the parents suffered any chronic illness.

Table 1 summarizes the descriptive statistics of the exposure, mediators, and outcome variables for the MSEM. The intra-class correlation coefficients (ICCs) computed based on the unconditional random coefficient model (Bolger & Laurenceau, 2013) revealed that 55.6 % in PedsQL were explained at the within-person level. The ICCs of mediators ranged from 0.391 (SDQ-PP) to 0.492 (MVPA), indicating that there were sufficient within-person variabilities for all examined mediators to make MSEM an appropriate approach.

3.2. Multilevel mediation analysis

We set out to examine the mediating effects of two displacement factors, i.e., sleep QoL and MVPA, and two relationship factors, i.e., PCDI and SDQ-PP. Results from model fit evaluation showed that standardized root-mean squared residual (SRMR) = 0.01, root mean square error of approximation (RMSEA) = 0.08 [0.07–0.09], and comparative fit index (CFI) = 0.93 (Browne & Cudeck, 1992). Screen time was found to be overall negatively associated with PedsQL ($\beta = -1.091$, 95 % CI -1.449 to -0.733, $p < .0001$), which was primarily partially mediated by sleep QoL (28.9 %; $\beta = -0.316$, 95 % CI -0.446 to -0.185), followed by PCDI (10.5 %; $\beta = -0.114$, 95 % CI -0.209 to -0.019), SDQ-PP (7.5 %; $\beta = -0.082$, 95 % CI -0.138 to -0.026), and MVPA (1.5 %; $\beta = -0.017$, 95 % CI -0.047 to -0.014). All mediated proportion accounted for 48.4 % of the total effect. Details of MSEM results are illustrated in Table 2 and Fig. 1. Sensitivity analysis with randomly imputed data yielded similar results (see eTable 1).

4. Discussion

4.1. Discussion

The present study contributes to the underexplored area of research on the possible mechanisms underlying the link between screen time and health outcomes in children. To test the displacement and relational hypotheses, we performed a MSEM to examine the association between screen time and HRQoL, and the extent to which the relationship is mediated by the displacement of health-promoting behaviors (i.e., time spent in physical activity and sleep quality) and the impairments in interpersonal relationships (i.e., parent-child and peer relationships) using multilevel mediation analyses. The results showed statistically significant total effect of screen time on HRQoL, suggesting an increase in the amount of screen time duration from the baseline to follow-up assessments was associated with a decrease in HRQoL within individuals. The finding is consistent with the current literature that increased screen time has an adverse impact on children's overall functioning (Wu et al., 2017). Although the current study did not explore this aspect, growing research indicates that some types of screen time may be more harmful to children. For instance, a review by Sanders et al. (2024) found that social media use consistently correlated with poor health outcomes in children, with no indication of potential benefit. However, it is also important to note that the effect of screen time on children's HRQoL was very small, suggesting that screen time is unlikely to be a major contributing factor to children's overall HRQoL.

Previous studies examining the sleep displacement hypothesis focused primarily on sleep duration. In this study, we showed a statistically significant indirect path linking screen time to children's HRQoL through reduced sleep QoL, supporting the idea of Hökby et al. (2025) that screen-sleep displacements impact several aspects of sleep, not just sleep duration. Studies involving adolescents and preschool children have reported similar findings (Zhou, Ding, Xiao, & Li, 2024; Lu et al.,

Table 1

Summary statistics of exposure, outcome, and mediators.

	Baseline			Follow-up			Variance			
Measure ^{a b}	Mean	SD	Min – Max	Mean	SD	Min – Max	Between	Within	Reliability ^c	ICC ^d
Screen time	5.38	3.24	0–14.07	5.66	3.55	0–15	9.82	4.00	NA	–
PedsQL	56.22	13.32	0–75	53.79	13.44	4.06–75	153.18	79.87	0.95	0.556
Sleep QoL	4.12	0.50	1.80–5.00	4.16	0.57	1.40–5.00	0.21	0.15	NA	0.459
MVPA	0.69	0.57	0–7.76	0.70	0.50	0.05–4.14	0.26	0.15	NA	0.492
PCDI	30.72	6.91	12–54	31.01	6.92	14–54	43.28	25.70	0.85	0.486
SDQ-PP	3.02	1.68	0–10	3.01	1.72	0–10	2.14	1.70	0.83	0.391

^a Screen time (average daily screen time exposure to any electronic devices) and MVPA (moderate-to-vigorous physical activities) were measured in hours.^b PedsQL = Pediatrics Quality of Life Inventory Parent-Proxy Report; Sleep QoL = sleep-related quality of life; MVPA = moderate-to-vigorous physical activity; PCDI = Parent-Child Dysfunctional Interaction; SDQ-PP = Peer Problems subscale of Strengths and Difficulties Questionnaire.^c Internal consistency reliability (Cronbach's alpha) measured at baseline.^d Intra-class correlation coefficient of major measures.**Table 2**

Results from multilevel mediation analysis testing indirect effects of sleep-related quality of life, moderate-to-vigorous physical activities, parent-child dysfunctional interaction, and child's peer problems on screen time exposure and health-related quality of life at within-person level.

	β	95 % LCI	95 % UCI	p-value	Proportion mediated
Indirect effect					
via Sleep QoL	−0.316	−0.446	−0.185	<0.0001	0.289
via MVPA	−0.017	−0.047	0.014	0.2782	0.015
via PCDI	−0.114	−0.209	−0.019	0.0186	0.105
via SDQ-PP	−0.082	−0.138	−0.026	0.0040	0.075
Indirect effect (total)	−0.528	−0.716	−0.341	<0.0001	0.484
Direct effect	−0.563	−0.884	−0.242	0.0006	–
Total effect	−1.091	−1.449	−0.733	<0.0001	–

Note. Mediation estimates are illustrated with lower and upper bounds of 95 % confidence intervals.

Sleep QoL = Sleep-related quality of life; MVPA = Moderate-to-vigorous physical activities; PCDI = Parent-child dysfunctional interaction; SDQ-PP = Peer problems measured in the Strengths and Difficulties Questionnaire.

Proportion mediated is obtained by dividing indirect effect by total effect.

2023), indicating that screen time is associated with emotional and behavioral outcomes through sleep quality. Other characteristics of screen time, such as during which periods of the day did children engage in ST, may play an important role in their sleep (Leung & Torres, 2021). For example, previous research has shown that screen time before bedtime is more harmful to children's sleep and health outcomes (Carter et al., 2016). Further investigation into different aspects of screen time in relation to different outcomes of sleep will provide insight into this hypothesis.

The indirect path of physical activity in accounting for the association between screen time and children's HRQoL is less clear. There was a significant but weak positive association between screen time and MVPA, suggesting children who spent increased time on screen-based media tend to be more physically active. Higher levels of screen time and MVPA may simply co-occur. It could also be the case that children's engagement in certain types of screen-based activities, such as video games or mobile applications designed to involve physical movements of gamers, may facilitate engagement in physical activity as opposed to substituting exercise (Sanders et al., 2024). If this is the case, the current understanding of the displacement hypothesis may not adequately capture the complexity of screen time and children's multitasking behaviors. Although our findings on the negative relationship between MVPA and HRQoL contradict the consensus in the literature regarding the potential benefits of physical activity on quality of life (Marker et al., 2018), one should bear in mind that children's level of participation in MVPA was very low (approximately 0.7 h per day on

average). Other aspects of a child's life may influence their HRQoL more strongly than their level of MVPA.

Extending previous cross-sectional evidence that suggests the mediating roles of relationship quality underlying the association between screen time and different psychosocial outcomes (Geng et al., 2023; Werneck et al., 2018; Zhao et al., 2018), the current study reveals that dysfunctional parent-child interaction and peer problems were significant mediators through which increased screen time is associated with HRQoL; thus, the relational hypothesis is supported. Spending more time on digital devices may reduce the opportunity for children to engage in direct interpersonal interactions and communication with parents and friends (Katz & Aspden, 1997; Kraut et al., 1998), which potentially explains the association between screen time and deterioration in parent-child and peer relationships (Richards et al., 2010). Another possible explanation may be related to parenting approaches to children's engagement with electronic media. Parents may adopt restrictive parenting practices in response to children's increased ST (Hsieh et al., 2018), resulting in more negative interactions and conflicts between parents (Geng et al., 2023). Given the protective effect of positive parent-child interaction and peer support on children's HRQoL (Otto et al., 2017), the consequences of excessive screen time may be partially counteracted by improving social relationships with family and friends.

4.2. Implications

Multiple meta-analyses have examined the current evidence regarding interventions aimed at reducing screen time in children, revealing that the existing interventions either result in only a small effect size or yield non-significant results (Jones et al., 2021). The evaluation of potential intervening factors in this study offers important insights into the development and refinement of intervention and prevention programs to reduce screen time and negative impacts on children's health. In view of the significant mediating effects of sleep QoL, parent-child dysfunctional interaction, and peer problems, screen time interventions that address these aspects may be particularly efficacious. As family is a crucial source of influence that can affect the lifestyle of children, family-based interventions that promote the creation and enforcement of family rules concerning sleep health and screen time, along with parental modeling of healthy screen time habits, could be beneficial (Rhodes et al., 2020; Williamson & Hale, 2024). A nurturing and positive parent-child relationship not only contributes to favorable health and developmental outcomes in children (Ranson & Urchuk, 2008) but also provides a strong foundation for setting rules and promoting healthy behavior modeling. We recommend that future studies integrate elements that enhance the parent-child relationship within their screen time interventions. Preventive efforts can also be devoted to providing school-based social skills training, equipping children with effective strategies to engage in peer interactions and develop friendships. Strengthening social relationships with friends may protect

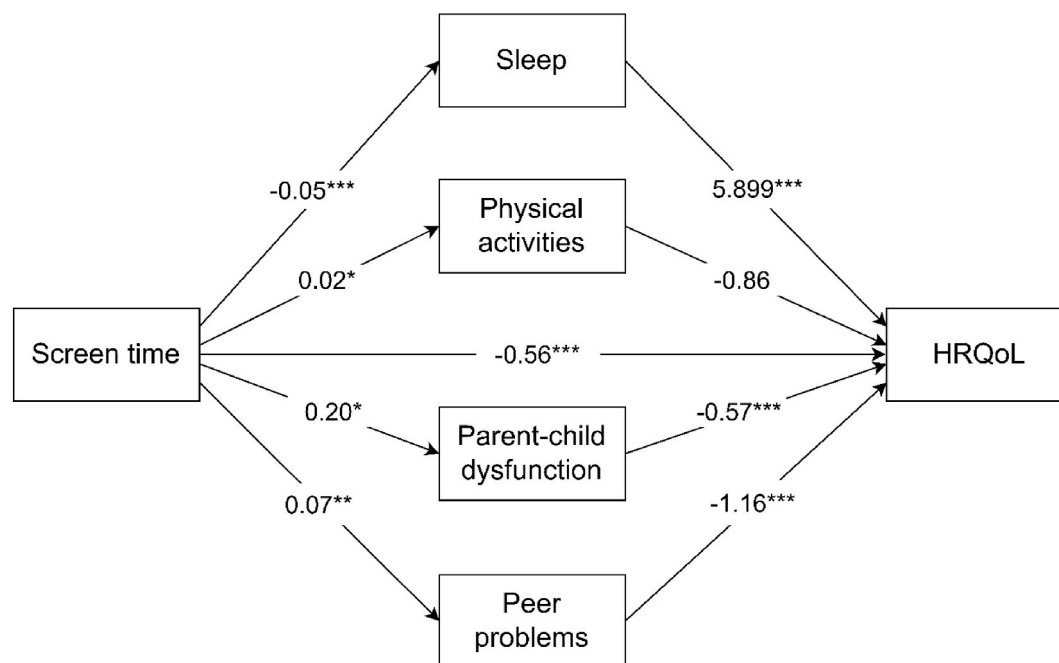


Fig. 1. Regression coefficients for the relationship between screen time exposure and health-related quality of life as mediated by sleep-related quality of life, moderate-to-vigorous physical activities, parent-child dysfunctional interaction, and child's peer problems.

Note. $^*p < .05$, $^{**}p < .001$, $^{***}p < .0001$.

children from the undesirable impacts of screen time on HRQoL.

Although the results indicate that screen time may have a negative impact on children's sleep QoL, interactions with parents and peer relationships—which in turn could contribute to a reduction in HRQoL—it is important to note that these mediating effects were only partial, and the overall effect of screen time on HRQoL was minimal. Further research is needed to explore the impact of screen time on additional aspects of children's lives, to investigate the unexplained associations, and to refine our understanding of the relationship between screen time and children's HRQoL. In addition, the mediating role of physical activity remains unclear. We call for additional research to revisit the displacement hypothesis. In future, researchers should consider the types of screen time (e.g., TV, video games, smartphones/tablets), types of physical activity, and other dimensions of sleep (e.g., sleep timing, continuation, and onset difficulties) to achieve a more complete understanding of the mechanisms responsible for the association between screen time and HRQoL among children.

4.3. Strengths and limitations

The strengths of the study include the use of population representative sample, the inclusion of theoretically- and empirically-based mediators, and a relatively rigorous analytic approach. Despite these strengths, several limitations should be noted. In the current study, we adopted proxy-reported measures for all major variables examined. Though previously shown valid, proxy-reported data might be prone to various biases. For instance, our study found lower PedsQL scores compared to other representative samples of children in the same age range (e.g., Wong et al., 2021). Being aware of the screentime-related study theme, our parent participants may be under the impression that their children would not be very active physically or socially. Consequently, this perception could have influenced them to assign lower scores on the questionnaire items. Researchers of future studies should attempt to utilize passive data from devices so that more objective results can be obtained. In addition, we used a single-dimension measure for some of our variables (e.g., screen time and sleep). A more comprehensive measure of the constructs may be advantageous to

gaining a better understanding of their relationships. On the other hand, while most of our regression results are aligned with previous work, some appear to be inconsistent with the literature. This could be due to diverse adjustments or testing methods among studies considering the nature of observational study data. That said, a thoroughly controlled environment on screen time exposure could be difficult to achieve in a real-world setting. We recommend various design approaches to be adopted in future studies to triangulate the evidence for the causal structure of the captioned topic.

5. Conclusion

Our study extends previous work on the association between screen time and HRQoL in children by testing the underlying mechanisms as suggested by the displacement and relational hypotheses. Our findings suggest that the worsening of sleep QoL and impairments in relationships with parents and peers are pathways through which screen time affects children's HRQoL. While the findings support the relational hypothesis, evidence for the displacement hypothesis remains inconclusive. Family-based interventions aimed at improving children's sleep health, along with strategies to strengthen parent-child and peer relationships, could be effective in mitigating the negative effects of screen time on children's functioning.

CRedit authorship contribution statement

Camilla K.M. Lo: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Conceptualization. **Edward W.W. Chan:** Writing – review & editing, Writing – original draft, Formal analysis. **Yuet Wing Cho:** Writing – review & editing, Writing – original draft. **Ko Ling Chan:** Writing – review & editing, Conceptualization. **Patrick Ip:** Writing – review & editing, Conceptualization. **Frederick K. Ho:** Writing – review & editing, Methodology, Conceptualization.

Ethics

Ethical approval for the study was obtained from the Institutional

Review Board of The Hong Kong Polytechnic University (first author's affiliated institution) prior to the commencement of the study (Reference number: HSEARS20191204001).

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chbr.2025.100720>.

Data availability

The link to the data is available in the manuscript.

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