

Humanities and Social Sciences Communications

Article in Press

<https://doi.org/10.1057/s41599-026-06731-0>

Associations between parental and child physical activity and screen time during the first wave of the COVID-19 pandemic

Received: 17 December 2024

Accepted: 10 February 2026

Cite this article as: Ng, L.A., Doyle-Baker, P.K., McCormack, G.R. Associations between parental and child physical activity and screen time during the first wave of the COVID-19 pandemic. *Humanit Soc Sci Commun* (2026). <https://doi.org/10.1057/s41599-026-06731-0>

Lyah A. Ng, Patricia K. Doyle-Baker & Gavin R. McCormack

We are providing an unedited version of this manuscript to give early access to its findings. Before final publication, the manuscript will undergo further editing. Please note there may be errors present which affect the content, and all legal disclaimers apply.

If this paper is publishing under a Transparent Peer Review model then Peer Review reports will publish with the final article.

Parent and Child Activity During COVID-19 1

**Associations Between Parental and Child Physical Activity and Screen Time during the
First Wave of the COVID-19 Pandemic**

ARTICLE IN PRESS

ABSTRACT

The COVID-19 pandemic interrupted daily routines but also provided family time opportunities. Our study estimated the associations between moderate-to-vigorous physical activity (MVPA) and screen time (ST) among parent-child dyads early during the first wave of the pandemic. Our secondary analysis included survey data ($n = 329$ parent-child dyads) gathered from a random sample of households (Calgary, Canada) between April and June, 2020. MVPA, ST, and sociodemographic characteristics of one parent and one child or adolescent (5-17 years) per family were captured. Covariate-adjusted logistic regression models estimated the associations (odds ratios; OR) between parent and child MVPA and ST. The sample included 149 girls and 180 boys (mean age: 10.7, SD 4.0 years). Among parents (mean age: 42.7, SD 8.9 years), 67.2% were female. Parent weekly hours of MVPA was associated with children achieving ≥ 60 minutes of MVPA 7 days/week (OR 1.05, 95% CI 1.01, 1.09). Parent weekly hours of recreational ST was associated with children being less likely to achieve ≥ 60 minutes of MVPA (OR 0.97, 95% CI 0.95, 0.99) and more likely to participate in at least one ST activity for ≥ 2 hours day (OR 1.12, 95% CI 1.04, 1.19). During the COVID-19 pandemic, parent movement behaviours remained key correlates of children's daily MVPA and ST.

Keywords: pandemic; parent; child; screen time; leisure; recreation

BACKGROUND

Identifying factors that enhance moderate to vigorous physical activity (MVPA) and reduce sedentary behaviour (SB), including screen time (ST) in children is crucial for promoting health during childhood and for establishing healthy movement behaviours that persist into adulthood (Hayes et al., 2019). The social environment, including parents, siblings, friends, and peers contributes to shaping children's movement behaviours (Sterdt et al., 2014). Parents influence their children's PA and SB through modelling (i.e., displaying healthy and unhealthy behaviours), co-participation (e.g., family walks and television viewing), providing resources and opportunities (i.e., instrumental behaviours), and positive or negative reinforcement (Kohl & Hobbs, 1998; Pugliese & Tinsley, 2007; Trost & Loprinzi, 2011; Yao & Rhodes, 2015).

Associations between parent and child movement behaviours, indicative of parent modelling and co-participation, have been observed in early and later childhood (Caldwell et al., 2025; Mitchell et al., 2012; Petersen et al., 2020; Pugliese & Tinsley, 2007; Trost & Loprinzi, 2011; Yao & Rhodes, 2015). Meta-analyses undertaken by Pugliese and Tinsley (2007) and Yao and Rhodes (2015) found small effect sizes in support of a positive association between parent and child PA ($r = 0.10$ and $r = 0.16$, respectively). The strength of associations between parent and child PA can vary, yet they remain positive regardless of the parent's or child's gender (Garriguet et al., 2017; Petersen et al., 2020; Yao & Rhodes, 2015). Studies have also observed positive parent-child associations for ST (Caldwell et al., 2025; Garriguet et al., 2017; Jago et al., 2010; Jago et al., 2012).

Opportunities for parents to influence their children's movement behaviours can be shaped by contextual factors that affect the amount of time families spend together (Emm-Collison et al., 2019; Fuemmeler et al., 2011; Garriguet et al., 2017). On 11 March 2020, the World Health Organization declared COVID-19 a pandemic (World Health Organization, 2020)

and public health authorities in Canada and elsewhere responded by implementing emergency measures to reduce disease transmission. The public health measures, including physical distancing, avoiding social gatherings, stay-at-home orders, remote working, and closures of businesses, educational, childcare, and recreational facilities adversely impacted the MVPA and SB of adults (Stockwell et al., 2021) and children (Moore et al., 2020; Neville et al., 2022). For example, adults reported reductions in gym use and active commuting, while children experienced declines in organized sport and outdoor play alongside increases in recreational ST (Moore et al., 2020; Stockwell et al., 2021; Salway et al., 2023). These measures compelled families to spend more time together in and around the home and abruptly altered how parents supported children's movement behaviours (Eyler et al., 2021; Ostermeier et al., 2022; Woodland et al., 2022).

For optimal health, the Canadian 24-Hour Movement Guidelines recommend children 5-17 years accumulate at least 60 minutes per day of MVPA (Tremblay et al., 2016) and adults 18-64 years accumulate at least 150 minutes of MVPA per week (Ross et al., 2020). In addition, these guidelines recommend children 5-17 years limit daily recreational ST to less than 2 hours (Tremblay et al., 2016) and adults 18-64 years limit daily sedentary time to less than 8 hours, including no more than 3 hours of recreational ST per day (Ross et al., 2020). ST is a primary contributor to total sedentary time among both age groups (Saunders et al., 2020; Tremblay et al., 2011). While most recreational ST (e.g., television, gaming, social media) is sedentary and negatively impacts health, some forms of ST can be active, such as online workouts, which became more common during the COVID-19 pandemic (Moore et al., 2021; Salway et al., 2023).

Qualitative findings highlight the experiences of parents in supporting their children's movement behaviours (Eyler et al., 2021; Ostermeier et al., 2022; Woodland et al., 2022) but,

there is a dearth of studies quantifying associations between parent and children MVPA and ST during the pandemic. Notably, a recent Canadian study using data gathered during the pandemic (October 2020 and April 2021) reported that children (5–17 years) were more likely to meet 24-Hour Movement Guidelines for MVPA and ST if their parents also met these guidelines, though cross-behavioural analyses showed little evidence beyond a small negative correlation between parent MVPA and child ST later in the pandemic (Caldwell et al., 2025). There remains limited evidence about these associations during the earliest phase of the pandemic when restrictions were abruptly implemented and family routines most disrupted. Our exploratory study aimed to determine whether parent MVPA and parent recreational ST were associated with children and adolescents (5–17 years) meeting recommended levels of MVPA and ST during the first wave of the COVID-19 pandemic, and whether cross-behavioural relationships (e.g., parent MVPA with child ST) were also present.

METHODS

Study Design and Data Collection

The Government of Alberta (Canada) declared a state of public health emergency in response to the COVID-19 pandemic on 15 March 2020 and implemented the immediate closure of sports programs, fitness centers, recreation facilities, schools, and childcare facilities. School-aged children in Calgary (Alberta) transitioned to online learning from March to June (end of the 2019/2020 school year). This secondary analysis included cross-sectional data from an online survey that was conducted from April to June 2020 (McCormack et al., 2021). Briefly, a random sample of 25,000 households in 14 Calgary communities were invited to participate in the survey. A postcard with a link to the online survey was mailed to households and one adult per household completed the survey. Eligible adults were ≥ 18 years of age with internet access. The

original aim of the survey was to gather baseline data as part of an evaluation of a community program implemented by a recreational facility which targeted PA, SB, play, and social connections among individuals and families with children or adolescents aged 5-17 years (hereafter referred to as ‘children’). Parents of children reported their own and their child’s PA, ST, and sociodemographic characteristics (via proxy). Parents provided data for one child selected based on the child with the next birthday in the case of multi-child households. Participants provided informed consent prior to beginning the survey. The University of Calgary Conjoint Health Research Ethics Board approved the original study (REB#19-1910) and this secondary analysis (REB#23-1487). Of the 1,256 survey respondents (response rate = 4.5%), 345 included parents of children aged 5-17 years (McCormack et al., 2020).

Variables

Parent MVPA: Three items from the International Physical Activity Questionnaire Short-Form (IPAQ-SF) captured adult MVPA (Craig et al., 2003). Participants recalled the frequency and time in the past seven days they had undertaken vigorous PA, walking, and other moderate PA (i.e., during work, house and yard work, transportation, recreation, exercise, or sport). Minutes for the three activities were summed and converted to total weekly hours of MVPA.

Parent Recreational Screen Time: A single item captured average recreational ST (e.g., videogames, computer games, DVD/movies, internet, and email outside of work) (McCormack & Mardinger, 2015). Daily minutes were multiplied by seven and converted to total weekly hours of recreational ST.

Child MVPA: Parents responded to a single item capturing the number of days during the past seven days their child accumulated at least 60 minutes of MVPA (i.e., play, brisk walking, swimming, biking, gardening, running, or any other activity that increased breathing and heart

rate) (Prochaska et al., 2001). Child MVPA was dichotomized into achieving versus not achieving ≥ 60 minutes of MVPA 7 days/week, reflecting MVPA recommended in Canadian 24-hour Movement Guidelines for children (Tremblay et al., 2016). Parent-reported proxy measures provide reasonably reliable and valid estimates of children's PA (Hidding et al., 2017; Loprinzi & Cardinal, 2011).

Child Screen Time: Parents reported their child's average daily hours over the past 30 days separately for watching TV/videos, computer use or video gaming, and other screen activity (<1, 1, 2, 3, 4, or ≥ 5 hours). Each ST activity was dichotomized (<2 vs ≥ 2 hours/day). Because the item response categories did not allow for the precise accumulation of total hours across activities, it was not possible to determine whether children engaged in <2 hours/day of total ST and therefore we could not directly compare against the Canadian 24-Hour Movement Guidelines for children (Tremblay et al., 2016). Instead, we created a summary variable indicating whether a child engaged in at least one of the three ST activities for ≥ 2 hours/day. Parent-reported proxy measures provide reasonably reliable estimates of children's daily TV and ST (Hidding et al., 2018; Lubans et al., 2011).

Sociodemographic Characteristics (Covariates): Relevant available covariates included parent and child gender, age, parent relationship status, ethnicity, education, household income, employment status, and number children ≤ 18 years residing in the household. Parent COVID-19 anxiety was also included as a covariate given its association with children's PA and ST in a previous analysis of these data (McCormack et al., 2020).

Statistical Analysis

Descriptive statistics were estimated for all parent and child sociodemographic, MVPA, and ST variables. Pearson's Chi-square tests compared gender differences in children's MVPA

and ST variables. We used covariate-adjusted binary logistic regression models to regress child MVPA and ST (i.e., total, watching TV/videos, using the computer/playing video games, and other screen activities) on weekly hours of parent MVPA and parent ST. To assess the presence of effect measure modification, we also tested interactions terms between child gender and parent MVPA and recreational ST. The logistic regression models provided estimates of odds ratios (OR) and 95% confidence intervals (CI). Statistically significant ORs were identified based on a *p*-value less than 0.05 for main effects and *p*-value less than 0.10 for interaction effects. The analysis was undertaken using IBM Statistical Package for Social Sciences (SPSS version 29).

RESULTS

Sample Characteristics

Our analytical sample included complete data for 329 parent-child dyads (149 girls and 180 boys), excluding 16 dyads with missing data (Table 1). Children represented in the survey had a mean (standard deviation; SD) age of 10.7 (SD 4.0) years, 54.7% were male, and 54.7% were white. Among parents, the mean age was 42.7 (SD 8.9) years and 67.2% identified as female. Over half of all parents had completed university (58.4%), were employed full-time (53.2%), married or in a common-law relationship (82.7%), and had a gross household income greater than \$80,000/year (60.2%). About one-third of parents reported being extremely or very anxious about COVID-19 (35.9%).

On average, parents participated in 7.6 (SD 6.8) hours of MVPA and 19.9 (SD 19.1) hours of recreational ST per week. The correlation between parent MVPA and recreational ST was not significant (Spearman's $r = -0.08$, $p=.146$).

Children's MVPA and Screen Time

Among children, 16.7% participated in ≥ 60 minutes of MVPA 7 days/week and 12.5% participated in <2 hours/day of total ST (Table 1). A high proportion of children engaged in ≥ 2 hours/day watching TV/videos (74.2%), gaming or using a computer (63.6%), and participating in other screen activities (60.6%) (Table 1). There were no significant differences in the proportions of boys and girls achieving ≥ 60 minutes of MVPA 7 days/week (18.3% vs. 14.8%) or participating ≥ 2 hours/day in at least one ST activity (88.3% vs. 86.6%), TV/video watching (72.8% vs. 75.8%), or other screen activities (62.8% vs. 58.4%). However, compared to girls, a higher proportion of boys gamed or used computers ≥ 2 hours/day (70.0% vs. 55.7%; $\chi^2 = 7.190$, $df=1$, $p=.007$).

Associations between Parent MVPA and Recreational Screen Time and Children's MVPA

Adjusting for covariates, weekly hours of parent MVPA was positively associated with the odds of a child participating in ≥ 60 minutes of MVPA 7 days/week (OR 1.05, 95% CI 1.01, 1.09, $p<.001$) (Table 2). Moreover, weekly hours of parent recreational ST was negatively associated with children achieving ≥ 60 minutes of MVPA 7 days/week (OR 0.97, 95% CI 0.95, 0.99). No evidence was found for effect measure modification by child gender.

Associations between Parent MVPA and Recreational Screen Time and Children's Screen Time

Adjusting for covariates, parent MVPA was not found to be significantly associated with participating ≥ 2 hours/day in at least one ST activity or any of the individual ST activities (Table 2). However, weekly hours of parent recreational ST was positively associated with the odds of a children participating ≥ 2 hours/day in at least one ST (OR 1.12, 95% CI 1.04, 1.19), watching

TV/videos (OR 1.06, 95% CI 1.02, 1.09), gaming or using a computer (OR 1.03, 95% CI 1.01, 1.04), and other screen activities (OR 1.02, 95% CI 1.01, 1.04). There was no evidence of effect measure modification by child gender.

DISCUSSION

Our study explored associations between parent and child movement behaviours during the first wave of the COVID-19 pandemic. Our findings are congruent with pre-pandemic (Garriguet et al., 2017; Jago et al., 2010; Jago et al., 2012; Mitchell et al., 2012; Petersen et al., 2020; Pugliese & Tinsley, 2007; Trost & Loprinzi, 2011; Yao & Rhodes, 2015) and pandemic-era evidence (Caldwell et al., 2025) showing positive associations between parent and child MVPA and ST. We also found similar associations boys and girls (Caldwell et al., 2025; Garriguet et al., 2017; Petersen et al., 2020; Yao & Rhodes, 2015). A novel aspect of our study is that data were gathered with the 3-months after the COVID-19 pandemic was declared and during which public health emergency measures were abruptly implemented. Pre-pandemic (2018/2019), among children in Canada, approximately 44% accumulated sufficient levels of accelerometer-measured MVPA and 53% met the ST guidelines (Surveillance & Applied Research Public Health Agency of Canada, 2023). In our sample 16.5% of children met the MVPA thresholds recommended by Canada's 24-hour Movement Guidelines. While we could not directly assess adherence to the ST guideline, 87.5% of children were found to engage in at least one of the three ST activities (i.e., watching TV/videos, gaming/using a computer, or other screen activity) for ≥ 2 hours/day. This measure likely underestimates non-adherence to the < 2 hour/day guideline, since children with < 2 hours/day across individual ST activities may still have exceeded the total threshold. Nevertheless, these estimates are consistent with a national

study conducted during the first month of the pandemic, which found that 18.2% and 11.3% of children (ages 5–17 years) met the MVPA and ST guidelines, respectively (Moore et al., 2020).

Among parent socialization practices, modelling is often observed to have the least effect on children's movement behaviour (Pugliese & Tinsley, 2007; Trost & Loprinzi, 2011; Yao & Rhodes, 2015). Nevertheless, the increased time families spent together in their homes because of the pandemic public health restrictions might have provided more opportunities for parent modelling as well as co-participation, thus amplifying associations between parent and child MVPA and ST. Caldwell et al. (2025) found that children whose parents met MVPA guidelines were more than twice as likely to meet MVPA guidelines themselves. Similarly, a key finding from our study was that each one-hour-per-week increase in MVPA among parents corresponded to a 5% increase in the likelihood of a child achieving ≥ 60 minutes of MVPA daily. This association was independent of parent and child sociodemographic characteristics as well as parent recreational ST, and we found no evidence that this association was modified by child gender. While this positive association between parent and child MVPA may reflect a combination of modelling and co-participation, we speculate the latter is likely the most dominant mechanism given parent's deliberate attempts to support their children's PA during the pandemic (Eyler et al., 2021; Ostermeier et al., 2022; Woodland et al., 2022).

We also observed that each additional hour of parent ST per week was associated with 12% higher odds of children engaging in at least one of the three ST activities for ≥ 2 hours/day. Parent ST was also positively associated with an increased likelihood of a child undertaking ≥ 2 hours per day watching TV/videos, gaming or using computers, and other screen-based activities. These results are consistent with Caldwell et al. (2025), who found that children were more likely to meet ST guidelines if their parents also met these guidelines, though our findings

suggest a potential dose-response relationship. Like Caldwell et al. (2025) we observed no differences between boys and girls regarding parent-child ST associations.

We found partial support for cross-behavioural associations between parent and child movement behaviours. Each one-hour-per-week increase in parent recreational ST was associated with 3% higher odds of a child achieving ≥ 60 minutes of MVPA daily, independent of parent MVPA. This unexpected positive association contrasts with Caldwell et al. (2025), who observed little cross-behavioural evidence apart from a small negative correlation between parent MVPA and child ST later in the pandemic. Moreover, while positive parallel associations between parent and child ST were anticipated (Caldwell et al., 2025; Garriguet et al., 2017; Jago et al., 2010; Jago et al., 2012), we did not find parent MVPA protective against child ST. A protective effect of parent MVPA on child ST was anticipated because active parents may model active behaviours, reduce shared screen time, and provide more opportunities for family PA. Activity compensation may partly explain this, though supporting evidence is inconclusive (Swelam et al., 2022). We also found no correlation between parent MVPA and recreational ST. Unmeasured factors such as the availability of screened devices in the home may confound the association. It is also plausible that parents encouraged children's screen use during the pandemic to create opportunities for their own physical activity (e.g., exercising, gardening, or yard work). Assuming parent modelling and co-participation as potential reasons underlying associations observed in our study, interventions should aim to educate parents on the negative impacts of ST and on setting limits to daily screen use for themselves and their children while also promoting family PA time and reducing access to screened devices within the home (e.g., Filanowski & Slade, 2023). While such messages reflect pre-pandemic public health guidance, they remain especially relevant during periods when families spend extended time at home, such as during the COVID-19 pandemic. Future research is needed to directly examine parent-child

co-participation in physical activity under pandemic-related or similar home-confinement conditions to clarify how shared family behaviours shape PA and ST patterns when opportunities for independent activity are constrained.

A strength of our study was that it provided a unique snapshot of parent–child movement behaviour relationships during the early phase of the COVID-19 pandemic. Additional strengths included covariate adjustment, assessment of effect modification by child gender, use of guideline-referenced PA thresholds, examination of common ST behaviours (Leblanc et al., 2017), and analysis of both parallel and cross-behavioural associations. Nevertheless, our findings should be interpreted considering methodological constraints, including a modest sample size from a low-response, mail-recruited survey and reliance on parent-reported measures of both PA and ST as parents may be prone to response bias when reporting their children's behaviours. However, these approaches were pragmatic during the early pandemic when in-person and device-based assessments were not feasible and still provide valuable early evidence on parent–child movement behaviours. As this was a cross-sectional analysis, causality and changes in associations from pre-pandemic to pandemic periods cannot be inferred. Limited information on parent–child interaction processes, temporal patterning of behaviours, broader family dynamics, home environment (e.g., screened devices), and biological maturation further restricts interpretation of underlying mechanisms (Davids & Roman, 2014; Patrick et al., 2013). In addition, child ST measures did not differentiate between recreational and non-recreational use, potentially inflating prevalence estimates, and data were available for only one parent–child dyad per household, precluding assessment of gender-matched and unmatched dyads (Yao & Rhodes, 2015).

Our exploratory study provides novel quantitative evidence demonstrating associations between parent and child MVPA and ST within the context of the first wave of the COVID-19

pandemic. Our findings corroborate quantitative (Moore et al., 2021) and qualitative (Eyler et al., 2021; Ostermeier et al., 2022; Woodland et al., 2022) study findings that highlight the role of parent support for children's movement behaviours during the pandemic. Our findings also align with pre-pandemic and pandemic-era evidence suggesting associations exist between parent and child movement behaviours (Caldwell et al., 2025; Fuemmeler et al., 2011; Garriguet et al., 2017; Jago et al., 2010; Jago et al., 2012; Mitchell et al., 2012; Petersen et al., 2020; Pugliese & Tinsley, 2007; Trost & Loprinzi, 2011; Yao & Rhodes, 2015). Public health and advocacy organizations (e.g., ParticipACTION) assume a vital role in promoting PA and discouraging ST, with their influence becoming particularly important during pandemics or other crises when access to PA opportunities is severely or suddenly limited and opportunities for parent-child co-participation are constrained to the home environment. Despite being unable to ascertain the mechanisms that explain the associations observed in our study, our findings may suggest that family-oriented health promotion interventions (Andermo et al., 2021; Brown et al., 2016; Filanowski & Slade, 2023) that encourage co-participation could be a potentially important strategy for encouraging healthy movement behaviours among children and their parents, especially during pandemics or other similar life-disruptive crises.

Data availability

The data that support the findings of this study are not publicly available due to restrictions imposed by institutional research ethics approval, which limit data sharing beyond the research team named on the ethics file. However, the data may be made available from the corresponding author upon reasonable request and subject to research ethics board approval. The full online questionnaire used for data collection is provided as Supplementary Material.

Acknowledgements

Funding support was provided by the Canadian Institutes of Health Research (CIHR; FDN-154331) and Vivo for Healthier Generations (a charitable enterprise in Calgary, Canada). The project contributions of Drs. Jennie Petersen and Dalia Ghoneim are greatly appreciated.

Contributions

GRM and PKD-B conceived the study. LAN and GRM undertook the analysis. All authors contributed to the interpretation of results. LAN drafted the first version of the manuscript. All authors contributed to the final version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

The University of Calgary Conjoint Health Research Ethics Board approved the original study (REB#19-1910; January 21, 2020) and the secondary analysis (REB#23-1487; October 27, 2013). The study was conducted in accordance with the Declaration of Helsinki and with the ethical principles outlined in Canada's Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS-2).

Informed consent

Participants interested in participating in the study were provided with an online study information and consent form prior to being granted access to the online survey (April to June 2020). Participants provided online written consent by selecting "I consent to participating in the

study". Participants consented to data collection, use of their data for study purposes, and the publication of results generated from their data. All participants consented

ARTICLE IN PRESS

REFERENCES

Andermo, S., Rydberg, H., & Norman, Å. (2021). Variations in perceptions of parenting role related to children's physical activity and sedentary behaviours – a qualitative study in a Northern European context. *BMC Public Health*, 21(1), 1550.
<https://doi.org/10.1186/s12889-021-11537-7>

Brown, H. E., Atkin, A. J., Panter, J., Wong, G., Chinapaw, M. J., & van Sluijs, E. M. (2016). Family-based interventions to increase physical activity in children: a systematic review, meta-analysis and realist synthesis. *Obesity Reviews*, 17(4), 345-360.
<https://doi.org/10.1111/obr.12362>

Caldwell, H. A. T., Campbell, J. E., Preston, A., Bhamra, S., Kirk, S. F. L., Faulkner, G., Tremblay, M. S., & Moore, S. A. (2025). Associations between parent and child 24-hour movement behaviours across the COVID-19 pandemic in Canada. *Journal of Activity, Sedentary and Sleep Behaviors*, 4(1), 10. <https://doi.org/10.1186/s44167-025-00081-z>

Craig, C., Marshall, A., Sjostrom, M., Bauman, A., Booth, M., Ainsworth, B., Pratt, M., Ekelund, U., Yngve, A., Sallis, J., & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, 35(8), 1381-1395. <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>

Davids, E. L., & Roman, N. V. (2014). A systematic review of the relationship between parenting styles and children's physical activity. *African Journal for Physical Health Education, Recreation and Dance*, 20(sup-2), 228-246.
<https://doi.org/doi:10.10520/EJC162511>

Emm-Collison, L. G., Lewis, S., Reid, T., Matthews, J., Sebire, S. J., Thompson, J. L., & Jago, R. (2019). Physical activity during the school holidays: Parent perceptions and practical

considerations. *International Journal of Environmental Research and Public Health*, 16(10), 1697. <https://doi.org/10.3390/ijerph16101697>

Eyler, A. A., Schmidt, L., Beck, A., Gilbert, A., Kepper, M., & Mazzucca, S. (2021). Children's Physical activity and screen time during COVID-19 pandemic: A qualitative exploration of parent perceptions. *Health Behavior and Policy Review*, 8(3), 236-246. <https://doi.org/10.14485/hbpr.8.3.5>

Filanowski, P. M., & Slade, E. (2023). Better together? Comparing physical activity of parents walking outdoors with and without their child. *Sports Medicine and Health Science*, 5(3), 190-195. <https://doi.org/10.1016/j.smhs.2023.07.007>

Fuemmeler, B. F., Anderson, C. B., & Mâsse, L. C. (2011). Parent-child relationship of directly measured physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1), 17. <https://doi.org/10.1186/1479-5868-8-17>

Garriguet, D., Colley, R., & Bushnik, T. (2017). Parent-Child association in physical activity and sedentary behaviour. *Health Reports*, 28(6), 3-11.

Hayes, G., Dowd, K. P., MacDonncha, C., & Donnelly, A. E. (2019). Tracking of physical activity and sedentary behavior from adolescence to young adulthood: A systematic literature review. *Journal of Adolescent Health*, 65(4), 446-454. <https://doi.org/10.1016/j.jadohealth.2019.03.013>

Hidding, L. M., Altenburg, T. M., Mokkink, L. B., Terwee, C. B., & Chinapaw, M. J. M. (2017). Systematic review of childhood sedentary behavior questionnaires: What do we know and what is next? *Sports Medicine*, 47(4), 677-699. <https://doi.org/10.1007/s40279-016-0610-1>

Hidding, L. M., Chinapaw, M. J. M., van Poppel, M. N. M., Mokkink, L. B., & Altenburg, T. M. (2018). An updated systematic review of childhood physical activity questionnaires. *Sports Medicine*, 48(12), 2797-2842. <https://doi.org/10.1007/s40279-018-0987-0>

Jago, R., Fox, K. R., Page, A. S., Brockman, R., & Thompson, J. L. (2010). Parent and child physical activity and sedentary time: Do active parents foster active children? *BMC Public Health*, 10(1), 194. <https://doi.org/10.1186/1471-2458-10-194>

Jago, R., Stamatakis, E., Gama, A., Carvalhal, I. M., Nogueira, H., Rosado, V., & Padez, C. (2012). Parent and child screen-viewing time and home media environment. *American Journal of Preventive Medicine*, 43(2), 150-158. <https://doi.org/10.1016/j.amepre.2012.04.012>

Kohl, H. W., 3rd, & Hobbs, K. E. (1998). Development of physical activity behaviors among children and adolescents. *Pediatrics*, 101(3 Pt 2), 549-554.

Leblanc, A., Gunnell, K., Prince, S., Saunders, T., Barnes, J., & Chaput, J.-P. (2017). The ubiquity of the screen: An overview of the risks and benefits of screen time in our modern world. *Translational Journal of the American College of Sports Medicine*, 2, 104-113. <https://doi.org/10.1249/TJX.0000000000000039>

Loprinzi, P. D., & Cardinal, B. J. (2011). Measuring children's physical activity and sedentary behaviors. *Journal of Exercise Science & Fitness*, 9(1), 15-23. [https://doi.org/10.1016/S1728-869X\(11\)60002-6](https://doi.org/10.1016/S1728-869X(11)60002-6)

Lubans, D. R., Hesketh, K., Cliff, D. P., Barnett, L. M., Salmon, J., Dollman, J., Morgan, P. J., Hills, A. P., & Hardy, L. L. (2011). A systematic review of the validity and reliability of sedentary behaviour measures used with children and adolescents. *Obesity Reviews*, 12(10), 781-799. <https://doi.org/10.1111/j.1467-789X.2011.00896.x>

McCormack, G. R., Doyle-Baker, P. K., Petersen, J. A., & Ghoneim, D. (2020). Parent anxiety and perceptions of their child's physical activity and sedentary behaviour during the COVID-19 pandemic in Canada. *Preventive Medicine Reports*, 20, 101275.

<https://doi.org/10.1016/j.pmedr.2020.101275>

McCormack, G. R., Doyle-Baker, P. K., Petersen, J. A., & Ghoneim, D. (2021). Perceived anxiety and physical activity behaviour changes during the early stages of COVID-19 restrictions in community-dwelling adults in Canada: a cross-sectional study. *BMJ Open*, 11(8), e050550. <https://doi.org/10.1136/bmjopen-2021-050550>

McCormack, G. R., & Mardinger, C. (2015). Neighbourhood urban form and individual-level correlates of leisure-based screen time in Canadian adults. *BMJ Open*, 5(11), e009418.

<https://doi.org/10.1136/bmjopen-2015-009418>

Mitchell, J., Skouteris, H., McCabe, M., Ricciardelli, L. A., Milgrom, J., Baur, L. A., Fuller-Tyszkiewicz, M., & Dwyer, G. (2012). Physical activity in young children: a systematic review of parental influences. *Early Child Development and Care*, 182(11), 1411-1437.

<https://doi.org/10.1080/03004430.2011.619658>

Moore, S. A., Faulkner, G., Rhodes, R. E., Brussoni, M., Chulak-Bozzer, T., Ferguson, L. J., Mitra, R., O'Reilly, N., Spence, J. C., Vanderloo, L. M., & Tremblay, M. S. (2020). Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 85. <https://doi.org/10.1186/s12966-020-00987-8>

Moore, S. A., Faulkner, G., Rhodes, R. E., Vanderloo, L. M., Ferguson, L. J., Guerrero, M. D., Brussoni, M., Mitra, R., O'Reilly, N., Spence, J. C., Chulak-Bozzer, T., & Tremblay, M. S. (2021). Few Canadian children and youth were meeting the 24-hour movement behaviour guidelines 6-months into the COVID-19 pandemic: Follow-up from a national

study. *Applied Physiology, Nutrition, and Metabolism*, 46(10), 1225-1240. <https://doi.org/10.1139/apnm-2021-0354>

Neville, R. D., Lakes, K. D., Hopkins, W. G., Tarantino, G., Draper, C. E., Beck, R., & Madigan, S. (2022). Global changes in child and adolescent physical activity during the COVID-19 pandemic: A systematic review and meta-analysis. *JAMA Pediatrics*, 176(9), 886-894. <https://doi.org/10.1001/jamapediatrics.2022.2313>

Ostermeier, E., Tucker, P., Tobin, D., Clark, A., & Gilliland, J. (2022). Parents' perceptions of their children's physical activity during the COVID-19 pandemic. *BMC Public Health*, 22(1), 1459. <https://doi.org/10.1186/s12889-022-13829-y>

Patrick, H., Hennessy, E., McSpadden, K., & Oh, A. (2013). Parenting styles and practices in children's obesogenic behaviors: Scientific gaps and future research directions. *Childhood Obesity*, 9(s1), S-73-S-86. <https://doi.org/10.1089/chi.2013.0039>

Petersen, T. L., Møller, L. B., Brønd, J. C., Jepsen, R., & Grøntved, A. (2020). Association between parent and child physical activity: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 67. <https://doi.org/10.1186/s12966-020-00966-z>

Prochaska, J. J., Sallis, J. F., & Long, B. (2001). A physical activity screening measure for use with adolescents in primary Care. *Archives of Pediatrics & Adolescent Medicine*, 155(5), 554-559. <https://doi.org/10.1001/archpedi.155.5.554>

Pugliese, J., & Tinsley, B. (2007). Parental socialization of child and adolescent physical activity: a meta-analysis. *Journal of Family Psychology*, 21(3), 331-343. <https://doi.org/10.1037/0893-3200.21.3.331>

Ross, R., Chaput, J.-P., Giangregorio, L. M., Janssen, I., Saunders, T. J., Kho, M. E., Poitras, V. J., Tomasone, J. R., El-Kotob, R., McLaughlin, E. C., Duggan, M., Carrier, J., Carson,

V., Chastin, S. F., Latimer-Cheung, A. E., Chulak-Bozzer, T., Faulkner, G., Flood, S. M., Gazendam, M. K., . . . Tremblay, M. S. (2020). Canadian 24-Hour Movement Guidelines for Adults aged 18–64 years and Adults aged 65 years or older: An integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, 45(10 (Suppl. 2)), S57-S102. <https://doi.org/10.1139/apnm-2020-0467>

Salway, R., Walker, R., Sansum, K., House, D., Emm-Collison, L., Reid, T., Breheny, K., Williams, J. G., de Vocht, F., Hollingworth, W., Foster, C., & Jago, R. (2023). Screen-viewing behaviours of children before and after the 2020–21 COVID-19 lockdowns in the UK: a mixed methods study. *BMC Public Health*, 23(1), 116. <https://doi.org/10.1186/s12889-023-14976-6>

Saunders, T. J., McIsaac, T., Douillette, K., Gaulton, N., Hunter, S., Rhodes, R. E., Prince, S. A., Carson, V., Chaput, J.-P., Chastin, S., Giangregorio, L., Janssen, I., Katzmarzyk, P. T., Kho, M. E., Poitras, V. J., Powell, K. E., Ross, R., Ross-White, A., Tremblay, M. S., & Healy, G. N. (2020). Sedentary behaviour and health in adults: An overview of systematic reviews. *Applied Physiology, Nutrition, and Metabolism*, 45(10 (Suppl. 2)), S197-S217. <https://doi.org/10.1139/apnm-2020-0272> %M 33054341

Sterdt, E., Liersch, S., & Walter, U. (2014). Correlates of physical activity of children and adolescents: A systematic review of reviews. *Health Education Journal*, 73(1), 72-89. <https://doi.org/10.1177/0017896912469578>

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., McDermott, D., Schuch, F., & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: A systematic review. *BMJ Open Sport and Exercise Medicine*, 7(1), e000960. <https://doi.org/10.1136/bmjsem-2020-000960>

Surveillance, C. f., & Applied Research Public Health Agency of Canada. (2023). Physical Activity, Sedentary Behaviour and Sleep (PASS) Indicators, 2023 Edition. *Public Health Infobase*.

Swelam, B. A., Verswijveren, S. J. J. M., Salmon, J., Arundell, L., & Ridgers, N. D. (2022). Exploring activity compensation amongst youth and adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, 19(1), 25. <https://doi.org/10.1186/s12966-022-01264-6>

Tremblay, M. S., Carson, V., Chaput, J.-P., Gorber, S. C., Dinh, T., Duggan, M., Faulkner, G., Gray, C. E., Gruber, R., Janson, K., Janssen, I., Katzmarzyk, P. T., Kho, M. E., Latimer-Cheung, A. E., LeBlanc, C., Okely, A. D., Olds, T., Pate, R. R., Phillips, A., . . . Zehr, L. (2016). Canadian 24-Hour Movement Guidelines for Children and Youth: An integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, 41(6 (Suppl. 3)), S311-S327. <https://doi.org/10.1139/apnm-2016-0151>

Tremblay, M. S., LeBlanc, A. G., Kho, M. E., Saunders, T. J., Larouche, R., Colley, R. C., Goldfield, G., & Gorber, S. C. (2011). Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1), 98. <https://doi.org/10.1186/1479-5868-8-98>

Trost, S. G., & Loprinzi, P. D. (2011). Parental Influences on Physical Activity Behavior in Children and Adolescents: A Brief Review. *American Journal of Lifestyle Medicine*, 5(2), 171-181. <https://doi.org/10.1177/1559827610387236>

Woodland, L., Hodson, A., Webster, R. K., Amlôt, R., Smith, L. E., & Rubin, G. J. (2022). A qualitative study about how families coped with managing their well-being, children's physical activity and education during the COVID-19 school closures in England. *PLoS ONE*, 17(12), e0279355. <https://doi.org/10.1371/journal.pone.0279355>

World Health Organization. (2020). *WHO Director-General's opening remarks at the media briefing on COVID-19*. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020> [accessed June 19 2024]

Yao, C. A., & Rhodes, R. E. (2015). Parental correlates in child and adolescent physical activity: a meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 12(1), 10. <https://doi.org/10.1186/s12966-015-0163-y>

ARTICLE IN PRESS

Table 1. Sample characteristics for girls (n = 149) and boys (n = 180)

Characteristics	Category	Pooled Mean (SD) or %	Girls Mean (SD) or %	Boys Mean (SD) or %
Parent MVPA (hrs/wk)		7.6 (6.8)	7.4 (6.4)	7.8 (7.4)
Parent recreational screen time (hrs/wk)		19.9 (19.1)	20.3 (20.7)	19.6 (17.7)
Parent age (years)		42.7 (8.9)	43.0 (8.4)	42.3 (9.3)
Parent gender	<i>Male</i>	32.8	32.9	32.8
	<i>Female</i>	67.2	67.1	67.2
Parent highest education completed	<i>High school or less</i>	15.2	14.8	15.6
	<i>Trade, diploma, some university</i>	26.4	25.5	27.2
	<i>University</i>	58.4	59.7	57.2
Annual gross household income	<i>≤\$79 999</i>	18.8	17.4	20.0
	<i>\$80 000 to \$119 999</i>	22.2	22.8	21.7
	<i>≥\$120 000</i>	38.0	40.3	36.1
	<i>Don't know/refused</i>	21.0	19.5	22.2
Parent marital status	<i>Married or common law</i>	82.7	84.6	81.1
	<i>Other</i>	17.3	15.4	18.9
Parent employment status	<i>Full-time</i>	53.2	58.4	48.9
	<i>Part-time</i>	17.0	15.4	18.3
	<i>Not employed</i>	29.8	26.2	32.8
Parent COVID-19 anxiety	<i>Extreme or very anxious</i>	35.9	34.2	37.2
	<i>Not extreme or very anxious</i>	64.1	65.8	62.8
Children <18 years in household		1.9 (0.9)	1.9 (0.8)	1.8 (0.9)
Child age (years)		10.7 (4.0)	10.7 (4.0)	10.7 (4.0)
Child gender	<i>Boy</i>	54.7	0	54.7
	<i>Girl</i>	45.3	45.3	0
Child ethnicity	<i>Non-white</i>	45.3	47.7	43.3
	<i>White</i>	54.7	52.3	56.7
Child MVPA	<i>≥60 min 7 days/wk</i>	16.7	14.8	18.3
Child TV/video watching	<i>≥2 hrs/day</i>	74.2	75.8	72.8
Child video games/computer	<i>≥2 hrs/day</i>	63.6	55.7	70.0
Child other screen devices	<i>≥2 hrs/day</i>	60.6	58.4	62.8
Child engaged in any screen time activity	<i>≥2 hrs/day</i>	87.5	86.6	88.3

Table 2. Covariate-adjusted binary logistic regression estimates for associations between parent MVPA and recreational screen time and children's MVPA and screen time.

Correlates	Achieving ≥ 60 minutes MVPA 7 days/week		≥ 2 hrs/day watching TV/videos		≥ 2 hrs/day video gaming/computer		≥ 2 hrs/day using other screen devices		≥ 2 hrs/day any screen time activity	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Pooled sample (n = 329)										
Parent MVPA (hrs/wk)	1.05*	1.01, 1.09	1.04	0.99, 1.08	1.00	0.96, 1.04	1.03	0.99, 1.07	1.06	0.98, 1.14
Parent recreational screen time (hrs/wk)	0.97*	0.95, 0.99	1.06*	1.02, 1.09	1.03*	1.01, 1.04	1.02*	1.01, 1.04	1.12*	1.04, 1.19

CI: Confidence interval

OR: Odds ratio

Models adjusted for: Parent MVPA, parent recreational screen time parent age, parent gender, parent highest education completed, annual gross household income, parent marital status, parent employment status, parent COVID-19 anxiety, children <18 years in household, child gender, child age, child's ethnicity.

N=329

* $p < .05$