

Leisure time activities of children: Inequalities, determinants, and inter-relations

Daniela Rodrigues^{*1 2}, Aida Isabel Tavares^{3 4}, Aristides M. Machado-Rodrigues^{1 5}, Augusta Gama^{1 6}, Helena Nogueira^{1 7}, Maria-Raquel G. Silva^{1 8}, Cristina Padez^{1 2}

¹ CIAS – Research Centre for Anthropology and Health, University of Coimbra, Coimbra, Portugal

² DCV – Department of Life Sciences, University of Coimbra, Coimbra, Portugal

³ CEISUC - Centre for Health Studies and Research, University of Coimbra, Coimbra, Portugal

⁴ ISEG - Lisbon School of Economics and Management, University of Lisbon, Lisbon, Portugal

⁵ Faculty of Sport Sciences and Physical Education, University of Coimbra, Coimbra, Portugal

⁶ Faculty of Sciences, Department of Animal Biology, University of Lisbon, Lisbon, Portugal

⁷ Faculty of Arts and Humanities, University of Coimbra, Coimbra, Portugal

⁸ Faculty of Health Sciences, University Fernando Pessoa, Porto, Portugal

* rodrigues1323@gmail.com

ORIGINAL ARTICLE

Submitted: 13 October 2023

Accepted: 15 April 2024

Published: 1 October 2024

Editor-in-Chief:

Claudio R. Nigg, University of Bern, Switzerland

Section Editor:

Martin Keller, University of Basel, Switzerland

ABSTRACT

More studies should adopt a combined approach to modifiable lifestyle behaviors because of their potential synergistic effects on health. This study aims to

1. observe how boys and girls allocate their time on different activities, during week and weekend days,
2. investigate the time inter-relations between different leisure activities, and
3. analyze how child and familial characteristics are associated with children's time use in multiple activities.

In 2016/17, a validated questionnaire collected data from 3-10-year-old Portuguese children ($n = 8,472$). Parents reported their children's time use in different behaviors: sleep, study, screen media use, indoor and outdoor play, and school commute, as well as children's participation in sports, and socio-economic characteristics of the family. A combination of statistical analysis (e.g., t -tests, pairwise correlations and multiple linear regression) revealed that:

1. boys reportedly have higher screen time than girls, but they also accumulate more time in outdoor play;

2. the time spent in different activities was determined by a set of family sociodemographic factors, such as urbanization and parental employment; and
3. exists some inter-relation between leisure activities with high screen time being significantly associated with less sport participation and less sleep duration.

Identifying time spent in multiple activities that differ by sex (and associated determinants) is critical for the development of activity promotion strategies, and may help to inform evidence-based policies designed to increase physical activity and decrease sedentary behavior in young children. Present findings highlight the growing importance of electronic media in children's life and how they can displace other leisure activities.

Keywords

screen time, physical activity, time use, sex inequalities, socio-economic

Citation:

Rodrigues, D., Tavares, A. I., Machado-Rodrigues, A. M., Gama, A., Nogueira, H., Silva, M.-R. G., & Padez, C. (2024). Leisure time activities of children: Inequalities, determinants, and inter-relations. *Current Issues in Sport Science*, 9(1), Article 008. <https://doi.org/10.36950/2024.9ciss008>

Introduction

The type of activities performed during leisure time can go along with an increased or decreased risk to children's health and psychological wellbeing. For example, sufficient physical activity has been shown to contribute to physical and mental health (World Health Organization, 2019), whereas excessive screen time has shown negative associations with physical, cognitive and emotional abilities (Muppalla et al., 2023). Moreover, how children spend their free time may affect leisure activities in adolescence and adulthood (Rovio et al., 2018; Telama et al., 2005). For this reason, it is important to investigate the leisure activities of children.

The use of screen-based media plays an increasing role in the leisure activities of children, including those below the age of 5 years (McArthur et al., 2022).

In Portugal, screen time varies between 2.5 and 3.3 hours for pre- and school-aged children (Rodrigues et al., 2020). In general, boys spend more time using media (especially computer and video games) than girls (Rodrigues et al., 2020). Physical activity represents another important leisure activity for children. However, the literature shows that a large proportion of children are not sufficiently active nor fit enough, particularly girls (Pizarro et al., 2023) Telford et al., 2016). Furthermore, the prevalence of active play, active transport and organized sports participation seems to have decreased among Portuguese children in the last five years (Pizarro et al., 2023).

Most previous studies focused on one leisure activity only. However, some have also investigated inter-relations between different leisure activities (Auhuber, 2019; Xie et al., 2017). A direct negative relationship between media use and physical activity has been

noted, although some studies also observed that those activities coexist rather than compete (Marshall et al., 2004; Taverno Ross et al., 2016). Despite intensive research in the leisure behavior of youth, some research gaps remain. For example, few studies explored how time spent in one activity related with the time in other activities in young children, and even less attention has been given to sex differences in daily physical activity behavior (Brazo-Sayavera et al., 2021; Mauldin & Meeks, 1990; Whitin et al., 2021).

The present study provides an investigation on how children aged 3 to 10 years allocate their time on different leisure activities. The focus is put on differences in these activities depending on the period of the week (weekdays vs. weekend), children's sex and age, as well as on inter-relations between time spent on different activities. We also explore individual and familial characteristics associated with children's time use in multiple leisure activities. This study hopes to contribute to the development of evidence-based public policies that reduce screen time and promote active leisure activities by:

1. indicating whether certain groups of children differ in their leisure behavior,
2. observe if the duration of certain leisure activities may favor or displace the engagement in other activities, and
3. detect harmful combinations of leisure behaviors.

Methods

Participants

The data used for this study was collected between November 2016 and April 2017 under the ObesInCrisis project. All 3 to 10 year old children from 118 public and private schools from Porto, Coimbra and Lisbon (three of the major districts in mainland Portugal, located North, center North and center South, respectively) were invited to participate. The procedure has been described elsewhere (Rodrigues et al., 2020). In

total, 8,472 children (50.8% male) with an average age of 7.17 ($SD = 1.91$) were included.

Informed written consent was received from the parents of all participants. The protocol was approved by Direção Geral do Ensino (Portuguese Ministry of Education) and Comissão Nacional de Proteção de Dados (CNPd), the Portuguese Data Protection Authority (Authorization number 745/2017). All procedures were in accordance with the 1964 Helsinki declaration and its later amendments.

Measures

Major leisure activities of children were assessed via a questionnaire. The duration (minutes per day, on weekdays and weekend) of screen-based media use (including television, computer, video-games, tablet and smartphone), indoor (e.g. "How much time per day does your child engage in passive play such as, reading, making puzzles, and playing with dolls/cars?") and outdoor play (e.g. "How much time per day does your child play to make him/her sweat and breath hard such as, playing ball, and riding bicycle?"), study time, active commuting, and sleep were reported by the parents as we consider that children aged 10 years or younger were not able to estimate how much time they spend with different leisure activities. Sleep time derived from parent-reported bedtime and wake-up time. For the other leisure activities, parents were asked to choose between seven different answer options: none (= 0), less than 1 hr/day (~30 min/day), 1 hr/day (60 min/day), 2 hr/day (120 min/day), 3 hr/day (180 min/day), 4 hr/day (240 min/day), and more than 4 hr/day (~270 min/day). Parents also reported children's participation in organized sports (0: no/1: yes).

The child characteristics considered in this study were: sex (0: male/1: female), age (continuous), siblings (0: none/1: one or more), type of family (0: live with both parents/1: live with a single parent), and neighborhood's degree of urbanization (0: less urbanized/1: most urbanized; Instituto Nacional de Estatística, n.d.). The parents' characteristics included age (continuous), education (e.g., number of complete school), and job status (0: unemployed/1: employed). All the measures

are described and summarized in Table 5 in the appendix.

Statistical analysis

First, *t*-tests were used to check mean differences in the duration of leisure activities according to sex, during both weekdays and weekends. The second analysis, pairwise correlations, investigated correlations between the duration of leisure activities. Pairwise correlations have the advantage of using the maximum amount of information available and do not exclude cases with missing data (e.g., the case is only excluded for those correlations where one variable or the other has missing values). To examine screen time (dependent variable) based on the participation in other leisure activities (independent variables: indoor play, outdoor play, school commute, study-time, sleep duration), linear regressions were used, adjusted for child characteristics (e.g., sex, age, siblings, type of family and neighborhood's degree of urbanization). Finally, multiple linear regressions were used, one for each child's leisure activity (e.g., screen time, study time, time in indoor and outdoor play as dependent variables) and using child and parents' characteristics as independent variables. STATA16 was used for all statistical analyses and statistical significance was set at 0.05. STATA procedures to perform computations and estimations are optimized for the available data,

that is, given the whole sample, STATA uses all possible cases with information and disregards cases with missing data. For this reason, some procedures have more, others less, number of observations. In Table 5 in the appendix, the summary of statistical description of variables is presented.

Results

The distribution of the different leisure activities can be seen in Table 1, separately for boys and girls. Besides sleep, outdoor play was the leisure activity that took up a larger portion of their daily schedule, independently of children's sex. There were statistical differences across sexes for all leisure activities. Boys spent significantly more time in outdoor play and accumulated more screen time, while girls accumulated significantly more time of study and indoor play. As children get older, the number of minutes per day (min/day) using media devices increases while the number of min/day playing outdoor decreases (Table 6 in the appendix). Findings show that the amount of screen time that increased between children aged 3 and 10 years, is about the same as the decreased time spent on outdoor activities between those same ages (a trade-off of ~30 min/day). About 62% of the boys ($n = 2,381$) and 58% of the girls ($n = 2,186$) were engaged in an organized sport (data not shown).

Table 1

Descriptive characteristics of the time use indicators of the study sample ($n = 8,472$).

Time (min/day)	Weekday		t-test	Weekend		t-test
	Boys	Girls	<i>p</i> -value	Boys	Girls	<i>p</i> -value
Sleep	604.4	603.4	0.256	636.1	647.2	0.000
Commute to school	28.2	28.4	0.614	NA	NA	NA
Outdoor play	68.6	64.8	0.010	150.3	144.7	0.003
Screen	20.8	18.8	0.000	49.6	42.4	0.000
Study	50.8	54.3	0.011	49.6	54.1	0.000
Indoor play	61.0	64.2	0.015	126.0	144.1	0.000

NA: not applicable. Boldface indicates statistical significance ($p < 0.05$).

The correlation between leisure activities are shown in Table 2. During weekdays, the strongest positive correlations were found between indoor and outdoor play-time and between screen time and indoor play, while sleep time was negatively correlated with commute

time. The correlations between leisure activities were weaker during the weekend days, but positive correlations were found between indoor and outdoor play, and between screen- and study time.

Table 2

Correlations of time use indicators (min/day) during the weekdays and the weekend.

Time*weekdays	Sleep	Outdoor play	Screen	Study	Indoor play	School commuting
Sleep	1.000					
Outdoor play	0.052 (0.000)	1.000				
Screen	-0.068 (0.000)	0.239 (0.000)	1.000			
Study	-0.053 (0.000)	0.181 (0.000)	0.205 (0.000)	1.000		
Indoor play	0.115 (0.000)	0.372 (0.000)	0.254 (0.000)	0.185 (0.000)	1.000	
School commuting	-0.245 (0.000)	-0.055 (0.000)	-0.046 (0.001)	-0.005 (0.728)	-0.073 (0.000)	1.000
Time*weekend	Sleep	Outdoor play	Screen	Study	Indoor play	NA
Sleep	1.000					
Outdoor play	0.081 (0.000)	1.000				
Screen	-0.058 (0.000)	0.049 (0.000)	1.000			
Study	0.048 (0.000)	0.053 (0.000)	0.151 (0.000)	1.000		
Indoor play	0.079 (0.000)	0.246 (0.000)	-0.040 (0.002)	0.040 (0.002)	1.000	

NA: not applicable. Boldface indicates statistical significance ($p < 0.05$).

The results of the linear regression analysis for associations of total screen time with other leisure activities are presented in Table 3. Overall the results were weak, but relevant effects were found for the sleep duration. Children who spend more time sleeping, spend less time using screens (~3 min/day on weekdays). Also, children who practiced an organized sport,

spent less time on screens, especially on weekends. Similar results were found for boys and girls separately, but for girls, the time trade-off between screen time and sleep time, and between screen time and sport participation was less intense than for boys (Table 7 in the appendix). As shown by the estimated coefficients, for each additional year of age, and con-

trolling for the remaining time allocation in other leisure activities, screen time increased on average 1.2 min/day during the week (8.4 min/day from 3 to 10

year old) and 3.8 min/day during the weekends (26.6 min/day from 3 to 10 year old).

Table 3

Linear regressions for daily time allocation across different leisure activities and screen time.

Screen time (min/day)	Weekday			Weekend		
	Coef.	SE	<i>P</i> > <i>t</i>	Coef.	SE	<i>P</i> > <i>t</i>
Age	1.195	0.173	0.000	3.788	0.254	0.000
Boy	2.879	0.535	0.000	8.245	0.819	0.000
Sleep	-3.004	0.459	0.000	-0.037	0.008	0.000
Organized sport	-4.268	0.560	0.000	-8.067	0.844	0.000
Outdoor play	0.042	0.005	0.000	0.020	0.005	0.000
Study	0.038	0.005	0.000	0.055	0.009	0.000
Indoor play	0.080	0.006	0.000	0.002	0.006	0.732
School commuting	-0.043	0.012	0.000	NA	NA	NA
_cons	33.957	5.130	0.000	37.846	5.976	0.000

NA: not applicable. Boldface indicates statistical significance ($p < 0.05$).

Children's daily time in leisure activities was associated with individual and family factors (Table 4). Boys spent significantly more time using screen media devices than girls (weekday: +2.366 min/day; weekend: +8.160 min/day), while an inverse significant association was found with multiple family socio-economic indicators, particularly mother's job status. Children whose mothers were employed (vs. unemployed), had less screen time (weekday: -4.142 min/day; weekend: -4.500 min/day). Study time was particularly associated with children's age, meaning that older children accumulated more time in this activity than younger

children, both during the weekdays (+7.978 min/day) and the weekend (+7.728 min/day). On weekdays, outdoor play was significantly longer in boys (vs. girls; +4.888 min/day), but shorter in children with employed mothers (vs. unemployed; -6.923 min/day). During the weekend, outdoor play was positively associated with living in an urban area (vs. non-urban; +14.920 min/day), but took less time in older children (vs. younger; -4.136 min/day). Indoor play was mostly associated with children's sex and age, with older children and boys spending approximately less 8-10 min/day and 3-19 min/day, respectively, playing indoors.

Table 4

Linear regression analysis for the prediction of time use (min/day) indicators during weekdays and weekends.

Weekday	Screen time		Study time		Outdoor play		Indoor play	
	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>
Age	0.657	0.000	7.978	0.000	-3.354	0.000	-8.577	0.000
Boy	2.366	0.000	-1.989	0.161	4.888	0.002	-3.278	0.016
Residence (urban area)	-2.756	0.000	-0.089	0.970	0.538	0.830	-4.049	0.056
Siblings	-1.522	0.007	0.217	0.896	-0.116	0.949	-2.090	0.179
Father age	-0.026	0.656	0.162	0.348	-0.034	0.861	-0.401	0.015
Father education	-0.142	0.146	-0.189	0.509	-0.167	0.604	0.169	0.538
Father job (employed)	-3.265	0.001	1.099	0.704	-6.567	0.044	-1.865	0.503
Mother age	-0.140	0.039	-0.663	0.001	-0.284	0.203	-0.030	0.876
Mother education	-0.602	0.000	-1.010	0.002	-0.441	0.234	0.288	0.362
Mother employed	-4.142	0.000	-2.409	0.269	-6.923	0.005	-6.682	0.001
Type of family (single parent)	-1.305	0.078	1.233	0.556	0.296	0.904	-1.951	0.345
_cons	40.782	0.000	26.944	0.000	119.216	0.000	149.985	0.000
Weekend	Screen time		Study time		Outdoor play		Indoor play	
	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>
Age	4.116	0.000	7.728	0.000	-4.136	0.000	-10.291	0.000
Boy	8.160	0.000	-2.858	0.025	6.775	0.001	-19.377	0.000
Residence (urban area)	-3.794	0.001	4.644	0.028	14.920	0.000	-7.385	0.011
Siblings	-1.127	0.178	2.200	0.141	4.190	0.070	-0.884	0.678
Father age	-0.022	0.805	0.459	0.003	-0.329	0.179	-0.126	0.575
Father education	-0.524	0.000	0.027	0.918	-0.759	0.062	0.302	0.420
Father job (employed)	-1.591	0.294	3.746	0.150	-0.257	0.950	7.081	0.063
Mother age	-0.292	0.004	-0.513	0.004	-1.446	0.000	-0.557	0.032
Mother education	-1.041	0.000	-0.900	0.002	-2.077	0.000	0.602	0.161
Mother employed	-4.500	0.000	-0.563	0.775	2.421	0.431	-9.220	0.001
Type of family (single parent)	-0.107	0.923	3.824	0.042	2.122	0.492	1.992	0.481
_cons	54.820	0.000	-4.565	0.485	255.245	0.000	243.058	0.000

NA: not applicable. Boldface indicates statistical significance ($p < 0.05$).

Discussion

The present study examined leisure activities of children aged 3 to 10 year old. The duration of leisure activities differed according to children's sex, possibly highlighting children's preferences. Furthermore, the interaction of different leisure activities was consid-

ered, and associations of total screen time with other leisure activities was assessed.

Leisure activities differed according to children's sex and age

Overall, girls, compared to boys, spent more time in sedentary or light intensity activities (e.g., studying, indoor play), except for screen time which was significantly higher in boys. Boys also accumulated more time in outdoor play. These results correspond to the current state of research (Auhuber, 2019; Nagata et al., 2022), including those using accelerometers (Hubbard et al., 2016; Kallio et al., 2020). Boys seem to be more active during all periods of the day, except evenings, and have a larger amount of play time outside than their female counterparts, who tend to spend more time playing indoors in more static types of play (Boxberger & Reimers, 2019).

While older children used screen-based media more frequently, they were also less physically active. This finding is in line with previous studies (Auhuber, 2019; Friel et al., 2020). The present study shows that after adjustment for child's sex, age, siblings, type of family and neighborhood's degree of urbanization, screen time differences between 3 and 10 year old were 5/8 min/day during weekdays and 27/29 min/day during the weekend. On the other hand, the amount of time dedicated to playing outdoors decreased to a similar amount of time. By the age of 10, there was a trade-off of ~30 minutes of additional screen time against less outdoor play. Such findings are alarming given the substantive literature showing that physical activity in childhood and adolescence are predictive of physical activity in adulthood (Lounassalo et al., 2019; Telama et al., 2005).

Overall, the results highlight the need to inform families about the importance of limiting media usage time and promoting active leisure activities, especially in older children and girls. Interventions integrated into primary health care and school education programs are recommended to educate parents from all socio-economic backgrounds while facilitating the access to recreational facilities in school settings.

Relationship between total screen time and other leisure activities

Overall, the correlations between multiple leisure activities were weak, particularly on weekends. Of note, children participating in an organized sport had lower screen time than children not engaging in sport. This finding agrees with previous studies that found an association between media use and physical activity (Allen & Vella, 2015; Araújo et al., 2018; Auhuber, 2019; Mäkelä et al., 2016; Sandercock et al., 2012). It is possible that the time spent in sports, including the travel to those facilities, diminish the available free time that could be spent in screen-media devices. Physical activity has been positively associated with playing outdoors (Auhuber, 2019; Lee et al., 2021). However, contradictory results have been reported in other studies which did not find any associations (Dahlgren et al., 2021; Taverno Ross et al., 2016). Previous research in Portugal observed that more active groups also accumulate more screen time, indicating that physical activity and sedentary behavior are not two sides of the same coin (Machado-Rodrigues et al., 2012).

Children with higher sleep time have less screen time. This is consistent with previous findings (Hale & Guan, 2015; Janssen et al., 2020; Rodrigues et al., 2021). Many studies have indicated that the extent of screen time among children and adolescents is associated with shorter total sleep time (Akacem et al., 2018), either by postpone bedtime to prolong screen entertainment, disrupting sleep because of the psychological stimulation from media content, or by screen-based light reducing sleepiness.

Parents' characteristics influence children's time use activities

The strength of the association between parental characteristics and children's time spent on different leisure activities differed by days of the week, being stronger on weekends than on weekdays. Similar results were previously observed (An et al., 2021; Jago

et al., 2014). Children's physical activity is likely to be more influenced by their parents on weekends, since they spend more time together. This influence has two dimensions, namely: parents are involved as guides (i.e., influencing their children's choices and enhancing their interests), and parents participate in these activities with their children (i.e., organizing and funding, serving as role models; Wheeler, 2014).

Children whose parents had a higher education level or were employed, had lower screen time and outdoor play time. Similar results for screen time were reported in other studies (Auhuber, 2019; Cameron et al., 2015; Rodrigues et al., 2020), but major inconsistencies have been found when examining family socio-economic status as a potential determinant of children's outdoor time (Larouche et al., 2023). Employed or higher educated parents are more likely to engage their children to participate in organized PA (Rodrigues et al., 2018), which may result in lower amounts of outdoor play and screen time. Moreover, those parents may have greater understanding, capabilities, and skills to adopt healthy lifestyles, while unemployed parents may feel more societal pressure in the forms of the high costs of sporting activities and valuableness of learning to use screens at early ages (Määttä, 2017). On the other hand, unemployed parents may have more time and possibilities to supervise and influence children's leisure time, by accompanying them in outdoor activities.

Living in urban areas was associated with children's lower screen time, lower playtime indoors and higher outdoor play on weekends. Children who live in more urbanized areas may enjoy a more suitable environment, characterized by mixed land use and urban design that are friendlier to physical activity. Higher walk indices were found in North American children living in urban environments, except for transportation which was more common in children from rural areas (Bucko et al., 2021).

Strengths and Limitations

The strengths of the present study are the large sample, and the variety of leisure behaviors considered,

both on week and weekend days, and according to children's sex. Nonetheless, some limitations have to be noticed. The data were collected through a parental-report questionnaire so only subjective information was examined, which can be prone to bias (e.g., social desirability, recall) or parents' unawareness about their children's time use, especially on weekdays. Also, the choice of activities was limited and pre-determined by the questionnaire, and there was no data for extracurricular sport duration. Future research could explore leisure time activities with more objective measures, and use multiple informants. Besides the duration of each activity, it could be important to also assess the time of the day when the activities take place and the quality of those leisure time activities. Only sociodemographic aspects were included in the study, but future work could examine parents' own physical activity and sedentary levels, as well as their encouragement and motivations to engage in different leisure activities. Those factors could be promising for reaching a better understanding of the mechanisms through which children's leisure time may be influenced. Finally, due to the cross-sectional design, conclusions can only be made on bidirectional associations. A longitudinal study is recommended to explore the interplay between leisure activities as well as trajectories of time in leisure activities from childhood to adolescence.

In conclusion, this study shows that leisure activities differed by sex, but the time-use correlation between activities was similar between boys and girls. Overall, boys accumulate more screen time and spend more time in outdoor plays than girls. Moreover, this study suggests that sport participation and sleep time have an inverse association with screen time, but no harmful combination of leisure behaviors were detected. The leisure activities discussed in this work such as outdoor play and screen time, are known to be associated with positive and negative health outcomes, respectively. That some groups are at risk of unhealthy behaviors (i.e., higher screen time, lower outdoor play) because of their sex or social class contradicts the political goals common in many western societies that

all children are entitled to have equal opportunities. Identifying activities that differ by sex (and associated determinants) is critical for the development of activity promotion strategies, and may help to inform evidence-based practices and policies designed to increase physical activity and decrease sedentary behavior in young children.

References

- Akacem, L. D., Wright, K. P., & LeBourgeois, M. K. (2018). Sensitivity of the circadian system to evening bright light in preschool-age children. *Physiological Reports*, *6*(5), Article e13617. <https://doi.org/10.14814/phy2.13617>
- Allen, M. S., & Vella, S. A. (2015). Are the correlates of sport participation similar to those of screen time? *Preventive Medicine Reports*, *2*, 114–117. <https://doi.org/10.1016/j.pmedr.2015.02.002>
- An, M., Chen, T., Zhou, Q., & Ma, J. (2021). Paternal and maternal support on children's weekday and weekend moderate-to-vigorous physical activity: A cross-sectional study. *BMC Public Health*, *21*, Article 1776. <https://doi.org/10.1186/s12889-021-11730-8>
- Araújo, L. G. M. de, Turi, B. C., Locci, B., Mesquita, C. A. A., Fonsati, N. B., & Monteiro, H. L. (2018). Patterns of physical activity and screen time among brazilian children. *Journal of Physical Activity and Health*, *15*(6), 457–461. <https://doi.org/10.1123/jpah.2016-0676>
- Auhuber, V. L. (2019). Leisure activities of healthy children and adolescents. *International Journal of Environmental Research and Public Health*, *16*, Article 2078. <https://doi.org/10.3390/ijerph16122078>
- Boxberger, K., & Reimers, A. K. (2019). Parental correlates of outdoor play in boys and girls aged 0 to 12 – A systematic review. *International Journal of Environmental Research and Public Health*, *16*(2), Article 190. <https://doi.org/10.3390/ijerph16020190>
- Bucko, A. G., Porter, D. E., Saunders, R., Shirley, L., Dowda, M., & Pate, R. R. (2021). Walkability indices and children's walking behavior in rural vs. urban areas. *Health & Place*, *72*, Article 102707. <https://doi.org/10.1016/j.health-place.2021.102707>
- Cameron, A. J., Spence, A. C., Laws, R., Hesketh, K. D., Lioret, S., & Campbell, K. J. (2015). A review of the relationship between socioeconomic position and the early-life predictors of obesity. *Current Obesity Reports*, *4*(3), 350–362. <https://doi.org/10.1007/s13679-015-0168-5>
- Dahlgren, A., Sjöblom, L., Eke, H., Bonn, S. E., & Lagerros, Y. T. (2021). Screen time and physical activity in children and adolescents aged 10-15 years. *PLoS One*, *16*(7), Article e0254255. <https://doi.org/10.1371/journal.pone.0254255>
- Friel, C. P., Duran, A. T., Shechter, A., & Diaz, K. M. (2020). US children meeting physical activity, screen time, and sleep guidelines. *American Journal of Preventive Medicine*, *59*(4), 513–521. <https://doi.org/10.1016/j.amepre.2020.05.007>
- Hale, L., & Guan, S. (2015). Screen time and sleep among school-aged children and adolescents: A systematic literature review. *Sleep Medicine Reviews*, *21*, 50–58. <https://doi.org/10.1016/j.smrv.2014.07.007>
- Hubbard, K., Economos, C. D., Bakun, P., Boulos, R., Chui, K., Mueller, M. P., Smith, K., & Satchek, J. (2016). Disparities in moderate-to-vigorous physical activity among girls and overweight and obese schoolchildren during school- and out-of-school time. *International Journal of Behavioral Nutrition and Physical Activity*, *13*, Article 39. <https://doi.org/10.1186/s12966-016-0358-x>
- Instituto Nacional de Estatística. (n.d.). *Administrative division*. https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_cont_inst&INST=6251038

- Jago, R., Thompson, J. L., Sebire, S. J., Wood, L., Pool, L., Zahra, J., & Lawlor, D. A. (2014). Cross-sectional associations between the screen-time of parents and young children: Differences by parent and child gender and day of the week. *International Journal of Behavioral Nutrition and Physical Activity*, *11*, 1–8. <https://doi.org/10.1186/1479-5868-11-54>
- Janssen, X., Martin, A., Hughes, A. R., Hill, C. M., Kotro-noulas, G., & Hesketh, K. R. (2020). Associations of screen time, sedentary time and physical activity with sleep in under 5s: A systematic review and meta-analysis. *Sleep Medicine Reviews*, *49*, Article 101226. <https://doi.org/10.1016/j.smr.2019.101226>
- Kallio, J., Hakonen, H., Syväoja, H., Kulmala, J., Kankaan-pää, A., Ekelund, U., & Tammelin, T. (2020). Changes in physical activity and sedentary time during adolescence: Gender differences during weekdays and weekend days. *Scandinavian Journal of Medicine and Science in Sports*, *30*, 1265–1275. <https://doi.org/10.1111/sms.13668>
- Larouche, R., Kleinfeld, M., Rodriguez, U. C., Hatten, C., Hecker, V., Scott, D. R., Brown, L. M., Onyeso, O. K., Sadia, F., & Shimamura, H. (2023). Determinants of outdoor time in children and youth: A systematic review of longitudinal and intervention studies. *International Journal of Environmental Research and Public Health*, *20*(2), Article 1328. <https://doi.org/10.3390/ijerph20021328>
- Lee, E.-Y., Bains, A., Hunter, S., Ament, A., Brazo-Sayav-era, J., Carson, V., Hakimi, S., Huang, W. Y., Janssen, I., Lee, M., Lim, H., Das, S., & Tremblay, M. S. (2021). Systematic review of the correlates of outdoor play and time among children aged 3-12 years. *International Journal of Behavioral Nutrition and Physical Activity*, *18*, Article 41. <https://doi.org/10.1186/s12966-021-01097-9>
- Lounassalo, I., Salin, K., Kankaanpää, A., Hirvensalo, M., Palomäki, S., Tolvanen, A., Yang, X., & Tam-melin, T. H. (2019). Distinct trajectories of physical activity and related factors during the life course in the general population: A systematic review. *BMC Public Health*, *19*, Article 271. <https://doi.org/10.1186/s12889-019-6513-y>
- Määttä, K., S. (2017). The mediating role of the home environment in relation to parental educational level and preschool children's screen time: A cross-sectional study. *BMC Public Health*, *17*, Article 688. <https://doi.org/10.1186/s12889-017-4694-9>
- Machado-Rodrigues, A. M., Coelho e Silva, M. J., Mota, J., Santos, R. M., Cumming, S. P., & Malina, R. M. (2012). Physical activity and energy expenditure in adolescent male sport participants and non-participants aged 13 to 16 years. *Journal of Physical Activity and Health*, *9*, 626–633. <https://doi.org/10.1123/jpah.9.5.626>
- Mäkelä, K., Kokko, S., Kannas, L., Villberg, J., Vasankari, T., Heinonen, O., Savonen, L., K. ad Alanko, Kor-pelainen, R., Selänne, H., & Parkkari, J. (2016). Physical activity, screen time and sleep among youth participating and non-participating in organized sports – The Finnish health promoting sports club (FHPSC) study. *Advances in Physical Education*, *6*(4), 378–388. <https://doi.org/10.4236/ape.2016.64038>
- Marshall, S. J., Biddle, S. J. H., Gorely, T., Cameron, N., & Murdey, I. (2004). Relationships between media use, body fatness and physical activity in children and youth: A meta-analysis. *International Journal of Obesity*, *28*, 1238–1246. <https://doi.org/10.1038/sj.ijo.0802706>
- McArthur, B. A., Volkova, V., Tomopoulos, S., & Madigan, S. (2022). Global prevalence of meeting screen time guidelines among children 5 years and younger. *JAMA Pediatrics*, *176*(4), 373–383. <https://doi.org/10.1001/jamapediatrics.2021.6386>

- Muppalla, S. K., Vuppalapati, S., Pulliahgaly, A. R., & Sreenivasulu, H. (2023). Effects of excessive screen time on child development: An updated review and strategies for management. *Cureus, 15*(6), Article e40608. <https://doi.org/10.7759/cureus.40608>
- Nagata, J. M., Ganson, K. T., Iyer, P., Chu, J., Baker, F. C., Gabriel, K. P., Garber, A. K., Murray, S. B., & Bibbins-Domingo, K. (2022). Sociodemographic correlates of contemporary screen time use among 9- and 10-year-old children. *Journal of Pediatrics, 240*, 213-220.e2. <https://doi.org/10.1016/j.jpeds.2021.08.077>
- Pizarro, A., Oliveira-Santos, J. M., Santos, R., Ribeiro, J. C., Santos, M. P., Coelho-e-Silva, M., Raimundo, A. M., Sardinha, L. B., & Mota, J. (2023). Results from Portugal's 2022 report card on physical activity for children and youth. *Journal of Exercise Science & Fitness, 21*(3), 280–285. <https://doi.org/10.1016/j.jesf.2023.05.002>
- Rodrigues, D., Gama, A., Machado-Rodrigues, A. M., Nogueira, H., Rosado-Marques, V., Silva, M.-R. G., & Padez, C. (2021). Home vs. bedroom media devices: Socioeconomic disparities and association with childhood screen- and sleep-time. *Sleep Medicine, 83*, 230–234. <https://doi.org/10.1016/j.sleep.2021.04.012>
- Rodrigues, D., Gama, A., Machado-Rodrigues, A. M., Nogueira, H., Silva, M.-R. G., Rosado-Marques, V., & Padez, C. (2020). Social inequalities in traditional and emerging screen devices among Portuguese children: A cross-sectional study. *BMC Public Health, 20*, Article 902. <https://doi.org/10.1186/s12889-020-09026-4>
- Rodrigues, D., Padez, C., & Machado-Rodrigues, A. M. (2018). Child participation in sports is influenced by patterns of lifestyle-related behaviors. *American Journal of Human Biology, 30*(6), Article e23142. <https://doi.org/10.1002/ajhb.23142>
- Rovio, S. P., Yang, X., Kankaanpää, A., Aalto, V., Hivensalo, M., Telama, R., Pahkala, K., Hutri-Kähönen, N., Viikari, J. S. A., Raitakari, O. T., & Tammelin, T. H. (2018). Longitudinal physical activity trajectories from childhood to adulthood and their determinants: The young Finns study. *Scandinavian Journal of Medicine & Science in Sports, 28*(3), 1073–1083. <https://doi.org/10.1111/sms.12988>
- Sandercock, R. H., Ogunleye, A., & Voss, C. (2012). Screen time and physical activity in youth: Thief of time or lifestyle choice? *Journal of Physical Activity and Health, 9*(7), 977–984. <https://doi.org/10.1123/jpah.9.7.977>
- Taverno Ross, S. E., Dowda, M., Dishman, R. K., & Pate, R. R. (2016). Classes of physical activity and sedentary behavior in 5th grade children. *American Journal of Health Behavior, 40*, 352–361. <https://doi.org/10.5993/AJHB.40.3.7>
- Telama, R., Yang, X., Viikari, J., Välimäki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: A 21-year tracking study. *American Journal of Preventive Medicine, 28*(3), 267–273. <https://doi.org/10.1016/j.amepre.2004.12.003>
- Wheeler, S. (2014). Organized activities, educational activities and family activities: How do they feature in the middle-class family's weekend? *Leisure Studies, 33*(2), 215–232. <https://doi.org/10.1080/02614367.2013.833972>
- World Health Organization. (2019). *Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age*. <https://www.who.int/publications/i/item/9789241550536>
- Xie, H., Scott, J. L., & Caldwell, L. L. (2017). Urban adolescents' physical activity experience, physical levels, and use of screen-based media during leisure time: A structural model. *Frontiers in Psychology, 8*, Article 2317. <https://doi.org/10.3389/fpsyg.2017.02317>

Acknowledgements

We thank all the children, families and school staff for their availability to participate during the data collection.

Funding

This work was supported by Fundação para a Ciência e Tecnologia (Portugal) through Grant PTDC/DTP-SAP/1520/2014, and 2020.03966.CEECIND.

Competing interests

The authors have declared that no competing interests exist.

Data availability statement

All relevant data are within the paper.

A Appendix

Table 5

Summary of descriptive statistics of variables.

Variable	Observations	<i>M</i>	<i>SD</i>	Min	Max
Age	8,472	7.19	1.91	3.05	11.95
Boy	8,472	0.51	0.50	0	1
Residence	7,667	0.89	0.32	0	1
Siblings	7,616	0.73	0.45	0	1
Sleep-time weekdays	7,550	603.86	37.93	420	780
Sleep-time weekend	7,456	641.61	49.37	420	882
School commuting	6,328	28.26	22.41	2	240
Sport activity	7,627	0.60	0.49	0	1
Outdoor play weekdays	7,300	66.71	62.88	0	270
Outdoor play weekend	7,299	147.53	81.02	0	270
Screen-time weekdays	6,597	19.83	18.84	0	270
Screen-time weekend	6,536	46.00	29.55	0	270
Study-time weekdays	6,234	52.57	53.57	0	270
Study-time weekend	6,031	51.86	48.86	0	270
Indoor play weekdays	7,465	62.61	57.16	0	270
Indoor play weekend	7,481	135.02	77.43	0	270
Father age	7,190	40.18	6.09	20	72
Father education	7,240	12.06	3.30	0	19
Father employed	7,143	0.93	0.26	0	1
Mother age	7,551	38.05	5.48	18	60
Mother education	7,555	12.88	2.98	0	19
Mother employed	7,444	0.85	0.35	0	1
Type of family	7,407	0.18	0.39	0	1

Age: number of years old. Boy: dummy variable; takes value 1 if boy, 0 if girl. Residence: dummy variable; takes value 1 if child lives in urban area, 0 otherwise. Siblings: dummy variable; takes value 1 if child has siblings, 0 otherwise. Sleep-time: number of minutes per day spent sleeping. School commuting: number of minutes per day spent actively commuting to school. Sport activity: dummy variable; takes value 1 if child practices an organized sport, 0 otherwise. Outdoor play: number of minutes per day spent playing outdoor. Screen-time: number of minutes per day using screen-media based devices. Study-time: number of minutes per day spent studying or doing homework. Indoor play: number of minutes per day spent playing indoors (excluding screen time). Father age: number of years old. Father education: number of completed schooling years. Father employed: dummy variable; takes value 1 if father is employed, 0 otherwise. Mother age: number of years old. Mother employed: dummy variable; takes value 1 if mother is employed, 0 otherwise. Type of family: dummy variable; takes value 1 if child has single parents, 0 otherwise.

Table 6

Average time on screen and outdoor playing by age (minutes).

Age	Average screen-time				Average outdoor playing time			
	Week	<i>n</i>	Weekend	<i>n</i>	Week	<i>n</i>	Weekend	<i>n</i>
3	17.99	413	31.4	408	82.65	441	163.17	443
4	18.53	649	34.36	647	75.37	724	159.91	722
5	20.88	852	40.29	843	79.47	946	154.24	948
6	18.2	1,131	43.34	1,120	65.42	1256	152.68	1,250
7	18.45	1,135	48.37	1,123	60.88	1255	147.92	1,253
8	20.09	1,084	51.01	1,072	57.41	1205	134.80	1,202
9	21.76	1,081	54.95	1,078	63.26	1184	138.34	1,196
10	25.9	231	61.02	224	59.08	262	132.67	257
Time change 3-10 years old	7.9		29.6		-23.57		-30.5	

Table 7

Linear regressions for time use during the weekdays and the weekend for boys and girls.

Screen-time (min/day)	Boys				Girls			
	Weekday		Weekend		Weekday		Weekend	
	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>	Coef.	<i>P</i> > <i>t</i>
Age	1.148	0.000	4.376	0.000	1.263	0.000	3.084	0.000
Sleep-time	-3.408	0.000	-0.037	0.005	-2.564	0.000	-0.035	0.001
Organized sport	-4.597	0.000	-6.701	0.000	-4.005	0.000	-9.519	0.000
Outdoor play	0.052	0.000	0.022	0.009	0.031	0.000	0.017	0.007
Study-time	0.054	0.000	0.065	0.000	0.021	0.004	0.045	0.000
Indoor play	0.063	0.000	-0.004	0.666	0.099	0.000	0.009	0.222
School commuting	-0.052	0.004			-0.037	0.017		
_cons	41.215	0.000	40.803	0.000	29.163	0.000	43.018	0.000
Number of obs	2,144		2,448		2,119		2,506	
<i>F</i> (7, 4946)	45.840		40.27		58.020		39.94	
Prob > <i>F</i>	0.000		0.0000		0.000		0.0000	
R-squared	0.131		0.0901		0.161		0.0875	
Adj R-squared	0.128		0.0878		0.159		0.0853	

Boldface indicates statistical significance ($p < 0.05$).