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Brief Communication

Home vs. bedroom media devices: socioeconomic disparities and association with childhood screen- and sleep-time

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ABSTRACT

Background: The literature has shown a widespread use of portable electronic devices among children over the last years. This study aimed to identify the availability of different media devices at home versus in children's bedroom according to the socioeconomic status (SES), and analyze the association between that availability and children's screen- and sleep-time on week and weekend days.
Methods: Data from 3 to 10 year-old children (n = 8430) from a cross-sectional study conducted in Portugal (2016/17) was used. Screen- and sleep-time, availability of media devices, father and mother education (as a proxy measured of SES) were assessed via questionnaire.
Results: Available devices at home were significantly more common among high-SES families; while media devices in the bedroom were more frequent in low-SES families ($p < 0.001$). In preschool and elementary school-aged children, media devices in the bedroom were associated with increase screen-time and shorter sleep per day. Also, mobile devices in the bedroom were shown to exert similar, or even more, influence on children's screen- and sleep-time as television.
Conclusions: Further research is needed to explore the pathways by which different electronic media negatively impacts on children's sleep and screen-time and to develop effective strategies to minimize device access at bedtime.

1. Introduction

Excessive screen-time and shorter sleep duration have important implications for children's health [1–4]. The widespread use of mobile devices and the popularization of screen media devices in the bedroom are likely to be responsible for the substantially increased in childhood screen-time over the years [5].

Increased screen-time and its adversely impact on school-aged children's sleep have been consistently reported before [6], but less is known about this association in preschool-aged children [7]. Moreover, the relationship between socioeconomic status (SES) and screen-time in children is not well characterized and requires further attention, but studies suggest that screen use is more likely among children with low parental SES than among children with higher SES backgrounds [8,9].

The purpose of this study was twofold: 1) to assess traditional and new media devices ownership in the house vs. in children's bedroom according to SES and 2) to explore the associations between screen media ownership with screen- and sleep-time on week and weekend days.

2. Methods

Data were derived from the ObesInCrisis Project, designed to study the impact of the socioeconomic crisis in childhood obesity and related determinants. During 2016-17, a total of 8430 Portuguese pre- and school-aged children (n = 2397 between 3 and 5

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years, 51.6% boys; n = 6033 between 6 and 10 years, 50.4% boys) were recruited from public and private schools, in the cities of Porto, Coimbra and Lisbon; details are available elsewhere [9]. Participation rates were 60% in Porto, 58% in Coimbra and 67% in Lisbon. Ethical approval was given by the Portuguese Ministry of Education (Direção Geral da Educação) and the Portuguese Data Protection Authority (Authorization number 745/2017). All procedures were in accordance with the ethical standards of the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Written informed consent was obtained from children's parents.

Using a questionnaire, parents were asked: "Do you have any of the following media equipment at home?" and "Does your child have any of the following media equipment in his/her bedroom?" For both questions, media devices assessed included: television, computer, laptop, and tablet. Response options for each item were no (=0) or yes (=1).

Screen-time was measured by asking parents: "On a typical weekday (Monday through Friday), how many hours does your child spend …" and "On a typical weekend day (Saturday and Sunday), how many hours does your child spend …" using the following devices: television, computer, electronic game devices, smartphone, and tablet. Details of this variable have been described elsewhere [9]. Total screen-time (in minutes; weekday vs. weekend) was determined by adding the time spent in each media device. Parents also reported children's average bedtime and wake up time, separating weekdays and weekends, which was used to calculate sleep duration.

Number of siblings was reported by the parents. Child's sleep arrangement was determined by asking parents if the child sleep in their own room (no/yes). Father and mother's educational level were used as a proxy measure of SES: low (≤9 years), medium (10–12 years of education), and high (university degree). This has been previously done in the Portuguese context, as it is know that education is positively associated with more health-related knowledge [10].

Availability of each screen media device in children's home and bedroom was analyzed however in the last case, only the subsample owning that specific device was considered. Differences in the availability according to SES and sex were examined by Chi-square tests. Linear regression analyses were performed to examine whether screen media devices in children's bedroom (independent variables) predicted screen- and sleep-time (dependent variables). Separate models were conducted for all the different media devices with the sample stratified for sex and age (preschool: 3–5 years; school-aged: 6–10 years). Models were adjusted for father and mother education, number of siblings and the child having its own bedroom. The P-value level of significance was 0.5.

3. Results

Screen devices at home were: television (home: 99.5%, of which 36.7% in the bedroom), laptop (home: 82.1%; bedroom: 6.4%), tablet (home: 81.6%; bedroom: 19.5%) and computer (home: 32.9%; bedroom: 8.9%). Similar results were found for boys and girls, except for having a computer in the bedroom which was significantly more common for boys than girls (10.1% and 7.7%, respectively, p = 0.04). Independently of sex, owning a computer, a laptop and a tablet was significantly more common among children from higher-than lower-SES. However, having screen media devices in the bedroom was more prevalent in children from lower and medium-SES compared with children from higher-SES (Fig. 1).

Among 3- to 5-year-old children, having a television (+54 min/day) and a tablet (+83 min/day) in the bedroom was associated with higher screen-time; also, sleep time was significantly and negatively associated with having a laptop in the bedroom and spending more time using screen media devices in girls but not in boys (Table 1). Among children aged 6- to 10-year-old, having devices in the bedroom (television: +57 min/day, laptop: +61 min/day, tablet: 75 min/day) was associated with higher screen-time. A computer in the bedroom was also associated with more screen-time among girls, but not among boys. Having a television was associated with fewer sleep-time, particularly on school days. Moreover, a tablet in the bedroom was associated with decreased sleep-time among girls, but not among boys, while a laptop in the bedroom was negatively associated with sleep-time in boys but not

Table 1
Associations examined by linear regression analyses between media presence in bedroom (no/yes), sleep duration (minutes per day) and screen time (minutes per day) among Portuguese children aged 3- to 5-year-old and 6- to 10-year-old.

	Boys; 3-5-year-old	Girls; 3-5-year-old	Boys; 6-10-year-old	Girls; 6-10-year-old
Television bedroom; β (95%CI)				
Sleep duration week days	−3.78 (−8.87; 1.31)	−3.92 (−9.61; 1.76)	−3.07 (−6.08; −0.07) *	−5.47 (−8.52; -2.41) ***
Sleep duration weekend	−5.36 (−12.02; 1.31)	−4.87 (−12.96; 3.24)	2.45 (−1.81; 6.71)	3.32 (−1.11; 7.74)
Screen time week days	21.77 (8.59; 34.95) **	22.94 (10.19; 35.69) ***	23.60 (14.02; 33.17) ***	24.33 (15.91; 32.75) ***
Screen time weekend	47.94 (29.36; 66.53) ***	51.93 (34.45; 69.41) ***	53.64 (38.36; 68.92) ***	49.42 (37.13; 61.71) ***
Computer bedroom; β (95%CI)				
Sleep duration week days	−5.45 (−21.05; 10.14)	3.94 (−18.95; 26.82)	−2.68 (−9.85; 4.49)	−0.22 (−8.30; 7.86)
Sleep duration weekend	−4.15 (−24.54; 16.23)	17.60 (−14.76; 49.95)	−2.10 (−12.19; 8.00)	3.12 (−8.67; 14.90)
Screen time week days	−2.24 (−42.45; 37.97)	−1.48 (−17.63; 6.85)	−5.53 (−28.49; 17.42)	23.40 (1.19; 45.60) *
Screen time weekend	−0.98 (−59.76; 57.79)	8.80 (−60.92; 78.52)	22.02 (−14.39; 58.44)	59.69 (26.93; 92.45) ***
Laptop bedroom; β (95%CI)				
Sleep duration week days	−9.71 (−24.11; 4.70)	−25.02 (−42.92; -7.12)**	−8.77 (−14.20; -3.35) **	−1.07 (−6.81; 4.68)
Sleep duration weekend	−6.41 (−25.56; 12.75)	−15.98 (−41.42; 9.47)	−8.03 (−15.70; -0.35) *	2.13 (−6.17; 10.43)
Screen time week days	52.28 (11.22; 93.34) *	9.57 (−29.55; 48.69)	32.04 (14.63; 49.44) ***	34.16 (17.94; 50.38) ***
Screen time weekend	70.60 (12.20; 129.01) *	51.75 (−0.48; 103.98)	85.29 (57.74; 112.84) ***	56.25 (32.54; 79.96) ***
Tablet bedroom; β (95%CI)				
Sleep duration week days	−4.18 (−11.85; 3.49)	−6.72 (−15.23; 1.80)	−2.79 (−6.46; 0.88)	−4.21 (−7.83; -0.59) *
Sleep duration weekend	8.66 (−1.45; 18.77)	−1.51 (−13.53; 10.51)	0.69 (−4.50; 5.87)	6.52 (1.28; 11.75) *
Screen time week days	61.60 (41.67; 81.54) ***	36.31 (16.78; 55.84) ***	46.52 (34.88; 58.17) ***	37.35 (27.42; 47.28) ***
Screen time weekend	98.84 (69.96; 127.71) ***	69.18 (41.82; 96.54) ***	100.22 (81.97; 118.46) ***	68.99 (54.41; 83.57) ***
Screen time (total for 7 days of the week); β (95%CI)				
Sleep duration week days	−0.02 (−0.04; 0.01)	−0.06 (−0.09; -0.03) ***	−0.03 (−0.04; -0.02) ***	−0.02 (−0.04; -0.01) **
Sleep duration weekend	0.02 (−0.01; 0.05)	−0.04 (−0.09; -0.00) *	−0.03 (−0.05; -0.02) ***	−0.02 (−0.04; −0.00) *

CI: confidence interval; models adjusted for mother education, father education, number of siblings, and children having their own room; *<0.05, **<0.01, ***<0.001.

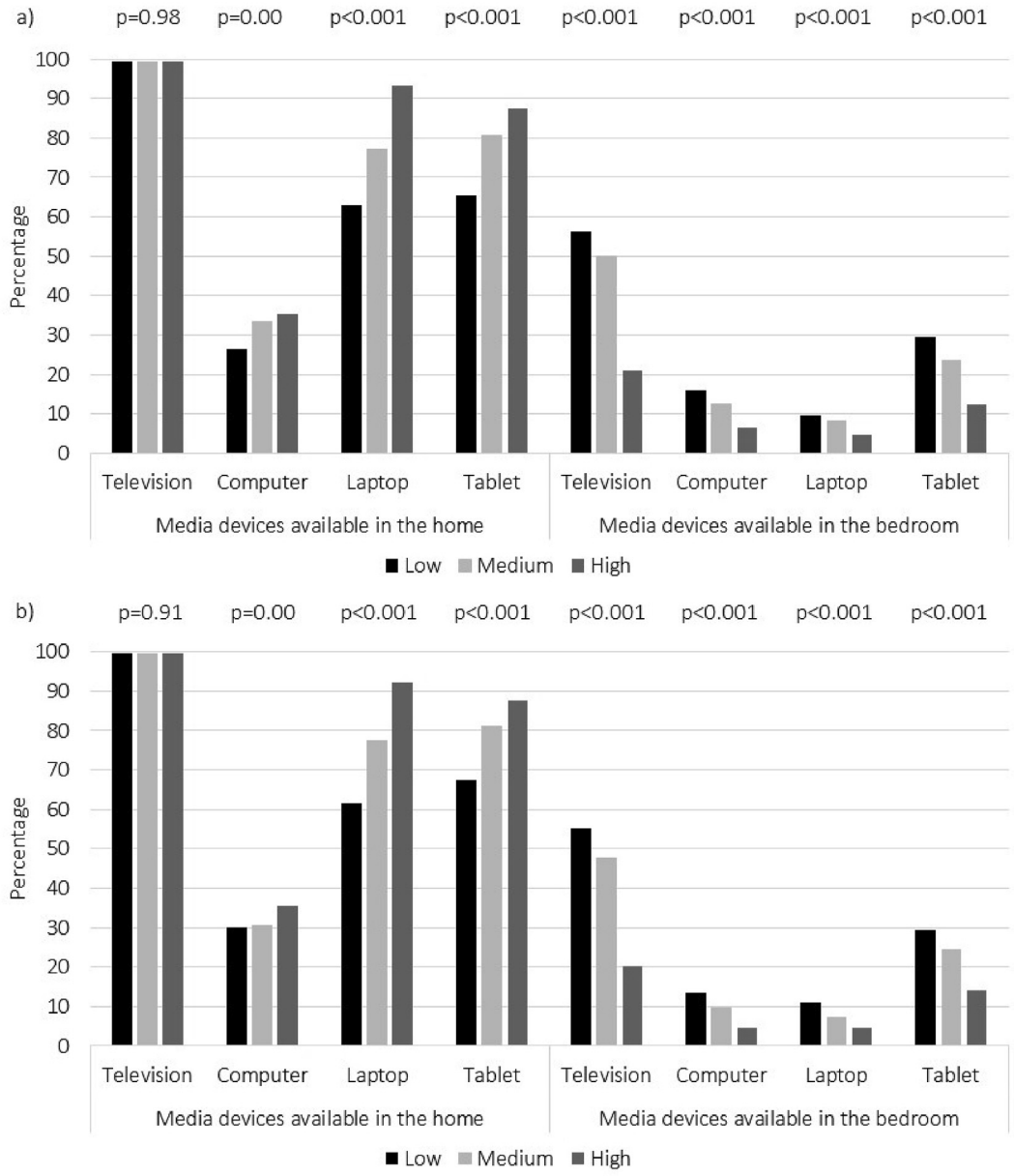

Fig. 1. Availability of at least one media device in children's home and bedroom, a) for boys and b) for girls, across family socioeconomic status (mother education level was used as an indicator of SES; similar results were found using father education-data not shown).

in girls. Independently of the sex, greater screen-time was associated with shorter sleep duration (Table 1).

4. Discussion

The present study identified that higher-SES children had more media equipment at home compared with children from lower-SES; however, the inverse was found for the availability of those devices in the children's bedroom. Similar findings were previously reported, were electronic devices were more likely to be located in lower-SES children's bedrooms [11–13]. This suggest that the socioeconomic differences in Portuguese children's screen media-time [9] may be driven primarily by cultural, rather than financial factors. Nevertheless, media devices in the bedroom may be more common among low-SES children because of more frequent room sharing or sleeping in a multi-purposed room [5].

There was an evidence of a positive association between bedroom media and children's screen-time on weekdays and weekends. This is consistent with previous research [12–14]. Among preschool-aged children, having a tablet in the bedroom was associated with higher screen-time while in school-aged children, a tablet or a laptop in the bedroom had the strongest association with screen-time both on week and weekend days. Findings may reflect age related changes in media preferences [9,15].

This study revealed that available media devices, particularly in the bedroom, significantly decreased children's sleep-time. This is consistent with previous studies on pediatric populations that reported an association between electronic use before bed and shorter sleep duration [16,17]; 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. Although television still exerts considerable

effects on children's sleep-time, this study suggests that, in the era of the mobile devices, laptops and tablets in the bedroom may start having a greater impact on sleep than passive screen media.

Previous studies have advocated the removal of electronic media from children's bedroom as a means of limiting screen-time and improving sleep-quality [18]; findings of the current study provide some support for this strategy. Nevertheless, children and parents may be resistant to the idea of removing media devices from the bedroom once they have been installed [19]. This suggest that not having electronic media in children's bedroom should be encouraged since early childhood, before the installment occur.

The strengths of this study include the large sample of preschool and school-aged children. Linear regression models were stratified by sex and age as well as adjusted for potentially confounding factors (ie, father and mother education, number of siblings and the child having its own bedroom). We did assess ownership of desktop and laptop computers in our questionnaire however; we did not included video game consoles because we were unable to differentiate between active and passive game consoles in baseline assessments. Also, smartphones in the bedroom were not assessed by the questionnaire. Other limitation is that screen-time, sleep-time as well as home and bedroom media environment were reported by the parents.

Altogether, the data suggests that presence of media devices in the bedroom is associated with increased screen-time and decreased sleep-time. While a greater number of media devices at home were more prevalent in high-SES families, the availability of devices in the child's bedroom was more common in low-SES families. This paradox may reflect social and environmental factors such as low-SES families having less knowledge on the health problems associated with excessive screen-media use, greater concerns about their neighborhood's safety, less time to supervise their children or less opportunities to engage them in extracurricular activities which makes indoor screen-based activities an interesting alternative [13]. It is clear that with the COVID-19 pandemic, children have been spending more time than ever before on their screens [20], so strategies to manage bedtime media use are urgent but must take into account that subgroups of young children, in particular, children from lower-SES may be more vulnerable. Perhaps most importantly, parents and children should remove screen-based devices from the bedroom to ensure less screen-time and more sleep duration.

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CRediT authorship contribution statement

Daniela Rodrigues: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization. **Augusta Gama:** Investigation, Writing – original draft, Writing – review & editing. **Aristides M. Machado-Rodrigues:** Investigation, Writing – original draft, Writing – review & editing. **Helena Nogueira:** Investigation, Writing – original draft, Writing – review & editing. **Vítor Rosado-Marques:** Investigation, Writing – original draft, Writing – review & editing. **Maria-Raquel G. Silva:** Investigation, Writing – original draft, Writing – review & editing. **Cristina Padez:** Investigation, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition.

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Conflict of interest

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleep.2021.04.012.

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