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ORIGINAL RESEARCH

Daily Activities in European Children and Adolescents During COVID-19 School Closure: A Longitudinal Study Exploring Physical Activity, Use of Screens, and Sleep Patterns

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Abstract

This longitudinal study aimed to analyze the evolution of patterns of daily activities (physical activity time, screen usage time, and sleep hours) in European youth during school closure due to the COVID-19 health crisis. Participants were 624 caregivers of children and adolescents aged 3–18 from Italy, Spain, and Portugal. Evaluations were online, and four time-points were considered: retrospective measurement of daily activities before confinement (T1), and two (T2), five (T3), and eight (T4) weeks after starting the lockdown. Generally accepted international guidelines on physical activity time, screen usage time, and hours of sleep by age group were used to determine whether the pattern might increase the risk for ill health or not. To estimate the evolution of daily activities, generalized estimating equations (GEE) were used. The percentage of children who practiced less than 60 min of daily exercise increased significantly from before home confinement (47.8%) to T2 (86.4%); it slightly decreased at T3 (79.8%), and remained stable at T4 (76.1%). The percentage of children who made excessive use of screens (according to their age group) significantly increased from T1 to T2 and remained stable and high in the rest of the evaluations. The percentage of children who slept fewer or more hours than recommended for their age group remained stable between T1 and T4, although there was a significant increase at T3. In general, results found unhealthier behaviors as confinement was extended. Results are discussed in order to find strategies for promoting healthy daily activities for future pandemics.

Keywords Youth · COVID-19 pandemic · School closure · Physical activity · Screens · Sleep pattern · Longitudinal

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Introduction

The coronavirus disease (COVID-19), declared by the World Health Organization (WHO) as a pandemic on March 11, 2020, spread quickly, forcing most countries worldwide to apply restrictions aimed at slowing down the infections. Despite that each country implemented different strategies, school closure was an action taken by most European countries, including Italy and Spain, two of the countries most affected by the COVID-19 disease, and Portugal, which managed to face the health crisis efficiently during the first six months of the pandemic. Closing schools implies an important change in youth´s academic routines but it also may irrupt abruptly in some daily activities, such as sleep patterns, physical activity, and screen use. In fact, healthy behaviors are less likely to occur when children are not attending schools, as highlighted in a review of 190 studies which concluded that, during class days, children were more physically active, their screen use was lower, and sleep was better regulated compared to vacation time and weekends (Brazendale et al., 2017).

Restrictions applied to face the pandemic altered the physical activity in children and adolescents. As schools were closed, no compulsory exercise was followed by youth, increasing the screen-use time, as the imposed restrictions encouraged sedentary activities (Orgilés et al., 2024). Furthermore, the educational system transitioned to an online format, leading to an increase in the workload for the youth (Tzankova et al., 2022). Closing parks and sports centers also made it difficult to be active. Besides, physical distance during the pandemic promoted sedentary activities and more screen use (Rundle et al., 2020). Previous research has shown that the COVID-19 health crisis negatively affected youth´s behavior. Main studies concluded that, during the pandemic, physical activity decreased in children and adolescents, screen time was higher, and sleep habits were altered (e.g., Carroll et al., 2020; Egan & Beatty, 2021; Slot-Heijs et al., 2020; ten Velde et al., 2021; Xiang et al., 2020). Although recent research on the psychological consequences of the pandemic in youth is vast (e.g. Orgilés et al., 2020; Tambunan et al., 2021; Xiang et al., 2020), there is a lack of longitudinal studies providing data on the evolution of unhealthy patterns of children and adolescents over time. Longitudinal studies are necessary to understand the change in psychological wellbeing as the COVID-19 pandemic situation extends because long confinements are related to more psychological problems (Brooks et al., 2011), and frustration and demoralization are higher when quarantines are prolonged (Rona et al., 2007).

The current longitudinal study explores daily activities in Italian, Spanish, and Portuguese children and youth aged 3–18 years old during the COVID-19 health crisis, expanding on previously cross-sectional findings by examining changes in physical activity, use of screens, and sleep hours across time. We analyzed the evolution of children's habits using four time-points: retrospective measurement of habits before confinement (T1), and two (T2), five (T3), and eight weeks (T4) after starting the lockdown. Generally accepted international guidelines on physical activity time, screen usage time, and hours of sleep by age group were used to consider a pattern might increase the risk for ill health or not. In line with previous studies showing that long confinements are related to higher psychological impact (Brooks et al., 2020),

it is hypothesized that the longer the home confinement, the unhealthier will be child daily activities.

Methods

Participants

The eligibility criteria to participate in the study were being a mother/parent or legal guardian of a child or adolescent between 3 and 18 years old, residing in Spain, Italy, and/or Portugal during the assessment period. Participants were the caregivers of 624 European children and adolescents aged 3–18 years old [Mean age = 8.94, *SD* = 4.19; ages 3–11 (*n* = 446), 12–15 (*n* = 127), 16–18 (*n* = 51)] 52.9% boys (Table 1). Caregivers were recruited from Italy (*n* = 324), Spain (*n* = 159), and Portugal (*n* = 141); 560 were female (89.7%), most of them were married (87.7%), and their average age was 42.20 years (*SD* = 5.48). All educational levels were represented: 27.4% had doctoral or master's studies, 43.3% had completed undergraduate studies, 25.3% had secondary studies, and 4% had primary studies. Regarding socioeconomic status, obtained based on the monthly family income (in euros), 5.2% earned up to 999; 26.9% earned between 1,000 and 1,999; 34.8% earned between 2,000 and 2,999; 27.1% earned between 3,000 and 4,999; and 5.9% earned 5,000 or more.

Table 1 Sample characteristics

	Total (*n* = 624)
Parents	
Female, *N* (%)	560 (89.7)
Age, *M* (*SD*)	42.20 (5.48)
Marital status, *N* (%)	
Married	547 (87.7)
Single	75 (12)
Other	3 (0.3)
Educational level, *N* (%)	
Doctoral or Master	171 (27.4)
Undergraduate	270 (43.3)
Secondary school	158 (25.3)
Primary school	25 (4)
Monthly family income (euros)	
Up to 999	29 (5.2)
Between 1,000 and 1,999	150 (26.9)
Between 2,000 and 2,999	194 (34.8)
Between 3,000 and 4,999	151 (27.1)
5,000 or more	33 (5.9)
Children	
Female, *N* (%)	294 (47.1)
Age, *M* (*SD*)	8.94 (4.19)

Note. *M* = Mean; *SD* = Standard Deviation

Procedure

This longitudinal study was carried out simultaneously in three European countries (Italy, Spain, and Portugal) during the COVID-19 health crisis. An online structured questionnaire was developed using Google Forms, with an informed consent appended to it. A snowball sample technique was employed. The link to the questionnaire was disseminated using social media, emails, and WhatsApp contacts. The data were collected from March to May 2020. During this period, data from four distinct time points were collected through three assessments. The initial assessment, conducted from March 23rd to March 29th, 2020, included retrospective measurements of the period before home confinement (T1) and during the first two weeks of lockdown (T2). Subsequent assessments took place at five weeks (T3; from April 13th to April 19th, 2020) and eight weeks after the commencement of lockdown (T4; from May 4th to May 10th, 2020). Each parent/legal guardian participated in the study with only one child. This was indicated in the instructions and verified in the database by checking personal data, such as email. Regarding restrictions applied during data collection, schools were closed in the three assessments in all three countries. Mandatory confinement was followed by Italian and Spanish children at all the timepoints. However, at T4, a less restricted phase began in Italy with parks opened and visits to relatives allowed; also at T4, Spanish children under 14 years old received permission from the government to go outside one hour a day, although playgrounds and public gardens were still closed. A general obligation of home confinement was applied in Portugal, with less restrictive measures, but schools were closed at all the time points. The Ethics Committee of the authors' universities approved the study. All participants were included in the analyses.

Measures

The assessment instruments were culturally adapted to the three countries, and a pilot test was conducted to ensure the understanding of the items. Parents of participating child subjects completed online the following measures:

General Questionnaire of Sociodemographic Variables

Caregiver participants reported their age and sex, marital status, educational level, family income, and children's age and sex.

Physical Activity

The baseline was obtained by asking caregivers: "Before quarantine, how much time did your child spend each day on physical activity?" Parents also responded to the following item in each assessment: "During quarantine, how much time per day is your child spending on physical activity?" The response scale included the following alternatives: (1) *Less than 30 min*, (2) *30 to 60 min*, (3) *60 to 90 min*, (4) *90 to 120 min*, (5) *120 to 180 min*, and (6) *More than 180 min*. The WHO (2010,2019) recommends at least 60 min of exercise a day for children and adolescents. Follow-

ing this recommendation, the physical activity variables (at each assessment) were recoded. Alternatives 1 and 2 (less than 60 min per day of physical activity) were recoded as 1 (*unhealthy pattern*), while the rest of the categories (more than 60 min of daily physical activity) were recoded as 0 (*healthy pattern*).

Screen Time Usage

The baseline measure was obtained by asking caregivers: "Before quarantine, how much time did your child use screens such as iPad, television, mobile phones, or computers every day?" Parents also responded to the following item in each assessment: "During quarantine, how much time is your child using screens such as iPad, television, cell phones, or computers daily?" The response scale included the following alternatives: (1) *Less than 30 min*, (2) *30 to 60 min*, (3) *60 to 90 min*, (4) *90 to 120 min*, (5) *120 to 180 min*, and (6) *More than 180 min*. The American Academy of Pediatrics (Hill et al., 2016; Tecnología en familia, 2020) indicates that screen time usage should not exceed 60 min in children aged 3–11, should not exceed 90 min in children aged 12–15, and should not exceed 120 min in adolescents aged 16–18. Following these guidelines, the use of screen variables (at each assessment) were recoded into two groups: recommended screen time usage (=0, *healthy group*) and exceeds recommended screen time usage (=1, *unhealthy group*).

Sleep Hours

The baseline was obtained by asking caregivers: "Before quarantine, how many hours did your child sleep during the week?" Parents also responded to the following item in each assessment: "During quarantine, how many hours does your child sleep during the week?" The response scale was numerical. The American Academy of Pediatrics recommends between 10 and 13 h of sleep for children aged 3–5 years, between 9 and 12 h of sleep in children aged 6–12, and between 8 and 10 h of sleep in adolescents aged 13–18 (Paruthi et al., 2016). Following these guidelines, sleep hours (at each assessment) were recoded to identify two groups: children who sleep the recommended hours (=0, *healthy group*) and children who do not sleep the recommended hours (=1, *unhealthy group*).

Data Analyses

The collected data were analyzed in IBM SPSS for Windows-version 26. The sample was described using statistical descriptive analyses (e.g. means and standard deviations for quantitative variables; and number and percentages for categorical variables). Attrition analyses were performed to examine the characteristics of participants who dropped out of the study. Logistic regression was employed to assess whether there were sociodemographic differences between those who dropped out (coded as "1") and those retained throughout the study ("coded as "0"). To estimate the evolution of time of physical activity, use of screens, and sleep hours during home confinement, we performed repeated measures data analysis using generalized estimating equation (GEE) models. Independent models were conducted for each daily activity, including

a moderate number of variables considering the multiple comparisons to be made and the principle of parsimony that should prevail in explaining psychological phenomena. The variables included in the model were the main outcome, the time variable (for comparisons between temporal moments), and sociodemographic variables, specifically the child's age and sex, as well as the outcome variable at baseline (T1). When the *p*-value was under .05, it was considered a statistically significant difference. To reduce the risk of type I errors in multiple tests, Bonferroni corrections were applied to the *p*-values (Beasley & Schumacker, 1995). The level of statistical significance in Bonferroni's test was .002. Measurements of all participants were included, even if they had not responded to all evaluations. A sample size calculation was not performed; instead, the goal was to reach the highest possible number of participants through the online dissemination of the study. There was no missing data because the assessments were conducted online, and the platform indicated to participants the items they had forgotten to answer on each screen.

Results

Attrition

A total of 624 participants responded the retrospective measurement of before home confinement (T1) and during the first two weeks of lockdown (T2; both from 23rd to 29th March, 2020). The return rate was 86,5% ($n=540$) at third assessment (T3; from 13rd to 19th April, 2020) and 62,3% ($n=389$) at the fourth one (T4; from 4th to 10th May, 2020). The reasons for not continuing to participate in the study were not reported by the participants.The odds of dropping out were similar across countries ($\chi^2=5.69$, $p=.06$). Dropping out at T3 and T4 was unrelated to caregivers' sex and age, educational level, marital status, monthly family income, or children's sex and age.

Daily Activities During Home Confinement

Table 2 presents the percentage of children classified in the unhealthy groups in terms of physical activity time (less than 60 min a day), screen time usage (greater use than recommended for their age group), and sleep hours (sleeping less or more than recommended for their age group) across the four-time periods: retrospective measurement of daily activities before confinement (T1), two (T2), five (T3), and eight weeks (T4) after starting the lockdown. T1 is compared with T2, T2 with T3, T3 with T4, and T1 with T4, using GEE models.

Physical Activity

In Table 3, GEE results revealed that the percentage of children who practiced less than 60 min of daily physical activity (risk factor group) significantly increased between T1 and T2, from 47.8 to 86.4% ($p<.001$). When T2 and T3 were compared, the percentage of children who did not comply with the recommendation to perform

Table 2 Percentages of child daily activities at the four time-points

	Physical activity	Use of screens			Sleep hours		
	3–18 years (n=624)	3–11 years (n=446)	12–15 years (n=127)	16–18 years (n=51)	3–5 years (n=180)	6–12 years (n=299)	13–18 years (n=145)
	≤60 min.	≥60 min.	≥90 min.	≥120 min.	≤9 h or ≥14 h	≤8 h or ≥13 h	≤7 h or ≥11 h
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
T1	298/624 (47.8)	119/446 (26.7)	44/127 (34.6)	15/51 (29.4)	64/180 (35.6)	74/299 (24.7)	46/145 (31.7)
T2	539/624 (86.4)	369/446 (82.7)	119/127 (93.7)	41/51 (80.4)	61/178 (34.3)	65/298 (21.8)	26/145 (17.9)
T3	431/540 (79.8)	315/380 (82.9)	84/113 (74.3)	28/47 (59.6)	126/152 (82.9)	191/257 (74.3)	118/131 (90.1)
T4	296/389 (76.1)	217/271 (80.1)	76/83 (91.6)	27/35 (77.1)	38/115 (33)	52/178 (29.2)	24/96 (25)

T1=retrospective measurement of before home confinement, T2=during the first two weeks of lockdown, T3=five weeks after the start of lockdown, T4=eight weeks after the start of lockdown. Number of cases that meet the condition / total of cases available for analysis

at least 60 min of daily physical activity significantly decreased, from 86.4 to 79.8% (p=.001). There was no statistically significant change between T3 and T4. When T1 and T4 were compared, there was a significant increase in the percentage of children who performed less than 60 min of daily physical activity, from 47.8 to 76.1% (p<.001), which suggested that physical activity time decreased in children and adolescents across home confinement. The sociodemographic variables introduced in the model were not significant, which suggests that child's sex and age were not related to physical activity.

Screen Use

GEE results revealed that the percentage of children who made excessive use of screens, according to generally accepted international guidelines, increased significantly from T1 to T2 in all three groups (p<.001): children aged 3–11 who used screens daily for more than 60 min (from 26.7 to 82.7%), children aged 12–15 who used screens daily for more than 90 min (from 34.6 to 93.7%), and children aged 16–18 who used screens daily for more than 120 min (from 29.4 to 80.4%). There were no statistically significant changes between T2 and T3, at least when applying Bonferroni corrections. When T3 and T4 were compared, the percentage of children aged 12–15 who used screens daily for more than 90 min increased significantly (from 74.3 to 91.6%). When T1 and T4 were compared, there was a significant increase in daily use of screens in all age groups (p<.001): 3–11 years (from 26.7 to 80.1%), 12–15 years (from 34.6 to 91.6%), and 16–18 years (from 29.4 to 77.1%). The sociodemographic variables introduced in the model were not significant, except for the child's age in the groups 12–15 and 16–18 years old. Higher age was associated with a greater probability of longer screen usage.

Table 3 Child daily activities at the four-time points: Repeated-measures data analysis using the GEE Models

	Physical activity		Use of screens						Sleep hours					
	3–18 years		3–11 years		12–15 years		16–18 years		3–5 years		6–12 years		13–18 years	
	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*	Estimates [95% CI]	*p*
T1-T2	12.39 [8.70, 17.65]	<0.001	0.01 [0.009, 0.02]	0.001	0.01 [0.007, 0.03]	<0.001	0.05 [0.02, 0.14]	<0.001	1.11 [0.67, 1.84]	0.68	1.36 [0.87, 2.11]	0.16	0.87 [0.79, 0.95]	0.004
T2-T3	1.76 [0.27, 2.43]	0.001	0.82 [0.59, 1.14]	0.25	0.91 [0.72, 1.15]	0.44	0.77 [0.61, 0.97]	0.03	15.24 [10.25, 22.65]	<0.001	30.49 [19.84, 46.86]	<0.001	0.62 [0.59, 0.65]	<0.001
T3-T4	1.33 [0.92, 1.93]	0.12	0.74 [0.49, 1.12]	0.16	4.43 [1.78, 11.02]	0.001	2.47 [0.84, 7.27]	0.09	0.04 [0.02, 0.09]	<0.001	0.07 [0.03, 0.13]	<0.001	1.92 [1.73, 2.13]	<0.001
T1-T4	5.32 [3.64, 7.79]	<0.001	0.02 [0.01, 0.04]	<0.001	0.02 [0.008, 0.057]	<0.001	0.09 [0.02, 0.28]	<0.001	1.25 [0.65, 2.37]	0.49	0.59 [0.31, 1.12]	0.11	0.93 [0.84, 1.02]	0.15

T1=retrospective measurement of before home confinement, T2=during the first two weeks of lockdown, T3=five weeks after the start of lockdown, T4=eight weeks after the start of lockdown

Sleep Hours

GEE results revealed that the percentage of children sleeping fewer or more hours than recommended for their age group remained stable between T1 and T2 in all age groups, when applying Bonferroni corrections. When T2 and T3 were compared, the percentage of children who did not sleep the recommended hours for their age group increased significantly ($p < .001$) in the 3-5-year group (from 34.3 to 82.9%), the 6-12-year group (from 21.8 to 74.3%), and the 13-18-year group (from 17.9 to 90.1%). When T3 and T4 were compared, the percentage of children who slept fewer or more hours than recommended for their age group decreased in all age groups ($p < .001$): 3–5 years (from 82.9 to 33%), 6–12 years (from 74.3 to 29.2%), and 13–18 years (from 90.1 to 25%). There were no statistically significant differences in the percentage of children who did not sleep the recommended hours for their age group between T1 and T4. The sociodemographic variables introduced in the model were not significant, which suggests that child's sex and age were not related to the sleep hours.

Discussion

The objective of the present study was to examine the patterns of daily activities in European children and adolescents during the COVID-19 health crisis. As expected, the pandemic impacted youth negatively, with the examined daily activities becoming unhealthier as the lockdown extended. Closing schools was applied as a main restriction to slow down the spread of the pandemic but, unfortunately, it implied physical distance with peers and leisure restricted to the home.

The results of the study show that the percentage of children and adolescents who did not practice the daily recommended physical activity increased—almost doubled—after two weeks of lockdown compared to before the pandemic. Although a slight decrease was perceived three weeks later, significant differences were found in the last time point compared to the first one, showing that the percentage of youth who spent less than 60 min on daily exercise was still far from the percentage that used to follow this recommendation before the pandemic. Previous studies have shown that physical activity in children during school holidays is lower compared to class days (Brazendale et al., 2017; Weaver et al., 2019) so it is not surprising that children were less active during the months that schools were closed during the pandemic. The results of our study are in line with cross-sectional research that evaluated retrospectively the children's daily activities before and during the pandemic in the same assessment. These concluded that physical activity decreased during home confinement (e.g., Slot-Heijs et al., 2020; Xiang et al., 2020), supporting the fact that children were less active during the entire period in which the restriction of closed schools was imposed to face the COVID-19 pandemic. Therefore, besides the implications in learning, school closure during the pandemic also impacted risky behaviors: as the children did not attend compulsory physical education classes, their activity depended on the routines of each family and the restrictions applied (Fig. 1,2 and 3).

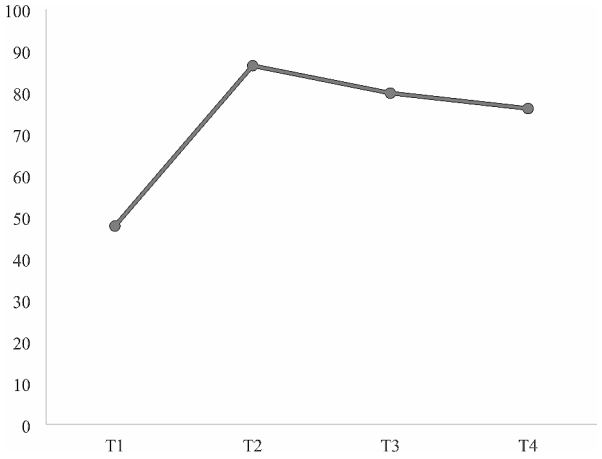

Fig. 1 Percentage of children and adolescents who spend less than 60 min on daily exercise (unhealthy group) across the four evaluation points. T1 = retrospective measurement of before home confinement, T2 = during the first two weeks of lockdown, T3 = five weeks after the start of lockdown, T4 = eight weeks after the start of lockdown

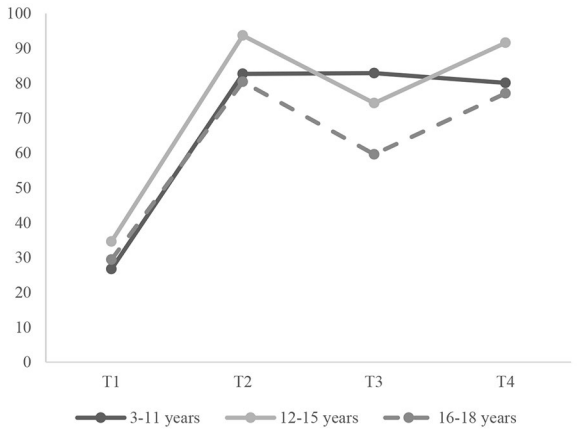

Fig. 2 Percentage of children and adolescents who use screens excessively, according to APP's recommendations (unhealthy group), across the four evaluation points. Children aged 3–11 who use screens daily ≥ 60 min. Children aged 12–15 who use screens daily ≥ 90 min. Adolescents aged 16–18 who use screens daily ≥ 120 min. T1 = retrospective measurement of before home confinement, T2 = during the first two weeks of lockdown, T3 = five weeks after the start of lockdown, T4 = eight weeks after the start of lockdown

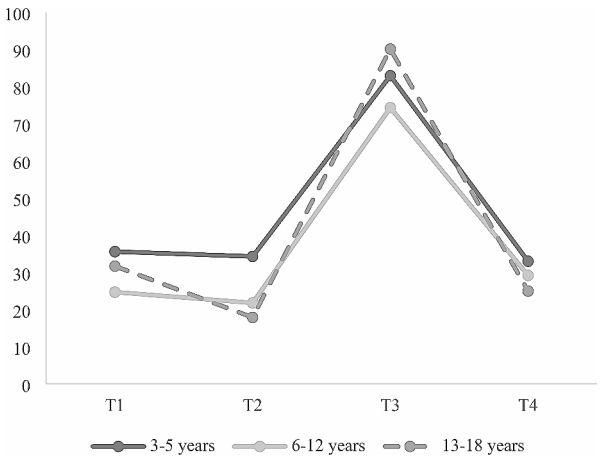

Fig. 3 Percentage of children and adolescents who sleep fewer or more hours than recommended by the APP (unhealthy group) across the four evaluation points. Children aged 3–5 who sleep daily ≤ 9 or ≥ 14 h. Children aged 6–12 who sleep daily ≤ 8 or ≥ 13 h. Adolescents aged 13–18 who sleep daily ≤ 7 or ≥ 11 h. T1 = retrospective measurement of before home confinement, T2 = during the first two weeks of lockdown, T3 = five weeks after the start of lockdown, T4 = eight weeks after the start of lockdown

As physical activity decreased, screen use seemed to increase. The results of the present study showed that, two weeks after the lockdown, the percentage of youth who used screens excessively was higher than before the pandemic and, although a slight decrease was perceived three weeks later, screen use increased again at the last assessment. Our findings are in line with other cross-sectional studies showing an increase in screen use during the pandemic. Almost 80% of parents from an Irish sample reported an increase in their children´s screen use compared to before the pandemic, spending more time not only on schoolwork but also on games or educational programs (Egan & Beatty, 2021). Screen time also increased in 87% of Canadian children (Carroll et al., 2020). As schools were closed during the lockdown and physical distance was imposed, leisure was restricted to the home. Digital appliances helped youth to remain in contact with their peers, and allowed them to follow the academic classes (Devitt et al., 2020). However, this could imply excessive use and negative consequences for their social and emotional development, as well as a decrease in physical activity. In fact, a study carried out with Dutch children showed a smaller increase in screen use than that found in other countries, but the authors hypothesized that it was due to the control of the pandemic in that country, which allowed children to go outdoors, as 91% of the parents informed (ten Velde et al., 2021).

Screen time use is related to sleep problems in children, as a recent systematic review highlights (Janssen et al., 2020). In this line, the present study found that sleep habits also seemed to be affected during the pandemic. Specifically, sleep problems started five weeks after the start of the lockdown and decreased at the eight-week time-point (T4). We expected that closing schools would modify children's and adolescent´s bedtime and wake-up time because they did not have to follow a schedule to attend classes (Guo et al., 2021). However, the results show that, during the first two weeks of home confinement, sleep habits did not seem to vary from those recommended for each age group. Effects were found at the five-week time-point (T3), but they only lasted three weeks, as seen in the results. Although the explanation for this finding is not clear, sleep hours may not have changed during the first weeks because sleep routines do not change so quickly even though the patterns of daily activities were altered. As the home confinement extended, sleep habits varied but, coinciding with fewer restrictions, which favored healthier habits, problems related to sleep decreased at the last time-point (T4). Our findings are in line with an international cross-sectional study that found no changes in sleep duration in more than 40% of the children, despite that bedtime and wake time differed compared to before the lockdown (Kaditis et al., 2021).

This study has as its main limitation that it was not possible to make comparisons with the main outcomes across countries; the sample size was considerably reduced when it was divided into the established age groups to determine whether the generally accepted recommendations for the time of physical activity, screen use and sleep were followed. Also, face-to-face assessment was not possible, so information was only provided online by parents. Applying measures to children would be desirable, but assessing behavioral problems was an objective, so parents were better informants than their children. This is a widely used procedure to assess health mental status during confinement (Spinelli et al., 2020; Morgul et al., 2023; Wang et al.,

2021). Despite its limitations, the present study increases knowledge about patterns of daily activities during the pandemic that may decrease the risk of illness, exploring the evolution of physical activity, screen use, and sleep habits over time.

Implications for Prevention Practice

Our study has significant implications for promoting physical activity, limiting screen time, and fostering healthy sleep habits within the context of lockdowns and restrictions. The proposed strategies are based on systematic reviews and studies supporting previous interventions that have highlighted the fundamental role of parental involvement in promoting and maintaining healthy lifestyle habits. These strategies include promoting physical activity (Drouka et al., 2023; Gorga et al., 2016; Kriemler et al., 2011; Santos et al., 2023), encouraging routines that facilitate appropriate sleep duration and habits (Busch et al., 2017), and monitoring screen use (Jones et al., 2021; Martin, Bednarz, & Aromataris, 2021; Oh et al., 2022).

As daily recommended physical activity tends to decrease during lockdown periods, parents should be provided with resources to facilitate indoor physical activity (Moore et al., 2020). Implementing simple yet effective strategies, such as creating exercise circuits using household items like pillows or books, or engaging in activities like dancing, can promote movement and mitigate sedentary behavior during the confinement (Chen et al., 2020). By offering accessible physical activities, we can counteract the sedentary lifestyle that often accompanies restrictions on outdoor mobility (Wang et al., 2020). Moreover, the increased reliance on screens during lockdowns underscores the need for alternative activities that promote family engagement and reduce screen time. Encouraging structured family time through board games or creative projects can be a constructive diversion from excessive screen usage. It is equally relevant to establish clear rules regarding device usage and for parents to model appropriate screen habits for their children (Council on Communications and Media, 2016). By fostering a balanced approach to screen time, the potential negative effects of prolonged digital exposure can be mitigated, promoting healthier lifestyles (Xiang et al., 2022).

In addition to physical activity and screen time, our findings underscore the importance of promoting healthy sleep habits during periods of confinement. A consistent sleep schedule is pivotal in improving sleep quality and overall well-being. This entails setting regular bedtime and wake-up times, trying to keep children active during the day, limiting screen exposure before bedtime, and engaging in relaxing activities before going to bed, such as reading or practicing mindfulness (e.g., Okely et al., 2021). By prioritizing healthy sleep hygiene practices, we can mitigate the adverse effects of disrupted sleep patterns and promote optimal cognitive and emotional functioning.

In conclusion, our study highlights the need for strategies to increase physical activity, limit screen time, and foster healthy sleep habits in the face of lockdowns and restrictions. By empowering parents with resources and guidance, encouraging alternative activities to screen time, and emphasizing the importance of sleep hygiene, healthier lifestyles may be established, mitigating the negative impacts of prolonged periods of confinement on physical and mental well-being.

Author Contributions MO designed the study and the survey. AM managed and analysed data. ED designed the Italian survey and collected data. CM participated in the Italian survey adaptation and collected data. RF designed the Portuguese survey and supervised the assessments. CG and MP collected Portuguese data. JPE designed this study and wrote the draft of this article. All the authors reviewed the draft and contributed to the final version of the manuscript.

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Declaration

Ethical Approval The study was approved by the Miguel Hernández University (2017.266.E.OEP) Informed consent was written by parents.

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