

# Correlates of Children's Physical Activity During the Covid-19 Confinement in Portugal

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## Research Article

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# Abstract

**Objectives:** Aiming to understand the role of household variables on the percentage of physical activity (%PA) during the COVID-19 confinement, an anonymous online survey was launched to be completed by Portuguese families with children. **Study Design:** A Cross-sectional study design using an anonymous online survey that was launched to assess how Portuguese families with children under 13 years of age adjusted their daily routines to this situation. **Methods:** Separate ANOVAs were performed to investigate how factors, such as the number of children, age, sex, the housing characteristics, and the adults' job situation, can affect the percentage of time for physical activity (%PA). **Results:** Findings, based on data from 2159 children, indicate that: I) Boys and girls did not differ in the %PA on any of the age groups; II) Children with an outdoor space and who had other children in the household were significantly more active ( $p < .001$ ); III) Children from families with all adults working from home showed lower levels of %PA; IV) Being younger, having a big outdoor space, having other children in the household, and having at least one adult free from working from home, were significant positive predictors of children's %PA, explaining 21% of the overall variance. **Conclusion:** Time allocated for PA during this period is reduced compared to what is usually reported on normal days. It is necessary to find strategies to increase children's PA, especially in families where both parents are working and have no outdoor space.

## 1. Introduction

Late December 2019, a series of unexplained cases of pneumonia were reported in the city of Wuhan, China<sup>1</sup>. On the 30<sup>th</sup> of January of 2020, WHO classified this epidemic as a public health emergency of international interest<sup>2,3</sup> and on February 11<sup>th</sup> classified the disease as Corona Virus Disease 2019 (COVID-19). On that same day, the Coronavirus Study Group (CSG) of the International Committee on Virus Taxonomy, named it Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)<sup>4</sup>.

As it continued to spread, on May 27, 2020, it had reached 188 countries, with 5.604.461 cases confirmed, of which 350.752 resulted in death. In Portugal, on this same date, 31.007 cases were registered, 1342 of which resulted in death<sup>5</sup>. In the absence of effective treatments for this pandemic situation, the best way to control the sources of infection was enforcing social isolation and confinement<sup>4</sup>. Therefore, in almost all countries, governments declared the state of emergency, tightening the effort to keep people at home. Schools' systems were shut down, non-essential government and private services were closed, and employees were moved to work from home. Portugal followed this same pattern, as schools, companies and non-essential public services across the country were closed on March 16<sup>th</sup> and the state of emergency was declared two days later, on March 18<sup>th</sup>. Also, the Portuguese government decided that children would stay at home-schooling until the end of school year, starting what it seems to be a long period of movement restriction, without any organized physical activity or free play time outdoors. It is known that during long periods without school, children are more susceptible to unhealthy behaviors,

such as excessive sedentary behaviors<sup>6,7</sup> with a negative impact on children's motor competence<sup>8</sup>, as well on their body composition and cardiovascular fitness<sup>9</sup>.

At the exact same week when the Portuguese state of emergency was instated we started an online survey for home confined families with children up to 13 years of age, in order to understand how the children's daily routines were established during confinement times, and specifically what, and how much, physical activity were children having at home. Following the international physical activity and public health research agenda to inform COVID-19 policies and practices<sup>10</sup> we created a survey to examine the behaviors of time expenditure by the Portuguese children. First results showed that children in confinement present high values of sedentary time, and playful screen time (without school related screen time), and low values of physical activity time<sup>11</sup>. In the present study, we intend to investigate if a differential effect of the COVID-19 confinement was felt according to the conditions children live in. Children's families have their own unique characteristics, as the size of the household<sup>12,13</sup>, children's age, the presence of siblings in the house<sup>14,15</sup>, whether or not parents are working at home<sup>16</sup>, the type of house and whether or not they have their own outdoor space<sup>7,17,18</sup>. It is expected that some of these variables may affect children's physical activity.

Knowing which variables are more related with physical activity is fundamental to better understand this phenomenon and can be helpful to create strategies, as well to prevent future unhealthy behaviors in similar situations of prolonged confinement.

## 2. Materials And Methods

### 2.1 The survey

To assess how children under 13 years of age are dealing with the COVID19 confinement situation, we created a survey on *LimeSurvey*, hosted on the *Faculty of Human Kinetics, University of Lisbon*. The survey was approved by the *Faculty of Human Kinetics* ethics committee. After a first validation of the questions by a group of five child development experts and a first pilot testing with 23 families, the survey was launched online on the 23rd March and publicized through the social media (Facebook, Instagram, WhatsApp), and by email. It takes approximately 5 minutes to complete, it should be completed by the parent / adult responsible for the child(ren), and it comprises 4 sections:

1. Household: Questions regarding the composition of the household and the number of children and adults who are at home and how many are working from home.

2. Housing characteristics: Type and characteristics of the house (e.g., apartment or detached house; number of rooms), existence or not of indoor space for physical activity (gym or exercise room) and of outdoor space (no outdoor space, small outdoor space - up to 12 m<sup>2</sup>; large outdoor space – more than 12 m<sup>2</sup>).

3. Household routines: Questions about the level of concern regarding the situation of Covid-19 and the way routines are being adjusted.

4. Children's routines: Questions related to the characterization of each child (age, sex, health status) and the time (reported in minutes) spent in different activities during the previous day.

## *2.2 Variables*

Five categories of activities were analyzed:

- a. Intellectual activity (school assignments and online classes);
- b. Playful screen time (games, movies, social networks, internet, audio and video calls); Play without physical activity (reading, drawing, painting, board games, cards, Legos, etc.);
- c. Play with physical activity (hide and seek, jumping, tag, etc.);
- d. Physical activity (organized physical activity indoors, physical activity outdoors, walk the dog).

The first three categories (Intellectual activity, playful screen time and play without physical activity) were added to calculate overall sedentary time, and the last two categories (play with physical activity and physical activity) were added to calculate overall physical activity time. This value was then converted into a percentage of the total time reported for all categories of the children, from now on called Percentage of Physical Activity (%PA).

Factors associated with the child (i.e., sex and number of children in the household), the housing characteristics (i.e., existence and dimension of outdoor space) and of the adults' job situation (i.e., all adults having to work from home or not) were used to analyze which would influence the %PA.

## *2.2 Participants*

The initial data of this survey included 3075 responses given by parents regarding their children under 13 years of age, who were in the household during the second week and beginning of third week of confinement (between 23<sup>rd</sup> of March and 1<sup>st</sup> of April). All participants read the information about the study and agreed with the conditions by clicking to proceed on the first page of the survey. Participants could withdraw at any given time by not proceeding or submitting the survey. After cleaning the database for second time responses (n=119 children) and for missing or obviously wrong information (e.g., more than 24 hours reported in a day, or no sleep time reported for children; n=797), data regarding 2159 children under 13 (1117 boys and 1042 girls), subdivided in four age groups (0-2 years – 462; 3-5 years – 765; 6-9 years – 606; and 10-12 years – 326) was used in this study.

## *2.3 Statistical analysis*

Descriptive statistics and frequency analysis were used for the initial characterization of the 2159 children divided by age groups, their household conditions and housing characteristics.

Separate ANOVAs were performed to investigate how different factors associated with the child (i.e., sex and number of children in the household), the housing characteristics (i.e., existence and dimension of outdoor space) and of the adults' job situation (i.e., all adults having to work from home or not) affected the %PA by age group. Age groups were considered as follows: group 1 = 0-2 years; n=462, group 2 = 3-5 years, n=765; group 3 = 6-9 years, n=606 and group 4 = 10-12 years, n=326. Finally, a forward stepwise regression ( $p$  to enter  $<0.05$ ,  $p$  to remove  $>0.10$ ) was performed to investigate the best predictors for the %PA done by children. Age of the child and the variables previously investigated in the ANOVAs were entered into the model. Qualitative variables (sex, outdoor spaces, and work from home) were transformed into dummy variables before entering the regression. A pairwise deletion method was used in the regression to accommodate for missing values. SPSS for Mac (version 25) was used for analyses.

### 3. Results

Descriptive data presented in table 1 showed that %PA decreased across all age groups. Additionally, four ANOVA'S testing for differences on daily PA according to sex, space, number of children in the house, whether or not parents are working from home (see table 1 and figure 1) revealed significant main effects for all tested factors (all  $p$ 's $<.002$ ), except for sex ( $p=.068$ ) and no interaction effects.

Boys and girls did not differ in the %PA on any of the age groups. Furthermore, the PA average time for both sexes was about two hours (2.2h and 2.3h respectively for girls and boys; data not shown).

Considering the typology of house space, we found that having a big outdoor space plays an important role, positively influencing PA mainly between 3-to-9 years of age (compared to all other typologies,  $p<.001$ ). This influence can also be seen in the younger age group, since having a big outdoor space is significantly different than having no outdoor space ( $p<.001$ ). No differences were found between the three typologies of outdoor space for the older age groups.

When analyzing the number on children in the household, we can see that being an only child is a disadvantage regarding the %PA. Higher values of %PA were found when more children were present in the household, and that it was true for all group ages ( $p$ 's $<.001$  in the first 3 age groups) except in the older age groups where no significant differences were found. Additionally, children from families who had all the adults working from home showed lower levels of %PA.

**Table 1:** Descriptive statistics and ANOVA results regarding the effect of sex, available outdoor space, number of children, and adults working from home, on children daily percentage of physical activity (%) reported by parents.

		Daily physical activity (%)				
		Age groups				Two way ANOVA
		0-2 years	3-5 years	6-9 years	10-12 years	
		Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Sex	Boy	38.80±26.15	29.35±16.82	22.19±15.14	16.42±13.39	Fage (3, 2085) =97.798, p = .000 Fsex (1,2085) = 3.449, p = .063 Fage*sex (3, 2085) =.884, p =.449
	Girls	36.23±27.62	26.31±15.53	21.80±14.31	16.22±13.88	
Available outdoor space	No out space	32.38±26.88	21.61±14.48	15.96±12.24	11.69±10.85	
	Small out space	36.22±27.06	25.35±14.32	18.69±12.69	16.25±13.45	Fspace (2,2089) = 69.275, p = .000
	Big out space	43.19±25.70	35.34±14.31	28.95±15.27	19.90±14.60	Fage*space (6, 2085) =1.385, p =.217
Number of children	Only child	31.71±22.48	24.86±15.17	18.90±13.91	13.46±10.82	Fage (3, 2093) =88.446, p = .000 Fchildren (1,2093) = 46.330, p = .000 Fage*children (3, 2093)
	2-5 children	40.83±28.62	29.98±16.65	23.69±14.93	17.76±14.62	

						=1.474, p = .220
Adults working from home	All adults	33.18±27.92	25.98±15.53	20.77±12.72	10.84±10.25	Fage (3, 569) =21.520, p = .000
	At least 1 free adult	38.85±27,68	29.34±17.86	25.02±15.09	18.98±13.07	Fwork (1,569) = 9.755, p = .002
						Fage*work (3, 569) =.393, p =.758

A linear regression analysis (table 2) showed that age, typology of spaces, number of children in the household, and all adults working from home, were significant predictors of children %PA, explaining 21% of the overall variance.

When looking for the predicting effect of each independent variable, we can see that age was the strongest predictor, suggesting a decrease in 2.1% of %PA for each year of age. Additionally, having a big outdoor space presented the second highest predicting effect, with an increase of 9,2% in %PA.

The number of children in the household and having all adults working from home presented the smallest predicting values. Also, it was verified an increase of 3.1% per children and a decreased of 3.8% if all adults were working from home in the %PA.

**Table 2:** Linear regression analysis summary for factors predicting %PA.

Predictors	$\beta$	Beta	T	P-value	F	R <sup>2</sup>
					38.230***	.21
Age	-2.057	-.357	-9.517	.000		
Big outdoor space	9.191	.229	6.130	.000		
Number of children	3.091	.114	3.062	.002		
All adults working from home	-3.703	-.091	-2.421	.016		

## 4. Discussion

Quantitative information about the intensity levels of PA were not gathered in the present study. Although apparatus like Fitbit and similar can be used for addressing PA in the adult population<sup>19</sup>, it is unusual to have these types of gadgets used by children, and in the wake of the sudden situation it was not possible to distribute such apparatus to families. Regardless, in our results, the value found in the PA average time for both sexes is less than half of the total time of PA reported by accelerometry for Portuguese children

(5.0h for boys and 4.5h for girls)<sup>20</sup>. In a normal school day, children have several physical activities opportunities like walking to school, engaging in physical education classes, playing in recess, participating on sport clubs, etc. All these normal activities are forbidden in this situation. The fact that %PA decreases along the growing age groups is not strange given the knowledge we have on PA behavior of children<sup>21</sup>, but the findings that boys and girls present no differences on this decrease is somehow new and not fully anticipated<sup>13-15</sup>. Boys use more play areas and equipment, tend to display higher levels of moderate-to-vigorous PA when using them<sup>22</sup> and seem to be more physically intense on the exploration of the playground features, while girls experience a higher enjoyment for activities like playing tag games, walking, creative tasks, climbing, sliding, hiding, sitting, and relaxing<sup>23</sup>. The same tendency occurs in organized sport participation during childhood, with boys engaging more often organized and high physically intense sports than girls<sup>20</sup>. In our results, girls and boys showed equal participation on organized physical activities before confinement (66% and 67% reported respectively for girls and boys) and that can help to explain why both sexes showed similar PA behavior along age groups. Another explanation can be that they are all “in the same boat”, without access to the kind of space, equipment, or social organization that usually afford sex-biased movement differences in the normal day time. Furthermore, the non-existence of sex differences in PA might be related to the fact that the majority of activities reported during confinement are probably of light intensity, which is usually not significantly different between boys and girls<sup>24,25</sup>. Although the government decision was the same for all people, it is wrong to think that this decision affects all equally. Most of the children in our study live in apartments (60,2%) and we found that having an outdoor space influences positively the %PA. The home environment is an important influence on the PA and sedentary behavior of children, being especially relevant for those who have limited independent mobility and spend much of their time at home and indoors<sup>12,13</sup>. Our results indicate that having a small outdoor space at home (up to 12 m<sup>2</sup>) did not make a difference, but having a larger space positively impacted the %PA. These results are in line with other studies, that mention that the amount or lack of outdoor space can have a great impact on the children PA<sup>7,16-18</sup>. Some studies showed that as the amount of home space increased, so did children’s PA<sup>16,26</sup>, and the lack of a yard space at home was identified as a barrier to PA and active play of children<sup>7,17</sup>. Yard features were positively associated with the minutes per day preschoolers spent in home-based outdoor play<sup>27</sup>. We believe that the results are in accordance with the knowledge that both boys and girls of lower socioeconomic status areas have decreased odds of spending more than 2h outdoors on weekends<sup>28</sup> and lower levels of fitness and activity compared to their peers from higher socioeconomic status areas<sup>29-31</sup>.

Having all adults in the household working from home had a detrimental effect on children’s %PA. This situation can surely be a stressful situation for a home confined family and it has been related with an increase in the depressive symptoms among working women with young children<sup>36</sup>. The number of tasks that parents have to undertake at this time is immense. They have to do work tasks, house tasks, children school tasks, meal related tasks, all this while trying to give emotional support to their kids and family. This can be a challenge for promoting PA, as fatigue is reported as an health barrier to be active with their

children<sup>37</sup>. Furthermore, with no parent free to engage in interaction with the children, and the need for a quiet work environment at home, surely that children's movement and noise inside the house are heavily censured.

Our findings showed that, although confined to their house, boys and girls still allocate some time to PA tasks (movement play and physical exercise). The %PA daily time reduces with age, but boys and girls showed no differences unlike what is usually reported for normal days. For children of both sexes and of all ages, the %PA showed to be positively affected by the existence of a big outdoor space in the house, and by the presence of other children in the house. On the opposite side, a negative effect was found when all adults were working from home, probably because of the related lack of attention to children and the need for a quiet home environment.

Even though this study provides important information regarding the role of several variables on the %PA during this confinement situation, it is important to highlight that it has some limitations. First, it is a cross-sectional study design and thus susceptible to biases. Second, it is a parental report online and not a direct or quantifiable observation of the children's time. We believe that these methodological options were necessary considering the confinement situation we are living.

The conclusions of this study highlight the fact that the COVID-19 response had a differential effect on children according to their household characteristics, being of outmost importance for parents and policy makers. Nobody can change their house size or add an outdoor area instantaneously, but governments can regulate about both parents working from home when there are children confined with them. Parents must be aware of the need to prioritize PA time for their children, since they are not getting the usual stimulation during this period. This effort should be even greater for parents of older children with no outdoor space available, especially because this can constitute a double burden situation when the family already presents a socioeconomic profile at risk. Furthermore, in the post-confinement stage, additional efforts will be required to offer PA and outdoor play opportunities for children who were most affected by the COVID-19 pandemic response.

## **Declarations**

### **5. Acknowledgments**

All the authors participated in the conceptualization of the study, the design, coordination and completion of data collections and drafting of the manuscript. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

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## 7. Competing Interest

The authors declare that they have no competing interests.

## 8. Ethics and Consent

All respondents read the information about the study and gave their consent to the conditions by clicking to proceed on the first page of the survey. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the Helsinki Declaration on Ethical Principles for Medical Research in Human Beings (2013) and the Convention on Human Rights and Biomedicine ("Oviedo Convention", 1997).

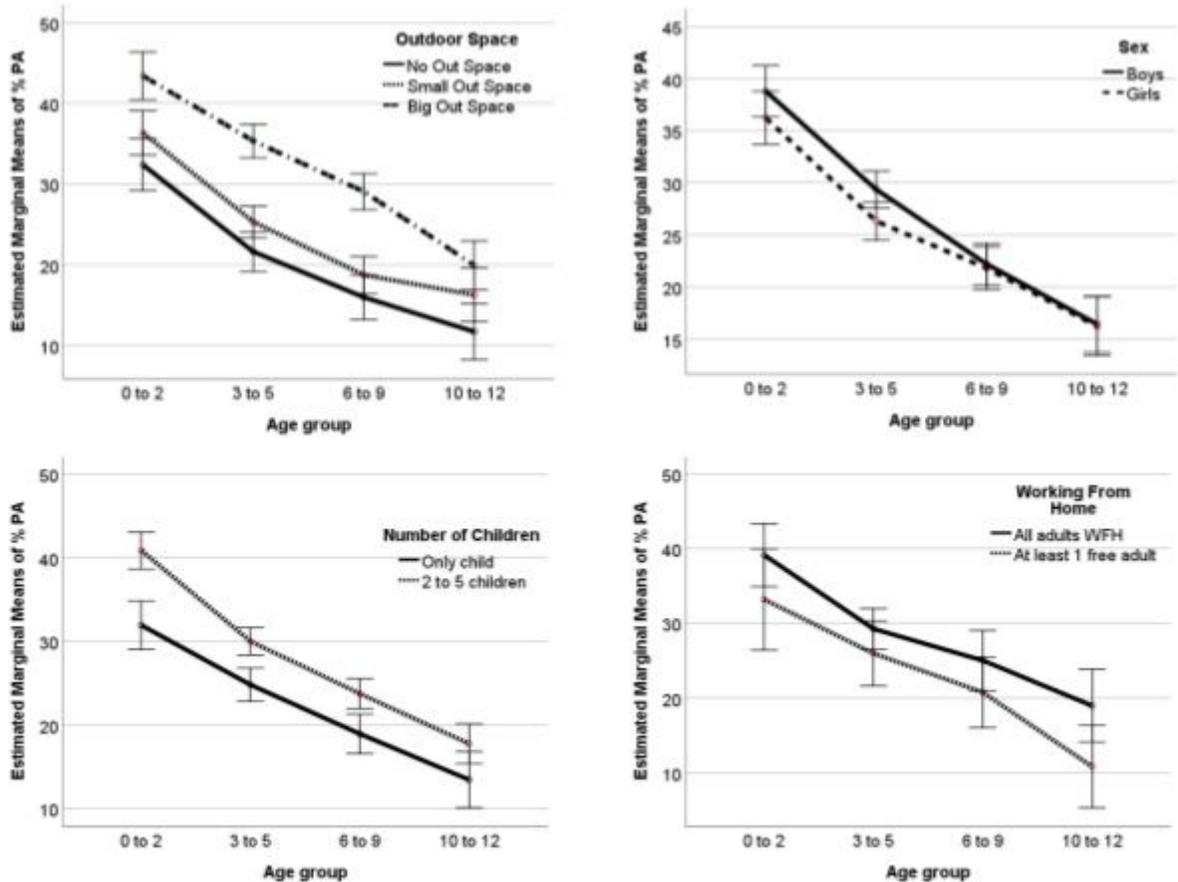
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## Figures



**Figure 1**

Descriptive statistics and ANOVA results regarding the effect of sex, available outdoor space, number of children, and adults working from home, on children daily percentage of physical activity (%) reported by parents.