

Original Article

Effects of the COVID-19 pandemic on preschool children and preschools in Portugal

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Abstract

Problem Statement: The COVID-19 pandemic led to significant changes in the life routines of preschool children, both during lockdown and post-lockdown periods. **Approach:** An online survey completed by parents, in-loco assessment scales filled in by a researcher and semi-structured interviews with preschool teachers were used to investigate the effects of the adjustments, which occurred in preschool children's lives, in the lockdown and post lockdown periods. **Purpose:** To characterize the levels of physical activity that Portuguese children had during the lockdown period and to understand what changed in their school routines in the post-lockdown period, regarding the organization of school spaces and routines. **Results:** Parents reported that children aged 3 to 5 spent most of their time during lockdown undertaking sedentary activities (72% of their daily activities). In the post-lockdown period, results indicate that in June there was an increase in the number of preschools with a poor quality of environment compared to the pre-pandemic period (October/November). Taking into account the measures implemented in preschools to prevent the COVID-19 transmission, teachers were of the opinion that limiting the number of children sharing material was the worst measure imposed, since it hampered children's socialization. Conversely, increasing the use of the outdoor space was deemed positive because it improved children's happiness and action possibilities outside. **Conclusions:** The COVID-19 pandemic has had a clear impact on Portuguese children's overall levels of physical activity during lockdown. In some schools, the implementation of health guidelines has also led to further negative effects on children's play opportunities. However, many schools seem to be successful in finding strategies to ensure a healthy balance between promoting children's physical activity and ensuring risk control.

Keywords: COVID-19, physical activity, preschool children, preschool spaces, pedagogical practices.

Introduction

In March 2020, the World Health Organization classified the outbreak of COVID-19 cases as a pandemic. In many countries a state of emergency was declared shortly after this date, which led to the closure of non-essential government and private services, such as school services (Islam et al., 2020). In Portugal, the state of emergency was declared on the 18th of March 2020, and most children were homeschooled till the end of the school year. Although it is recognized that such measure prevents high rates of the virus transmission (Sun, Lu, Xu, Sun, & Pan, 2020), being locked at home, is in itself an unpleasant experience as it can give a feeling of loss of freedom, boredom, and uncertainty over disease status (Mattioli, Sciomer, Cocchi, Maffei, & Gallina, 2020). During such times, people are likely to experience fear, helplessness, and stigma (Jeong et al., 2016), and with the closure of schools and businesses, such emotions can become exacerbated (Hall, Hall, & Chapman, 2008; Rubin, Potts, & Michie, 2010).

The lockdown brought a new reality to children's lives. Deprived of learning at school, free playtime outdoors, and with no opportunities to spend time with friends, children were suddenly locked in their homes and confronted with a home-schooling program. Although brief walks and outdoor playtime (20 min) were permitted during this time, all outside playgrounds were closed and children were encouraged to maintain social distance between themselves. This initiated the beginning of a long period of inactivity and play restriction, which can lead to serious consequences for children's physical and mental health (Graber et al., 2020). Low

values of children's physical activity (PA) and high values of sedentary behavior have a negative impact on their motor competence (Vandorpe et al., 2011), body composition, and cardiovascular fitness (Tomkinson & Olds, 2007). Alongside with providing significant health benefits (high bone density, high levels of motor competence, better physical fitness and a healthy weight), PA promotes children's mental health, psychosocial skills, academic performance (Biddle, Gorely, & Stensel, 2004) and a more robust immune system (Lasselin, Alvarez-Salas, & Grigolet, 2016).

Studies in different countries indicate that children's daily routines were more sedentary after the pandemic, with a decrease in PA behaviors (S. A. Moore et al., 2020; Pietrobelli et al., 2020), and an increase in screen time (Carroll et al., 2020). According to Jiao et al. (2020) these new daily routine patterns are considered to be risk factors for the onset of acute symptoms of anxiety, stress, irritability, inattention and emotional regulation difficulties, feelings, that have also been reported by children and those who cared for them during the pandemic phase (Idoiaga, Berasategi, Eiguren, & Picaza, 2020).

The initial lockdown was quite effective in reducing the virus spread in Portugal, and led to a gradual lifting of the emergency measures. The first children allowed back at school were those in daycare (May 18th, 2020) and preschool (June 1st, 2020). During this gradual lifting, the first approach of Portuguese National Institute of Health (DGS) was more restrictive in terms of safeguarding the rights of children. However, with the intervention of the Association for Early Childhood Teachers (APEI) (APEI, 2020), some measures were reconsidered (Direção Geral de Saúde, 2020) and a greater balance between the risk of transmission and the well-being of children was achieved in the subsequent guidelines for daycare and preschools. On the latter, the DGS recommendations and specific operating conditions were as follows: i) flexibility of rules for capacity (e.g., decreasing the number of children per room, maximizing the distance between children); ii) carrying out activities in the outer space; iii) organization of alternative routes and schedules; iv) disinfection procedures for adults, children, spaces and materials. In other words, removing from the rooms the accessories not essential to pedagogical activities, enhancing the cleaning and disinfection of those who remain there; and favoring the use of materials that are easier to disinfect, therefore ensuring that shared materials are properly disinfected. In this document, the Government highlighted that each preschool should apply the proposed measures according to its own reality, without ever losing sight of the importance of ensuring the child's wellbeing (Direção Geral da Educação, 2020).

In June 2020, many parents were still working from home and did not feel comfortable to send their children to school, so the number of children attending daycare and preschool at the end of the school year was relatively small. However, in September 2020, a new school year started: Portugal was no longer in a state of emergency, the possibilities for remote work decreased, and therefore children of all ages went back to school, which demanded from preschools a more complex organization. Due to the persistence of the COVID-19 pandemic, and the increase in the daily contamination rate, preschools had to deal daily with the difficult dilemma of fulfilling the health recommendations, while avoiding putting their children in a new form of lockdown, in which they could not play with their friends as they used to in the pre-lockdown period. This dilemma has challenged schools to reorganize spaces and practices that promote children's wellbeing and opportunities for active play without compromising their health (Moreira, Cordovil, Veiga, & Lopes, 2020b).

When analyzing the opportunities for active play, consideration must be given to the possibilities for action offered by the environment to each child, according to his/her needs, interests, motivations and abilities (Gibson, 1979; Kyttä, 2002; Waters, 2017). These possibilities for action arise not only from the characteristics of the socio-physical environment, but also from the pedagogical practices, defined by educational staff, which can facilitate or restrict the child's exploration of the environment (Kyttä, 2004). Then, both the socio-physical environment and the pedagogical practices modulate children's active play opportunities (Berti, Cigala, & Sharmahd, 2019b; Farinha, Correia, & Carvalho, 2019).

Studies suggest that the quality of the socio-physical environment contributes to children's motor, cognitive and socio-emotional development (Evans, 2006; Guo, Justice, Kaderavek, & McGinty, 2012; G. T. Moore, 2012; Wick et al., 2017). According to Berti, Cigala, and Sharmahd (2019a), in order to promote children's healthy development, early care childhood education environments should be salubrious and safe, not chaotic or crowded. Equally they should have a variety and complexity of materials and arrangements that encourage and facilitate play, as well as a clear spatial definition (legibility of space, clarity of thematic areas), with cozy spaces where children can withdraw and find privacy and intimacy. Materials used should be suitable for the children's age and the proposed pedagogical intentions. The outdoor spaces should offer a variety of elements, both natural and manufactured, designed to broaden the children's opportunities for play and move. Reinforcing this idea, Sandseter, Storli, and Sando (2021), highlighted that optimal physical environments for children should have multiple indoor and outdoor play and activity opportunities, allowing for exploration, social interactions, and a wide range of experiences and learning. Finally, the preschool physical environment should support and strengthen pedagogical practices (Bilton, 2010), helping the educators to focus on providing children different opportunities for action that enhance their development.

During the COVID-19 pandemic, preschools had to adjust their physical environment and pedagogical practices to comply with the health recommendations. It is essential to understand the impact of such

reorganization on children’s opportunities for action (Moreira et al., 2020b), to try to assure that time and space for active play continue to be guaranteed in children’s daily routines (Kytta, 2004).

In this article, we aim to understand what happened in the life of Portuguese children up to 5 years of age during the COVID-19 lockdown and upon their return to school. More specifically, we aim to characterize the levels of physical activity that children had during the lockdown period (study 1) and to understand what changed in their school routines in the post-lockdown period, regarding the organization of school’s spaces and routines (study 2).

Study 1

Materials and methods

As the Portuguese state of emergency became more established, we conducted an online survey for home confined families, with children up to the age of 13. The idea was to understand how the families’ daily routines were impacted during lockdown times, and specifically what and how much physical activity were children having at home (Pombo, Luz, Rodrigues, & Cordovil, 2020; Pombo, Luz, Rodrigues, Ferreira, & Cordovil, 2020). The survey was created on ‘LimeSurvey’ and approved by the Faculty of Human Kinetics ethics committee. It was launched online on the 23rd March and publicized through the social media (Facebook, Instagram, WhatsApp), and by email. It took approximately 5 minutes to complete and comprised 4 sections:

1. Household: Questions regarding 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, existence or not of indoor space for physical activity and of outdoor space.
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 each child (age, sex, PA before confinement, health status) and the time (reported in minutes) spent in different activities during the previous day.

Parents reported the time their children spent on intellectual activity (e.g., school assignments and online learning); playful screen time (e.g., games); play without physical activity (e.g., reading, drawing, painting, board games, cards, Legos, etc.); play with physical activity (hide and seek, jumping, tag, etc.), and physical activity (organized physical activity indoors, physical activity outdoors, walk the dog). For each child, overall sedentary time was calculated adding time spent on intellectual activity, playful screen time and play without physical activity, whereas overall physical activity time was calculated adding play with physical activity and physical activity. These values were then converted into a percentage of the total time reported.

Results

Our first results (corresponding to 2159 children; 1168 under 6 years of age) showed that children in lockdown presented high values of sedentary time, and playful screen time, and low values of physical activity time. These results were more concerning in the older age groups since as children’s age increased, there was also a decrease in the overall physical activity percentage they performed during the day. In fact, 10 to 12 year-old children spent an average of 83.68% of their day in sedentary activities (Pombo, Luz, Rodrigues, & Cordovil, 2020). Results regarding the percentage of time that daycare and preschool children spent doing different activities, whilst in lockdown, as well as their overall physical activity and sedentary time, were not as pernicious, and are presented in Figure 1.

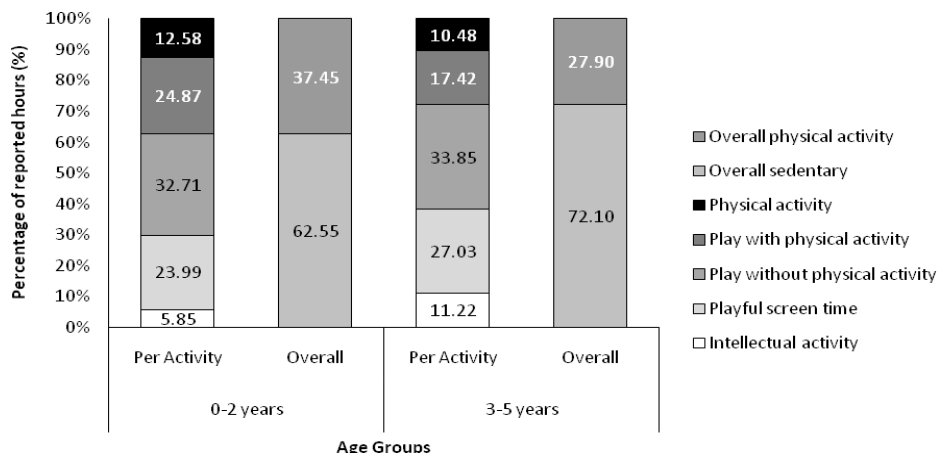


Figure 1. Mean percentage of time that children up to 5 years of age spent doing different activities during lockdown in Portugal, as reported by parents. Active and non-active activities were grouped to present overall physical activity and sedentary time.

Our results also indicate that for children of both sexes and of all age groups, the percentage of physical activity was positively affected by the existence of a big outdoor space in the house, and by the presence of other children in the household. Conversely, 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 (Pombo, Luz, Rodrigues, Ferreira, et al., 2020).

Although preschool children were not the most affected age group regarding the percentage of physical activity during lockdown, some children were particularly sedentary during this period. Hence, coming back to the preschool was an important moment for these children, since preschool should provide opportunities for these children to be active with their friends in a healthy and safe environment. For this reason, study 2 was conducted.

Study 2

Materials and methods

Sixteen preschools (14 public and 2 private) from Gondomar (Porto area in Portugal) agreed to participate in this study. The quality of the physical environment was assessed by the Escala de Avaliação dos Envolvimentos Físicos para Crianças [EAEFC] (Moreira, Cordovil, Veiga, & Lopes, 2020a). This scale is the Portuguese version of the Children's Physical Environments Rating Scale (CPERS5) (G. T. Moore, 2012), which has high inter-rater reliability ($r=0.84$) and test-retest reliability ($r=0.91$), good internal consistency in most subscales (Cronbach's $\alpha > 0.7$), and good construct and content validity (G. T. Moore & Sugiyama, 2007).

The EAEFC is divided into 124 items that assess the characteristics of physical environment of early childhood centers. It includes 4 parts, which assess: the size of the establishment in relation to the number of children (Part A); the qualities of aesthetics, scale, circulation, indoor environment, safety and security (Part B); the characteristics of the indoor spaces for care, for quiet activities, physical activity and messy and dirty activities (Part C), and the functional and developmental needs of the outdoor play areas and aspects of the building's location in relation to the community (Part D). Most items are assessed on a scale ranging from 0 (does not meet the criterion) to 4 (complies with excellence). Other items assess the existence of specific spaces. In this case, the rating varies between 0 (does not exist), 2 (exists, but is shared with other functions or ages), 4 (exists only for that activity) or NA (not applicable). The final score corresponds to the sum of the scores of each sub-scale, varying between 0.00-1.00=bad; 1.01-2.00=fair; 2.01-3.00=good and 3.01-4.00=excellent (Moreira et al., 2020a).

The EAEFC was filled in-loco in a visit of one of the researchers to each preschool at 3 different times: in October/November 2019; in June 2020 and in September 2020. The impact of the strategies that were implemented by each preschool in the post-lockdown period (June and September) was assessed by semi-structured interviews with the preschool teachers. The interviews lasted approximately 45 minutes, and covered themes such as the strategies used to implement the government guidelines and the perception about the feasibility of applying those guidelines.

Results

The EAEFC results of the 16 participating schools are presented in Table 1. Table 1. EAEFC results of the 16 Preschools prior to lockdown, right after lockdown and in the beginning of the next school year.

EAEFC quality levels	Oct. / Nov. 2019	June 2020	Sept. 2020
Poor (0.00-1.00)	1 (6.25%)	4 (25.00%)	1 (6.25%)
Fair (1.01-2.00)	14 (87.50%)	11 (68.75%)	15 (93.75%)
Good (2.01-3.00)	1 (6.25%)	1 (6.25%)	0 (0%)
Excellent (3.01-4.00)	0 (0%)	0 (0%)	0 (0%)

Note. The average number of children per pre-school was 50.25 in October/November, 17.70 in June and 48.63 in September.

None of the preschools were considered to have an excellent quality of the physical environment on all three periods. Results from June show that there was an increase in the number of preschools with a poor quality of the environment, compared to the pre-pandemic period (October/November). However, by September the physical environment quality reached scores similar to the ones they had in October / November, suggesting an efficient readjustment. It should be noted that only one preschool managed to maintain a good quality of the physical environment in June, although it fell to a reasonable level in September. Our results indicate that the small number of children attending preschool in June 2020 allowed for a better ratio between the indoor and outdoor activity areas and the number of children, so each child had more room available right after lockdown. However, this was not sufficient to prevent a reduction in the quality of the physical environment in some preschools.

The EAEFC lower scores right after the lockdown period (June) were influenced by thereorganization of the activities' spaces and the type and variety of materials available (both indoors and outdoors). This reorganization was necessary due to the DGS guidelines for the reopening of preschools. The semi-structured interviews allowed the examination of how the different strategies to prevent the COVID-19 transmission were being addressed by the different preschools and preschool teachers. In table 2 we present some of the implemented strategies, their frequency of implementation (i.e., number of schools that followed each recommendation), and teachers' assessment about their feasibility of execution and impact on the pedagogical practices and children's behavior.

Table 2. Frequency of implementation of different strategies (number of schools that implemented each strategy), and teachers' assessment (number of positive, negative, or null opinions) of each strategy, when implemented, in the post lockdown period (June and in September).

Strategy	Frequency of implementation		Teachers' assessment					
	June	Sept.	Opinion June			Opinion Sept.		
			Pos.	Neg.	Null	Pos.	Neg.	Null
Limitation of the number of children who can use the material at the same time (indoor and outdoor)	13	8	0	5	8	0	5	3
Increase the use of outdoor space	12	4	2	1	9	2	0	2
Removal of indoor and/or outdoor loose objects and materials that promote gathering or sharing	14	11	1	3	10	2	2	7
Restriction/prohibition of using outdoor equipment that promotes gatherings (e.g., slides and swings)	0	4	0	0	0	1	1	2
Use the outdoor space at a fixed schedule, different for each class.	3	5	0	1	2	0	1	4
Different classes use the outdoor space at the same time, but space is divided, and each class always stays in the same play area	2	1	1	0	1	0	0	1
Different classes use the outdoor space at the same time, but space is divided, and classes rotate from time to time between play areas	1	8	1	0	0	0	0	8
Focus mainly on disinfection measures	1	5	0	0	1	3	2	0

As shown in Table 2, in June, when the preschools reopened, the most commonly used strategies were: to remove indoor and/or outdoor loose objects and materials that promoted gathering or sharing, to limit the number of children using the material at the same time, and to increase the use of outdoor space. Limiting the number of children using the material at the same time was the measure that preschool teachers considered to be the worst one since it hampered children's socialization. On the other hand, increasing the use of the outdoor space was considered positive, since preschool teachers felt that children were happier and had more action possibilities outside. The only negative perception regarding this measure related mainly to the lack of outdoor space conditions with extreme weather conditions in summer (little shade, cement ground). It should also be noted that in June, 12 preschools reported to have increased the use of the outdoor space as a strategy to prevent COVID-19 dissemination, whereas in September only 4 preschools adopted this strategy. Although the weather conditions in September are usually not bad in the north of Portugal, there is more wind and rain than in June, and most preschools avoid using the outdoor space in rainy days.

In September there was a decrease concerning the implementation of most strategies, except the ones focused on the use of outdoor space and in promoting disinfection measures. This latter strategy was the one with the greatest positive perception among the teachers, who considered that disinfection measures were better than limiting the use of materials and sharing materials among children because they did not compromise children's opportunities for physical and social play. It should be noted that the only strategy that was not used by any preschool in June (restriction of using the fixed equipment) was enforced by 4 preschools in September. A significant increase in the number of children attending the preschool in September meant that it was more challenging to ensure that the number of children using the material was limited, so some preschools decided to restrict the use of outdoor equipment.

Discussion

Our findings show the hard-hitting effect of COVID-19 lockdown in the lives of preschool children and specifically their school routines, namely in terms of the increase of sedentary time and decrease of quality in their play environments. Having an outdoor space at home and siblings was a critical factor that contributed for children's physical activity and play, as well as having access to outdoor action possibilities at preschool to be shared by peers. According to Bronfenbrenner and Morris (2006), the home and school environments interact

between each other acting as mesosystems, in which crucial children's developmental proximal processes are established. Therefore, the quality of children's lifestyles at home affects their lifestyles at school and vice-versa. Considering the impact of children's sedentarism on health and well-being (Graber et al., 2020), the increase of children's sedentary lifestyles during lockdown, shown by the present study, is alarming and should deserve more attention from governmental, educational and health agents. In fact, the lack of physical activity might be a contributing factor to the increase of mental health problems during lockdown reported in other studies (Idoiaga et al., 2020; Jiao et al., 2020). Essentially, a strong and consistent relationship has been found between sedentary time and both depressive symptomatology and psychological distress (Hoare, Milton, Foster, & Allender, 2016). Thus, promoting and preserving children's play and physical activity, even in pandemic times, is crucial for their healthy development and well-being.

The present study showed that after lockdown, preschools looked for strategies to mitigate the effects that this period had on children's opportunities to play. The small number of children attending preschool in June 2020 allowed for a better ratio between the indoor and outdoor activity areas and the number of children, so each child had more room available immediately after lockdown, which might have mitigated the lack of physical activity during lockdown. Nevertheless, in some preschools, such ratio was not sufficient to prevent a downward spiral on the quality of the physical environment. It is important to note that from June to September, preschools started to prioritize sanitization measures, rather than measures related to limiting their access to play materials. This might reflect that preschool teachers reconsidered the importance of guaranteeing children rich and varied opportunities for action, allowing them to create their own time and space for free and playful action (Kyttä, 2004). Indeed, despite the decrease of quality of physical environments, schools are trying to reorganize themselves in order to ensure opportunities for action that promote a balanced development and well-being of the child.

The present study shows that the majority of the outdoor spaces do not seem to be prepared to be used all year round, nor do they seem to have adequate proportions for the number of children attending. In fact, the use of the outdoor space varies according to the seasons of the year and in the winter, for instance, preschoolers spend most time indoors even when it does not rain. The idea that preschool spaces (both in terms of building and in terms of equipment), as well as early childhood education practices, highly affect children's behaviors and activities (Berti et al., 2019b; Farinha et al., 2019; Gibson, 1979; G. T. Moore, 2012) is vastly recognized. Considering that other pandemics are to be expected (Schlein, 2020), our findings reinforce the importance of rethinking the architecture of preschools; the design of equipment and play materials that allow and promote children's movement and outdoor-oriented practices; and teachers' supervision attitudes and beliefs as to ensure a good balance between safety and risk-taking and active play.

Conclusions

These two studies indicate that the COVID-19 pandemic has had a clear impact on Portuguese children's overall levels of physical activity during lockdown (study 1). Besides, despite some negative effects of the implementation of health guidelines on children's play opportunities, many schools seem to be successful in finding strategies to ensure a good balance between promoting children's opportunities to diverse actions while ensuring risk control (study 2). Yielding from these two studies an important conclusion may be stressed. The use of appropriate outdoor socio-physical environments for play, movement and physical activity is a fundamental message that should be reinforced by governments, health directorates and communities in general, as a key measure for children and families to adopt in times of uncertainty and challenge, such as those created by the actual pandemic.

References

- APEI. (2020). *Contribution to ensure the educational quality in daycare (0-3 years) in time of COVID19* [in Portuguese]. Retrieved from http://apei.pt/upload/ficheiros/var/DocumentoAPEI_final_redux.pdf
- Berti, S., Cigala, A., & Sharmahd, N. (2019a). Early Childhood Education and Care Physical Environment and Child Development: State of the art and Reflections on Future Orientations and Methodologies. *Educ Psychol Rev*, 31, 991–1021. doi:<https://doi.org/10.1007/s10648-019-09486-0>
- Berti, S., Cigala, A., & Sharmahd, N. (2019b). *The meanings of spaces in Early Childhood Education and care centres: a literature review*. Retrieved from <https://www.issa.nl/sites/default/files/u327/EDUCAS%20Literature%20Review%20.pdf>
- Biddle, S. J., Gorely, T., & Stensel, D. J. (2004). Health-enhancing physical activity and sedentary behaviour in children and adolescents. *J Sports Sci*, 22(8), 679–701. doi:10.1080/02640410410001712412
- Bilton, H. (2010). *Outdoor Learning in the Early Years - Management and Innovation (Third Edition)*. Oxon: Routledge.
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In R. M. Lerner & W. Damon (Eds.), *Handbook of child psychology: Theoretical models of human development* (pp. 793–828). N.J.: John Wiley & Sons Inc.
- Carroll, N., Sadowski, A., Laila, A., Hruska, V., Nixon, M., Ma, D. W. L., . . . On Behalf Of The Guelph Family

- Health, S. (2020). The Impact of COVID-19 on Health Behavior, Stress, Financial and Food Security among Middle to High Income Canadian Families with Young Children. *Nutrients*, 12(8). doi:10.3390/nu12082352
- Direção Geral da Educação (2020). *Guidelines - Preschool, Reopening Education* [in Portuguese]. Retrieved from https://www.dge.mec.pt/sites/default/files/orientacoes_para_a_reabertura_da_educacao_pre-escolar.pdf
- Direção Geral de Saúde (2020). *COVID-19 - Prevention and control measures in day care, family day care and nannies* [in Portuguese]. Retrieved from <https://www.dgs.pt/directrizes-da-dgs/orientacoes-e-circulares-informativas/orientacao-n-0252020-de-13052020-pdf.aspx>
- Evans, G. W. (2006). Child Development and the Physical Environment. 57(1), 423-451. doi:10.1146/annurev.psych.57.102904.190057
- Farinha, J., Correia, V., & Carvalho, J. (2019). Influence of the behavior setting on children's behavior [in Portuguese]. *Cadernos de Educação de Infância*, 118, 7-13.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
- Graber, K. M., Byrne, E. M., Goodacre, E. J., Kirby, N., Kulkarni, K., O'Farrelly, C., . . . development. (2020). A rapid review of the impact of quarantine and restricted environments on children's play and the role of play in children's health. doi:<https://doi.org/10.31234/osf.io/p6qxt>
- Guo, Y., Justice, L. M., Kaderavek, J. N., & McGinty, A. (2012). The literacy environment of preschool classrooms: contributions to children's emergent literacy growth. *Journal of Research in Reading*, 35(3), 308-327. doi:10.1111/j.1467-9817.2010.01467.x
- Hall, R. C., Hall, R. C., & Chapman, M. J. (2008). The 1995 Kikwit Ebola outbreak: lessons hospitals and physicians can apply to future viral epidemics. *Gen Hosp Psychiatry*, 30(5), 446-452. doi:10.1016/j.genhosppsych.2008.05.003
- Hoare, E., Milton, K., Foster, C., & Allender, S. (2016). The associations between sedentary behaviour and mental health among adolescents: a systematic review. *Int J Behav Nutr Phys Act*, 13(1), 108. doi:10.1186/s12966-016-0432-4
- Idoiaga, N., Berasategi, N., Eiguren, A., & Picaza, M. (2020). Exploring Children's Social and Emotional Representations of the COVID-19 Pandemic. *Front Psychol*, 11, 1952. doi:10.3389/fpsyg.2020.01952
- Islam, N., Sharp, S. J., Chowell, G., Shabnam, S., Kawachi, I., Lacey, B., . . . White, M. (2020). Physical distancing interventions and incidence of coronavirus disease 2019: natural experiment in 149 countries. *BMJ*, 370, m2743. doi:10.1136/bmj.m2743
- Jeong, H., Yim, H. W., Song, Y. J., Ki, M., Min, J. A., Cho, J., & Chae, J. H. (2016). Mental health status of people isolated due to Middle East Respiratory Syndrome. *Epidemiol Health*, 38, e2016048. doi:10.4178/epih.e2016048
- Jiao, W. Y., Wang, L. N., Liu, J., Fang, S. F., Jiao, F. Y., Pettoello-Mantovani, M., & Somekh, E. (2020). Behavioral and Emotional Disorders in Children during the COVID-19 Epidemic. *J Pediatr*, 221, 264-266 e261. doi:10.1016/j.jpeds.2020.03.013
- Kytta, M. (2002). Affordances of children's environments in the context of cities, small towns, suburbs and rural villages in Finland and Belarus. *Journal of Environmental Psychology*, 22(1-2), 109-123. doi:10.1006/jevps.2001.0249
- Kytta, M. (2004). The extent of children's independent mobility and the number of actualized affordances as criteria for child-friendly environments. *Journal of Environmental Psychology*, 24(2), 179-198. doi:10.1016/S0272-4944(03)00073-2
- Lasselin, J., Alvarez-Salas, E., & Grigoleit, J. S. (2016). Well-being and immune response: a multi-system perspective. *Curr Opin Pharmacol*, 29, 34-41. doi:10.1016/j.coph.2016.05.003
- Mattioli, A. V., Sciomer, S., Cocchi, C., Maffei, S., & Gallina, S. (2020). Quarantine during COVID-19 outbreak: Changes in diet and physical activity increase the risk of cardiovascular disease. *Nutr Metab Cardiovasc Dis*, 30(9), 1409-1417. doi:10.1016/j.numecd.2020.05.020
- Moore, G. T. (2012). Update on The Children's Physical Environments Rating Scale (CPERS5). *Children Youth and Environments*, 22(2), 311-312.
- Moore, G. T., & Sugiyama, T. (2007). The Children's Physical Environment Rating Scale (CPERS): reliability and validity for assessing the physical environment of early childhood educational facilities. *Children, Youth and Environments*, 17(4), 24-53.
- Moore, S. A., Faulkner, G., Rhodes, R. E., Brussoni, M., Chulak-Bozzer, T., Ferguson, L. J., . . . Tremblay, M. S. (2020). Impact of the COVID-19 virus outbreak on movement and play behaviours of Canadian children and youth: a national survey. *Int J Behav Nutr Phys Act*, 17(1), 85. doi:10.1186/s12966-020-00987-8
- Moreira, M., Cordovil, R., Veiga, G., & Lopes, F. (2020a). Children's Physical Environment Rating Scale (CPERS5): Translation and Adaptation Process to assess the physical environments of kindergartens in Portugal [in Portuguese]. In R. Mendes, M. J. C. Silva, & E. Sá (Eds.), *Estudos em Desenvolvimento*

- Motor da Criança 13*. Coimbra: CIDAF & FCT.
- Moreira, M., Cordovil, R., Veiga, G., & Lopes, F. (2020b). Times change, kindergartens change. The impact of the COVID-19 pandemic on the quality of physical environment and kindergarten practices and its influence on the behavior of preschool children [in Portuguese]. *Cadernos de Educação de Infância*, *121*, 15–20.
- Pietrobelli, A., Pecoraro, L., Ferruzzi, A., Heo, M., Faith, M., Zoller, T., . . . Heymsfield, S. B. (2020). Effects of COVID-19 Lockdown on Lifestyle Behaviors in Children with Obesity Living in Verona, Italy: A Longitudinal Study. *Obesity (Silver Spring)*, *28*(8), 1382-1385. doi:10.1002/oby.22861
- Pombo, A., Luz, C., Rodrigues, L. P., & Cordovil, R. (2020). COVID-19 Confinement in Portugal: Effects on the Household Routines of Children Under 13. 1-16. doi: <https://doi.org/10.21203/rs.3.rs-45764/v1>
- Pombo, A., Luz, C., Rodrigues, L. P., Ferreira, C., & Cordovil, R. (2020). Correlates of children's physical activity during the COVID-19 confinement in Portugal. *Public Health*, *189*, 14-19. doi:10.1016/j.puhe.2020.09.009
- Rubin, G. J., Potts, H. W., & Michie, S. (2010). The impact of communications about swine flu (influenza A H1N1v) on public responses to the outbreak: results from 36 national telephone surveys in the UK. *Health Technol Assess*, *14*(34), 183-266. doi:10.3310/hta14340-03
- Sandseter, E. B. H., Storli, R., & Sando, O. J. (2021). The relationship between indoor environments and children's play - confined spaces and materials. *Education 3-13*. doi:10.1080/03004279.2020.1869798
- Schlein, L. (2020). WHO Urges Nations to Prepare for Future Pandemics. <https://www.voanews.com/science-health/who-urges-nations-prepare-future-pandemics>
- Sun, P., Lu, X., Xu, C., Sun, W., & Pan, B. (2020). Understanding of COVID-19 based on current evidence. *J Med Virol*, *92*(6), 548-551. doi:10.1002/jmv.25722
- Tomkinson, G. R., & Olds, T. S. (2007). Secular changes in aerobic fitness test performance of Australasian children and adolescents. *Med Sport Sci*, *50*, 168-182. doi:10.1159/000101361
- Vandorpe, B., Vandendriessche, J., Lefevre, J., Pion, J., Vaeyens, R., Matthys, S., . . . Lenoir, M. (2011). The KorperkoordinationsTest fur Kinder: reference values and suitability for 6-12-year-old children in Flanders. *Scand J Med Sci Sports*, *21*(3), 378-388. doi:10.1111/j.1600-0838.2009.01067.x
- Waters, J. (2017). Affordance theory in outdoor play. In T. Waller, E. Årlemalm-Hagsér, E. B. Sandseter, L. Lee-Hammond, K. Lekies, & S. Wyver (Eds.), *The SAGE Handbook of outdoor play and learning* (pp. 40-54): SAGE Publications Ltd.
- Wick, K., Leeger-Aschmann, C. S., Monn, N. D., Radtke, T., Ott, L. V., Rebholz, C. E., . . . Kriemler, S. (2017). Interventions to Promote Fundamental Movement Skills in Childcare and Kindergarten: A Systematic Review and Meta-Analysis. *Sports Med*, *47*(10), 2045-2068. doi:10.1007/s40279-017-0723-1