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Child development and parenting practices of Brazilian children in the second year of the COVID-19 pandemic

Desenvolvimento infantil e práticas parentais de crianças brasileiras no segundo ano da pandemia de COVID-19

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ABSTRACT
Using the ICF biopsychosocial model, this study aimed to examine the association between child development and parenting practices of Brazilian families during the second year of the COVID-19 pandemic. This was a descriptive cross-sectional study. Thirty children and their respective families participated. Denver-II test was applied in person. In a virtual form, families answered questions about biological and environmental factors related to the interference of the COVID-19 pandemic in the child's daily life. It was verified that 83,3% of children were classified with typical development and 16,7% of children with questionable development. Regarding parenting practices during the pandemic, it was identified that children had excessive screen time (60%) and different behavioural, and emotional impacts (43.3%). Despite the potential of the pandemic to affect children's development, there was no negative effect of the second year of the COVID-19 pandemic on their global development which could be due to the characteristics of the participants and their families.

Keywords: International Classification of Functioning, Disability and Health. Covid-19. Child development.

RESUMO
Usando o modelo biopsicossocial da CIF, este estudo teve o objetivo de examinar a associação entre o desenvolvimento infantil e as práticas parentais de famílias brasileiras no segundo ano da pandemia de COVID-19. Trata-se de uma pesquisa descritiva transversal que envolveu 30 crianças e suas respectivas famílias. O teste Denver-II foi aplicado presencialmente, e, de forma virtual, as famílias responderam perguntas sobre fatores biológicos e ambientais relacionados à interferência da pandemia no cotidiano da criança. Verificou-se que 83,3% das crianças foram classificadas com desenvolvimento típico, e 16,7%, com desenvolvimento questionável. Quanto às práticas parentais durante a COVID-19, identificou-se que as crianças tiveram tempo excessivo de tela (60%) e diferentes impactos comportamentais e emocionais (43,3%). Apesar do potencial da pandemia de afetar o desenvolvimento das crianças, não houve efeito negativo do segundo ano da pandemia no desenvolvimento global, o que pode dever-se às características dos participantes e suas famílias.

Palavras-chave: Classificação Internacional de Funcionalidade, Incapacidade e Saúde. COVID-19. Desenvolvimento infantil.

INTRODUCTION

During the COVID-19 pandemic, the daily routine of families around the world was characterized by different behaviors because of social distancing, which may have had an impact on the child's development during early childhood (e.g. different sleep patterns, excessive screen time, reduced play time, reduced interactions with other children), as well as

changes in parenting practices (e.g. family dynamics, daily care of children, access to health and day-care services)[1-4].

In general, studies carried out in several countries show that the pandemic negatively affected neuropsychomotor development in early childhood. Infants born during the pandemic period, between March and December 2020 (n = 255), in the United States, presented significantly lower scores on the Child Development Ages and Stages Questionnaire (ASQ-3), at six months of age, in the areas of communication, personal-social development, and motor coordination when compared to babies born in pre-pandemic periods[5].

In Brazil, a study[6] from Marília Cecília Souto Vidigal Institution pointed out that the pandemic affected the cognitive and language development of preschool children (n = 671), also increasing educational inequalities, especially for those with lower socioeconomic status. In addition, the authors observed low physical fitness and delays in children's motor skills, assessed by the Sit and Stand Test (SST), when comparing pre- and post-assessment periods (beginning and ending of 2020, respectively), and also when the results were compared with children of the same age group, born in the pre-pandemic period, in 2019.

In Uruguay, a comparison of two cohorts of pre-schoolers (control group n = 34.355; experimental group n = 30.158), assessed between 2018 and 2020 through a readiness instrument for public school, showed delayed motor and cognitive development, and internalizing attitudes (e.g. anxiety, sadness, or social inhibition) in the children cohort born during the COVID-19 pandemic[7].

Finally, a recent systematic review[1] of 537 publications from 35 countries, carried out between January 2020 and June 2021, showed that stressors associated with the pandemic exerted a heavy burden on young children's development, in part mediated by the impacts of parenting practices on behavioral domains, access to health services and daily child care. Furthermore, the authors noted that there was a much larger body of evidence to date about the impact of the pandemic on maternal mental health than on early childhood development and parenting practices.

Considering these multifactoral aspects of the progression of child development, ecological models have been used to understand the neuropsychomotor development of children which point out that there is an intrinsic relationship between individual, environment, and task, and all these elements are directly involved in the development process[8]. To monitor the health of the child from this ecological perspective, the biopsychosocial model of the International Classification of Functioning, Disability and Health (ICF) is recommended for the description and states related to health, to offer expanded assistance to the individual and their

functionality[8,9].

The effects of the COVID-19 pandemic on child development and its relationships with the biopsychosocial context, especially in parenting practices, still need to be explored considering the different periods of the pandemic. Possible neuro-psychomotor delays in early childhood may have late consequences that only become apparent over years and must be carefully reported so that the results are translated into public policies, as well as health guidelines for the community. Based on this issue, the aim of this study was to examine the association between child development and parenting practices of Brazilian children during the second year of the COVID-19 pandemic, using the ICF biopsychosocial model.

METHODOLOGY

A descriptive cross-sectional study was conducted with participants residing in São Paulo, one of the cities most affected by the COVID-19 pandemic in terms of the number of deaths in Brazil[10]. The study included 30 children (mean = 24.4 months old, ± 14.7, 15 boys and 15 girls) and their families.

As inclusion criteria, children should be aged between 0 and 72 months and reside with parents or guardians in Sao Paulo city. Exclusion criteria were non-compliance with the age limit of the child development assessment instruments, or if the participating child presented any neuromuscular or sensory problems that compromised the performance of the study procedures.

The recruitment period was between January and February 2021 and data collection took place between March and April, exactly one year after the beginning of pandemic restrictions in Brazil. Contact with the families was established through a sports consultancy and a non-governmental organization that focuses on promoting and supporting child development.

The procedures of the study were carried out in two sessions. In the first session, an experimenter, a specialist in early childhood education, applied the Child Development Screening Test (Denver-II)[11] in person in the homes of each family to identify the risk of developmental delay. The Denver-II test is widely used by researchers in Brazil, is culturally adapted for Brazilian children, and has good psychometric properties, being a reliable and valid instrument[12]. Based on the performance score of children in activities expected for their age in skills language, personal-social, fine motor adaptive, and gross motor, children were classified

as typical development or questionable development (i.e. risk of delay). The test application took place in a space free of distractions, reduced flow of people, or electronic objects.

In addition, to evaluate the growth pattern and nutritional status, height and body mass were assessed to estimate body mass index (BMI), classifying the participants as low body fat for age, appropriate body fat, overweight, or obesity[13]. Safety protocols and the use of personal protective equipment (e.g. mask and face shield) were adopted in all in-person stages of the study, respecting the guidelines for easing isolation proposed by the Government of the São Paulo state.

The second session was held in a virtual environment where families answered questions from a form on the Google Forms platform based on the ICF biopsychosocial model[8]. This questionnaire consisted of questions about general characteristics of the children, neonatal and gestational characteristics, and family characteristics; personal and environmental factors related to possible interferences of the COVID-19 pandemic in child development; and a description of parenting practices in the daily routine. Figure 1 shows a schematic representation of the neuropsychomotor areas assessed by the Denver-II and the form questions associated with the components of the ICF model.

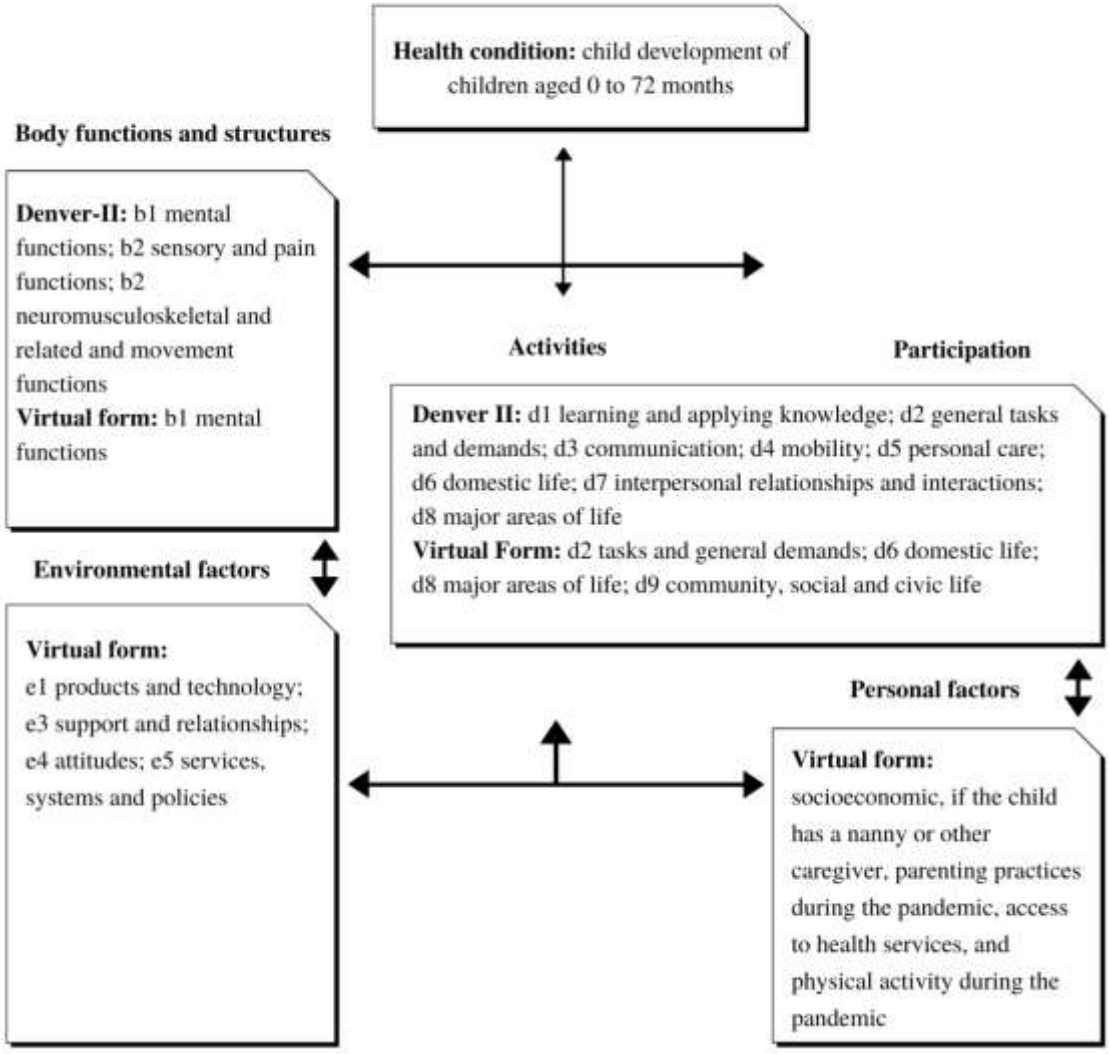

Figure 1. Description of the neuropsychomotor development areas (NPMD) assessed by the Denver-II and the virtual form questions associated with the components of the ICF model[8].
Note: Adapted from World Health Organization (WHO)[8].
Source: The authors.

Descriptive and percentage analyses were used to classify Denver-II test results (typical or questionable). Results of Neuropsychomotor development areas (NPMD) screening obtained through the Denver-II test were analyzed according to the technical manual of the instruments[11], with classification nomenclature adapted to current times, meaning that "typical" was used in place of the term "normal"[14]. Descriptive and percentage analyses were also performed for sociodemographic data, parenting practices, and behaviors during the pandemic period, and associated with the NPDM results. BMI was calculated using WHO Anthro personal computer software.

Variable classifications were grouped in a 2 x 2 table to increase the power of the statistical analysis due to the number of participants. Fisher's exact test was performed to

compare the associations between Denver-II and parenting practices categorical variables (SPSS, 21).

The participation in the study was conditioned to the signing of an informed consent form by the parents and/or guardians, and an assent term in coloring format by the child. The study was approved by the Ethics Committee of the Science Faculty, São Paulo State University (CAAE: 53670916.5.0000.5398).

RESULTS

Considering the first quarter of 2021, data were grouped into sections and described based on the classification of the NPMD screening measured by the Denver-II, the characterization of the sample and parental practices, and the reports of parents and/or guardians about the period of the COVID-19 pandemic. Table 1 shows NPMD screening results by Denver-II.

Table 1. NPMD screening classification by Denver-II

Categories	Boys n (%)	Girls n (%)	Total n (%)	*p* [a]
Typical development	11 (73.3%)	14 (93.3%)	25 (83.3%)	0.165
Questionable development	4 (26.7%)	1 (6.7%)	5 (16.7%)	

[a] Fischer's exact test.
Source: The authors.

The results of the virtual form used to characterize the participants showed that the answers were provided most part (96.7%) by the mother or guardian (woman) of the child. The overall results are shown in Table 2.

Table 2. Comparison of sociodemographic variables concerning NPMD by Denver-II

Variables	Categories	Typical NPMD (n = 25)	Questionable NPMD (n = 5)	*p*[a]
Age (months)		25 (±15.67)	21 (±2.55)	-
Race/Ethnicity[15]	White	21 (84%)	3 (60%)	0.254
	Yellow or Brown	4 (16%)	2 (40%)	
Classification of Adequate BMI	Adequate	22 (88%)	5 (100%)	0.567
	Overweight or obese	3 (12%)	0 (0%)	
Birth weight (kg)	⩽2.5	4 (16%)	1 (20%)	0.627
	>2.5	21 (84%)	4 (80%)	
Premature	Yes	4 (16%)	0 (0%)	0.462
	No	21 (84%)	5 (100%)	
Household income[15]	Class A	13 (52%)	3 (60%)	0.567
	Class B-D	12 (48%)	2 (40%)	
Type of residence	Apartment	25 (100%)	5 (100%)	-

Number of residents in the house	4 people or more	11 (44%)	4 (80%)	0.165
	Up to 3 people	14 (56%)	1 (20%)	

[a] Fischer's exact test
Notes: Race/Ethnicity[15], BMI values (adequate or overweight/obese), birth weight (≤2.5 kg or >2.5 kg), prematurity (yes or no), Household income (class A or B-D) A – more than R$ 20.900,01, B – between R$ 10.450,01 and R$ 20.900, C – more than R$ 4.180 up to R$ 10.450, D – between R$ 2.090,01 and R$ 4.180, E – up to R$ 2.090; type of residence, number of residents: up to 3 or ≥4.
Source: The authors.

The results regarding parenting practices during the first quarter of 2021, as obtained from the virtual form, are shown in Table 3.

Table 3. Comparison between parenting practices concerning NPMD by Denver-II

Variables	Categories	Typical NPMD (n = 25)	Questionable NPMD (n = 5)	*p*[a]
Has a caregiver	Yes	21 (84%)	3 (60%)	0.254
	No	4 (16%)	2 (40%)	
Use of the external area of the house	Daily	21 (84%)	4 (80%)	0.627
	3 days a week	4 (16%)	1 (20%)	
Children have contact with children from other families	Yes	25 (100%)	5 (100%)	-
Screen time (daily) [16]	Adequate	11 (44%)	1 (20%)	0.318
	Not adequate	14 (56%)	4 (80%)	
Access to medical services	Monthly or bimonthly	13 (52%)	2 (40%)	0.500
	Quarterly or semiannually	12 (48%)	3 (60%)	
In person physical activity	Yes	21 (84%)	2 (40%)	0.068
	No	4 (16%)	3 (60%)	
The child plays alone	Often or sometimes	17 (68%)	3 (60%)	0.551
	Rarely or never	8 (32%)	2 (40%)	
The family encourages and plays at home	Often	24 (96%)	3 (60%)	0.064
	Sometimes	1 (4%)	2 (40%)	

[a] Fischer's exact test.
Notes: Caregiver (yes or no), use of the external area of the house: daily (≥ 5 days a week) or less (4 days a week or 3 days a week), contact with other children (yes or no), screen time[16] (adequate or inadequate), access to health services (monthly/bimonthly or quarterly/semesterly), In-person physical activity weekly (yes or no), plays alone often (daily) or sometimes (4 days a week) or rarely (2 days a week) or never, The family encourages and plays at home: often (daily) or sometimes (2 days a week) or never.
Source: The authors.

Contingency analyses showed no association between the categorical variables of environmental and biological factors, parenting practices, and the categorical variables of child development measured by the Denver-II test. However, our results revealed the effects of the pandemic on the personal social and language development, the routine of screen time, and sleep time of the participants.

In total, twenty-five (84%) children were classified as typically developing and five children as questionably developing. None of the children with questionable development were born prematurely. Among children with questionable development: child #1 (21 months old, male) had low scores in language and fine motor adaptive areas, adequate sleep[17], and adequate screen time[16]; child #2 (18 months old, female), scored low on personal social and language, sleep time may be appropriate[17], and inadequate screen time[16]; child #3 (25 months old, male) had low scores in language, adequate sleep time[17,] and inadequate screen time[16]; child #4 (21 months old, male), scored low on personal social and language, sleep time may be appropriate[17], and inadequate screen time[16]; and child #5 (20 months old, male), scored low on personal social, language, gross and fine motor adaptive, adequate sleep time[17], and inadequate screen time[16].

Regarding daily screen time, it was identified that 60% (n = 18) of the participants spent more time than recommended by WHO [16], against 40% (n = 12) of the participants who had adequate time in front of the screen. When stratified by hours, the results showed that children spent >1 hour (36.7%), 1-2 hours (43.3%), 2-3 hours (3.3%), and 3 hours or more (16.7%). No family reported their child participating in online physical activity during the period.

Table 4. Comparison between parents' reports on the pandemic period concerning NPMD by Denver-II

Variables	Categories	Typical NPMD (n = 25)	Questionable NPMD (n = 5)	p^a
Using of mask outside the house	Yes	9 (36%)	0 (0%)	0.143
	No	16 (44%)	5 (100%)	
Parents' perceptions of negative behaviors in the pandemic	Yes	10 (40%)	3 (60%)	0.367
	No	15 (60%)	2 (40%)	
Sleep routine increased during the pandemic time	Yes	1 (4%)	0 (0%)	0.833
	No	24 (96%)	5 (100%)	
Parent/guardian working/studying remotely	Yes	25 (100%)	4 (80%)	0.167
	No	0 (0%)	1 (20%)	

[a] Fischer's exact test
Notes: Mask outside the house (yes or no), Parent´s perception of negative behaviors in the pandemic: yes (excessive dependency; stress and restlessness) or no (not noticing negative behaviors), Sleep routine increased during the pandemic time (yes or no), Parent/guardian working/studying remotely: yes (both or just one of those responsible) or no.
Source: The authors.

Regarding sleep routine, when analyzing each child individually based on their chronological age and the sum of the total time recommended by the National Sleep Foundation[17], our results showed that 83.3% (n = 25) had an adequate sleep period, in 6.6% (n = 2) may be adequate and for 10% (n = 3), the sleep period is not adequate. During the pandemic, only 4% (n = 1) of the sleep routine increased according to family perception.

DISCUSSION

We aimed to analyze the association between child development and parenting practices of Brazilian children during the second year of the COVID-19 pandemic, using the ICF biopsychosocial model. Despite the potential of the pandemic to affect child development, most children in the present study showed typical NPMD whose results corroborate Mélo and colleagues[18] study carried out during the pandemic, and studies carried out before the social isolation of the pandemic period[19,20]. For children with questionable NPMD, mastering language showed the greatest delays, as shown in other studies[19-21.] These results are interesting since our study is one of the few studies with in-person evaluations of children during the pandemic period outside the hospitals and clinics. Most studies that investigated child development during the pandemic period exclusively used electronic questionnaires for the investigation[21,22].

Therefore, in general, the second year of the COVID-19 pandemic did not show a negative association between NPMD in the sample investigated according to Denver-II and parenting practices in our cohort. However, advancing in multidimensional comprehension and unique language in health, the use of the ICF biopsychosocial model allowed to identify possible impacts of the pandemic on the parenting practices of upper-middle-class families in the city of São Paulo, Brazil, regarding components in areas of activities and participation in daily life, factors environmental, biological, and parenting practices.

In general, our results corroborate Imboden et al.[23] study that did not find significant differences in the global development of 1024 infants and toddlers between 6 and 36 months old through the ASQ-3 test between pre- and post-pandemic periods. However, it is noteworthy that some developmental areas seem to be affected even after the acute period of the pandemic, such as personal social and language development. A recent systematic review and meta-analysis[21] concluded that although overall neurodevelopment was not affected by the COVID-19 pandemic, being born or raised during the pandemic, regardless of gestational exposure, was associated with a risk of impairment of communication/language which supports our results.

Another interesting point of our results was that being engaged in daily playtime, environmental stimuli, and daily activities during the pandemic seem not to have been sufficient for adequate global development, as shown by children who were classified with questionable NPMD (16.7%), mainly in language skills, in which all scored below expectations for their age. Of these children with questionable NPMD, four out of five had inadequate screen time[17], two out of five did not practice regular physical activity systematized by a professional, and four

out of five frequently used outside areas of the house to play. Most of these behaviors are considered risky for growth and development[16]. In this sense, the identification of the risk of developmental delay (questionable NPMD) through screening tests such as Denver-II based on the ICF model was essential for targeted orientation for actions for families as well as guidance for activities for the most delayed areas of these children.

One aspect that may have influenced our results and might be considered a limitation was likely the economic status of the participants' families. Most of them (83%) were classified as upper-middle household income and without risk of social vulnerability, which profile has been associated with favorable factors for child development[24,25], as was identified for the majority of the participants. Deoni et al.[24] found that in the first months of the pandemic, higher economic status was considered to be protective for the child development of children up to three years old, as assessed by the Muller Scales of Early Learning (MSEL). Moreover, the authors pointed out that, conversely, children from low-income families were more prone to mental health impairments and manifestations such as depression and anxiety than their peers from high-income families.

Furthermore, our findings indicate that the COVID-19 pandemic has imposed limitations on parenting practices during the acute period. This may be attributed to the government's isolation and distancing recommendations, which might have resulted, for instance, in increased negative behaviors in children's screen time. The use of electronic devices such as TVs, tablets, and cell phones was essential for children's entertainment during the pandemic period, probably because it was an activity that was easily supervised by families and by parents who worked from home. Moreover, this percentage was higher in children with questionable NPMD than those with typical NPMD. These results are worrying as early exposure to screens, longer exposure time, and less verbal interaction with their caregivers during screen time in the first two years of the infants' life, are considered factors that lead to an increased risk of impaired cognition and delay in language development in preschoolers[26].

According to the families' perception, regarding the emotional characteristics of the child, many parents reported excessive dependence on an adult, stress, or restlessness. This data is in line with Jião et al.[27] study which pointed out that in China, in the first months of the pandemic, social distancing accentuated or caused some emotional behaviors in children (e.g.: 36% excessive dependence on parents, 29% concern, 13% discomfort, and anguish).

Our results also showed that children used the external area of the house (apartments) with moderate to high frequency, maintained contact with other children, and did not use masks frequently. At first sight, these data may seem worrying concerning a greater risk of contagion

among children. However, we can consider that during or shortly after the acute period of the pandemic, the restrictions imposed by the Government of the State of São Paulo and WHO recommendations for wearing masks did not extend to children under two years of age. The easing of isolation in the second year of the pandemic was important because it allowed children to have contact with their peers and access other spaces outside the home, and this may have led to adequate development for most participants.

In our study, most families had regular access to health services at least quarterly, which means that the participants did not show vulnerability in primary care during the second year of the pandemic period. This aspect may have protected children from having delayed NPMD and could be examined with a larger cohort. These data are different from the initial period of the pandemic, where the median number of public consultations for children aged 0 to 2 years old throughout Brazil was significantly lower than in the same period in previous years, serving more than 50% of attendances[3]. Also, all participants in our study had access to systematic physical activity in person with a specialist professional, and this may have benefited the acquisition and refinement of motor skills in early childhood and maintaining an adequate BMI[28].

As limitations, we highlight that more than 83% of the participating families belong to the upper-middle class and that 80% of the children were white. These characteristics may not be totally in line with the standard reality of early childhood in Brazil and the city of São Paulo[29].

Importantly, recent studies have shown signs and persistent symptoms of long COVID in children that last for several weeks and months after the initial SARS-CoV-2 infection which suggests long-term effects and constant monitoring of children's health and development[30]. Our results sought to show possible long-term consequences of the pandemic period examining how the children's development and families' routines were affected in the second year of the pandemic (first quarter of 2021).

Based on our data, we have identified key factors that may contribute to the development of NPMD, not only during the pandemic but also in the post-pandemic period. A family environment with strict restrictions and limited access to healthcare professionals, such as physiotherapists, physical trainers, speech therapists, and occupational therapists, may compromise the development of NPMD. In this sense, it is important to note that some children in the sample exhibit risk factors such as lack of physical activity, sedentary behavior, and inadequate sleep, which can lead to health problems later in life[16]. It is crucial to understand that effective and economical public policies to prevent risks and delays in children should be

implemented during the first years of life before such changes are consolidated[31].

Therefore, these data, in addition to providing specific insights into other health crises, contribute to the construction of public policies in order to reduce social inequalities. Future studies should focus on class, race, and social contexts to identify possible changes in neuropsychomotor development and parenting practices, mainly associated with the long-term effects of COVID-19.

CONCLUSION

We can conclude, therefore, that there was no association between children's development level and parenting practices during the second year of the pandemic. Parenting practices were characterized by the ICF biopsychosocial model, in which was possible to observe important behavioral changes, in upper-middle-class families, living in the city of São Paulo, Brazil. Family stimulation, systematic physical activity, contact with other children, and access to primary care may have contributed to compensat for the potential of the pandemic to affect child development.

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