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ORIGINAL ARTICLE

Functional status of hospitalized pediatric patients with COVID-19 in southern Brazil: a prospective cohort study

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Study conducted at the Hospital de Clínicas de Porto Alegre, Rio Grande do Sul (RS), Brasil.

ABSTRACT

Objective: The present study aimed to assess the functional status of children diagnosed with COVID-19 at the time of hospitalization and the associations with clinical features. **Methods:** This prospective cohort study was carried out with children diagnosed with COVID-19 admitted to a tertiary hospital. The patients' functioning was assessed using the pediatric Functional Status Scale (FSS). **Results:** A total of 62 children with a median age of 3 years old were included in the study, and 70% had some comorbidity prior to the diagnosis of COVID-19. The median length of stay was nine days, during which period five patients died. The FSS assessment of the sample showed that approximately 55% had some functional alteration. The group of patients with the highest FSS scores presented a lengthier hospital stay ($p = 0.016$), required more oxygen therapy ($p < 0.001$), mechanical ventilation ($p = 0.001$), and intensive care unit admissions ($p = 0.019$), and had more cardiac ($p = 0.007$), neurological ($p = 0.003$), and respiratory ($p = 0.013$) comorbidities. In the multivariate analysis, there was an association between the dependent variable length of stay and the total FSS score ($\beta = 0.349$, $p = 0.004$) and the presence of comorbidities ($\beta = 0.357$, $p = 0.004$). **Conclusions:** We observed that more than half of the children hospitalized due to COVID-19 had some level of functional change. Greater alterations in functional status were associated with the presence of previous comorbidities, a greater need for ventilatory support, and longer hospital stays.

Keywords: COVID-19, coronavirus, pediatrics, physical functional performance, functional status.

INTRODUCTION

In November 2019, an outbreak of pneumonia of unknown etiology began in Wuhan, China, which was then identified as a new coronavirus, known as SARS-CoV-2.[1,2] The first cases of the disease in the pediatric population appeared at the beginning of the pandemic.[3]

Most cases of this infection in the pediatric population are asymptomatic or present with mild symptoms.[3–5] However, the presence of previous comorbidities is a risk factor for the development of severe disease.[6] Studies show that half of the COVID-19 patients admitted to intensive care units (ICU) and nearly 80% of those hospitalized had at least one comorbidity prior to admission.[4,6] Moreover, approximately 46% of pediatric patients with COVID-19 require hospitalization, and around 10% require intensive care; the mortality rate is 5.7%.[3,4,7,8]

COVID-19 has been shown to cause many aftereffects, including impairment of respiratory and muscle functions, reduced functionality, and difficulty performing daily tasks.[9,10] These changes can manifest in children as loss of motor milestones and delay in motor development.[10–12] Among the several professionals who work in the treatment of COVID-19, physical therapists are involved in the treatment, prevention, and rehabilitation of the functional changes caused by the disease. Thus, the assessment of the functional status of patients with COVID-19 at the time of hospital admission could contribute to the screening of more critically ill patients and assist in physical therapy during hospitalization.

Few studies analyze the functional profile of hospitalized children with COVID-19. The pediatric population usually shows mild symptoms of the disease, but children with previous comorbidities are more likely to develop severe cases of COVID-19, thus requiring hospitalization. Therefore, the functional profile of these children must be assessed to prepare the healthcare system for their admission, as well as intensify preventive practices and plan better physiotherapeutic strategies for adequate treatment.

Thus, the aim of the present study was to verify the prevalence of altered functioning in pediatric patients diagnosed with COVID-19 admitted to the pediatric inpatient unit of the Hospital de Clínicas de Porto Alegre (HCPA).

METHODS

A prospective cohort study was conducted in children diagnosed with COVID-19 admitted to the HCPA from

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March 2020 to June 2021. This study was approved by the Research Ethics Committee of the HCPA, under Protocol No. 48189021400005327, according to Resolution 466/2012 of the HCPA National Health Council.

The collection of clinical and sociodemographic data was performed with the aid of electronic medical records, and the analyzed variables were: date of hospital admission, ethnicity/skin color, sex, age, weight, presence of comorbidities (cardiac, respiratory, neurological, metabolic, and/or oncological), laboratory tests (C-reactive protein, d-dimers, and lymphocyte, leukocyte, and platelet counts), the need for ventilatory support (oxygen therapy, non-invasive, high-flow nasal cannula (HFNC), mechanical ventilation (NIV), and invasive mechanical ventilation (MV)), functional status assessed using the Functional Status Scale (FSS), the severity of involvement by COVID-19 (Ordinal Scale for Clinical Improvement), length of stay, and death. The latter was defined as a patient who died for any given reason.

Pediatric patients of either sex, aged less than 18 years old, with a positive result in the reverse transcriptase polymerase chain reaction (RT-PCR) test for SARS-CoV-2,[13,14] who were hospitalized at the HCPA were included in the study. Those who refused to participate and cases of reinfection were excluded.

According to the institutional protocol for the management of patients with COVID-19, individuals with moderate to severe symptoms were hospitalized, as well as patients with previous comorbidities due to exacerbation of the underlying disease. Oxygen therapy was indicated for patients with peripheral oxygen saturation (SpO_2) < 93%, increased respiratory rate (RR) according to age, and/or signs of respiratory effort. In cases of SpO_2 < 93% with supplemental oxygen therapy > 5 L/min without signs of multiple organ failure, the use of an HFNC was indicated. NIV was indicated for cases of hypoxemic respiratory failure without a satisfactory response to oxygen therapy alone and/or HFNC. Patients with hemodynamic instability requiring vasoactive drugs, respiratory failure regardless of the support provided in the ward, a need for invasive MV, and other organic dysfunctions were transferred to the ICU. The criteria for the use of invasive MV were: severe acute respiratory syndrome, SpO_2 < 93% using HFNC or NIV, PaO_2/FiO_2 ratio < 200, and evident signs of respiratory distress. The criteria for hospital discharge were considered as the improvement of SpO_2 and RR to baseline levels or acceptable limits, with the stability of the patient's condition, for at least 12 hours (ideally 24 hours).

The functionality of the patients was evaluated using the pediatric FSS, which was translated and validated for the Brazilian pediatric population.[15] This scale assesses the following domains: mental status, sensory functioning, communication, motor functioning, feeding, and respiratory status. Each domain receives a final score ranging from 1 to 5, where 1 is considered "normal" and 5, "very severe dysfunction." The total scores ranged from 6 to 30, in which the results could be categorized as adequate functionality (6–7 points), mild dysfunction (8–9 points), moderate dysfunction (10–15 points), severe dysfunction (16–21 points), and very severe dysfunction (22–30 points).[15,16] These data were collected from the physical therapy evaluations recorded in the electronic medical records of the study patients at the time of hospitalization. The evaluation of functional status is part of the standard assessment of the hospital's physical therapy service and is always performed within the first 24 hours of hospitalization. Prior to the beginning of the study, all the physical therapists involved underwent specific training.

The severity of COVID-19 was classified using the World Health Organization (WHO)'s Ordinal Scale for Clinical Improvement.[17] This scale has domains ranging from 0 to 8 points, in which the results can be categorized as not infected (0 points), outpatient follow-up (1–2 points), hospitalization with mild disease (3–4 points), hospitalization with severe disease (5–7 points), and death (8 points).

Functional status was also evaluated using the Lansky scale,[18] intended for individuals under 16 years of age, in which the patient's performance and well-being are assessed, including their ability to perform daily activities and functional capacity. The score on an ordinal scale ranges from 10 to 100, where 10 represents a child who does not get out of bed, and 100, a child who is fully active.

The sample size was calculated using the online version of the PSS Health tool.[19] The mean FSS score was estimated with a 2.5-point absolute margin of error and a 95% confidence level. Based on an expected FSS standard deviation (SD) of 8.9 points[20] (estimated from the interquartile range), the sample size was defined as 52 subjects. Considering 15% of losses, a total of 62 individuals were recruited.

All variables were expressed as number of cases (proportion), median, and interquartile range (IQR) (25 percentile and 75 percentile). The Shapiro-Wilk test was used to assess the normality of continuous variables. The individuals were classified into two groups for analysis: FSS score ≤ 9 points and FSS score ≥ 10 points. Non-parametric comparisons between groups were conducted using the Mann-Whitney U test. Spearman's correlation analysis (non-parametric data) was used for correlations between the global FSS score and other clinical variables. Univariate and multivariate linear regression were performed, considering the logarithm of length of stay as the dependent variable since it had asymmetric distribution. All data were stored in a Microsoft Office Excel 2019 spreadsheet and analyzed using the Statistical Package for the Social Sciences (SPSS), version 18.0, adopting a 5% statistical significance level ($p < 0.05$).

RESULTS

A total of 62 unvaccinated children diagnosed with COVID-19 were included in the study, 39 (62.9%) of

whom were male and with a median age of 3 years old (0.4–10). Approximately 70% (n = 43) of the patients already had some comorbidity prior to the diagnosis of COVID-19. Around 8% were diagnosed with COVID-19 at the time of admission due to the underlying pathology and were asymptomatic. The median length of stay of patients was nine days (5–23); 26 patients required ventilatory support during hospitalization (41.9%), and five died (8.1%). The sample characterization data are shown in Table 1.

Table 2 shows the comparison between the groups of patients with FSS ≤ 9 points (preserved functionality or mild dysfunction) and FSS ≥ 10 points (moderate, severe, or very severe dysfunction). The group of patients with FSS ≥ 10 points had a longer hospital stay ($p = 0.016$), required more oxygen therapy ($p < 0.001$) and mechanical ventilation ($p = 0.001$), more admissions to the ICU ($p = 0.019$), and presented more cardiac ($p = 0.007$), neurological ($p = 0.003$), and respiratory ($p = 0.013$) comorbidities than children with FSS ≤ 9 points.

We found a moderately significant and positive correlation between the total FSS score and the length of hospital stay ($r = 0.607$, $p < 0.001$) and the severity of COVID-19 ($r = 0.575$, $p < 0.001$). The FSS score was also inversely correlated with the Lansky scale score ($r = -0.664$, $p < 0.001$).

Only 11 children in this sample required invasive mechanical ventilation and, consequently, used sedative analgesics and/or neuromuscular blockers. However, the functionality scale was evaluated in the first 24 hours of hospitalization, when the patients had not yet received invasive mechanical ventilation, showing no interference in the initial functionality assessment.

The univariate and multivariate linear regression data considering the dependent variable logarithm of length of stay are shown in Table 3.

DISCUSSION

In this study, we report the prevalence of functional changes in pediatric patients hospitalized with COVID-19 in a hospital in southern Brazil. In our sample, 69.4% of the patients had some comorbidity prior to COVID-19 diagnosis. The assessment via pediatric FSS showed that 53.2% of the individuals had some change in functioning, with 27.4% presenting moderate to very severe alterations. In the stratification of our data, patients with FSS ≥ 10 points had a higher prevalence of previous comorbidities (respiratory, neurological, cardiac, and metabolic), longer hospital stays, and required more ventilatory support and ICU admissions than those with FSS ≤ 9 points. In the correlation analysis, we observed a moderately significant and positive correlation of the total FSS score, the length of hospital stay, and the severity of COVID-19, and an inverse correlation with the Lansky scale score. The univariate analysis showed a significant association of length of stay, the FSS score, the presence of comorbidities, the Lansky scale score, and the severity of COVID-19. The multivariate analysis showed a significant association of length of stay, the FSS score, and the presence of comorbidities.

According to our data, the patients with greater functional changes (FSS ≥ 10 points) were the ones with the most comorbidities (83.3%). The presence of comorbidities is a risk factor for the development of more severe forms of the disease.[6] The study by Woodruff et al. (2022)[21] corroborates our findings by demonstrating that more than 50% of pediatric patients hospitalized with COVID-19 had at least one comorbidity prior to hospital admission. As observed herein, cardiac, respiratory, oncological, and neurological comorbidities are the most prevalent in the literature.[21,22]

Most of the evaluated sample had at least one comorbidity before the diagnosis and hospitalization for COVID-19. Despite no prior assessment, the changes in functionality found at hospital admission may relate to the presence of previous comorbidities. Other studies suggest that patients with chronic diseases have impaired functioning, motor performance, and independence.[23,24] Kolman et al. (2018)[25] demonstrated that functional status and mobility are predictors of health and quality of life in neurological patients.

Our study showed that the group of patients with FSS ≥ 10 points had a longer duration of hospital stay. The length of stay at the hospital relates to the presence of previous chronic pathologies, as patients with comorbidities require more healthcare assistance.[26] According to the literature, the length of hospital stay in pediatric patients with COVID-19

Table 1. Characterization of the individuals hospitalized with COVID-19.

Characteristics	n = 62
Male	39 (62.9%)
White	51 (82.3%)
Age (years)	3.0 (0.4-10)
SpO_2 admission	98.5 (96-100)
FiO_2 admission	21 (21-21)
Length of Stay (days)	9 (5-23)
Comorbidities	43 (69.4%)
Asymptomatic	5 (8.1%)
Ventilatory Support	26 (41.9%)
Functional Status Scale	
Adequate Functionality	28 (45.2%)
Mild Dysfunction	16 (25.8%)
Moderate Dysfunction	14 (22.6%)
Severe Dysfunction	1 (1.6%)
Very Severe Dysfunction	2 (3.2%)
Ordinal Scale for Clinical Improvement (points)	4 (3-5)
Lansky Scale (points)	70 (40-85)
Deaths	5 (8.1%)

Data were expressed as n (%) or median (25 percentile –75 percentile). n = number of cases; SpO_2 = oxygen saturation; FiO_2 = fraction of inspired oxygen.

Table 2. Comparison of the sample of pediatric individuals hospitalized with COVID-19 according to the presence of changes in functionality by the FSS.

Characteristics	FSS ≤ 9 points n = 44	FSS ≥ 10 points n = 17	p
Male	26 (59.1%)	13 (76.5%)	0.562
Weight (kg)	12,1 (6.4-36)	11.88 (6.9-21.9)	0.794
Age (years)	2 (0.4-10)	2.5 (0.4-9)	0.924
SpO_2 admission, %	99 (97-100)	98 (94-100)	0.487
FiO_2 admission, %	21 (21-21)	21 (21-28)	0.122
PaO_2/FiO_2 admission	161.5 (94.5-288.1)	109.9 (72.8-173.2)	0.346
Length of Stay (days)	7.5 (5-14)	21.5 (7-40)	0.016
Comorbidities	28 (63.6%)	15 (88.2%)	0.265
Cardiac Comorbidity	1 (2.3%)	5 (29.4%)	0.007
Respiratory Comorbidity	5 (11.4%)	8 (47.1%)	0.013
Neurological Comorbidity	4 (9.1%)	8 (47.1%)	0.003
Metabolic Comorbidity	6 (13.6%)	5 (29.4%)	0.275
Oncological Comorbidity	11 (25%)	1 (5.9%)	0.089
Immunosuppression	7 (15.9%)	1 (5.9%)	0.417
Tracheostomy	0 (0%)	4 (23.5%)	0.006
Ventilatory Support			
Oxygen Therapy	17 (38.6%)	17 (100%)	<0.001
HFNC	7 (15.9%)	6 (35.3%)	0.176
NIV	3 (6.8%)	4 (23.5%)	0.180
MV	3 (6.8%)	8 (47.1%)	0.001
ICU admission	11 (25%)	11 (64.7%)	0.019
Clinical laboratory tests			
CRP	13.8 (1.8-54.9)	41.1 (7.3-112.9)	0.328
D-dimers	1.4 (0.6-2.2)	1.1 (0.6-3.6)	0.957
Lymphocytes	3.4 (1.9-6.4)	2.1 (0.8-3.1)	0.144
Leukocytes	9 (5.5-11.7)	7.8 (5.6-11.7)	0.816
Platelets	289 (192-418)	229 (143-326)	0.337
Deaths	3 (6.8%)	2 (11.8%)	0.616

Data were expressed as n (%) or median (25 percentile - 75 percentile). FSS = Functional Status Scale; n = number of cases; kg = kilograms; SpO_2 = oxygen saturation; FiO_2 = fraction of inspired oxygen; PaO_2 = oxygen blood pressure; HFNC = high-flow nasal cannula; NVI = non-invasive ventilation; MV = mechanical ventilation; ICU = intensive care unit; CRP = C-reactive protein.

Table 3. Univariate and multivariate linear regression analyses considering the dependent variable length of stay (logarithm).

Characteristics	Univariate			Multivariate		
	β	CI	p	β	CI	p
FSS, points	0.397	0.036-0.159	0.002	0.349	0.028-0.143	0.004
Comorbidities	0.404	0.313-1.323	0.002	0.357	0.246-1.200	0.004
Lansky scale, points	-0.406	-0.024-0.006	0.002	-	-	-
Ordinal Scale for Clinical Improvement, points	0.327	0.055-0.460	0.014	-	-	-

β = linear regression coefficient; CI = confidence interval.

ranges from 1 to 20 days and shows less than 35% presence of comorbidities.[27–29] The longer length of stay in our study may be due to the higher prevalence of comorbidities and the complexity of our sample.

The study by Pollack et al., in 2009,[16] evidenced that higher FSS scores at the time of hospital admission correlate with longer hospital stays and increased use of mechanical ventilation. In addition, patients with higher scores at discharge tend to have worse clinical outcomes in the subsequent three years.[30] Thus, the assessment of the functional status of pediatric patients with COVID-19 during hospitalization can be considered a useful instrument that can assist in the physical therapy of groups at higher risk.

The group of children with FSS ≥ 10 points required more oxygen therapy, high-flow nasal cannula support, non-invasive mechanical ventilation, and invasive mechanical ventilation. Similar to other studies, few cases of children have progressed to the severe form of COVID-19. However, the presence of comorbidities

is an incisive factor and is present in most patients who require ventilatory support and ICU hospitalization.[3,31–33]

The role of COVID-19 in the functional changes of children remains unclear, as many children had previous comorbidities that contributed to such alterations. The need for ICU admission can also be associated with comorbidities and complex medical histories.[34] COVID-19 can exacerbate a coexisting chronic disease or be an additional factor in a patient's severe clinical course, as well as alter their functionality. Therefore, the influence of comorbidities and SARS-CoV-2 infection on the clinical outcome may be combined.[28]

This study prospectively evaluated hospitalized children diagnosed with COVID-19 for one year and four months. It was conducted at a single center, which may limit the generalization of its findings to different populations. Additional studies are necessary to identify long-term outcomes, as are multicenter studies involving larger sample sizes. We did not assess the use of medications due to the heterogeneity of the analyzed sample. This can be considered a limitation of the study, as some drugs can influence some domains of the functional status scale. Despite these limitations, our study is one of the pioneers in the evaluation of the functioning of pediatric patients diagnosed and hospitalized with COVID-19 in Brazil.

In conclusion, functional changes were found in approximately 53% of the pediatric patients hospitalized with COVID-19 in a hospital in southern Brazil. Greater alterations in functional status were associated with the presence of previous comorbidities, greater need for ventilatory support, and longer hospital stays. The FSS is essential to assess the functional status of pediatric patients hospitalized with COVID-19 since it is validated for the Brazilian population, simple to apply, and crucial to assist in physical therapy management.

AUTHOR CONTRIBUTIONS

Literature search: GMC, CJS, GHA, DSM, LKBA, CM, and BZ; data collection: GMC, CJS, GHA, and BZ; study design: GMC, CJS, DSM, LKBA, CM, and BZ; data analysis: GMC, CJS, and BZ; manuscript preparation: GMC, CJS, GHA, DSM, LKBA, CM, and BZ; manuscript review: DSM, LKBA, CM, and BZ.

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REFERENCES

1. Du H, Dong X, Zhang J-J, Cao Y-Y, Akdis M, Huang P-Q, et al. Clinical characteristics of 182 pediatric COVID-19 patients with different severities and allergic status. Allergy. 2021;76(2):510-532. https://doi.org/10.1111/all.14452.
2. Su L, Ma X, Yu H, Zhang Z, Bian P, Han Y, et al. The different clinical characteristics of corona virus disease cases between children and their families in China – the character of children with COVID-19. Emerg Microbes Infect. 2020;9(1):707-713. https://doi.org/10.1080/22221751.2020.1744483.
3. Dong Y, Mo X, Hu Y, Qi X, Jiang F, Tong S. Epidemiology of COVID-19 among children in China. Pediatrics. 2020;145(6):e20200702. https://doi.org/10.1542/peds.2020-0702.
4. Bailey LC, Razzaghi H, Burrows EK, Bunnell HT, Camacho PEF, Christakis DA, et al. Assessment of 135794 Pediatric Patients Tested for Severe Acute Respiratory Syndrome Coronavirus 2 across the United States. JAMA Pediatr. 2021;175(2):176-184. https://doi.org/10.1001/jamapediatrics.2020.5052.
5. Mustafa NM, A Selim L. Characterisation of COVID-19 Pandemic in Paediatric Age Group: A Systematic Review and Meta-Analysis. J Clin Virol. 2020;128:104395. https://doi.org/10.1016/j.jcv.2020.104395.
6. Shekerdemian LS, Mahmood NR, Wolfe KK, Riggs BJ, Ross CE, McKiernan CA, et al. Characteristics and outcomes of children with coronavirus disease 2019 (COVID-19) infection admitted to US and Canadian pediatric intensive care units. JAMA Pediatr. 2020;174(9):868-873. https://doi.org/10.1001/jamapediatrics.2020.1948.
7. Sena GR, Lima TPF, Vidal SA, et al. Clinical characteristics and mortality profile of COVID-19 patients aged less than 20 years old in Pernambuco – Brazil. Am J Trop Med Hyg. 2021;104(4):1507-1512. https://doi.org/10.4269/ajtmh.20-1368.
8. Hoang A, Chorath K, Moreira A, Evans M, Burmeister-Morton F, Burmeister F, et al. COVID-19 in 7780 pediatric patients: A systematic review. EClinicalMedicine. 2020;24:100433. https://doi.org/10.1016/j.eclinm.2020.100433.
9. da Silva e Silva CM, do Nascimento Andrade A, Nepomuceno B, et al. Evidence-based physiotherapy and functionality in adult and pediatric patients with COVID-19. J Hum Growth Dev. 2020;30(1). https://doi.org/10.7322/JHGD.V30.10086.
10. Schaan CW, Vieira VS, Miller C, Peiter APD, Piccoli T, Cavion G, et al. Hospital physical therapy management in pediatric patients with COVID-19: Case reports. Rev Paul Pediatr. 2020;39:e2020238. https://doi.org/10.1590/1984-0462/2021/39/2020238.
11. Pinto TF, Carvalho CRF. SARS CoV-2 (COVID-19): lessons to be learned by Brazilian Physical Therapists. Braz J Phys Ther. 2020;24(3):185-186. https://doi.org/10.1016/j.bjpt.2020.04.004.
12. Boswell L, Weck M, Hayner A, Fjørtoft T, Støen R, Adde L, et al. The impact of prolonged hospitalization on infant motor development compared with healthy controls. Dev Med Child Neurol. 2015;57(S5):79-80. https://doi.org/10.1111/dmcn.8_12886.
13. Wölfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Müller MA, et al. Virological assessment of hospitalized patients with COVID-2019. Nature. 2020;581(7809):465-469. https://doi.org/10.1038/s41586-020-2196-x.
14. Badal S, Thapa Bajgain K, Badal S, Thapa R, Bajgain BB, Santana MJ. Prevalence, clinical characteristics, and outcomes of pediatric COVID-19: A systematic review and meta-analysis. J Clin Virol. 2021;135:104715. https://doi.org/10.1016/j.jcv.2020.104715.
15. Bastos VCS, Carneiro AAL, Barbosa MDSR, Andrade LB. Brazilian version of the Pediatric Functional Status Scale: Translation and cross-cultural adaptation. Rev Bras Ter Intensiva. 2018;30(3):301-307. https://doi.org/10.5935/0103-507X.20180043.
16. Pollack MM, Holubkov R, Glass P, Dean JM, Meert KL, Zimmerman J, et al. Functional status scale: New pediatric outcome measure. Pediatrics. 2009;124(1):e18-28. https://doi.org/10.1542/peds.2008-1987.
17. World Health Organization. WHO R&D Blueprint novel Coronavirus COVID-19 Therapeutic Trial Synopsis. World Heal Organ. 2020;(February 18, 2020, Geneva, Switzerland).
18. Lansky LL, List MA, Lansky SB, Cohen ME, Sinks LF. Toward the development of a play performance scale for children (PPSC). Cancer. 1985;56(7 Suppl):1837-1840. https://doi.org/10.1002/1097-0142(19851001)56:7+<1837::AID-CNCR2820561324>3.0.CO;2-Z.
19. Borges RB, Mancuso ACB, Camey SA, Leotti VB, Hirakata VN, Azambuja GS, et al. Power and Sample Size for Health Researchers: a tool for calculating sample size and statistical power designed for health researchers. Clin Biomed Res. 2020;40(4):247-253. https://doi.

org/10.22491/2357-9730.109542.

20. Pereira GA, Schaan CW, Ferrari RS. Functional evaluation of pediatric patients after discharge from the intensive care unit using the Functional Status Scale. Rev Bras Ter Intensiva. 2017;29(4):460-465. https://doi.org/10.5935/0103-507X.20170066.
21. Woodruff RC, Campbell AP, Taylor CA, Chai SJ, Kawasaki B, Meek J, et al. Risk Factors for Severe COVID-19 in Children. Pediatrics. 2022;149(1):e2021053418. https://doi.org/10.1542/peds.2021-053418.
22. Bellino S, Punzo O, Rota MC, Del Manso M, Urdiales AM, Andrianou X, et al. COVID-19 Disease Severity Risk Factors for Pediatric Patients in Italy. Pediatrics. 2020;146(4):e2020009399. https://doi.org/10.1542/peds.2020-009399.
23. Netto ART, Wiesiolek CC, Brito PM, Rocha GA da, Tavares RMF, Lambertz KMF. Functionality, school participation and quality of life of schoolchildren with cerebral palsy. Fisioter Mov. 2020;33. https://doi.org/10.1590/1980-5918.033.ao29.
24. Camargos ACR, Lacerda TTB de, Barros TV, Silva GC da, Parreiras JT, Vidal TH de J. Relationship between functional independence and quality of life in cerebral palsy. Fisioter Mov. 2012;25(1). https://doi.org/10.1590/s0103-51502012000100009.
25. Kolman SE, Glanzman AM, Prosser L, Spiegel DA, Baldwin KD. Factors that Predict Overall Health and Quality of Life in Non-Ambulatory Individuals with Cerebral Palsy. Iowa Orthop J. 2018;38:147-152. PMID: 30104938. PMCID: PMC6047378.
26. Hudson SM. Hospital readmissions and repeat emergency department visits among children with medical complexity: an integrative review. J Pediatr Nurs. 2013;28(4):316-339. https://doi.org/10.1016/j.pedn.2012.08.009.
27. Gonçalves ALN, Feitoza AC, Albuque LJV, Falcão ACAM, Rocha MAW, Novais DMGA, et al. COMORBIDADES ASSOCIADAS EM PACIENTES PEDIÁTRICOS POSITIVOS COM COVID-19. Braz J Infect Dis. 2021;25:101104. https://doi.org/10.1016/j.bjid.2020.101104.
28. Mania A, Pokorska-Śpiewak M, Figlerowicz M, Pawłowska M, Mazur-Melewska K, Faltin K, et al. Pneumonia, gastrointestinal symptoms, comorbidities, and coinfections as factors related to a lengthier hospital stay in children with COVID-19—analysis of a paediatric part of Polish register SARSTer. Infect Dis (Lond). 2022;54(3):196-204. https://doi.org/10.1080/23744235.2021.1995628.
29. Nallasamy K, Angurana SK, Jayashree M, Mathew JL, Bansal A, Singh MP, et al. Clinical Profile, Hospital Course and Outcome of Children with COVID-19. Indian J Pediatr. 2021;88(10):979-984. https://doi.org/10.1007/s12098-020-03572-w.
30. Pinto NP, Rhinesmith EW, Kim TY, Ladner PH, Pollack MM. Long-Term Function after Pediatric Critical Illness: Results from the Survivor Outcomes Study. Pediatr Crit Care Med. 2017;18(3):e122-e130. https://doi.org/10.1097/PCC.0000000000001070.
31. Tezer H, Bedir Demirdağ T. Novel coronavirus disease (COVID-19) in children. Turk J Med Sci. 2020;50(SI-1):592-603. https://doi.org/10.3906/SAG-2004-174.
32. Chen ZM, Fu JF, Shu Q, Chen YH, Hua CZ, Li FB, et al. Diagnosis and treatment recommendations for pediatric respiratory infection caused by the 2019 novel coronavirus. World J Pediatr. 2020;16(3):240-246. https://doi.org/10.1007/s12519-020-00345-5.
33. Cascella M, Rajnik M, Aleem A, Dulebohn SC, Di Napoli R. Features, Evaluation and Treatment Coronavirus (COVID-19). StatPearls - NCBI Bookshelf. 2020.
34. Pathak EB, Salemi JL, Sobers N, Menard J, Hambleton IR. Covid-19 in children in the United States: Intensive care admissions, estimated total infected, and projected numbers of severe pediatric cases in 2020. J Public Health Manag Pract. 2020;26(4):325-333. https://doi.org/10.1097/PHH.0000000000001190.