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Clinical profile during the first and second pandemic waves in children and adolescents with COVID-19 at pediatric public hospital, Rio de Janeiro, Brazil

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Abstract

Background: COVID-19 is usually milder in children and adolescents, leading to lower hospital admission rates than adults. This study evaluated clinical manifestations in children (< 10 years) and adolescents (10 to < 18 years) with COVID-19 admitted to a tertiary municipal hospital in Rio de Janeiro (Brazil) during the first (February to November 2020) and second pandemic waves (November 2020 to April 2021). **Methods**: this retrospective observational study considered patients in the pediatric age group (<18 years old) with confirmed diagnosis of COVID-19 using RT-PCR. Descriptive and bivariate analysis were performed assuming a p-value<0.05 level of significance for all analyses. **Results**: among the 34 included patients (50% boys; 73.5% children), the most prevalent symptom was fever (88.2%), followed by asthenia (85.3%), and cough associated with dyspnea (50%); 29.4% were admitted to the ICU, and 5.9% needed invasive mechanical ventilation. All patients were treated with antibiotics, 88.2% with antivirals, and 52.9% with corticosteroids. Asthenia was more frequent among children than adolescents (96.0% vs. 55.6%; p < 0.01). Tuberculosis was observed in none of the children, but 33.3% of the adolescents (p-value = 0.003). The percentage of hospitalized patients with family members infected with SARS-CoV-2 was smaller among children than adolescents (8.0% vs. 44.0%; p-value = 0.01). Other variables that differed between children and adolescents were C-reactive protein, creatinine, and need for non-invasive mechanical ventilation. There were no deaths among participants. **Conclusion**: in our hospital, COVID-19 was most often not severe in children and adolescents. Overall, children were hospitalized more frequently by COVID-19 than adolescents, with some differences for clinical characteristics.

Key word: children, adolescents, COVID-19, SARS-CoV-2, symptoms, mortality.

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Introduction

The infection caused by the new SARS-CoV-2, the etiological agent of COVID-19 (Coronavirus Disease 2019), can affect people at any age(1). COVID-19 may present asymptomatic or with milder clinical manifestations in children and adolescents in comparison to adults(2). Typical symptoms of respiratory syndromes, such as fever, dry cough, fatigue, congestion, and runny nose may also present in children and adolescents. Moreover, gastrointestinal symptoms, such as abdominal discomfort, nausea, vomiting, abdominal pain, and diarrhea have also been reported in pediatric populations with COVID-19(3, 4).

Although less frequently, children and adolescents may present with severe manifestations of COVID-19, including dyspnea, central cyanosis, and percutaneous oxygen saturation (SaO2) below 92%. At more critical stages, patients may experience respiratory failure, septic shock, refractory metabolic acidosis, and signs of multiple organ failure (such as encephalopathy, heart failure, coagulation disorders, and kidney failure). In these cases, clinical management may include hospitalization and require invasive procedures, such as orotracheal intubation (OTI), and consequent admission to an intensive care unit (ICU)(5-7). In Brazil, data from SIVEP-Gripe (a nationwide notification data system) showed 14,638 cases of pediatric COVID-19 cases in 2020, with 1,203 deaths, an 8.2% lethality rate(8). Another Brazilian study examining COVID-19 cases in pediatric population from 2020 to 2021 identified 144,041 patients, of whom 18.2% had confirmed cases. Within this group, 21.3% were admitted to an ICU, and the mortality rate was 3.1%. Adolescents exhibited a higher mortality rate at 5.7%(9).

Examining COVID-19 characteristics in the pediatric population is crucial. It helps in recognizing new cases and informs the development of targeted public health interventions to control the spread of the disease. Moreover, a comprehensive examination of pediatric cases enables the identification of unique symptoms, facilitating prompt and accurate diagnosis and treatment. This focus allows researchers and healthcare professionals to contribute to a more tailored and effective response to the pandemic, enhancing the overall health and well-being of the community(8, 10). Therefore, the present study examined the main clinical manifestations and outcomes of children and adolescents hospitalized with COVID-19 in a tertiary municipal hospital in Rio de Janeiro (Brazil) during the first (February to November, 2020) and second pandemic (November 2020 to April 2021) waves.

Methods

Study design

This retrospective observational study drew on medical records of pediatric patients (< 18 years old) with a confirmed diagnosis of COVID-19, treated at a tertiary municipal hospital in Rio de Janeiro, Brazil, a referral center for the treatment of suspected and confirmed cases of COVID-19 in children. This is one of the largest pediatric reference center in the public health system in the state of Rio de Janeiro. On average, the hospital conducts 6,000 outpatient consultations from several medical specialties, 300 hospital admissions, and 190 surgeries per month.

Population

The study included patients < 18 years old hospitalized due to COVID-19, with confirmed diagnosis by nasopharyngeal or oropharyngeal RT-PCR swab test for SARS-CoV-2, in a tertiary municipal hospital in the city of Rio de Janeiro, Brazil (Hospital Municipal Jesus). Patients were admitted either directly or transferred from other hospital units. A convenience sample from the total COVID-19 admissions to the hospital during the study period (March 2020 to March 2021) was considered. No exclusion criteria were applied. The decision for hospitalization was made through clinical judgment, considering the clinical aspects presented by patients during their medical evaluation.

Measurements

Sociodemographic, clinical, laboratory and imaging information were obtained from medical records during hospital admission. Information was also obtained on clinical outcomes, such as the need for non-invasive ventilation (NIV), OTI, length of hospital stay, and death.

Sociodemographic information

Sociodemographic information included age, sex, and skin color/race. Patients < 10 years old were considered children and those between 10 and 18 years old were considered adolescents, on criteria set by the World Health Organization .

Clinical parameters

Information on hospitalization unit (ward, IU, or ICU), time of symptom onset prior to admission, main symptoms (fever, cough, dyspnea, abdominal pain, diarrhea, vomiting, myalgia, asthenia, anosmia, ageusia, and other symptoms), presence of comorbidities or associated infections, and COVID-19-positive family member were obtained on hospital admission.

Laboratory exams

Laboratory exams performed on hospital admission included complete blood count, C-reactive protein (CRP), glycemia, urea, creatinine, glutamic oxaloacetic transaminase (GOT), glutamate pyruvate transaminase (GPT), D-dimer, and arterial blood gases.

Imaging exams

Imaging exams performed on hospital admission were X-ray, ultrasound (USG) and/or tomography (CT) of the chest, and others (abdominal exams, for example) requested at the physician's discretion based on the clinical findings and symptoms presented.

Ethical aspects

This research project was submitted to, and approved by, the Research Ethics Committees of the Evandro Chagas National Institute of Infectious Disease - INI/FIOCRUZ (number 4.622.601) and the Rio de Janeiro Municipal Health Department - SMS/RJ (number 4.665.345).

Given the study retrospective design and use of information collected from medical records, a waiver was granted on application of an informed consent form. Participant confidentiality was maintained when accessing data from patient medical records, and an anonymous electronic dataset was built up using REDCap software.

Data analysis

Descriptive analysis was performed using frequencies and percentages for categorical variables, and median and interquartile range (25%-75%) for continuous variables. Variables were compared, by age group (children vs. adolescents), using the Mann-Whitney test for independent samples for continuous variables and Fisher's test for categorical variables. Data were analyzed using Stata 13.0 statistical software (CollegeStation, TX: StataCorp LP) to a p-value < 0.05 level of significance for all analyses.

Results

Table 1 shows the main characteristics of the 34 patients included in this study. Median age was 2.5 years and

Table 1

Characteristics of participants included in the study (n=34)

Variable	Median (25%-75% IQR) or % (n)
Sociodemographic characteristics	
Men	17 (50.0)
Race (n=14)	
White	6 (42.9)
Black	1 (7.1)
Mixed	7 (50.0)
Age (years)	2.5 (0.5 – 10)
Clinical characteristics	
Hospitalization unit	
Ward	24 (70.6)
Intermediate unit	2 (5.9)
Intensive care unit	8 (23.5)
Time of symptom onset prior to admission (days)	4 (3-6)
Length of hospital stay (days)	7.5 (5-12)
Main symptoms	
Fever	30 (88.2)
Respiratory symptoms	
Cough	10 (29.4)
Dyspnea	4 (11.8)
Cough and dyspnea	17 (50.0)
Gastrointestinal symptoms	
Abdominal pain	1 (2.9)
Diarrhea	3 (8.8)
Vomiting	1 (2.9)
Diarrhea and vomiting	1 (2.9)
Abdominal pain, diarrhea and vomiting	1 (2.9)
Other symptoms	
Myalgia	4 (11.8)
Asthenia	29 (85.3)
Anosmia	0 (0.0)
Ageusia	0 (0.0)
Other	4 (11.8)
COVID-19-positive family member	6 (17.7)
Associated infection	
Pneumonia	13 (38.2)
Tuberculosis	3 (8.8)
Gastroenteritis	4 (11.8)
Previous comorbidities	11 (32.4)
HIV	1 (2.9)
Diabetes Mellitus	3 (8.8)
Obesity	1 (2.9)
Congenital adrenal hyperplasia	1 (2.9)
Asthma	2 (5.9)
Down syndrome	1 (2.9)
West syndrome	1 (2.9)
Dilated cardiomiopathy	1 (2.9)
Pediatric Multisystem Inflammatory Syndrome (P-MIS)	1 (2.9)

Complementary exams (imaging and laboratory)		
Abnormal chest X-ray		13 (38.2)
Abnormal chest ultrasound		8 (23.5)
Abnormal chest tomography		5 (14.7)
Hemoglobin (g/dL)		11.6 (10.3-12.5)
Hematocrit (%)		34.3 (30-36.3)
Leucocytes (µL)		9800 (7100-15900)
Plaquettes (µL)		34900 (28900-50700)
C-reactive protein (mg/dL) (n=30)		17.3 (6.2-41)
Glycemia (mg/dL) (n=22)		123 (99-147)
Urea (mg/dL) (n=31)		24 (15-28)
Creatinine (mg/dL) (n=31)		0.4 (0.3-0.5)
TGO (U/L) (n=30)		25.5 (21-39)
TGP (U/L) (n=30)		15 (11-24)
D-dimer (ng/mL) (n=7)		1.6 (1.0-8.5)
Arterial blood gases		
	pH	7.39 (7.32-7.42)
	PO2 (mmHg)	80.6 (62.9-190.4)
	HCO3 (mEq/L)	19.4 (17.9-25.4)
	PCO2 (mmHg)	31.4 (28.2-42)
Treatment		
Antibiotics		34 (100.0)
	Number of schemes	2 (1-2)
	1 antibiotic	16 (47.1)
	2 antibiotics	11 (32.4)
	3 or more antibiotics	7 (20.5)
	Amoxicillin + Clavulanate	27 (79.4)
	Azithromycin	5 (14.7)
	Cefepime	9 (26.5)
	Vancomycin	4 (11.8)
	Clarithromycin	9 (26.5)
	Metronidazole	1 (2.9)
	Ampicillin	2 (5.9)
	Ciprofloxacin	1 (2.9)
	Ceftriaxone	3 (8.8)
	Oxacillin	2 (5.9)
Antiviral (oseltamivir)		30 (88.2)
Corticoid		18 (52.9)
	Prednisolone	13 (38.2)
	Dexamethasone	3 (8.8)
	Hydrocortisone	3 (8.8)
Anticoagulation (Clexane)		1 (2.9)
Intermediate unit		2 (5.9)
Intensive care unit		10 (29.4)
Non-invasive mechanic ventilation		24 (70.6)
Invasive mechanic ventilation		2 (5.9)
Other procedures		
	Chest drainage	2 (5.9)
	Central venous access	2 (5.9)
Death		0 (0.0)

IQR: interquartile range

73.5% (n = 25) were children. Half of the patients included were boys. Information on skin color/race was missing from the medical records of almost 60% of the sample, although mixed race was predominant (50%) among those with complete information. In 71% of cases, the initial hospitalization admission unit was a ward bed. The median time of symptom onset prior to admission was 4 days, and median length of hospital stay was 7.5 days. The main symptoms presented were fever (88.2%), asthenia (85.3%), cough (29.4%), and dyspnea (11.8%), with cough and dyspnea occurring concomitantly in 50% of patients. Other symptoms, such as headache (2.9%), odynophagia (5.9%), and oliguria and mental confusion (2.9%), were also reported. Of total patients, 17.7% had a COVID-19-positive family member. Co-infections associated with COVID-19 were bacterial pneumonia (38.2%), gastroenteritis (11.8%), and tuberculosis (8.8%). About one-third of the patients (32.4%) had comorbidities, of which diabetes mellitus was the most prevalent (8.8%). Only one case (2.9%) of pediatric multisystem inflammatory syndrome (P-MIS) was observed.

Complementary exams that showed alterations were chest X-ray (38.2%), chest USG (23.5%), and chest CT (14.7%). All patients were treated with antibiotics, mostly antimicrobial monotherapy (47.1%). Two antibiotics were administered in association in 32.4% of cases and three or more antibiotics were used in 20.5%. The antibiotic most used was amoxicillin with clavulanate (79.4%). Antivirals (oseltamivir) were used in most cases (88.2%). Corticosteroids were used in 52.9% of patients, the most used being prednisolone (38.2%). Anticoagulants were used in only 2.9% of cases.

Admission to IU or ICU were necessary in 5.9% and 29.4% of the cases, respectively. Use of NIV was frequent (70.6% of cases). On the other hand, OTI was necessary in only 5.9% of cases. Other procedures required during hospitalization included chest drainage (5.9%) and central venous access (5.9%). No deaths were observed in the study sample.

Table 2 shows the sample characteristics stratified by age group (73.5% children vs. 26.5% adolescents). Median age was 2 years for children and 12 years for adolescents (p-value < 0.001). The groups were observed to differ in asthenia symptoms, reported in 96% of children and 55% of adolescents (p-value 0.003). The percentage of children and adolescents with a COVID-19-positive family member was 8% and 44%, respectively (p-value 0.003). Tuberculosis was observed in 33.3% of the adolescents (p-value = 0.003), but none of the children. In the laboratory tests, median CRP values were 13.2 and 41 mg/dL for children (n = 21) and adolescents (n = 9), respectively (p-value 0.02). Median creatinine values were 0.4 and 0.6 mg/dL in children (n = 23) and adolescents (n = 8), respectively (p-value 0.002). NIV was needed more among the children (80%) than the adolescents (44.4%) (p-value 0.04).

Table 2

Comparison of characteristics of study participants according to age (children vs. adolescents)

Variable		Median (25%-75% IQR) or % (n)		p-value
		Children (73.5%; n=25)	Adolescents (26.5%; n=9)	
Sociodemographic characteristics				
Men		12 (48.0)	5 (55.6)	0.70
Race (n=14)				
	White	6 (42.9)	NA	
	Black	1 (7.1)	NA	---
	Mixed	7 (50.0)	NA	
Age (years)		2.0 (0.5-3.0)	12.0 (11.0-13.0)	<0.001
Clinical characteristics				
Hospitalization unit				
	Ward	19 (76.0)	5 (55.6)	
	Intermediate unit	2 (8.0)	0 (0.0)	0.18
	Intensive care unit	4 (16.0)	4 (44.4)	
Time of symptom onset prior to admission (days)		4.0 (3.0-6.0)	5.0 (3.0-6.0)	0.69
Length of hospital stay (days)		7.0 (5.0-12.0)	8.0 (5.0-10.0)	0.71
Main symptoms				
	Fever	23 (92.0)	7 (77.8)	0.26
	Respiratory symptoms			
	Cough	7 (28.0)	3 (33.3)	
	Dyspnea	2 (8.0)	2 (22.2)	0.13
	Cough and dyspnea	15 (60.0)	2 (22.2)	

Gastrointestinal symptoms			
Abdominal pain	1 (4.0)	0 (0.0)	
Diarrhea	2 (8.0)	1 (11.1)	
Vomiting	1 (4.0)	0 (0.0)	0.25
Diarrhea and vomiting	0 (0.0)	1 (11.1)	
Abdominal pain, diarrhea and vomiting	0 (0.0)	1 (11.1)	
Other symptoms			
Myalgia	2 (8.0)	2 (22.2)	0.26
Asthenia	24 (96.0)	5 (55.6)	0.003
Other	2 (8.0)	2 (22.2)	0.26
COVID-19-positive family member	2 (8.0)	4 (44.4)	0.01
Associated infection			
Pneumonia	9 (36.0)	4 (44.4)	0.66
Tuberculosis	0 (0.0)	3 (33.3)	0.003
Gastroenteritis	2 (8.0)	2 (22.2)	0.26
Previous comorbidities			
HIV	1 (4.0)	0 (0.0)	0.54
Diabetes Mellitus	1 (4.0)	2 (22.2)	0.10
Obesity	0 (0.0)	1 (11.1)	0.10
Congenital adrenal hyperplasia	1 (4.0)	0 (0.0)	0.54
Asthma	2 (8.0)	0 (0.0)	0.38
Down syndrome	1 (4.0)	0 (0.0)	0.54
West syndrome	1 (4.0)	0 (0.0)	0.54
Dilated cardiomiopathy	1 (4.0)	0 (0.0)	0.54
Pediatric Multisystem Inflammatory Syndrome (P-MIS)	0 (0.0)	1 (11.1)	0.10
Complementary exams (imaging and laboratory)			
Abnormal chest X-ray	10 (40.0)	3 (33.3)	0.72
Abnormal chest ultrasound	4 (16.0)	4 (4.4)	0.08
Abnormal chest tomography	3 (12.0)	2 (22.2)	0.46
Hemoglobin (g/dL)	11.6 (10.3-12.5)	11.6 (10.3-11.9)	0.92
Hematocrit (%)	34.1 (30.0-36.3)	34.6 (30.2-34.9)	0.83
Leucocytes (µL)	9900 (7500-15900)	8700 (5700-13000)	0.57
Plaquettes (µL)	367000 (297000-526000)	285500 (181500-345500)	0.07
C-reactive protein (mg/dL) (n=30)	13.2 (5.8 – 25.6) n=21	41 (18.1-134.0) n=9	0.02
Glycemia (mg/dL) (n=22)	124 (104-141) n=15	99 (88-224) n=7	0.92
Urea (mg/dL) (n=31)	19 (14-26) n=23	27.5 (18-30.5) n=8	0.27
Creatinine (mg/dL) (n=31)	0.4 (0.3-0.4) n=23	0.6 (0.5-0.7) n=8	0.002
TGO (U/L) (n=30)	28 (21-42) n=21	24 (18-27) n=9	0.19
TGP (U/L) (n=30)	15 (11-24) n=21	15 (9-17) n=9	0.91
D-dimer (ng/mL) (n=7)	1.3 (0.7-5.0) n=4	1.8 (1.3-10.0) n=3	0.29
Arterial blood gases			
pH	7.39 (7.32-7.44) n=7	7.38 (7.22-7.41) n=4	0.64
PO2 (mmHg)	72.9 (62.9-114.3) n=7	166.2 (89.3-266.7) n=4	0.35

	HCO3 (mEq/L)	22 (18.5-25.4) n=7	18.5 (10.2 -22.4) n=4	0.53
	PCO2 (mmHg)	35.4 (28.2-44.8) n=7	31.0 (19.2-35.4) n=4	0.45
Treatment				
Antibiotics				
	Number of schemes	2 (1-2)	2 (1-4)	0.46
	1 antibiotic	12 (48.0)	4 (44.4)	
	2 antibiotics	9 (36.0)	2 (22.2)	0.50
	3 or more antibiotics	4 (16.0)	3 (33.3)	
	Amoxicillin + Clavulanate	20 (80.0)	7 (77.8)	0.89
	Azithromycin	5 (20.0)	0 (0.0)	0.15
	Cefepime	6 (24.0)	3 (33.3)	0.59
	Vancomycin	2 (8.0)	2 (22.2)	0.26
	Clarithromycin	5 (20.0)	4 (44.4)	0.15
	Metronidazole	0 (0.0)	1 (11.1)	0.10
	Ampicillin	2 (8.0)	0 (0.0)	0.38
	Ciprofloxacin	0 (0.0)	1 (11.1)	0.10
	Ceftriaxone	1 (4.00)	2 (22.2)	0.10
	Oxacillin	1 (4.0)	1 (11.1)	0.44
Antiviral (oseltamivir)				
Corticoid				
	Prednisolone	11 (44.0)	2 (22.2)	0.25
	Dexamethasone	2 (8.0)	1 (11.1)	0.78
	Hydrocortisone	3 (12.0)	0 (0.0)	0.28
Anticoagulation (Clexane)		1 (4.0)	0 (0.0)	0.54
Intermediate unit		2 (8.0)	0 (0.0)	0.38
Intensive care unit		6 (24.0)	4 (44.4)	0.25
Non-invasive mechanic ventilation		20 (80.0)	4 (44.4)	0.04
Invasive mechanic ventilation		1 (4.0)	1 (11.0)	0.44
Other procedures		3 (12.0)	1 (11.0)	0.94

IQR: interquartile range
Estimates in bold are statistically significant

Discussion

This study offers important information on the characteristics of children and adolescents hospitalized with COVID-19 during the first and second pandemic waves, which may usefully serve as the foundation for intervention strategies to improve clinical outcomes in this population. Overall, COVID-19 was most often not severe in children and adolescents, with children being hospitalized more frequently by COVID-19 than adolescents, with some differences for clinical characteristics.

In the present study sample, the distribution of COVID-19 between sexes was balanced. This result is similar to those observed by Götzinger et al. (12), a multicenter study including 582 COVID-19 patients aged 18 years in 25 European countries. In Brazil, a similar sex distribution was also found in a single-center retrospective study including 1,303 cases admitted in a general hospital (13). In terms of race, our study observed a higher frequency of COVID-19 among non-white race (about 60%), very similar to a previous study using information from a nationwide surveillance database of patients admitted to hospital with COVID-19 in Brazil (14). A study by Mannheim et al. (15), describing the main characteristics of 1,302 US children who tested positive for COVID-19, showed a predominance of COVID-19 in Hispanic/Latino patients (53%), followed by Blacks/African-Americans (25%), and whites (13%), underling the potential influence of racial disparities on the risk of COVID-19. Despite the considerable influence of race on COVID-19 outcomes, medical records had skin color/race information for only 41.2% (n = 14) of the patients, indicating that little importance was given to this information by the professional who provided the first patient care. Furthermore, our study revealed a higher proportion of hospitalizations among children compared to adolescents, suggesting a propensity for increased hospitalization among children, consistent with findings from a prior investigation (16). A potential explanation for this unexpected finding was a compassionate concern of health professionals in managing children with COVID-19 during the initial phase of the pandemic when there was a lack of prior information on disease management.

The time from symptom onset to hospital admission

was approximately 4 days in our study, with the most frequent symptoms in consonance with those reported by Rahman et al. (17), who found fever (84%), cough (61%), and fatigue/weakness (42%) as the most prevalent. Similarly, Oliveira et al. (14) found fever (74,5%) and cough (67.4%) as the most prevalent symptoms in a Brazilian pediatric population. On hospitalization, most patients were allocated to ward beds. This finding is compatible with the non-severe profile of the disease described by Irfan et al. (18), who evaluated 9335 hospitalized pediatric patients and found that only about 20% needed to be admitted to the ICU, a similar percentage in comparison to our study.

In our study, COVID-19-related co-infections included 38.2% of patients with bacterial pneumonia, 11.8% with gastroenteritis, and 8.8% with tuberculosis. Comorbidities associated with more severe conditions were also observed, such as diabetes mellitus (8.8%), asthma (5.9%) and obesity (2.9%). Biharie et al. (19) found that, of 83 pediatric patients with COVID-19, 55% had comorbidities, obesity being the most common (22%), followed by respiratory (19.6%) and neurological disorders (17.4%). Rare in our study was P-MIS, a possible condition associated with more severe COVID-19, which was identified in only one (2.9%) patient, who had no previous comorbidities, but presented with fever, conjunctivitis, and mucocutaneous infection. Conversely, Uka et al. (20) evaluated the clinical characteristics, treatment and outcomes of 126 children hospitalized with COVID-19, 35% of whom were diagnosed with P-MIS; 53% of those, in turn, were admitted to the ICU, raising concerns about the potential adverse impact of P-SIM on COVID-19 prognosis.

Abnormalities in chest imaging exams were reported in 76.4% of patients. Most abnormal results were found in X-rays (38.2%), followed by USG (23.5%), and CT scans (14.7%). Rudan et al. (21) note that chest CT findings in children and adolescents would occasionally show ground-glass opacities, as in adults. In the laboratory exams, hemoglobin and hematocrit remained within normal limits, despite a slight tendency to leukocytosis. CRP analysis, requested for 88.2% of the patients, returned a high median value (17.3 mg/dL). A systematic review by Souza et al. (22) showed that most (75.8%) of patients with COVID-19 in the pediatric age group had leukocyte values within the normal range. They also found high CRP levels in approximately 20% of the cases studied, corroborating the findings of this study and other studies in the literature (23), confirming the inflammatory nature of the disease. In this study, blood glucose was analyzed in approximately 65.0% of the patients, with three patients with diabetes mellitus (two adolescents and one child). The two adolescents with diabetes required ICU admission, reinforcing the need for greater care in children and adolescents with this condition due to the risk of complications (24). Markers of renal and hepatic function values were within normal limits, although slightly higher among adolescents. D-dimer was measured in 20.5% of patients to investigate coagulopathies, but no very high values were observed, confirming that thromboembolic events are not a common concern in pediatric patients with COVID-19 (25, 26).

Fewer than 30% of patients in this study required ICU admission. Invasive procedures such as OTI, central venous access and chest drainage were required in a small percentage of patients (5.9% for all procedures), and no deaths were reported. Similarly, a study conducted by Luz Romero et al. (27) of 30 patients aged < 18 years found a low percentage of ICU admissions and no deaths, reinforcing the less severe nature of COVID-19 in the pediatric population.

All patients in this study were treated with antibiotic therapy. Antibacterial monotherapy was performed in almost half the patients, although associations of two or even three or more drugs were necessary in almost a third. Antiviral medication was used in the vast majority (~ 90%) of patients, for which oseltamivir was the only therapeutic choice. Corticosteroid therapy was initiated in approximately one-third of the patients: prednisolone was the most frequent therapy, and dexamethasone and hydrocortisone, the second. In Toba et al. (28), 82.7% were treated with antivirals, including alpha interferon, lopinavir, ritonavir, oseltamivir and umifenovir. In that same study, antibiotic therapy was initiated in 41% of patients studied, and glucocorticoids, in 16.8%.

As this was a retrospective study based on an information search of medical records, information for some patients was incomplete, limiting data analysis. The small sample size, which made it impossible to identify variables associated with clinical outcomes, can also be considered a limitation of the study. Moreover, patients included in this study were infected during the first year of COVID-19 pandemic in Brazil (March 2020 to March 2021), in which medical knowledge about clinical management of COVID-19 was uncertain. The medications used to treat patients at that time may noy reflect the best therapeutical treatment options to treat patients with COVID-19 nowadays. In addition, the inclusion of patients from a tertiary hospital may limit the extrapolation of results to other patients with milder COVID-19 cases. On the other hand, because COVID-19 prognoses are better in pediatric populations, hospitalizations are not common, reinforcing the originality of the – albeit only descriptive – study findings.

Conclusion

To conclude, COVID-19 was not severe in most of the children and adolescents in the study. Overall, children were more affected by COVID-19 than adolescents and hospitalizations were more frequent among children. Only one case was diagnosed with P-MIS and needed no intensive care. Fever, asthenia, and cough, among the main symptoms associated with hospitalization, were treated mostly in ward beds. Severe cases requiring ICU admission accounted for less than 30% of total cases, and there were no deaths, underlining the less severe nature of the disease in the pediatric population.

Author's contribution Statement

Jeferson Tobias da Silva de Oliveira: Study design and conception, data analysis and interpretation, read and

agreed with this final version of the manuscript. **Luciana Fernandes Portela**: manuscript written and review, read and agreed with this final version of the manuscript. **Marcelo Carvalho Vieira**: data analysis and interpretation, manuscript written and review, read and agreed with this final version of the manuscript. **Mariana Cristina Mendes Almeida**: manuscript written and review, read and agreed with this final version of the manuscript. **Luiz Henrique Conde Sangenis**: manuscript written and review, read and agreed with this final version of the manuscript. **Ivonete Siviero:** manuscript written and review, read and agreed with this final version of the manuscript. **Tatiana Rehder Gonçalves**: manuscript written and review, read and agreed with this final version of the manuscript. **Mauro Felippe Felix Mediano**: study design and conception, data analysis and interpretation, read and agreed with this final version of the manuscript.

Ethics statement

This research project was submitted to, and approved by, the Research Ethics Committees of the Evandro Chagas National Institute of Infectious Disease - INI/FIOCRUZ (number 4.622.601) and the Rio de Janeiro Municipal Health Department - SMS/RJ (number 4.665.345).

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Conflict of interest

None to declare.

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