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PREVALENCE OF SEVERE COVID-19 CASES AND ASSOCIATED FACTORS IN A PEDIATRIC HOSPITAL

PREVALÊNCIA DE CASOS GRAVES DE COVID-19 E FATORES ASSOCIADOS EM UM HOSPITAL PEDIÁTRICO

PREVALENCIA DE CASOS GRAVES DE COVID-19 Y FACTORES ASOCIADOS EN UN HOSPITAL PEDIÁTRICO

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Objective: to describe the prevalence of severe cases by SARS-Cov-2 infeccion and factors associated with the occurrence in children and adolescents. Method: cross-sectional study with 236 children and adolescents with COVID-19 between March 2020 and February 2022. Results: the prevalence of severe cases of COVID-19 was 37%. The highest frequency was male (41%), up to 1 year of age (41.8%) and surrounding cities (46.5%). Clinical manifestations within 72 hours of hospitalization, associated with severe cases, were respiratory distress (PRc: 1.91; 95% CI 1.36 –2.67), O2 saturation < 92% (PRc: 9.27 95% CI 5.99 – 14.35), need for intensive care (PRc: 5.25; 95% CI 3.7 – 87) and comorbidities (PRc: 1.73 95% CI 1.25 – 2.40). The outcomes death/transfer were associated with a higher proportion of severe cases. Conclusion: knowing the profile of COVID-19 cases in the pediatric population and associated factors can contribute to review processes for proper management of cases.

Descriptors: COVID-19. SARS-CoV-2. Pediatric Hospitals. Child. Prevalence.

Objetivo: descrever a prevalência de casos graves de infecção pelo SARS-Cov-2 e fatores associados à ocorrência em crianças e adolescentes. Método: estudo transversal com 236 crianças e adolescentes com COVID-19 no período de

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março/2020 a fevereiro/2022. Resultados: a prevalência de casos graves da COVID-19 foi de 37%. A maior frequência foi de pacientes do sexo masculino (41%), com até 1 ano de idade (41,8%) de municípios circunvizinhos (46,5%). As manifestações clínicas em até 72 horas após hospitalização, associadas aos casos graves foram: desconforto respiratório (RPb: 1,91; IC 95% 1,36– 2,67), saturação de O2 < 92% (RPb: 9,27 IC 95% 5,99– 14,35), necessidade de cuidados intensivos (RPb: 5,25; IC 95% 3,87– 7,12) e comorbidades (RPb: 1,73 IC 95% 1,25– 2,40). Os desfechos, óbito/transferência, associaram-se com maior proporção de casos graves. Conclusão: conhecer o perfil de casos de COVID-19 na população pediátrica e fatores associados pode contribuir para revisar processos a fim de manejar adequadamente os casos.

Descritores: COVID-19. SARS-CoV-2. Hospitais Pediátricos. Criança. Prevalência.

Objetivo: describir la prevalencia de casos graves por el SARS-Cov-2 infección y factores asociados a la ocurrencia en niños y adolescentes. Método: estudio transversal con 236 niños y adolescentes con COVID-19 entre marzo-2020 y febrero-2022. Resultados: la prevalencia de casos graves de COVID-19 fue del 37%. La mayor frecuencia fueron del sexo masculino (41%), hasta 1 año de edad (41,8%) y municipios circundantes (46,5%). Las manifestaciones clínicas en hasta 72 horas después de la hospitalización, asociados a los casos graves fueron: malestar respiratorio (RPb: 1,91; IC 95% 1,36– 2,67), saturación de O2 < 92% (RPb: 9,27 IC 95% 5,99– 14,35), necesidad de cuidados intensivos (RPb: 5,25; IC 95% 3,87– 7,12) y comorbilidades (RPb: 1,73 IC 95% 1,25– 2,40). Los resultados, muerte/transferencia, se asociaron con mayor proporción de casos graves. Conclusión: conocer el perfil de casos de COVID-19 en la población pediátrica y factores asociados puede contribuir para revisar procesos a fin de manejo adecuado de los casos.

Descriptores: COVID-19. SARS-CoV-2. Hospitales Pediátricos. Niño. Prevalencia.

Introduction

In Brazil, the first case of SARS-Cov-2 infection was confirmed in February 2020 in São Paulo, with the first death recorded on March 17, 2020. Since then, the country has had a significant increase in the number of infected people, surpassing 35 million cases and more than 690 thousand deaths in 2022 [1,2].

In the state of Bahia, the first contagion of COVID-19 was confirmed in Feira de Santana, the second largest and most important city in the interior of the North and Northeast regions, two months after the appearance of the first case in the country. In almost two years of pandemic, Bahia recorded about 1,720,338 confirmed cases and 30,000 deaths, of which 78,000 cases and 1,338 deaths occurred in Feira de Santana [2,3].

Among children and adolescents aged 0 to 19 years, the proportion of hospitalizations in Brazil attributed to COVID-19 was 2.46% in 2020 and 1.79% in 2021, while the proportion of deaths was 0.62% in 2020 and 0.39% in 2021 [4]. In Bahia, up to the epidemiological week of December 5, 2022, 216 deaths were recorded in the population aged 0 to 19 years [1,2]. These data show a lower proportion of clinical severity of COVID-19 compared to the adult population [5,6].

The manifestations of severity of COVID-19 in children and adolescents involve mainly the respiratory and gastrointestinal systems, generating from asymptomatic, mild and moderate symptoms to severe conditions that can evolve to pneumonia, inflammatory syndromes and death [6,7].

Risk factors for greater severity of COVID-19 in this population include: existence of chronic conditions with insufficient control, challenges in access and quality of care provided in Primary Health Care (PHC) and levels of greater complexity, as well as social vulnerability [8].

The specificities of COVID-19 in the pediatric population justify studies that investigate the pathophysiological and epidemiological aspects involved. This study aimed to describe the prevalence of severe cases of SARS-Cov-2 infection and factors associated with their occurrence in children and adolescents treated in a reference hospital unit of the second largest urban center in the state of Bahia.

Methods

This is a cross-sectional study conducted in a state pediatric hospital, a reference unit for the care of COVID-19 cases for children and adolescents in the state of Bahia.

The study population consisted of all cases of SARS-Cov-2 infection with laboratory confirmation by Reverse Transcription followed by Real-time Polymerase Chain Reaction (RT-PCR), during March 2020 to February 2022.

The following were excluded from the study: 1) cases without laboratory confirmation; 2) who died within 24 hours of hospitalization and 3) with incomplete data in the medical records. Data were collected from medical records from 15 March 2020 to 28 February 2022. Cases with oxygen saturation (SpO2) < 92% within 72 hours of hospital admission, need for transfer to the Intensive Care Therapy (ICU) or oxygen support were considered as severe. The other cases were categorized as mild or moderate [6].

The variables analyzed were: 1) sociodemographic (sex, age, city of origin, self-reported skin color, degree of kinship of the patient's companion at hospital admission); 2) clinical (clinical manifestations in the first 72 hours of hospital admission, presence of comorbidities (any chronic disease pre-existing to the occurrence of COVID-19), devices used in the first 72 hours of admission, severity and outcome of cases).

Initially, a descriptive analysis of sociodemographic and clinical variables was performed, and the prevalence of severe cases with respective 95% confidence intervals (95% CI) was estimated. In order to analyze the association between the occurrence of severe cases and the variables included in the study, crude prevalence ratios (PRc) and their 95% CI were calculated. The data were processed and analyzed with the help of the software Stata® version 14.0.

The project of the study received the approval of the Ethics Committee in local research upon opinion CAAE n. 39758920.0.0000.0053. Only data without identification were used, extracted from medical records with consent of the hospital institution, ensuring the confidentiality and privacy of personal information.

Results

The participants were 236 children and adolescents, of which 149 (63%) had mild and moderate forms of COVID-19 and 87 (37%) were classified as severe cases, among which there was a predominance of males (41%), under 1 year of age (41.8%), who reported not black/brown skin color (40%), residents in other cities (46.5%) and whose companion at the time of hospital admission was not the parent (43.7%). Living in other cities was positively associated with a higher proportion of severe cases (PRc: 1.84; 95% CI 1.26 - 2.68) (Table 1).

Table 1 - Sociodemographic characteristics of study participants. Feira de Santana, Bahia, Brazil, 2022. (N=236) (continued)

Variables	Study participants	Severe cases	PR_c (95% CI)	p-value*
	n (%)	n (%)		
Total	236	87		
Sex				
Female	97 (41.1)	30 (30.9)	0.75 (0.53 - 1.08)	0.11
Male	139 (58.9)	57 (41)	1	
Age (years)				

Table 1 - Sociodemographic characteristics of study participants. Feira de Santana, Bahia, Brazil, 2022. (N=236) (conclusion)

Variables	Study participants	Severe cases	PR_c (95% CI)	p-value*
	n (%)	n (%)		
≤ 1	67 (28.4)	28 (41.8)	1.20 (0.84 - 1.7)	0.32
> 1	169 (71.6)	59 (34.9)	1	
Ethnicity/skin color				
Not black/brown	10 (4.2)	04 (40)	1.12 (0.51 – 2.46)	0.76
Black/brown	189 (80)	67 (35.4)	1	
Omitted**	37 (15.6)	-		
City of origin				
Other cities	129 (54.7)	60 (46.5)	1.84 (1.26 – 2.68)	0.00
Feira de Santana	107 (45.3)	27 (25.2)	1	
Companion at hospital admission				
Mother	204 (86.4)	73 (35.8)	1	
Others	32 (13.5)	14 (43.7)	1.22 (0.79 – 1.88)	0.38

95%CI: 95% confidence interval; PR_c: prevalence ratio.

*Chi-square test, 5% significance level.

**The omitted cases were those not recorded in the medical records.

The clinical manifestations registered within 72 hours after hospital admission associated positively, with a higher proportion of severe cases of COVID-19, were: respiratory distress (PRc: 1.91; 95% CI 1.36 – 2.67) and O2 saturation < 92% (PRc: 9.27 95% CI 5.99 – 14.35). The need for transfer to the intensive care unit (ICU) (PRc: 5.25; 95% CI 3.87 – 7.12) and presence of comorbidities (PRc: 1.73 95% CI 1.25 – 2.4) also showed a positive association with a higher proportion of severe COVID-19 cases in the population studied (Table 2).

Among the clinical manifestations, fever emerges as a protective factor to avoid the evolution to severe case, possibly associated as a signal for greater investment in clinical care and more careful observation by the team.

Table 2 - Clinical manifestations within 72 hours of hospital admission and health status of study participants. Feira de Santana, Bahia, Brazil, 2022. (N=236) (continued)

Variables	Frequency	Severe cases	PR_c (95% CI)	p-value*
	n (%)	n (%)		
Runny nose				
Yes	37 (15.7)	10 (27)	0.69 (0.39 – 1.21)	0.17
No	199 (84.3)	77 (38.7)	1	
Respiratory discomfort				
Yes	95 (49.3)	49 (51.6)	1.91 (1.36 – 2.67)	0.000
No	141 (59.7)	38 (27)	1	
Cough				
Yes	112 (47.5)	36 (32.1)	0.78 (0.55 – 1.0)	0.15
No	124 (54.5)	51 (41.1)	1	
O_2 saturation < 92%				

Table 2 - Clinical manifestations within 72 hours of hospital admission and health status of study participants. Feira de Santana, Bahia, Brazil, 2022. (N=236) (conclusion)

Variables	Frequency	Severe cases	PR_c (95% CI)	p-value*
	n (%)	n (%)		
Yes	69 (29.2)	69 (100)	9.27 (5.99 – 14.35)	0.000
No	167 (70.8)	18 (10.8)	1	
Fever				
Yes	113 (47.9)	29 (25.7)	0.54 (0.37 – 0.78)	0.001
No	123 (54.1)	58 (47)	1	
Diarrhea				
Yes	31 (13.1)	09 (29)	0.76 (0.42 – 1.35)	0.33
No	205 (86.9)	78 (38)	1	
Vomiting				
Yes	33 (14)	9 (27.3)	0.70 (0.39 – 1.27)	0.21
No	203 (86)	78 (38.4)	1	
O_2 support				
Yes	69 (29.2)	69 (100)	9.27 (5.99 – 14.35)	0.000
No	167 (70.8)	18 (10.8)	1	
Transfer to ICU				
Yes	54 (23)	53 (98.1)	5.25 (3.87 – 7.12)	0.000
No	182 (77)	34 (18.7)	1	
Comorbidities				
Yes	85 (36)	43 (50.6)	1.73 (1.25 – 2.4)	0.001
No	151 (64)	44 (29.1)	1	

95% CI: 95% confidence interval; PRc: prevalence ratio. *Chi-square test, 5% significance level.

**Omitted cases were those not recorded in the medical record.

Regarding the outcomes of COVID-19 cases in the study population (discharges, deaths and transfers), 94.1% (222) were discharged from hospital and 5.9% (14) evolved with negative outcomes, 12 deaths and two transfers to another hospital, all classified as severe cases. Thus, outcomes death/transfer to another unit were positively associated with a higher proportion of severe cases (PRc = 3.04; 95% CI 2.52 - 3.67) in the study population.

Table 3 - Clinical outcomes of COVID-19 cases included in the study. Feira de Santana, Bahia, Brazil, 2022. (N=236)

Outcomes	Frequency	Severe cases	PR_c (95% CI)	p-value*
	n (%)	n (%)		
Death/transfer**	14 (5.9)	14 (100)	3.04 (2.52 – 3.67)	< 0.001
Hospital discharge	222 (94.1)	73 (32.8)	1	

95%CI: 95% confidence interval; PRc: prevalence ratio.

*Chi-square test, 5% significance level.

**12 deaths and two transfers were recorded among serious cases

Discussion

This study analyzed, in a pioneering way, socioeconomic and clinical characteristics, as well as the severity classification of COVID-19 cases diagnosed in children and adolescents treated in a referral hospital in the second largest and most important city in the state of Bahia.

The results showed higher prevalence of severe cases among males, below 1 year of age and non-residents in the city.

Since the beginning of the COVID-19 pandemic, epidemiological and clinical aspects of SARS-CoV-2 infection in the pediatric population have aroused interest from the scientific community, due to their specificities and lower severity when compared to other population groups [6].

In a study conducted in a pediatric hospital in João Pessoa (PB), 54.5% of the participants were male, similar to international studies that show the predominance of this group in pediatric hospitalizations due to COVID-19. No association between sex and hospitalization due to COVID-19 is established in the literature, but it is believed that there may be a relationship with cultural, socioeconomic and behavioral issues [9].

One of the first published studies on COVID-19 in the pediatric population showed that infants were more vulnerable to infection. The proportion of severe cases was 10.6%, 7.3%, 4.2%, 4.1% and 3.0% for the age group <1 year, 1-5, 6-10, 11-15 and ≥ 16 years, respectively [6]. Studies inform that, in Brazil, almost half of the deaths due to COVID-19 in the pediatric population occurred in children up to 2 years of age [8].

Studies indicate a higher incidence of COVID-19 in the black population and it is believed that this disparity is related to the greater social vulnerability of this population [10,11]. In the present study, 37% of the participants had no record of self-reported skin color in medical records. In Brazil, Ordinance n. 344/2017 made the registration of racial classification mandatory in the forms of information and health systems, respecting the self-declaration of the user. The absence of these data can impact on the formulation of social indicators for public policies and on the specific demands of each ethnic-racial group [12].

The higher proportion of severe cases of COVID-19 in children and adolescents from other cities, as seen in this study, may be related to difficulties in access to specialized care and diagnostic tests, as well as aspects related to the transfer between hospitals, including: community infrastructure or institution of origin, waiting time for regulation, planning, qualified team, clinical picture of the patient, distance between cities, precariousness of highways, and materials in transportation [13].

The transportation of the critical patient represents a logistical challenge for patient care and is not exempt from adverse events/incidents. In the COVID-19 pandemic, these problems were being faced daily by health professionals in smaller units, often by admitting large numbers of patients and/or by not having adequate physical structure as material and human resources to deal with seriously ill patients. In such cases, the transfer of the serious pictures to units of greater complexity is essential, and should be carried out in a systematic way based on protocols that provide safety in transport [14].

Regarding clinical characteristics, the present study showed that the most common manifestations are respiratory (runny nose, cough, dyspnea and decreased O2 saturation), gastrointestinal (diarrhea and vomiting) and fever. Comorbidities were present in almost half of the severe cases, with neuropathies, cardiopathies, asthma and sickle cell disease as the most frequent. Most patients needed oxygen support and transfer to the ICU. Respiratory distress, fever, decreased saturation, need for oxygen and transfer to the ICU, as well as the presence of comorbidities, were more frequent among severe cases of COVID-19.

Regarding the signs and symptoms of COVID-19 in the pediatric population, a meta-analysis that included 9,335 participants aged 0-19 years from 31 countries with SARS-CoV-2 infection showed as the main manifestations: fever (63%), cough (34%), nausea/vomiting (20%), diarrhea (20%) and dyspnea (18%) [15].

Chronic diseases have often been found in patients infected with SARS-Cov-2, but are not always associated with greater severity of the disease. In a multicenter study including 582 patients up to 18 years of age treated in hospitals

in 21 European countries, 25% of the participants had comorbidities and 8% needed ICU (16,17).

In relation to the decreased saturation with consequent need for oxygen support, a study that classified the severity of COVID-19 in children and adolescents brought as manifestations of severe cases: early respiratory symptoms, fever, cough, which may be accompanied by gastrointestinal symptoms. The infection usually progresses around one week with dyspnea, central cyanosis, hypoxia and a decrease in oxygen saturation below 92% [6]. A study conducted with 36 children with COVID-19 found that 17% of participants had hypoxia, requiring oxygen therapy [18].

Regarding the clinical outcomes of the participants of this study, deaths and hospital transfers occurred in severe cases, a data similar to those obtained in other investigations (19,20). Recent surveys of the demographic database on COVID-19 of the Max Planck Institute for Demographic Research (MPIDR) COVerAGE disclosed until the period of August 2022 that, of the 4.1 million deaths due to COVID-19, 0.4% occurred in children and adolescents, which corresponds to more than 16,100 deaths. Of these, 53% occurred in the population aged 10 to 19 years and 47% in the age group 0 to 9 years [21].

A Brazilian study evaluated risk factors for death due to COVID-19 in 11,613 patients under 20 years of age notified in the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe), between February 16, 2020, and January 9, 2021, verifying that 886 (7.6%) died in the hospital (mean 6 days [IQR 3-15] after hospitalization), 10,041 (86.5%) were discharged, 369 (3.2%) were in the hospital at the time of analysis, and 317 (2.7%) had no information on the outcome. Multivariate analysis showed that deaths due to COVID-19 were associated with age (below 2 years old or 12-19 years old in relation to the age group of 2-11 years old), indigenous ethnicity in relation to white ethnicity, geopolitical region (North and Northeast in relation to the Southeast) and pre-existing medical conditions in relation to the absence of comorbidity [22].

Despite the lower prevalence of severe cases of COVID-19 in the pediatric population, prevention and control measures, such as vaccination, need to be encouraged throughout the population. In addition, drugs for the treatment of COVID-19 are restricted, and symptomatic treatment is recommended in most cases [1]. Nevertheless, the low vaccination coverage in the pediatric population worries health authorities, since until June 2022 Brazil recorded an average of two daily deaths among children under 5 years [23].

It is worth mentioning that, at the end of the semester of 2022, a new wave of cases of the disease occurred, associated with two new subvariants of Omicron, which has already caused an impact in Europe, China, the United States and now begins to grow in Brazil. As a result, it was necessary to resume measures to prevent the spread of the disease, control actions and expansion of vaccination coverage in children under 5 years, as well as the active search for the missing population [24].

Some factors should be considered in case of increased morbidity and mortality due to COVID-19 among children and adolescents, such as: demographic composition of the Brazilian population with a large number of children and adolescents; children with chronic conditions and insufficient control; challenges in access to primary health care; challenges in access to pediatric care of greater complexity, taking into account the number of pediatric beds available and increased social vulnerability [25].

The present study had as limitations: 1) development in a single hospital service; 2) exclusive use of secondary data extracted from medical records; 3) relatively small study population, which limits inferences and generalization of the results. However, knowing the results obtained has the potential to contribute to the redirection of care flows, aiming at better quality in the care provided.

Conclusion

The results of this study showed that SARS-Cov-2 infection in the pediatric population

may result in severe clinical conditions, especially in males and children under 1 year of age. The most common clinical manifestations in severe patients were respiratory, gastrointestinal and fever. Comorbidities were present in almost half of severe cases. Most of these patients required oxygen support and transfer to the ICU. Respiratory distress, fever, decreased saturation, oxygen requirements and transfer to the ICU were more frequent among severe cases of COVID-19.

Knowledge of the sociodemographic and clinical profile of COVID-19 cases in the hospitalized pediatric population can contribute to review flowcharts and protocols already established and reorient health professionals for quality care and proper management of cases.

Collaborations:

1 – conception and planning of the project: Paula Ribeiro da Silva; Aisiane Cedraz Morais; Juliana de Oliveira

2 – analysis and interpretation of data: Paula Ribeiro da Silva; Aisiane Cedraz Morais; Juliana de Oliveira Freitas Miranda; Kaio Vinicius Freitas de Andrade.

3 – writing and/or critical review: Paula Ribeiro da Silva; Aisiane Cedraz Morais; Juliana de Oliveira Freitas Miranda; Kaio Vinicius Freitas de Andrade; Deisy Vital dos Santos and Lucas Amaral Martins

4 – approval of the final version: Paula Ribeiro da Silva; Aisiane Cedraz Morais; Juliana de Oliveira Freitas Miranda; Kaio Vinicius Freitas de Andrade; Deisy Vital dos Santos; Lucas Amaral Martins and Guilherme de Souza Costa.

Competing interests

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