

# Severe Acute Respiratory Syndrome due to COVID-19 among children and adolescents in Brazil: profile of deaths and hospital lethality as at Epidemiological Week 38, 2020

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## Abstract

**Objective:** To describe the profile of deaths and the lethality of Severe Acute Respiratory Syndrome (SARS) due to COVID-19 in hospitalized children and adolescents in Brazil. **Methods:** This was a cross-sectional study conducted with data from the SARS notification forms of children and adolescents (0 to 19 years old) with laboratory-confirmed COVID-19. Notifications with complete progression of SARS due to COVID-19 were included, up to the 38th Epidemiological Week of 2020. **Results:** 6,989 hospitalizations were investigated, 661 died, resulting in 9.5% hospital lethality. Higher lethality rates were observed among children under 1 year of age (14.2%), female children and adolescents (9.7%), the indigenous (23.0%), and those living in rural areas (18.1 %), as well as in the Northeast (15.4%) and North (9.7%) regions of Brazil. **Conclusion:** Differences in hospital mortality were found according to sociodemographic characteristics and marked regional inequalities.

**Keywords:** Severe Acute Respiratory Syndrome; Coronavirus Infections; Child; Adolescent; Lethality; Cross-Sectional Studies.

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## Introduction

COVID-19 is a communicable disease caused by SARS-CoV-2, a new type of coronavirus related to severe acute respiratory syndrome (SARS).<sup>1</sup> The disease has spread rapidly and gained pandemic proportions, with social, health and economic implications. As at September 28th 2020, 33,034,598 COVID-19 cases and 996,342 deaths had been confirmed worldwide.<sup>2</sup>

In Brazil, 388,901 SARS cases due to COVID-19 were notified between Epidemiological Weeks 1 and 38, 2020. Hospitalizations due to this condition among children and adolescents (0-19 years old) totaled 9,483 cases in the same period, corresponding to 2.4% of all hospitalizations for SARS due to COVID-19. In addition, 69.9% of SARS deaths between Epidemiological Weeks 1 and 38, 2020, were confirmed as COVID-19 cases, whereby deaths among children and adolescents from this cause accounted for 0.68% in relation to all age groups.<sup>3</sup>

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The fourth phase of the largest epidemiological study of coronavirus in Brazil, 'Evolution of COVID-19 Infection Prevalence in Brazil – Epicovid19-BR', demonstrated a change in the age pattern of infected people in Brazil between June and August 2020, with proportional growth in infection among children and elderly people and a reduction among adults, for whom the rates were initially the highest.<sup>4</sup> Moreover, there is a scarcity of special prevention and control measures specifically for children and adolescents, except for schools being closed and children over 5 years old and adolescents wearing facemasks.<sup>5</sup>

There are studies that describe COVID-19 characteristics among adults and the elderly in India<sup>6</sup> and China.<sup>7</sup> However, aggregated data for children and adolescents are still limited, especially with regard to lethality.<sup>8</sup> A systematic review of COVID-19 among children found that they accounted for between 1 and 5% of confirmed cases and generally the clinical course was milder than among adults.<sup>8</sup> However, a study conducted with cases aged under 18 years old in China, between January 16<sup>th</sup>

and February 8th 2020, indicated that up to 2.9% of confirmed cases can be severe or critical, rising to 5.8% when taking suspected cases into consideration, with cases being more serious and more prevalent among those under 1 year old.<sup>9</sup>

In the Brazilian context, distinct actions to address the disease can be seen between the country's states, in addition to regional inequalities in access to health services.

With the aim of contributing to a more comprehensive understanding of certain epidemiological characteristics of the disease, so as to inform the construction of prevention and combat measures, the objective of this study was to describe the profile of deaths and lethality of severe acute respiratory syndrome (SARS) caused by COVID-19 in hospitalized children and adolescents in Brazil.

## Methods

This was a cross-sectional study using secondary data from SARS notification forms of hospitalized cases, retrieved from the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe).

In 2020, COVID-19 surveillance was incorporated into the influenza and other respiratory virus surveillance network. SARS cases are defined when the following criteria are met: (i) hospitalized individual with fever, even when self-reported; (ii) cough or sore throat; (iii) dyspnea or O<sub>2</sub> saturation <95% or breathing difficulties; and (iv) need for hospitalization or progression to death when presenting the above symptoms, regardless of hospitalization.<sup>10</sup>

The study included children and adolescents (0-19 years) hospitalized due to SARS with laboratory diagnosis of COVID-19 in Brazil. Cases were excluded if the 'progression' (cure/death) variable on their notification form did not contain complete information. The analysis period covered Epidemiological Weeks 1 to 38, 2020 (up to 19/09/2020).<sup>11</sup>

The variables studied were:

- Age range (in years: under 1 year old 1; 1-4; 5-9; 10-14; 15-19);
- Sex (female; male);
- Race/skin color (white; black; brown; yellow; indigenous; unknown);
- Zone of residence (urban; rural; peri-urban); and
- Brazilian macro-region of hospitalization by place of residence (South; Southeast; Midwest; Northeast; North).

The absolute and relative frequencies of the variables of interest were calculated, with their respective 95% confidence intervals (95%CI), and were also stratified according to the 'death' variable.

The proportions of hospital lethality for children and adolescents were calculated by taking the number of SARS deaths with confirmation of COVID-19 in the 0-19 years age range up to Epidemiological Week 38, divided by the total number of cases hospitalized due to SARS with confirmation of COVID-19 in the respective age range up to Epidemiological Week 38, multiplied by 100. The data were stored on Microsoft Excel spreadsheets and later exported and analyzed using the Stata computer program, version 14.0.

The study was conducted using public domain secondary data,<sup>12</sup> available at a website maintained by the Brazilian National Health System Department of Information Technology – [opendatasus.saude.gov.br](http://opendatasus.saude.gov.br) – and accessed by the authors on September 28th 2020.

## Results

Brazil recorded 6,989 hospitalizations because of SARS due to COVID-19 among children and adolescents up to Epidemiological Week 38, 2020. The majority of these hospitalizations were concentrated in the Southeast region (35.2% – 95%CI 34.1;36.4), followed by the Northeast region (27.5% – 95%CI 26.4;28.5). The 1-4 year and 15-19 year age groups accounted for the majority of hospitalizations, with 27.5% (95%CI 26.4;28.4) and 24.4% (95%CI 23.3;25.4), respectively. There were more hospitalizations among female children and adolescents (51.6% – 95%CI 50.4;52.7) and those of brown race/skin color (50.8% – 95%CI 49.6;52.0) (Table 1).

With regard to proportional distribution of deaths, similar proportions were found between children under 1 year old (28.9% – 95%CI 25.5;32.4) and adolescents aged 15-19 years old (28.4% – 95%CI 25.1;32.0), with a higher proportion of females (52.9% – 95%CI 49.1;56.7), those of brown race/skin color (54.1% – 95%CI 50.1;58.0) and those living in urban areas (84.6% – 95%CI 81.3;87.2) (Table 1).

Of the total number of hospitalizations (n=6,989), 661 died (9.5% – 95%CI 8.9;13.7), resulting in 9.5% hospital lethality. Hospital lethality was found to be greater in children under 1 year old (14.2%), females (9.7%) and those who lived in rural areas (18.1%). Attention is drawn to the high lethality rate found among the

indigenous (23.0%), which was the highest among all the categories analyzed. Among the Brazilian macro-regions, the Northeast (15.4%) and the North (9.7%) had the highest hospital lethality (Table 1).

## Discussion

Among children and adolescents hospitalized because of SARS due to COVID-19, hospital lethality was greater among children under 1 year old, females, those living in rural areas and in Northeast Brazil and, above all, among the indigenous.

Data contained in the Ministry of Health Epidemiological Bulletin (2020)<sup>3</sup> indicated that as at Epidemiological Week 38, 2020, hospitalizations of children and adolescents due to SARS with confirmed COVID-19 accounted for 2.4% of all hospitalizations due to this cause.<sup>3</sup> Although this percentage does not represent the majority of hospitalizations because of SARS due to COVID-19, a study conducted at the Massachusetts General Hospital, in the United States of America (USA),<sup>13</sup> suggests that children may have high viral loads despite frequently not developing severe COVID-19 symptoms, so that they represent a potential source of contagion and greater cause for concern for public health services, especially in the case of multigenerational families.<sup>3</sup>

The number of deaths among children and adolescents in other countries diverges from the Brazilian context.<sup>14,15</sup> Data from the USA 'Coronavirus in Kids (COVKID) Tracking and Education' project,<sup>15</sup> indicate that as at July 19<sup>th</sup> 2020, 75 deaths from COVID-19 among children and adolescents aged 0-19 had been detected in that country. Despite the USA – with regard to the number of cases – having been recognized as the epicenter of the pandemic in July 2020,<sup>2</sup> its statistics for children and adolescents are lower, indicating that Brazil needs to strengthen its prevention measures in this age range.

This study corroborates the severity of the disease in children under 1 year old found by an earlier study. In China, among 2,143 pediatric patients with COVID-19, researchers found that neonatal babies were more vulnerable for the severe type of infection.<sup>9</sup> A recent study highlighted that the main form of COVID-19 infection in children (4 days to 14 years old) was through family groups, and that standing out among the clinical characteristics were long incubation periods, fever and coughing.<sup>16</sup> The same study found that 30% of asymptomatic children had post-infection lung damage.<sup>16</sup>

**Table 1 – Percentage hospitalizations, deaths and lethality rate among children and adolescents hospitalized diagnosed as having severe acute respiratory syndrome (SARS) due to COVID-19 (N=6,989) as at Epidemiological Week 38, Brazil, 2020**

Variables	Hospitalizations (N=6,989)			Deaths (N=661)			Lethality
	N	%	95%CI <sup>a</sup>	N	%	95%CI <sup>a</sup>	%
<b>Age range (in years)</b>							
<1	1,341	19.2	18.2;20.1	191	28.9	25.5;32.4	14.2
1-4	1,918	27.5	26.4;28.4	129	19.5	16.6;22.7	6.7
5-9	1,073	15.3	14.5;16.2	68	10.3	8.1;12.8	6.3
10-14	954	13.6	12.8;14.4	85	12.9	10.5;15.6	8.9
15-19	1,703	24.4	23.3;25.4	188	28.4	25.1;32.0	11.0
<b>Sex</b>							
Female	3,604	51.6	50.4;52.7	350	52.9	49.1;56.7	9.7
Male	3,383	48.4	47.2;49.6	311	47.1	43.2;50.8	9.2
<b>Race/skin color</b>							
White	1,819	27.7	26.6;28.8	138	22.6	19.4;26.1	7.6
Black	191	2.9	2.5;3.3	18	2.9	1.8;4.6	9.4
Brown	3,335	50.8	49.6;52.0	330	54.1	50.1;58.0	9.9
Yellow	48	0.8	0.5;0.9	4	0.7	0.2;1.7	8.3
Indigenous	113	1.7	1.4;2.0	26	4.3	2.9;6.1	23.0
Unknown	1,058	16.1	15.2;17.0	94	15.4	12.7;18.5	8.9
<b>Zone of residence</b>							
Urban	5,832	91.8	91.0;92.3	492	84.6	81.3;87.2	8.4
Rural	485	7.6	7.0;8.3	88	15.1	12.4;18.3	18.1
Peri-urban	40	0.6	0.4;0.8	2	0.3	0.1;1.3	5.0
<b>Brazilian macro-region</b>							
South	429	6.1	5.5;6.7	32	4.8	3.4;6.7	7.5
Southeast	2,462	35.2	34.1;36.4	173	26.2	22.9;29.6	7.0
Midwest	881	12.6	11.8;13.4	34	5.1	3.6;7.1	3.9
Northeast	1,918	27.5	26.4;28.5	296	44.8	41.0;48.6	15.4
North	1,299	18.6	17.6;19.5	126	19.1	16.2;22.2	9.7

a) 95%CI: 95% confidence interval.

Although hospital lethality was greater among children under 1 year old, they were closely followed by adolescents aged 15-19 years old. It is possible that among adolescents hospitalized with COVID-19, pre-existing chronic conditions may have been associated with worsening of the clinical picture and with high death and lethality frequency in the group studied. Data indicate that occurrence of chronic diseases, such as obesity, diabetes *mellitus* and asthma, is growing among adolescents, and this may explain the findings.<sup>17</sup> It is important to highlight that this study did not investigate whether there were pre-existing chronic diseases.

Highest hospital lethality was found among females, although there is no evidence of differences between the sexes of susceptibility to COVID-19 infection and lethality, especially among pediatric populations.<sup>18</sup> With regard to zone of residence, greater frequency of deaths in urban areas may be explained by most of the population living in these areas. On the other

hand, greater lethality among those living in rural areas may be a warning of COVID-19 gaining strength in rural areas,<sup>19</sup> given the vulnerabilities of population groups in rural communities, such as poorer access to health services.<sup>20</sup>

Greater hospital lethality occurred in the Northeast and North regions, which also had the highest overall COVID-19 mortality rates.<sup>21</sup> In September 2020, the Northeast and the North recorded rates of 68.1 and 80.5 deaths per 100,000 inhabitants, respectively.<sup>21</sup> These data confirm the social inequalities existing between Brazil's regions, since despite the levels of social isolation of some state in those two regions having remained the highest in Brazil during the COVID-19 pandemic,<sup>22</sup> nevertheless lethality due to the disease continues to be higher there. Addressing the pandemic therefore needs to take into consideration social vulnerabilities not only in relation to health conditions but also health service structure, organization and quality in each territory.<sup>23</sup>

The results reveal that the majority of deaths occurred among children and adolescents of brown race/skin color, pointing to racial and ethnic disparities in the COVID-19 pandemic, regardless of age. Specific data on children in New York City, USA, demonstrated that out of total deaths among those aged 0-17 years old, approximately 15% were of Black race/skin color, compared to 4.4% of White race/skin color.<sup>15</sup>

Hospital lethality was greater among indigenous children and adolescents. Once again in the United States, the COVID-19 hospitalization rate is 4 to 5 times higher among non-Hispanic indigenous Americans or Alaskan natives, non-Hispanic Black people and Hispanic or Latino people than among non-Hispanic White people.<sup>24</sup>

Greater lethality among the indigenous population may be a reflection of the historical barrier to health services, health conditions, prevalence of malnutrition, communicable and chronic diseases, apart from countless problems associated with invasion and environmental contamination of their lands by precious metal prospecting, farming and cattle-rearing activities, which are determining factors of the inequality faced by the indigenous population in Brazil.<sup>25,26</sup> Limited access to water – for hand-washing as a prevention measure –, poor communication and lack of a Health response with an intercultural perspective, along with large-scale migration from large cities and tourist locations back to communities of origin, represent high risk of contagion for indigenous communities. These elements can contribute to severe COVID-19 cases “sweeping through” communities with precarious health and living conditions.<sup>25</sup>

Likewise, the macro-regions where greater hospital lethality was found, as well as the demographic characteristics of the most affected children, point to the health inequalities existing in Brazil.

Lethality is influenced both by individual intrinsic characteristics and also by Health resource availability, distribution and quality.<sup>27,28</sup> As such the data presented warn as to the impact of these inequalities on lethality among the population. As coronavirus infection is new and has the potential to result in severe cases, researchers recommend that health care should be reinforced, principally to protect children with underlying diseases.<sup>29</sup>

A positive point of the study is that analysis of secondary databases, especially national databases, is a good way of assessing the epidemiological status of

a given population, in addition to investigating an age group that has not been given much consideration within the COVID-19 scenario.

Among the limitations of the study is the bias related to severe cases being hospitalized more (hospitalization bias) and, consequently, the lethality rates found not representing the rates among the general population of children and adolescents. A further point is the direct influence of the heterogeneous quality of notification form completeness in each Brazilian region. Moreover, it was not possible to control duplicated cases in the records used since there are no variables identifying cases. However, if someone was affected more than once by SARS diagnosed as COVID-19, few studies have demonstrated cases of reinfection.<sup>30</sup> Finally, this study did not investigate the presence of pre-existing diseases.

Analysis of hospitalizations and death and lethality profiles is essential for building measures to prevent and combat COVID-19 in Brazil, especially among hospitalized children and adolescents. Although this is not the most affected population, it is a group that is a source of transmission of infection and is showing increased COVID-19 lethality. The results presented highlight the need to meet the demands of the entire Brazilian pediatric population, especially those living in rural areas, those under 1 year old, indigenous and living in Brazil's North and Northeast regions. There is no single measure for addressing the disease in a country as large and so structurally, culturally and geographically diversified as Brazil. Notwithstanding, health service managers need to adopt measures that are most appropriate for particularities of each region and of the most vulnerable population segments.

## Authors' contributions

Hillesheim D took part in the concept and design of the article, data analysis and interpretation, drafting the manuscript and critically reviewing its contents. Tomasi YT and Figueiró TH took part in the concept of the study, reviewing the literature, drafting and critically reviewing the contents of the manuscript. Paiva KM took part in the concept of the study, drafting and critically reviewing the contents of the manuscript. All the authors have approved the final version of the manuscript and are responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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