

**HOSPITALIZATIONS FOR SEVERE ACUTE RESPIRATORY SYNDROME IN CHILDREN IN THE STATE OF PARANÁ: CROSS-SECTIONAL STUDY**

**HOSPITALIZACIONES POR SÍNDROME RESPIRATORIO AGUDO SEVERO EN NIÑOS EN EL ESTADO DE PARANÁ: ESTUDIO TRANSVERSAL**

**HOSPITALIZAÇÕES POR SÍNDROME RESPIRATÓRIA AGUDA GRAVE EM CRIANÇAS NO ESTADO DO PARANÁ: ESTUDO TRANSVERSAL**

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**ABSTRACT**

**Objective:** to analyze the factors associated with hospitalization in the intensive care unit (ICU) due to severe acute respiratory syndrome due to COVID-19 and other respiratory viruses in children from 0 to 5 years of age in Paraná in the years 2020 to 2022. **Method:** Cross-sectional study, carried out based on secondary data made available in the Influenza Epidemiological Surveillance Information System. For analysis, Poisson regression with robust variance was used for the response variables (hospitalization in COVID-19 ICU, ICU due to other respiratory viruses and deaths) and independent variables (age group, use of ventilator support, presence of comorbidities and factors risk). **Results:** 17,995 children were hospitalized, 265 in COVID-19 ICU and 2,994 in non-COVID-19 ICU due to other pathogens. The average age was 1.9 years and 2.2 years respectively. The white color/race and male sex were predominant in both groups. 184 deaths were recorded due to COVID-19, and 83 deaths considered to be due to other causes. The use of ventilator support was associated with all outcomes, the presence of comorbidities was associated with the need for ICU regardless of the etiological agent. **Conclusion:** The need for ventilator support was associated with greater ICU hospitalization and death. Children affected by SARS-CoV-2 were not more likely to be hospitalized in the ICU compared to those with other respiratory pathogens, but they were more likely to die. **Keywords:** COVID-19; Hospitalization; Child; Intensive Care Units; Respiratory Insufficiency

**RESUMEN**

**Objetivo:** analizar los factores asociados a la internación en unidad de cuidados intensivos (UCI) por síndrome respiratorio agudo grave por COVID-19 y otros virus respiratorios en niños de 0 a 5 años en Paraná en los años 2020 a 2022. **Método:** Estudio transversal, realizado a partir de datos secundarios disponibles en el Sistema de Información de Vigilancia Epidemiológica de Influenza. Para el análisis se utilizó regresión de Poisson con varianza robusta para las variables respuesta (hospitalización en UCI COVID-19, UCI por otros virus respiratorios y muertes) y variables independientes (grupo etario, uso de soporte ventilatorio, presencia de comorbilidades y factores de riesgo). **Resultados:** 17.995 niños fueron hospitalizados, 265 en UCI COVID-19 y 2.994 en UCI no COVID-19 por otros patógenos. La edad media fue de 1,9 años y 2,2 años respectivamente. El color/raza blanca y el sexo masculino fueron predominantes en ambos grupos. Se registraron 184 muertes por COVID-19 y 83 muertes consideradas por otras causas. El uso de soporte ventilatorio se asoció con todos los resultados, la presencia de comorbilidades se asoció con la necesidad de UCI independientemente del agente etiológico. **Conclusión:** La necesidad de soporte ventilatorio se asoció con mayor hospitalización en UCI y muerte. Los niños afectados por el SARS-CoV-2 no tenían más probabilidades de ser hospitalizados en la UCI en comparación con aquellos con otros patógenos respiratorios, pero sí tenían más probabilidades de morir.

**Palabras-clave:** COVID-19; Hospitalización; Niño; Unidades de Cuidados Intensivos; Insuficiencia Respiratoria.

**RESUMO**

**Objetivo:** analisar os fatores associados a hospitalização em unidade de terapia intensiva (UTI) por síndrome respiratória aguda grave em decorrência da COVID-19 e de outros vírus respiratórios em crianças paranaenses de 0 a 5 anos nos anos de 2020 a 2022. **Método:** Estudo transversal, realizado a partir dos dados secundários disponibilizados no Sistema de Informação de Vigilância Epidemiológica da Gripe. Para análise utilizou-se a regressão de Poisson com variância robusta, para as variáveis respostas (hospitalização em UTI COVID-19, UTI por outros vírus respiratórios e óbitos) e variáveis independentes (faixa etária, uso de suporte ventilatório, presença de comorbilidades e fatores de risco). **Resultados:** foram hospitalizadas 17.995 crianças, sendo 265 em UTI COVID-19 e 2.994 em UTI não COVID-19 por outros patógenos. A média de idade foi de 1,9 anos e 2,2 anos respectivamente. A raça cor/branca e o sexo masculino foi predominante em ambos os grupos. Foram registrados 184 óbitos por COVID-19, e 83 óbitos considerados por outras causas. O uso de suporte ventilatório esteve associado a todos os desfechos, a presença de comorbilidades estiveram associados a necessidade de UTI independentemente do agente etiológico. **Conclusão:** A necessidade de suporte ventilatório esteve associada a maior hospitalização em UTI como o óbito. Crianças acometidas por SARS-CoV-2 não apresentam maior chance de ser hospitalizada em UTI frente aquelas com outros patógenos respiratórios, mas tiveram maiores chances de vir a óbito.

**Palavras-chave:** COVID-19; Hospitalização; Crianças; Unidade de Terapia Intensiva; Insuficiência Respiratória.



## INTRODUCTION

Respiratory tract infections are one of the main causes of morbidity and mortality, particularly in children under five years old. According to the World Health Organization (WHO), a severe acute respiratory infection is characterized by symptoms such as cough, fever above 38°C and requiring hospitalization. It is among the five causes of child death, and viruses are the main causes; globally, it is estimated that, in 2019, about 740,000 children died from this cause<sup>(1)</sup>.

The respiratory infection that became known as Coronavirus disease (COVID-19), caused by the SARS-CoV-2 virus, was responsible for the last global pandemic, with the first cases identified in the city of Wuhan, China, at the end of 2019. This infection can present different clinical conditions from asymptomatic to more severe with the need for hospitalization in an Intensive Care Unit (ICU) promoted by the evolution of Acute Respiratory Syndrome (SARS)<sup>(2)</sup>.

The studies identified some groups that are more vulnerable to developing the severe form of the disease, such as the elderly, individuals with some comorbidity and pregnant women<sup>(3)</sup>. These were the groups that caused the greatest concern at the beginning of the pandemic, however, over time, children became a group of significant importance. Because they are potential transmitters, they develop multisystemic inflammatory syndrome (MIS-C) and respiratory discomfort syndrome<sup>(4)</sup>.

Children affected have nonspecific symptoms such as fever, cough, shortness of breath, abdominal pain, diarrhea and vomiting. These symptoms make the diagnosis difficult, as they are common for several pathologies and other viruses that affect the respiratory tract. Thus, this population contributes to complications and greater severity of the disease due to the difficulty of diagnosis and incorrect treatments, since some viruses have specific antiviral and others not, such as SARS-CoV-2<sup>(5)</sup>.

In the United States, by August 2021, there were more than four million cases of COVID-19 in children under 18. At the end of that year, hospitalization rates among children from zero to four years quickly increased to 14.5 per 100,000. The scenario in Brazil was more drastic with greater proportionality of ICU use and higher mortality rate<sup>(6)</sup>. According to records of Fiocruz, Brazil registered one death per day among children from six months to five years old in 2022, due to COVID-19<sup>(7)</sup>.

Among the various regions of Brazil, the South region presented the second highest number of COVID-19 cases and the third highest mortality rate. Among the states that comprise it, Paraná has the highest mortality rate and the second highest number of cases<sup>(8)</sup>. The vaccination for children under five years old was approved in Brazil on September 16, 2022, however, parental hesitation is still great and after four months of the beginning only 5.5% of Brazilian children had received the two necessary doses<sup>(7)</sup>.



In addition to the above, there are few publications that sought to identify the epidemiological profile of children hospitalized for severe acute respiratory syndrome (SARS) due to COVID-19 and other pathogens in the state of Paraná that required the use of ICUs. Therefore, the present research aims to analyze the factors associated with hospitalization in intensive care unit (ICU) for severe acute respiratory syndrome (SARS) due to COVID-19 and other respiratory viruses in children from Paraná from 0 to 5 years old in the years 2020 to 2022.

## METHODS

Cross-sectional, analytical and exploratory research whose report followed the guidelines of the initiative Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)<sup>(9)</sup>.

The study was conducted with data from children reported in the Influenza Epidemiological Surveillance System (SIVEP-Gripe) in the state of Paraná, state unit located in the Southern region of Brazil. The state is composed of 399 municipalities, consisting of an

estimated population of 11,800,000. The human development index (HDI) is 0.749 (average), being the fifth highest in the country and the second highest in the South region<sup>(10)</sup>. Paraná is divided into four major health regions, which are the macroregional East, West, North and Northwest and 22 regional health that contemplate the municipalities of Paraná.

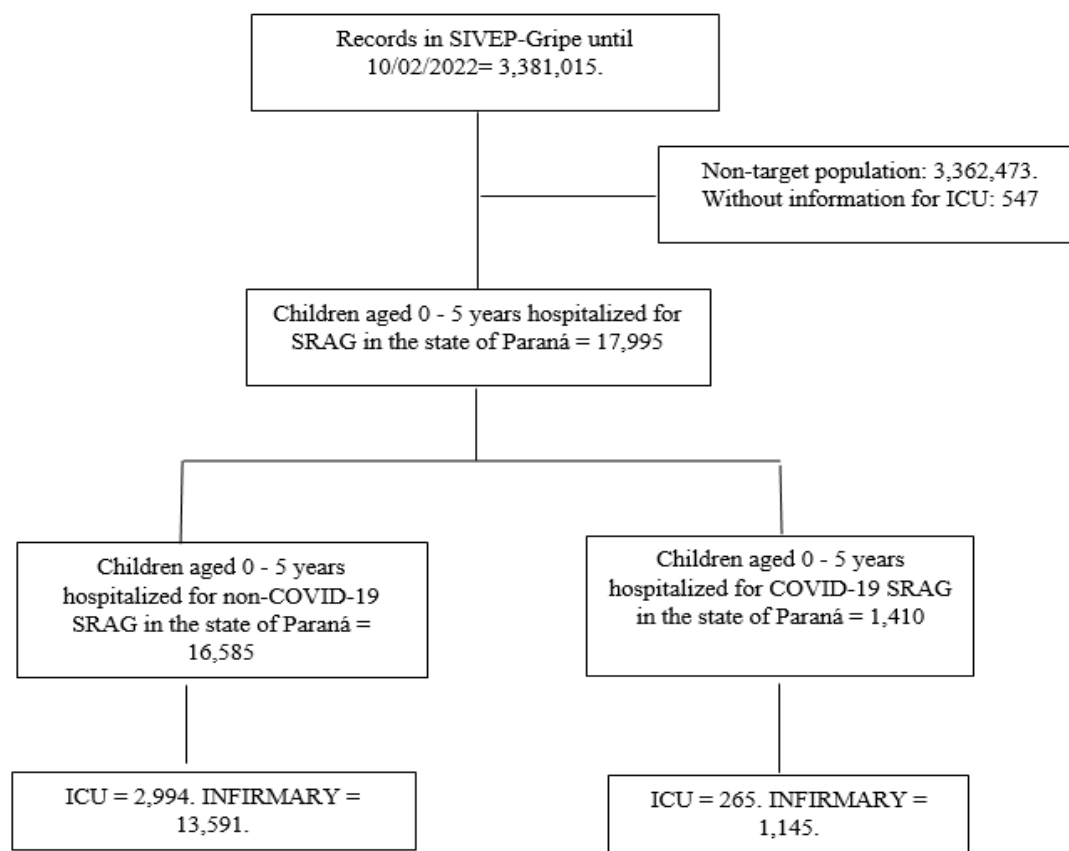
The data collected and analyzed concern the period from January 2020 to September 2022. All children aged zero to five years hospitalized for SARS in the state of Paraná due to or not COVID-19 were included. The sample did not include children whose information considered indispensable was absent.

The information was extracted from SIVEP-Gripe, a secondary database that has been publicly available since the influenza pandemic in 2009. Therefore, all cases hospitalized for SARS were notified by health institutions in this system.

The sample was for convenience and composed of 17,995 children from Paraná hospitalized for SARS due to or not COVID-19. Figure 1 illustrates the population definition flowchart.



**Figure 1** – Flowchart for selection of children from Paraná aged 0 - 5 years hospitalized for SRAG in SIVEP-Gripe



Hospitalization in ICU for COVID-19, ICU for non-COVID-19 and death were determined as outcome variables. To facilitate reading and understanding of the text, those hospitalized in COVID-19 ICU were named as ICU C and the hospitalizations in ICU by other respiratory viruses as ICU N.

The independent variables were gender (female or male), zone (periurban, rural, urban), ventilator support use (Yes, invasive; Yes, non-invasive; No), final classification (COVID-19 and others), classification criteria (clinical image, laboratory, clinical epidemiological, clinical), evolution (Death by other causes,

death, cure), comorbidities (yes and no), symptoms: abdominal pain, fatigue, loss of smell, loss of taste, fever, cough, throat, dyspnea, respiratory discomfort, saturation <95%, diarrhea, vomiting, other symptoms (yes and no).

The analysis and graphs were performed using R (R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria). The sociodemographic and clinical characteristics of SRAS hospitalized patients who required ICU C, ICU N and those who did not need ICU are presented through absolute and relative frequencies, mean and standard

deviations and length of stay in ICU. The prevalence of hospitalization in ICU C due to SARS and hospitalization in ICU N due to SARS were also calculated.

For statistical analysis of the inferential type in order to verify possible associations between independent and dependent variables, the Poisson regression model with robust variance was used, by means of adjusted prevalence ratios and 95% confidence intervals (95%CI), the significance level of 5%.

Since the data collection occurred through a publicly available database, there was no need for approval by an ethics committee. However, it is emphasized that all ethical precepts were followed in the development of the research.

## RESULTS

Of the 17,995 pediatric hospitalizations that occurred for SARS during the study period, 18.1% (n = 3,259) required ICU; of these, 8.1% (n = 265) were due to COVID-19.

The highest number of ICU admissions (in absolute numbers) for COVID-19 in children aged zero to five was in January 2022.

Meanwhile, ICU admissions for other respiratory pathogens occurred throughout the study period, mainly from June 2021, 15 admissions were recorded in ICU C and 125 in ICU N. In mid-April and May 2022, eight (08) cases of COVID-19 were admitted to the ICU, and 175 for other respiratory diseases.

The mean age and standard deviation (SD) of children hospitalized for SARS in infirmary was 2.4 years (SD=1.39), ICU N was 1.9 years (SD= 1.47) and ICU C was 2.2 years (SD= 1.53).

White race/color was predominant for hospitalizations in ICU N (n=1,772; 59.1%) and ICU C (n=169; 63.8%). Males were more frequent in all hospitalizations. The chi-square test showed no significant differences related to sex. Other sociodemographic and clinical characteristics of children hospitalized for SARS in the infirmary, ICU N and ICU C are detailed in Table 1.

**Table 1** – Sociodemographic and clinical characteristics of children hospitalized for SRAG, according to the hospitalization unit in infirmary, non-COVID-19 ICU (N) and COVID-19 ICU (C), Maringá/Paraná, 2023

Sociodemographic and clinical characteristics	Infirmary (n=14.736)	ICU N (n=2.994)	ICU C (n=265)
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	n	%	n	%	n	%
<b>Sex</b>						
Male	8.051	(54.6)	1.611	(53.8)	139	(52.5)
Female	6.678	(45.0)	1.377	(46.0)	125	(47.2)
Not defined	7	(0.1)	6	(0.2)	1	(0.3)
<b>Race/color</b>						
White	8.449	(57.3)	1.772	(59.2)	169	(63.8)
Black	219	(1.5)	33	(1.1)	3	(1.1)
Yellow	21	(0.1)	6	(0.2)	0	(0.0)
Brown	1.513	(10.3)	221	(7.4)	25	(9.4)
Indigenous	46	(0.3)	8	(0.3)	0	(0.0)
Ignored	4.488	(30.5)	954	(31.8)	68	(25.7)
<b>Zone</b>						
Urban	13.452	(91.3)	2.725	(94.7)	248	(93.6)
Rural	458	(3.1)	99	(3.4)	6	(2.3)
Periurban	30	(0.2)	7	(0.2)	0	(0.0)
Ignored	796	(5.4)	163	(5.5)	11	(4.1)
<b>Risk factor</b>						
Yes	3.462	(23.5)	1.188	(39.7)	115	(43.4)
No	11.274	(76.5)	1.806	(60.3)	150	(56.6)
<b>Ventilator support</b>						
Yes, invasive	159	(1.1)	972	(32.5)	95	(35.8)
Yes, non-invasive	6.843	(46.4)	1.554	(51.9)	105	(39.6)
No	7.482	(50.8)	440	(14.7)	59	(22.3)
Ignored	252	(1.7)	28	(0.9)	6.	(2.3)
<b>Criterion</b>						
Laboratorial (PCR-RT)	13.362	(90.7)	2.798	(93.5)	258	(97.4)
Epidemiological clinical <sup>1</sup>	48	(0.3)	7	(0.2)	0	(0.0)
Clinical <sup>2</sup>	426	(2.9)	29	(1.0)	3	(1.1)
Image clinical <sup>3</sup>	4	(0.0)	1	(0.0)	0	(0.0)



Ignored	896	(6.1)	159	(5.3)	4	(1.5)
<b>Evolution</b>						
Cure	13.126	(89.1)	2.577	(86.1)	222	(83.8)
Death	41	(0.3)	111	(3.7)	32	(12.0)
Death from other causes	18	(0.1)	62	(2.1)	3	(1.1)
Ignored	1.551	(10.5)	244	(8.1)	8	(3.1)

The most frequent comorbidity in those hospitalized for SARS in nursing was asthma in 42.8% of cases, neurological diseases in ICU N was 28.6% as well as in ICU C with 30.8% of cases. Among the children who presented some comorbidity, most of them (85.8%) had only one

type. The number of children with two comorbidities at the same time was around 12.3%, and 1.9% had three to five comorbidities. The frequency of comorbidities such as diabetes, obesity and others can be seen in table 2.

**Table 2** – Absolute and relative frequencies of comorbidities in children hospitalized for SRAG, according to the hospitalization unit in infirmary, COVID-19 ICU (C) and non-COVID-19 ICU (N). Maringá/PR, 2023

Comorbidities	Infirmary (n=2.958)		ICU N (n=864)		ICU C (n=91)	
	n	%	n	%	n	%
Heart diseases	281	(9.5)	195	(22.6)	19	(21.0)
Hematological diseases	121	(4.1)	21	(2.4)	0	(0.0)
Down syndrome	136	(4.6)	64	(7.4)	9	(9.9)
Liver diseases	30	(1.0)	17	(1.9)	0	(0.0)
Asthma	1.268	(42.9)	151	(17.5)	9	(9.9)
Diabetes	33	(1.1)	11	(1.3)	4	(4.4)
Neurological diseases	556	(18.8)	247	(28.6)	28	(30.8)
Lung diseases	276	(9.3)	86	(10.0)	12	(13.2)
Immunodepression	150	(5.1)	37	(4.3)	6	(6.6)
Kidney diseases	76	(2.6)	20	(2.3)	2	(2.1)
Obesity	31	(1.0)	15	(1.7)	2	(2.1)

Regarding the symptoms, coughing (78%) was the most prevalent in children hospitalized for SARS in the infirmary, followed by fever (66.1%) and other respiratory symptoms, the lowest complaint was loss of

smell and taste. For those hospitalized in ICU N, the drop in saturation (61.7%) and respiratory discomfort (61.5%) were more frequent followed by dyspnea (57.6%). Finally, fever was present in 59.6% of the cases hospitalized in ICU C,



followed by respiratory discomfort (52.5%). The chi-square test showed that these symptoms increase the prevalence in ICU. The signs and

symptoms presented by children with SARS, according to the hospitalization unit, are detailed in Table 3.

**Table 3** – Absolute and relative frequencies of the signs and symptoms presented by children hospitalized for SRAG, according to the hospitalization unit in infirmary, non-COVID-19 (N) and COVID-19 ICU (C). Maringá/PR, 2023

Signs and symptoms	Outcome					
	Infirmary (n=14.736)		ICU N (n=2.994)		ICU C (n=265)	
	n	%	n	%	n	%
Abdominal pain	837	(5.6)	92	(3.1)	15	(5.6)
Fatigue	1.172	(7.9)	263	(8.8)	25	(9.4)
Loss of smell	96	(0.7)	15	(0.5)	2	(0.8)
Loss of taste	85	(0.6)	8	(0.3)	2	(0.8)
Fever	9.743	(66.1)	1.446	(48.3)	158	(59.6)
Cough	11.498	(78.0)	1.687	(56.3)	120	(45.3)
Sore throat	1.357	(9.2)	142	(4.7)	8	(3.0)
Dyspnea	6.609	(44.8)	1.726	(57.6)	119	(45.0)
Respiratory distress	6.839	(46.4)	1.842	(61.5)	139	(52.5)
O <sub>2</sub> saturation <95%	6.150	(41.7)	1.847	(61.7)	135	(51.0)
Diarrhea	1.605	(10.9)	211	(7.0)	30	(11.3)
Vomiting	2.940	(20.0)	406	(13.6)	45	(17.0)

The average length of hospitalization in ICU N was 10.14 days, in ICU C the average was 11.2 days. The peak of hospitalization days in ICU C occurred in mid-August 2020, there were no major increases in hospitalizations in ICU N remaining stable with a slight decrease in January 2021.

The prevalence of hospitalizations of children in the age group in ICU C during the study period was 1.47%. For other respiratory viruses, it was 16.64%. The hospitalizations in ICU in the health regions of Paraná with higher prevalence of hospitalizations for COVID-19 were in the 12<sup>th</sup> regional - Umuarama (54.5%); 1<sup>st</sup> regional - Paranaguá (50.0%); and 14<sup>th</sup> regional - Paranavaí with 50.0%, respectively.

For hospitalizations in ICU due to other respiratory agents, the highest prevalence were in the 12<sup>th</sup> regional - Umuarama (78.6%); 6<sup>th</sup> regional - União da Vitória (58.7%) and 7<sup>th</sup> regional - Pato Branco (34.9%).

The regression showed that the fact that the child was affected by SARS-CoV-2 did not increase the prevalence of hospitalization in ICU (PR=0.97; IC95%= 0.88-1.07).

Table 4 presents the crude prevalence ratios (CPR) of the outcome variables, according to age group, use of ventilator support, presence of comorbidities.





**Table 4** – Crude prevalence ratios of the research outcomes, according to age group, use of ventilator support, presence of risk factor and comorbidities. Maringá/PR, 2023

Variable	Outcome								
	ICU C			ICU N			DEATH		
	bPR	P-value	95%CI	RPb	P-value	IC95%	bPR	Valor-p	95%CI
<b>Age group</b>									
0-2 years	1.00	-	-	1.00	-	-	1.00	-	-
3-5 years	0.83	0.14	0.64-1.06	0.66	<0.01	0.61-0.72	1.01	0.97	0.75-1.35
<b>Comorbidities</b>									
no	1.00	-	-	-	-	1.00	1.00	-	-
yes	1.65	<0.01	1.25-2.16	1.33	<0.01	1.22-1.45	2.94	<0.01	2.18-3.93
<b>Use of ventilator support</b>									
no	1.00	-	-	1.00	-	-	1.00	-	-
yes	6.71	<0.01	5.19-8.62	6.55	<0.01	6.05-7.08	23.20	<0.01	17.21-31.53

Table 5 presents the adjusted prevalence ratios for the outcomes.

**Table 5** – Adjusted prevalence ratios (aPR) of the research outcomes, according to age group, use of ventilator support, presence of risk factor and comorbidities. Maringá/PR, 2023

Variable	Outcome								
	ICU C			ICU N			DEATH		
	aPR	P-value	95%CI	aPR	P-value	95%CI	aPR	P-value	95%CI
<b>Age group</b>									
0-2 years	1.00	-	-	1.00	-	-	1.00	-	-
3-5 years	0.83	0.13	0.64-1.06	0.66	<0.01	0.61-0.72	1.01	0.97	0.75-1.36
<b>Comorbidities</b>									
no	1.00	-	-	-	-	1.00	1.00	-	-
yes	1.66	<0.01	1.26-2.18	1.33	<0.01	1.22-1.45	2.94	0.31	0.37-23.50
<b>Use of ventilator support</b>									
no	1.00	-	-	1.00	-	-	1.00	-	-
yes	6.88	<0.01	5.34-8.85	6.71	<0.01	6.20-7.26	23.23	0.09	0.62-875.81

It is found that the age group is not significant for admissions to the ICU C and even when the outcome is death. However, when it comes to ICU N, the age group of 3-5 years presents 34% less chance of admission in ICU compared to children from 0 to 2 years.

When it comes to the use of ventilator support, this was a significant factor for all outcomes, increasing the chance of hospitalization in C by 6.9 times, in cases of ICU N by 6.71 times and increasing by 23 times the chance of death of those who make use of this resource.



The fact that the child has at least one comorbidity was also significant for the outcomes of ICU admission and death. Having comorbidities increases the chance of hospitalization in ICU C by 1.66 times, the chance of ICU N by 1.33 times and death by 2.94 times.

The application of the Poisson model with robust variance resulted that, as age increases, the prevalence of COVID-19 also increases. The PR estimates that, with the increase of one year in age, the chance of hospitalization due to COVID-19 increases by 15%.

It was found that the child hospitalized due to COVID-19 had a 2.8 times greater chance of death than SRAG caused by other microorganisms. Furthermore, the risk factor increased by 1.53 times the probability of death. The use of ventilator support increased by 5.72 times the chance of death compared to those children who did not make use of it. The days of hospitalization in ICU showed no influence on the reduction or increase in the chance of death.

## DISCUSSION

The adjusted analysis of prevalence ratios showed that children aged zero to two years hospitalized for SARS due to other microorganisms had a higher chance of needing an ICU and dying. The use of ventilator support increased the probability of admission to the ICU in all cases, as well as the chance of the child

dying. Having comorbidity was a risk factor, such as prematurity, increasing the chances of being admitted to the ICU.

In Spain, the highest rate of hospitalization for COVID-19 among children was among those under five years old, with most being male<sup>(11)</sup>. Nevertheless, in Mexico, the highest hospitalization rate occurred among young people between 10-14 years of age. However, in Mexico, approximately 48% of the children hospitalized were under five years old<sup>(12)</sup>. It is possible to observe that the average age in hospitalizations for COVID-19 was higher than other respiratory viruses in Turkey, which resembles the one found in this study<sup>(13)</sup>.

Another study suggests that older children had milder respiratory infections because they had a better immune system. This is due to previous exposure to these viruses, however, it requires more extensive and robust investigations to ensure that successive viral infections make the immune system more effective<sup>(14)</sup>.

Study conducted in Saudi Arabia with children hospitalized for SARS presented as main symptoms cough and fever. Those hospitalized due to COVID-19 also had the same symptoms and complaints of gastrointestinal discomfort, identified in this study<sup>(15)</sup>. In Turkey, children hospitalized for other respiratory viruses exhibited more severe respiratory symptoms<sup>(16)</sup>.

Regarding the length of hospitalization in the ICU, a study conducted in Brazil found that the average hospitalization was five days<sup>(6)</sup>. In



the state of Paraná, children affected by SARS-CoV-2 remained on average in the ICU C for 11.2 days.

In Germany, at the end of October and beginning of November 2021, respiratory syncytial virus was responsible for hospitalization of numerous children due to respiratory infection. This rate was higher than in the previous year (2020), especially in children under two years old<sup>(17)</sup>. In this study, hospitalizations for other viruses followed a stability.

The need for ICU in cases of COVID-19 reached 46% in children under one year old in a Latin American country<sup>(12)</sup>. In Korea, the rates of ICU in children with new coronavirus were similar to those of patients aged 50 to 59 years<sup>(18)</sup>. In Saudi Arabia, the rate was lower (6.5%)<sup>(19)</sup>. For other respiratory viruses, such as respiratory syncytial virus, the need for ICU was higher, reaching 69%<sup>(20)</sup>. However, in Brazil, children with COVID-19 had a greater need for ICUs compared to those affected by other respiratory viruses<sup>(21)</sup>.

The most prevalent comorbidities in Indian and Middle Eastern children requiring ICU for COVID-19 were neurological problems, hematological malignancies and heart disease<sup>(22)</sup>. For other respiratory viruses in which there was a need for ICU, neurological diseases were also the most cited<sup>(14)</sup>. In Japan, there was a higher prevalence of kidney disease, heart disease and asthma<sup>(23)</sup>.

In the United States, the use of ventilator support for children was necessary in 38.1% of those hospitalized for COVID-19<sup>(24)</sup>. In Iran, children hospitalized in the ICU with invasive mechanical ventilation had worse prognoses. In contrast, the need for ventilator support may be greater in children affected by other respiratory pathogens<sup>(16)</sup>, which was also observed in children from Paraná. In Brazil, the rates of ventilator support were similar in children affected by different viruses<sup>(25)</sup>.

In relation to death among children with COVID-19, severe respiratory discomfort may have been a contributing factor, as well as having comorbidity. However, the effects of SARS-CoV-2 on children with underlying diseases have not yet been established<sup>(26)</sup>.

Nonetheless, the younger age group was not related to higher mortality among children. A systematic review showed that low and middle income countries had higher death rate among children than those of high income, which could be related to the lack of access to health services<sup>(27)</sup>. This study could not assess information like this.

A Brazilian study conducted in the state of Sergipe identified high death rates among children hospitalized for COVID-19, most of them infants with comorbidities, many of which did not use an ICU due to lack of availability of beds<sup>(28)</sup>. The COVID-19 death rate in the ICU obtained in Paraná (12%) was higher than another study that covered the Brazilian



population of children and adolescents in which the death rate was 7.5%<sup>(6)</sup>.

In the screen study, SARS-CoV-2 presented more chances of death; however, influenza could present a greater risk for this outcome according to some authors<sup>(29)</sup>. For the syncytial virus that affects the respiratory system of children, having heart disease, immunodeficiency and metabolic diseases are related to a higher probability of death<sup>(30)</sup>. But studies in Brazil, which compared deaths with children affected by different viruses such as influenza, corroborated the higher mortality among those affected by COVID-19, with a risk of death three times greater, reaching 15.2%. These high mortality rates reinforce that, despite the efforts of the Brazilian government to expand beds, there was an overload in the health system<sup>(25)</sup>.

The study presented some limitations, such as the use of secondary data, which present inconsistencies in the records and a relevant number of ignored responses. Added to this, it was restricted to one location, the state of Paraná. Considering the great regional differences in Brazil regarding health services, cultural aspects and socioeconomic conditions, there is no way to generalize the results for other regions.

Taking into account the low number of studies that evaluate and compare hospitalizations in children affected by SARS-CoV-2 and other viruses, this study is further scientific evidence, reinforcing that, although

viruses affect the respiratory system, the care needs may differ and require different strategies from health professionals and institutions. The pandemic has shown that the surveillance of these viruses is of paramount importance to offer a quality and problem-solving service.

## CONCLUSIONS

Children with comorbidities were associated with the need for hospitalization in ICU regardless of whether they are affected by SARS-CoV-2 or other respiratory viruses. Those who used some type of ventilator support presented higher risks for all non-successful outcomes including death.

It was identified that SARS-CoV-2 infection did not increase the chances of hospitalization in the ICU compared to other pathogens that affected the respiratory tract, but increased the chances of death.

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1 Study design and planning, data collection and critical review of the version.

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3 Critical review and final approval.

4 Critical review and final approval.



5 Critical review and final approval.

6 Study design.

7 Study design.

### Declaration of conflict of interests

“Nothing to declare.”

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