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Factors influencing prolonged length of hospital stay and ICU admission in a pediatric population admitted with infectious SARS

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Abstract

Objective: During the COVID-19 pandemic the largest exclusively pediatric hospital in Brazil created a care pathway (CPW) for patients admitted with infectious severe acute respiratory syndrome (SARS). We aimed at identifying factors associated with prolonged hospital length of stay (LOS) and intensive care unit (ICU) admission of children with infectious SARS. **Methods**: Retrospective cohort study that included pediatric patients with infectious SARS through March to September 2020, when COVID-19 dissemination arose locally. The primary study outcomes were hospital length of stay and ICU admission, which were considered as dependent variables in univariate analysis, followed by logistic regression multivariate model. Variables with p-values <0.05 were considered statistically significant. **Results**: 122 hospitalized patients were identified. The factors associated with prolonged hospitalization and ICU admission were female (β 0.753, p=0.000), public health care (β 0.903, p=0.000), respiratory comorbidity (β 0.610, p=0.000), with comorbidity (β 0.610, p=0.000) and COVID-19 (β 1.796, p=0.000). Moreover, with comorbidity (OR 3.182, p=0.017), X-ray alterations (OR 6.126, p=0.003) and COVID-19 (OR 6.284, p=0.005) were the independent factor and predictor of ICU admission at SARS-CPW. **Conclusions**: Children with SARS with certain comorbidities and other respiratory diseases were considered to be at risk because they were associated with prolonged length of stay and greater ICU admission. The results suggest that interventions focused on these groups may be essential to optimize the management of CPW-SARS, avoids dissemination of infectious disease and promotes better results and resource allocation.

Keywords: severe acute respiratory syndrome; pediatrics; multivariate analysis; length of stay; intensive care units

Fatores que influenciam o tempo prolongado de internação hospitalar e admissão na UTI em uma população pediátrica admitida com SRAG infecciosa

Resumo

Objetivo: Durante a pandemia de COVID-19, o maior hospital exclusivamente pediátrico do Brasil criou uma linha de cuidado (LC) para pacientes internados com síndrome respiratória aguda grave (SRAG) infecciosa. Nosso objetivo foi identificar os fatores associados ao tempo prolongado de internação hospitalar (IH) e admissão na unidade de terapia intensiva (UTI) de crianças com SRAG infecciosa. **Métodos**: Estudo de coorte retrospectivo que incluiu pacientes pediátricos com SRAG infecciosa de março a setembro de 2020, quando a disseminação do COVID-19 surgiu localmente. Os desfechos primários do estudo foram o tempo de internação hospitalar e a admissão na UTI, considerados como variáveis dependentes na análise univariada, seguidos do modelo de regressão logística multivariada. Os resultados foram expressos em *Odds Ratio* (OR) e as variáveis com valor de p<0,05 foram consideradas estatisticamente significativas. **Resultados**: foram identificados 122 pacientes hospitalizados. Os fatores de risco independentes para hospitalização prolongada são comorbidade neurológica (OR 7,537, p<0,001), combinação de comorbidades (OR 14,536, p<0,001) e comorbidades como transplante, doenças onco-hematológicas e autoimunes (OR 20,886, p=0,017) , Raio-X com opacidade peri-hilar bilateral com comprometimento brônquico (OR 8,160, p=0,026), COVID-19 (OR 11,370, p=0,049) e pneumonia por aspiração brônquica (OR 29,933, p=0,029). Além disso, derrame pleural (OR 53,540, p=0,002) é um preditor de admissão na UTI. **Conclusões**: Crianças com SRAG com certas comorbidades e outras doenças respiratórias foram consideradas de risco por estarem associadas ao tempo de internação prolongado e maior admissão na UTI. Os resultados sugerem que intervenções focadas nesses grupos podem ser essenciais para otimizar o manejo do LC-SRAG, evitar a disseminação e promover melhores resultados e alocação de recursos.

Palavras-chave: síndrome respiratória aguda grave; pediatria, análise multivariada, tempo de internamento; unidade de terapia intensiva

Introduction

Severe Acute Respiratory Syndrome (SARS) is characterized by the presence of dyspnea or respiratory distress or persistent pressure in the chest or low oxygen saturation. In children the following manifestations should also be considered: cyanosis, use of intercostal muscle for respiration, dehydration and loss of appetite.[1, 2]

SARS includes several etiologies, leading to significant variability in clinical presentation and it can be classified as infectious or non-infectious SARS.[3, 4] Infectious SARS can usually be presented in association with leukocytosis, left shift in neutrophils, fever, hypotension and acidosis.[5]

In order to improve the quality and efficiency of pediatric care, we implemented a quality management program focused on standardized protocols and data analytics, in a specialized care pathway (CPW).[6-8] This tool addresses the stages in which the patient can move during hospital journey and includes information from physical exam, adherence to protocols, resources consumed, in addition to allowing the acquisition of clinical and economic outcomes. Such structure and processes allowed to identify non-optimized clinical interventions, protocol deviations and quick problem solving. Importantly, it allowed better accountability towards physicians, and shared responsibilities as decision-making were outcomes-driven and decentralized.[9]

One of the most important goals of CPW is the definition of outcomes of interest to be managed. In view of a perspective of efficiency and effectiveness, the management of hospital stay and admission to the ICU become prominent indicators, mainly in the context of the pandemic. Rare publications, especially in pediatrics, have been proposed to assess factors that may influence hospital stay, as well as the ICU admission.

Considering the contemporary importance of this theme and aiming to optimize the outcomes of children with infectious SARS, this study aimed to evaluate the factors that may be related to longer hospital stay and admission to the ICU in a highly monitored SARS-CPW.

Methods

Study design

A retrospective cohort study was conducted. The study was performed at the largest pediatric hospital in Brazil, located in the south of this country. The project was approved by the ethics committee of Pequeno Príncipe Hospital (number CAAE: 40812320.3.0000.0097).

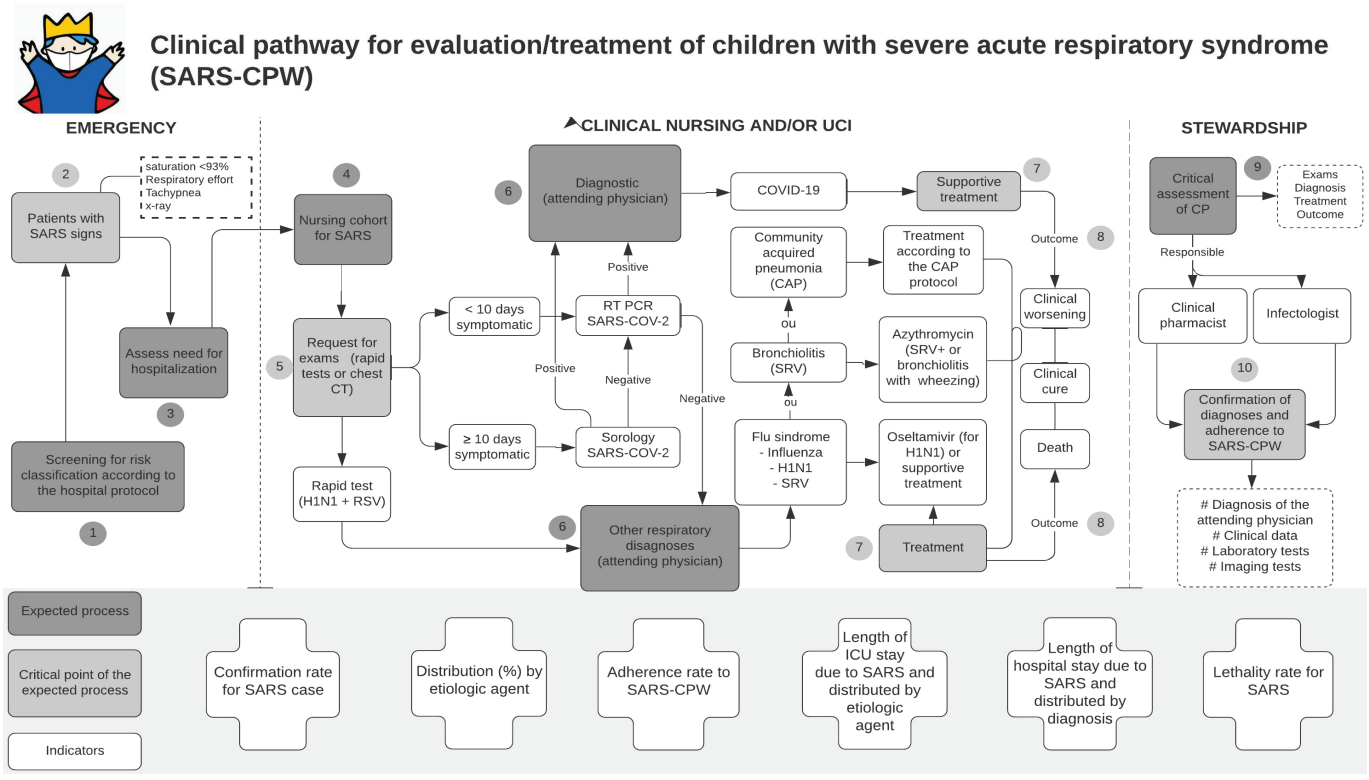
SARS-CPW description

The SARS-CPW is an organizational structure for tracking relevant data and managing resources associated with a specific type of service. For this, this CPW should include most or all aspects of patient care for a specific set of medical conditions, usually from the perspective of the management organization, such as a hospital. In addition, this CPW allows the use of service data to identify the impact that their practices have on hospitals or health systems.[10-12]

The CPW for SARS aimed to standardize protocols, diagnosis, treatment and reduce outcomes heterogeneity. Furthermore, this is intended for patients who meet criteria for hospitalization, with the presence of respiratory signs of infectious etiology (viral or bacterial) or not, including community-acquired pneumonia (CAP), bronchiolitis, COVID-19 and others. The operation of CPW-SARS is a set of coordinated actions between services, including the ID physician, nurse, clinical pharmacist and different hospital areas, such as quality management, laboratory, pharmacy and local ward.

The SARS-CPW at Pequeno Príncipe Hospital is demonstrated in figure 1. The CPW was established after consensus between several health care professionals who are directly involved in the delivery of care for such patients.

Figure 1. SARS care pathway



In the emergency, the patient is initially screened and evaluated for signs of SARS and the need for hospitalization (based on oxygen saturation, respiratory effort, tachypnea and X-ray results). After admission to the nursery or ICU, some tests are requested, such as rapid tests (H1N1, RSV), chest Computed tomography (CT) and tests for covid-19 (PCR or serological test established according to the number of symptomatic days). Considering the results of these tests, the attending physician will be able to diagnose COVID-19, community-acquired pneumonia (CAP), bronchiolitis and flu syndrome. Furthermore, according to the diagnosis, therapeutic management will be carried out and supportive treatment can be performed for the patient with COVID, bronchiolitis and flu syndrome. For patients diagnosed with CAP there is a specific protocol adopted by the institution.

These patients included in the care pathway is monitored in all their management and may have the following outcomes: clinical worsening or clinical cure and death. It is important to highlight that the patient is diagnosed with SARS considering the results obtained in the requested exams and according to the consensus between the radiologist, the attending physician and also through the discussion between the infectologist and the clinical pharmacist in the Stewardship program.

Throughout the patient's journey it is assessed whether the treatment, exams and vital signs are being carried out or monitored properly, allowing to optimize the entire process.

Inclusion criteria and data collection

Patients with suspected or confirmed bacterial or viral infection in CPW between March and September 2020 were included in the study if on admission they presented: infectious respiratory effort symptoms (subcostal circulation, intercostal effort, dyspnea), increased respiratory rate with altered auscultation (crackles or wheezing), increased c-reactive protein (>40 mg/dL) and with a complete blood count with leukocytosis or lymphopenia. Patients who had chronic lung disease and who did not have infectious SARS (such as severe asthma, bronchospasm and bronchodysplasia) were excluded.

The following data were collected from electronic medical records: baseline data (sex, age, public or private health care or health insurance), clinical data (comorbidities, pulmonary comorbidities, vital signs and deaths), procedures (requested tests, X-ray, mechanical ventilation), non-invasive ventilation, dialysis, length of stay in the hospital and ICU, and treatment (medication, if it was in accordance with the protocol).

Outcomes

Among the measured variables, the following outcomes were selected: long length of stay (LOS) and ICU admission. We understand that patients who had no complications related to any other disease, should not be hospitalized more than 5 days. On the contrary, hospitalizations over 5 days refer to complicated cases and therefore should be analyzed differently from the others. In addition, according to other study, Coffins et al (2007) also suggested such cut-off for LOS in pediatric patients with SARS.[13]

ICU admission is directly related to SARS complication, ICU admission is a potent predictor of SARS complication,as patients are treated in this setting if their clinical condition worsens and is also frequently considered in SARS studies.[14] We did not considered death as outcome in our study because pediatric patients were less exposed to fatal outcomes during the contemporary pandemic.

Statistical analysis

All patient data were recorded in Excel® and the variables were encoded in numerical data for transfer to the IBM® Statistical Package for the Social Sciences®, SPSS® Statistics 20.0 software (Chicago, Illinois, USA).

Initially descriptive analysis was performed. Categorical variables were expressed in absolute and relative frequency. The numerical variables, according to the acceptance or rejection of the null hypothesis in the analysis of normality by Kolmogorov-Smirnov, were described as mean and standard deviation, or median and interquartile range (25-75%), respectively.

Exploratory univariate regression was carried out as a preparatory phase of the multivariate regression, allowing to correlate possible variables that may influence the length of stay and admission to the ICU. For statistical analysis, chi-square was used for categorical variables and the t-test or Mann Whitney test for numerical variables, being established between these two tests according to the normality of the data.

In order to assess what are the prognostic factors in infectious SARS, a multivariate analysis was performed by logistic regression for ICU admission and poisson loglinear for length of stay. The factors initially considered for the study were those that had a p value ≤ 0.05 in univariate analyses.

In the final model, it was evaluated which factors remained in the model, adopting a 95% confidence interval. P-values <0.05 were considered statistically significant.

Results

Descriptive analysis

Of the 489 patients with SARS between March and September 2020, 122 patients (25%) were included in the SARS-CPW and were considered for analysis. The other 367 patients (75%) had non-infectious SARS. In table 1 is demonstrated the baseline data of patients included in the SARS-CPW. It is noted that 48% (58/122) patients had comorbidity, with neurological comorbidity representing 40% of these (23/58). Furthermore, 32% patients had respiratory comorbidity, such as asthma (n=9), bronchopulmonary dysplasia (n=8) and bronchospasm (n=6).

Table 2 shows the clinical variables of the patients included in the SARS-CPW. Approximately 35% of patients were diagnosed with community acquired pneumonia (CAP), by clinical criteria only, since then etiologic diagnosis is extremely rare in this scenario (n = 31). Regarding the etiological agents in another diagnosis, 24 patients (20%) had SARS associated with COVID. Furthermore, for most patients it was not possible to establish the etiologic agent due to the difficulty of microorganism's isolation.

The main X-ray findings were bilateral perihilar opacity plus bronchial involvement (n=22) and consolidation (n=18). Moreover, 101 (83%) patients used mechanical ventilation, 54 (44%) patients remained in hospital for more than 5 days and 5 (4%) patients died.

Table 1. Evaluation of baseline data for patients included in the SARS-CPW (n = 122)

Variable	N (%) / Mean ± SD / Median (IQR)
Males	71 (58%)
Median age (years)	3 (1-8)
Public health care	75 (62%)
Presence of comorbidities	
No comorbidity	64 (53%)
Neurologic disease	23 (19%)
Cardiac disease	9 (7%)
Renal disease	2 (2%)
Onco/hematologic disease	4 (3%)
Transplant	1 (1%)
Autoimmune disease	2 (2%)
Neurologic + cardiac disease	11 (9%)
Neurologic + renal disease	5 (4%)
Neurologic + onco / hematologic disease	1 (1%)
Respiratory comorbidities	
No comorbidity	83 (68%)
Asthma	9 (7%)
Bronchospasm	6 (5%)
Bronchopulmonary dysplasia	8 (7%)
Respiratory failure with tracheostomy	8 (7%)
Congenital lung disease	1 (1%)
Bronchiolitis obliterans	2 (2%)
Bronchitis	1 (1%)
Bronchospasm + use of tracheostomy	1 (1%)
Asthma + bronchospasm	1 (1%)
Bronchopulmonary dysplasia + bronchitis	1 (1%)

Multivariate analysis – length of stay

To assess which variables can influence the patient's length of stay, initially the univariate analysis was performed as a preliminary analysis, as shown in Table 3. In the univariate analysis, the following variables were initially eligible as independent factors: patients with respiratory comorbidity (OR 2.3; p=0.04), with mechanical ventilation (OR 6.1; p=0.01), with complicated SARS at admission (OR 4.2; p=0.02). Also, some X-ray findings (pleural effusion, bilateral perihilar opacity plus bronchial involvement and consolidation), the type of comorbidity (neurological, cardiac/nephrological, transplantation, onco-hematological and autoimmune diseases or combination of comorbidities) and clinical diagnosis (CAP, COVID-19, flu syndrome, bronchial aspiration pneumonia, virus flu syndrome with CAP) were also significant variables.

In the multivariate model (shown in Table 4), the variables that were related to longer length of stay were: female (β 0.753, [CI 95% 0.658-0.848], p=0.000), public health care (β 0.903, [CI 95% 0.799-1.007], p=0.000), respiratory comorbidity (β 0.610, [CI 95% 0.506-0.714], p=0.000), with comorbidity (β 0.610, [CI 95% 0.506-0.714], p=0.000) and COVID-19 (β 1.796, [CI 95% 1.700-1.892], p=0.000).

Logistic regression – ICU admission

In this study 31 patients were admitted in ICU. Considering the outcome of admission to the ICU, X-ray findings (pleural effusion, consolidation, consolidation with atelectasis), flu-like syndrome by COVID, flu-like syndrome by virus with CAP, were initially eligible as risk factors (Table 5).

In the multivariate analysis, with comorbidity (OR 3.182, [CI 95% 1.234-8.204], p=0.017), X-ray alterations (OR 6.126, [CI 95% 1.882-19.938], p=0.003) and COVID-19 (OR 6.284, [CI 95% 1.738-22.711], p=0.005) were the independent factor and predictor of ICU admission at SARS-CPW, as demonstrated in Table 4.

Table 2. Patients' clinical data at SARS-CPW (n = 122)

Variable	N (%) / Mean ± SD / Median (IQR)
Final diagnosis	
Bronchiolitis	11 (9%)
Community acquired pneumonia- bacterial	31 (25%)
Community acquired pneumonia - Viral	4 (3%)
Atypical community acquired pneumonia	2 (2%)
Flu syndrome by COVID-19	16 (13%)
Flu syndrome by other viruses	30 (25%)
Bronchodysplasia	4 (3%)
Infection of the upper respiratory tract	3 (3%)
Bronchial aspiration pneumonia	13 (11%)
COVID-19 Flu Syndrome and other viruses	1 (1%)
Flu syndrome by COVID-19; community acquired peumonia	5 (4%)
Flu Syndrome due to other viruses and COVID-19; community acquired pneumonia	1 (1%)
COVID-19; Tuberculosis; Flu Syndrome; community acquired pneumonia	1 (1%)
X-Ray Image	
Normal	49 (40%)
Local or diffuse interstitial infiltrate	3 (3%)
Local or diffuse perihilar infiltrate	12 (10%)
Pleural effusion	3 (3%)
Bilateral perihilar opacity + bronchial involvement	22 (18%)
Consolidation	18 (15%)
Pleural effusion; consolidation	4 (3%)
Consolidation; atelectasis	5 (4%)
Pleural effusion; consolidation; atelectasis	3 (3%)
Pleural effusion; atelectasis	1 (1%)
Local or diffuse perihilar infiltrate; atelectasis	1 (1%)
Local or diffuse perihilar infiltrate; bilateral perihilar opacity; bronchial involvement	1 (1%)
Complicated SARS in hospitalization (ICU)	101 (83%)
ICU admission	32 (26%)
Presence of coinfection **	7 (6%)
Mechanical ventilation	101 (83%)
Non-invasive ventilation	8 (6%)
Need for dialysis	2 (2%)
Median time on mechanical ventilation (days) (n = 21)	5 (2-19)
Mean time of non-invasive ventilation (days) (n = 8)	3 ± 2
Median ICU stay (days) (n = 32)	8 (3-20)
Median hospital stay (days)	7 (4-15)
Hospitalization time ≥ 5 days	68 (56%)
Outcome	
Hospital discharge	117 (96%)
Death	5 (4%)

** Co-infection refers to the patient who had one more microorganism identified in a laboratory test and / or clinically defined community acquired pneumonia

Table 3. Univariate for the outcome of length of stay ≥ 5 days and UCI admission

Variable	N	Length of stay			UCI admission		
		OR	95% CI	p-value	OR	IC 95%	p-value
Female	51	1.1	0.5-2.2	0.832	1.1	0.4-2.4	0.875
Age range							
12-18 years	12	—	—	—	—	—	—
6-12 years	34	1.2	0.3-4.2	0.831	1.6	0.4-7.2	0.515
3-5 years	29	0.4	0.1-1.7	0.236	0.5	0.1-2.5	0.392
29 days - 2 years	47	1.4	0.3-4.4	0.834	1.1	0.3-4.9	0.853
Public health care	75	1.2	06-2.5	0.654	1.5	0.6-3.6	0.327
Respiratory comorbidity	39	2.3	1.0-5.2	**0.042**	0.9	0.4-2.3	0.919
Comorbidities							
Without	64	—	—	—	—	—	—
Neurologic disease	23	24.9	5.3-116.7	**0.000**	3.5	1.2-10.2	**0.023**
Cardiac / renal disease	11	4.1	1.1-15.8	**0.038**	3.1	0.8-12.5	0.115
Transplantation, autoimmune and onco-hematologic diseases	7	14.2	1.6-126.2	**0.017**	4.1	0.8-20.9	0.095
Comorbidity combination	17	17.7	3.7-85.4	**0.000**	2.9	0.9-9.8	0.078
X-ray characteristics							
Normal	49	—	—	—	—	—	—
Local or diffuse interstitial infiltrate	3	4.5	0.4-53.9	0.232	2.9	0.3-33.8	0.388
Local or diffuse perihilar infiltrate	13	1.4	0.3-5.1	0.591	0.7	0.1-6.9	0.786
Pleural effusion	11	10.2	1.9-53.0	**0.006**	39.6	6.6-237.1	**0.000**
Bilateral perihilar opacity; bronchial involvement	23	8.2	2.5-26.1	**0.000**	2.4	0.6-9.5	0.196
Consolidation	18	11.3	2.8-45.0	**0.001**	8.8	2.4-32.5	**0.001**
Consolidation; atelectasis	5	9.1	0.9-88.1	0.057	13.2	1.7-98.9	**0.012**
Mechanical ventilation	21	6.1	1.7-22.1	**0.006**	1.8	0.4-7.8	0.458
Non-invasive ventilation	8	2.5	0.5-13.0	0.271	4.1	0.8-19.6	0.073
Complicated SARS in hospitalization (ICU)	21	4.2	1.3-13.3	**0.016**	—	—	—
Co-infection	7	2.1	0.4-11.1	0.398	2.9	0.3-33.8	0.388
Diagnosis							
Bronchiolitis	11	—	—	—	—	—	—
CAP	37	4.5	0.4-53.9	0.232	6.7	0.8-57.6	0.083
COVID flu syndrome	16	1.4	0.3-5.1	0.591	11.0	1.1-106.4	**0.038**
Flu syndrome by other viruses	30	10.2	1.9-53.0	**0.006**	0.8	0.1-9.6	0.850
Bronchodysplasia	4	8.2	2.5-26.1	**0.000**	2.8	0.1-55.2	0.508
Upper respiratory tract infection	3	11.3	2.8-45.0	**0.001**	3.7	0.2-77.5	0.404
Bronchial aspiration pneumonia	13	9.1	0.9-88.1	0.057	3.3	0.3-37.1	0.334
Flu syndrome; CAP	8	6.1	1.7-22.1	**0.006**	18.3	1.5-222.9	**0.022**

Note: *patient with more than one comorbidity; CAP, community-acquired pneumonia; in bold: significant variables (p <0.05)

Table 4. Univariate and multivariate analysis for the outcome of length of stay and UCI admission

Variable	N	Univariate analysis			Multivariate analysis			Univariate analysis			Multivariate analysis		
		β	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
Female	51	0.154	0.068-0.241	0.000	0.753	0.658-0.848	**0.000**	1.068	0.470-2.425	0.875			
Public health care	75	0.755	0.653-0.857	0.000	0.903	0.799-1.007	**0.000**	1.536	0.652-3.620	0.327			
Respiratory comorbidity	39	0.387	0.287-0.487	0.000	0.610	0.506-0.714	**0.000**	0.956	0.401-2.279	0.919			
With comorbidity	58	0.383	0.297-0.470	0.000	0.495	0.406-0.583	**0.000**	3.300	1.399-7.785	**0.006**	3.182	1.234-8.204	**0.017**
X-ray alterations	73	0.220	0.134-0.306	0.000	-0.002	-0.093-0.090	0.973	5.165	1.826-14.612	**0.002**	6.126	1.882-19.938	**0.003**
COVID	16	1.510	1.422-1.597	0.000	1.796	1.700-1.892	**0.000**	3.417	1.160-10.065	**0.026**	6.284	1.738-22.711	**0.005**

Non-Flu syndrome: Bronchiolitis; CAP; Bronchodysplasia; Upper respiratory tract infection; Bronchial aspiration pneumonia
Non COVID: Bronchiolitis; CAP; Flu syndrome by other viruses; Bronchodysplasia; Upper respiratory tract infection; Bronchial aspiration pneumonia; Flu syndrome; CAP

Discussion

The findings of our study are important to improve the prognosis and care of children hospitalized with SARS. We would like to emphasize that children with comorbidity (especially neurological disorders, autoimmune or onco-hematological diseases) were considered risk factors for prolonged LOS and ICU admission; so as other respiratory syndromes (flu-like syndrome due to COVID-19), such as those presenting x-ray alterations (bilateral hilar peri opacity with bronchial involvement or pleural effusion).

Patients who presented COVID-19-related flu syndrome were at higher risk for prolonged LOS and ICU admission. Previous authors suggested that length of hospital stay for this etiologic agent could range between 5 days to 2 months in adults [15] and between 4 to 13 days in pediatric population,[16] which was in agreement with our findings (OR for LOS ≥5 days, p=0.04). Furthermore, our results are consistent with other studies in which COVID-19 had a less severity course among younger patients.[16-18] These findings can be attributed to the following aspects: the angiotensin-converting enzyme 2 (a possible SARS-COV-2 receptor) is more immature and has inferior functionality in children than in adults; the fact that children have more respiratory infections, having higher level of antibodies against viruses; and also because children's immune systems are developing and can respond to pathogens differently from adult immune systems.[15, 16, 19] Therefore, there is a significant difference in clinical manifestations between children and adults, and these results justify COVID-19 not being a predictive factor for admission to the ICU in our study.

We observed that neurological comorbidity was a clinical and statistical predictor for prolonged hospital stay. More than statistical findings, our results corroborate with other studies in the literature,[13, 20-23] which demonstrated that children with neurological disorders have a higher risk of severe respiratory infections and prolonged hospitalizations. The reason for the greater risk of prolonged LOS might be attributed to the impaired innate immune function in these patients, who are exposed to many invasive procedures, from catheters to mechanical ventilation. They also present decreased muscle strength and tone and, impaired mobility, decrease lung function and compromised ability to eliminate secretions.[21, 22]

Children hospitalized with aspiration pneumonia have also a higher rate of morbidity and mortality, and are more likely to need ICU care and have a prolonged LOS.[24] Our results are in agreement with that addressed by Hirsch et al,[25] in which 35.4% of patients had prolonged hospital stay longer than 7 days.

Oropharyngeal, neurological, esophageal motility dysfunction, and enteral tube feeding are risk factors already reported that favor aspiration and aspiration pneumonia.[25, 26]

Synergistically, reports have been demonstrating that children with neurological deficiency diagnosed with aspiration pneumonia require more hospital resources than children hospitalized with non-aspirating pneumonia and hence implying in incremental health care costs.[27]

Oncohematologic patients (OR 20.9; p=0.017) are also at higher risk of prolonged LOS due to their impaired innate and acquired immune function.[28] Furthermore, both patients with neurological comorbidity and patients undergoing transplantation, or with onco-hematology or combination of comorbidity tend to be susceptible to longer length of stay in hospital due to impaired immune function in these patients.[20]

Pleural effusion can be considered a marker of severe disease and worsening of organic dysfunction, justifying this as a factor for admission to the ICU. Given those pleural effusions are associated with significantly worse outcomes in the ICU setting, it is crucial to direct attention to these patients in this care pathway.[29]

Our study has limitations. Though our health care center is one of the largest in Latin America, we included results from a single hospital center, and consequently, this result may not be generalizable for all pediatric patients. Another limitation is the quality of registration in our electronic medical records, which might have impacted data collection quality, but it is intrinsic to retrospective studies. We believe that this was attenuated by an institutionally agreed CPW, that allows rapid identification and resolution of inappropriate clinical conducts. Finally, our study might be limited by study sample, which affects some of the inferential analysis, but still is one of the largest registries in Latin America. We emphasize that the present findings are important for better resource allocation, especially health care professionals in charge of screening and treating children admitted with SARS. Given the high morbidity and mortality associated with SARS in children with these significant factors in our study, more efforts should be applied to vulnerable groups, who might impact the offer of ward and ICU beds.

Conclusion

During Covid-19 pandemic, pediatric patients with SARS with selected comorbidities and other respiratory-related diseases were considered risk groups, as they were associated with prolonged LOS and more admissions to the ICU. Efforts to avoid the spread of infectious SARS to this population, studying risk-tailoring approaches to reduce the evolution from mild to severe SARS, and early interventions to identify patients at higher risk to require ICU are important to promoting better outcomes and resource allocation (medical staff, equipment, medications and number of beds) for children and adolescents (at risk) with SARS.

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Collaborators

All authors of this manuscript participated directly in the planning, execution and writing of this study, in which each author had the following contribution:

DCKS contributed to data collect, study design, analysis, development and preparation of this manuscript.

MCR contributed to study concept, study design, development of this manuscript, and reviewing of the manuscript.

MMF contributed to study design, analysis, development and preparation of this manuscript.

LMO contributed to study concept, study design, and the preparation and editing of the manuscript.

VHSCJ contributed to study concept, study design and reviewing of the manuscript

FAM contributed to study concept, study design and reviewing of the manuscript

Conflict of interest statement

The authors declare no conflict of interest regarding this article.

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