








Reduced PICU respiratory admissions during COVID-19

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ABSTRACT

Background The COVID-19 pandemic reached the Southern Hemisphere in the autumn of 2020, thus coinciding with its expected annual viral respiratory season. The potential impact of national strategies aimed at mitigating COVID-19 during the pandemic on the incidence of other critical viral lower respiratory tract infections (LRTIs) in children is unknown.

Methods We analysed admission data for LRTIs from 22 paediatric intensive care units (PICUs) in four countries, part of a large international Latin American registry of children with acute respiratory failure (Red Colaborativa Pediátrica de Latinoamérica [LARed Network]).

Results Between January and August, there were 83% fewer PICU admissions for LRTIs in 2020 compared to the 2018/2019 average over the same period. Similar decreases were noted for PICU admissions due to respiratory syncytial virus and influenza (92% and 78%, respectively).

Conclusion We observed a striking reduction in PICU admissions due to viral LRTIs over winter, during the COVID-19 pandemic in South America.

INTRODUCTION

Viral lower respiratory tract infections (LRTIs), particularly bronchiolitis and pneumonia due to respiratory syncytial virus (RSV) and influenza, are a frequent cause of hospitalisation, morbidity and mortality in children under 5 years of age.¹ Viral LRTIs have a predictable seasonal pattern and result in a large number of paediatric intensive care unit (PICU) admissions worldwide, primarily during the winter months. The COVID-19 pandemic has changed the epidemiology of adult respiratory failure, resulting in a high demand for inpatient hospital services that have stressed health-care systems to their capacity. Although children have been relatively spared from COVID-19 both in numbers of cases and disease severity, there is concern that an overlap between COVID-19 disease and the high burden of seasonal viral LRTIs could have disastrous consequences. This is of particular concern in the Southern Hemisphere, where the usual viral LRTI season (May–August) is occurring while the COVID-19 pandemic is at its peak in South America.²

What is already known?

- ▶ COVID-19 is the leading cause of severe acute respiratory failure in adults, yet children are relatively spared.
- ▶ Severe viral respiratory infections have a seasonal pattern and result in a large number of paediatric intensive care unit (PICU) admissions worldwide, primarily during the winter months.
- ▶ There is concern that an overlap between COVID-19 and seasonal viral respiratory infections could lead to an unprecedented healthcare burden with disastrous consequences.

What this study adds?

- ▶ We observed a striking reduction in PICU admissions for critical lower respiratory tract infections during the 2020 viral respiratory season in the Southern Hemisphere concurrently with the COVID-19 pandemic.
- ▶ Our findings could have implications for the upcoming paediatric winter viral respiratory season in the Northern Hemisphere.

A potential consequence of this pandemic could be that of a ‘perfect storm’, where SARS-CoV-2 converges with seasonal respiratory viruses during their annual winter outbreak.³ It is unknown, however, whether strategies implemented to mitigate COVID-19 could influence the epidemiology of concurrent seasonal viral LRTIs in children. To date, no studies have examined changes in the use of PICU due to seasonal viral LRTIs during the COVID-19 pandemic. To address this gap, we studied the epidemiology of paediatric acute respiratory failure (ARF) admissions in South American PICUs during the COVID-19 pandemic compared with two preceding viral respiratory seasons within the same region.

METHODS

We interrogated the Red Colaborativa Pediátrica de Latinoamérica (LARed) Network paediatric ARF registry, which includes prospectively acquired data



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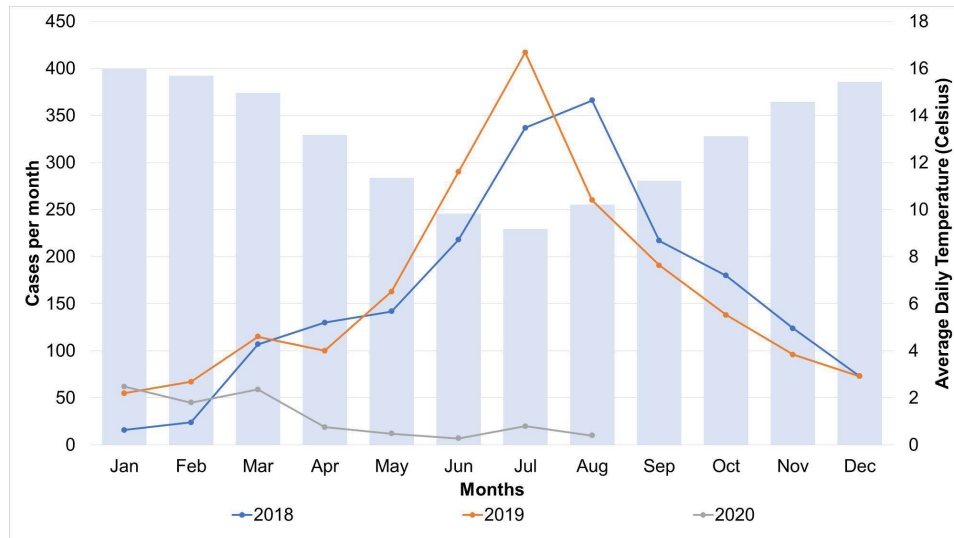


Figure 1 Monthly case numbers of paediatric intensive care unit admissions due to lower respiratory tract infections for 2018–2020 (left axis) and aggregate average daily temperature among all included sites (right axis).

from children up to 18 years of age admitted for ARF in 40 PICUs across eight Latin American countries. Data are continuously entered and managed using a secure web-based research electronic data capture platform. The registry collects epidemiological information on paediatric admissions due to ARF, defined here as children with a primary respiratory diagnosis who required admission to a PICU for advanced respiratory support (eg, high-flow oxygen via nasal cannula, continuous or bilevel-positive airway pressure and mechanical ventilation) or close monitoring, and is described in greater detail elsewhere.⁴

Viral testing for RSV and influenza is routinely performed on all children with ARF at participating centres. Testing for SARS-CoV-2 was performed with a dedicated PCR test and did not affect our ability to test for RSV or influenza.

For this report, we selected cases of LRTI from PICUs with continuous data submission between 1 January 2018 and 31 August 2020. Data from January to August of 2020 were compared with those of the preceding 2 years and were stratified by country, primary diagnosis, specific viral isolate and age. Data are presented descriptively, along with absolute percentage differences between the 2020 season and the arithmetic mean of the 2018/2019 seasons.

RESULTS

A total of 4135 cases from 22 hospitals in four countries (Bolivia, Chile, Colombia and Uruguay) fulfilled the inclusion criteria. Of these, 3041 cases occurred during the period of interest between January and August and were used for the multiyear comparisons. There were 234 cases from 2020, which were compared with 1340 cases and 1407 cases for the same period during 2018 and 2019, respectively (figure 1). There were 83% fewer PICU admissions for LRTIs in 2020 compared with the 2018/2019 average, and similar decreases were noted for admissions due to RSV and influenza (92% and 78%, respectively). These lower numbers admitted were consistent across diagnostic and age categories (table 1). There were only nine COVID-19 cases presenting with ARF in this cohort. Unlike the 2018 and 2019 seasons, when critical viral LRTIs exhibited a typical ramp-up period in May and June with a peak in July, the 2020 season had declining case numbers over those months, which were lower than the summer season baseline.

DISCUSSION

Our study shows a remarkable reduction in the incidence of paediatric LRTIs requiring PICU admission across South America during the COVID-19 pandemic. To our knowledge, this is the first report from hospitals in the Southern Hemisphere showing that, despite the intense circulation of SARS-CoV-2 during the 2020 winter season, the number PICU admissions did not peak, and the potential ‘perfect winter storm’ of RSV, influenza and SARS-CoV-2 among children did not occur.

RSV and influenza are two of the most common viral pathogens in children with LRTIs; they are responsible for high rates of paediatric hospital and PICU admissions, and constitute a substantial healthcare burden every winter.⁵ The winter season accounts for 81% of the annual RSV-associated hospitalisations and PICU admissions in the USA.⁶ In Latin America, bronchiolitis

Table 1 Case counts from January to August presented by year, country, diagnosis, viral isolates and age groups

	Case counts per study year			Relative reduction (%)*
	2018	2019	2020	
Entire cohort	1340	1467	234	83
Country				
Bolivia	53	23	19	50
Chile	315	376	24	93
Colombia	460	534	164	67
Uruguay	512	534	27	95
Admission diagnosis				
Bronchiolitis	733	771	126	83
Pneumonia	308	378	45	87
Others	299	318	63	80
Viral isolate				
RSV	474	596	45	92
Influenza	29	36	7	78
Age group				
≤2 years of age	1065	1156	165	85
>2 years of age	275	311	69	76

*Relative percentage change between the 2020 case numbers and the average 2018/2019 case numbers.

RSV, respiratory syncytial virus.

and pneumonia are responsible for most PICU admissions due to ARF requiring mechanical ventilation during a typical year.² The marked reduction in RSV and influenza detection during 2020 in Latin America is consistent with the informal perception of PICU clinicians of a 'season without bronchiolitis'. Our findings are unprecedented and could suggest that if the upcoming paediatric winter viral respiratory season in the Northern Hemisphere occurs under similar conditions, it might also be attenuated.

The four countries studied in our cohort implemented public health measures early in the course of the pandemic to control the spread of SARS-CoV-2, which included national lockdowns with stay-at-home orders, school closures, physical distancing, mandated masks and hand hygiene. It is very likely that these measures to curb the spread of SARS-CoV-2 had the added effect of preventing seasonal LRTIs caused by RSV, influenza and other agents. It is interesting to note that the marked reduction in LRTI cases was consistent across countries with very different pandemic courses. For instance, Uruguay had the lowest per capita rate of COVID-19 cases in the continent during the study period. It has progressively eased restrictions, including reopening of schools, while Chile and Colombia have experienced a surge in COVID-19 cases since early May, and restrictions remain in place to date. Despite these different trajectories for COVID-19 disease, our data show a similar reduction in seasonal LRTIs in Uruguayan and Chilean PICUs. Another possible explanation for the reduction in LRTIs is that national lockdowns could have decreased access to health-care. Although this may be true for patients with milder LRTIs, we believe this is not a factor in our sample since we focused on more severe cases that required intensive care and could not have been managed at home. The future trajectory of this pandemic and its associated studies may help further elucidate this epidemiological phenomenon.

Our study has limitations. Because the period of interest (January–August) does not encompass the entire historical respiratory season in South America, we are unable to determine if COVID-19 led to a relative suppression of critical viral LRTIs or merely a delayed seasonal peak. However, we believe it was important for us to share these data early enough to provide potential insights to those preparing for the upcoming viral respiratory season in the Northern Hemisphere. Other limitations are the possible reporting bias to our database and exclusion of centres with incomplete reporting during the period of interest. Our network includes only a fraction of PICUs within South America and may not be representative of the entire continent. Notwithstanding, we believe the consistency in our results suggests that extrapolations from our findings to other countries in South America are probably valid. Finally, while we hypothesise that the reduction in LRTI admissions caused by other agents was likely due to measures enacted to limit the spread of COVID-19, it is possible that other unrecognised factors unique to South America were responsible for our findings, thus limiting generalisability outside of that region.

CONCLUSION

We observed a striking reduction in PICU admissions due to critical viral LRTIs during the COVID-19 pandemic in South America.

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REFERENCES

- 1 Kyu HH, Pinho C, *et al*, Global Burden of Disease Pediatrics Collaboration. Global and national burden of diseases and injuries among children and adolescents between 1990 and 2013: findings from the global burden of disease 2013 study. *JAMA Pediatr* 2016;170:267–87.
- 2 Farias JA, Fernández A, Monteverde E, *et al*. Mechanical ventilation in pediatric intensive care units during the season for acute lower respiratory infection: a multicenter study. *Pediatr Crit Care Med* 2012;13:158–64.
- 3 Belongia EA, Osterholm MT. COVID-19 and flu, a perfect storm. *Science* 2020;368:1163.

- 4 González-Dambrasuskas S, Díaz F, Carvajal C, *et al*. La colaboración para mejorar Los cuidados médicos de nuestros niños. El desarrollo de Una red Pediátrica Latinoamericana: LARed. *Archivos de Pediatría del Uruguay* 2018;89:194–202.
- 5 Shi T, McAllister DA, O'Brien KL, *et al*. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in young children in 2015: a systematic review and modelling study. *Lancet* 2017;390:946–58.
- 6 Gupta P, Beam BW, Rettiganti M. Temporal trends of respiratory syncytial virus-associated hospital and ICU admissions across the United States. *Pediatr Crit Care Med* 2016;17:e343–51.