

Waiting for the next winter. Outpatient pediatric visits for respiratory infections before, during and after the COVID-19 pandemic in the city of Buenos Aires

Fernando Ferrero¹, Paula Gonzalez Pannia¹, Fernando Torres¹, and Manuel Rodriguez Tablado²

¹Hospital General de Ninos Pedro de Elizalde

²Buenos Aires Ciudad

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Abstract

Introduction: During the COVID-19 pandemic, pediatric visits due to acute lower respiratory infections (ALRIs) decreased, but most reports are from hospitalized patients. There is little information on this phenomenon in outpatients, who are the majority in IRABs. We evaluated the impact of the COVID-19 pandemic on ALRIs related outpatient visits in the City of Buenos Aires. **Methods:** Observational study including all outpatient visits of children under 2 years of age to the public health system of the City of Buenos Aires, between Jan 01, 2018 and Dec 31, 2022. We estimated the total number visits and the ALRIs-related visits, and their distribution throughout the study period. **Results:** A total of 704,426 visits were registered, 7.38% of them due to ALRIs. ALRIs-related visits decreased from the implementation of a national lockdown (2020) and increased again as the restriction measures decreased, particularly the return to full school attendance (2021). In general, the proportion of ALRIs-related visits was significantly higher in the cold months than in the warm ones (9.8% vs. 5.5%; OR: 1.76, 95%CI: 1.73-1.79; $p < 0.001$). This difference was observed before (2018, 2019) and after the pandemic (2022), but not in 2020-2021. The peak of ALRIs-related visits occurred in the cold months in pre-pandemic years (2018-2019), did not appear in 2020, reappeared delayed in 2021 and recovered seasonality in 2022. **Conclusion:** Outpatient ALRIs-related visits decreased significantly in the city of Buenos Aires during the COVID-19 pandemic and currently seem to have recovered their magnitude and seasonality.

Introduction

Acute lower respiratory infections (ALRIs) are the main cause of illness and hospitalization in children, and their most frequent etiology is viral (1). During the COVID-19 pandemic, a decrease in pediatric visits for respiratory causes was observed (2,3), probably because the nonpharmacological mitigation measures used to face the pandemic altered the circulation of the most common respiratory viruses.

However, many of the reports refer to a specific disease (bronchiolitis) or to a particular virus (respiratory syncytial virus (RSV) and influenza), include data from one or a few centers, or refer to hospitalized patients (4,5,6). In contrast, there is little information on the magnitude of this phenomenon in larger populations, especially in relation to less seriously affected patients, who tend to be the majority in the case of ALRIs. Unfortunately, recording the reasons for health facility visit due to ALRIs can be confusing (7). Despite the different coding systems used, there is still difficulty in identifying ALRI-related visits (8). We recently developed an algorithm that showed acceptable precision in the identification of ALRI-related visits in electronic health records, based not only on the reasons for consultation or identified diseases but also on terms used by professionals in the text of the registry (9). The public health system of the City of

Buenos Aires has electronic health records for ambulatory care areas before the pandemic, allowing a precise evaluation of the impact of the pandemic on outpatient visits for different causes in a large urban population.

Our objective was to evaluate the impact of the COVID-19 pandemic on outpatient visits for acute respiratory infections in the city of Buenos Aires.

Methods

This was an observational study that included all visits at health facilities of the public health system of the City of Buenos Aires (Gobierno de la Ciudad de Buenos Aires - GCABA) for children under 2 years of age, registered in the GCABA electronic health records, between January 1, 2018, and December 31, 2022. The visits occurred at one of the hospitals or primary care centers of the system (10).

To identify the visits in the GCABA health database, a validated algorithm was (9).

The total number of visits and ALRIs-related visits and their distribution throughout the study period, by year and by season (cold months - autumn/winter: April, May, June, July, August and September -, and warm months - spring/summer: October, November, December, January, February and March) were evaluated.

The proportion of ALRIs-related visits was calculated (percentage with 95% CI). The proportion of ALRIs-related visits was compared between different years (chi square for trend) and seasons (chi square). The analysis was carried out using IBM-SPSS Statistics 22.0. Data were conveniently anonymized. Approval by the Institutional Ethics Committee was requested and obtained (GCABA public research registry number 7141/2022). **Results** In the period under study, 704,426 outpatient visits were registered for children under 2 years of age in hospitals and primary care centers of the GCABA. The average age of the patients was 0.8 ± 0.5 months, and 48% were male. Of the total number of visits, 51,975 (7.38%; 95% CI 7.32-7.44) were ALRIs-related. The total number of visits, particularly those ALRIs-related, decreased significantly during 2020 ($p < 0.001$) (Table 1). In general, the proportion of ALRIs-related visits was significantly higher in cold months than in warm months (9.8% vs. 5.5%; OR: 1.76 95% CI: 1.73-1.79; $p < 0.001$). This distribution was clearly observed before (2018, 2019) and after the pandemic (2022); during 2020, it was reversed (more ALRI in warm months), and in 2021, no difference was observed (Table 2). A peak of ALRI-related visits occurred in the cold-month period in the prepandemic years (2018-2019); there was no peak in 2020; and the peak was delayed in 2021, with a recovery of prepandemic seasonality in 2022 (Figure 1). Visits for ALRIs decreased after a strict lockdown was imposed (March 2020) and increased again when the restrictions decreased, in particular with the return to full school attendance (July 2021) (Figure 1). **Discussion** In countries with a temperate climate, ALRIs usually have a seasonal pattern with an increase in cold months, following the circulation of the main viruses responsible for such infections (RSV and influenza virus); this pattern is observed both in the Northern Hemisphere and in the Southern Hemisphere (11,12). In our study, in 2018 and 2019, we verified this pattern in the city of Buenos Aires, with cases of ALRI appearing in the cold months and peaking in June, the beginning of the southern winter. During the first year of the COVID-19 pandemic, a drastic decrease was observed in health visits in general, and in visits for respiratory infections in particular, for the pediatric population around the world (13,14). This decrease was fundamentally attributed to the nonpharmacological mitigation measures that adopted to reduce the risk of SARS-CoV-2 infection: the use of face masks, frequent hand washing and social distancing measures, including school closings and public circulation limitations (15). In this study, in 2020, the number of cases of ALRIs decreased after the establishment of a national-wide lockdown at the end of the summer (16), remaining very low during the rest of the year, without showing a characteristic winter peak. This phenomenon is similar to that reported in other countries in the Southern Hemisphere, such as Brazil (17) and Australia (18), where there was a decrease in cases of bronchiolitis and hospitalizations for respiratory causes among the pediatric population in that period. In the Northern Hemisphere, during the first pandemic winter (2020-2021) and with mitigation measures still in force, similar findings were described: in cities in northern Italy (19) and in England (20), a decrease was observed in the number of pediatric hospitalizations and, particularly, in the incidence of RSV bronchiolitis between October 2020 and March 2021. During 2021, mitigation measures gradually

decreased, and the circulation of common respiratory viruses reappeared (21). In this study, the cases of ALRIs increased in winter 2021 but later and with a somewhat lower intensity than in the prepandemic years (2018-2019). This phenomenon was also reported in relation to cases of RSV infection in pediatric hospitals in Buenos Aires (22,23). A similar delay in the onset of respiratory infections was observed in the Northern Hemisphere in the winter of 2021-2022 (24,25). In 2022, the winter increase in ALRIs cases occurred earlier and with greater intensity than in 2021, approaching prepandemic values. Something similar was observed in the Northern Hemisphere (2022-2023), with the seasonal cycle of RSV circulation moving toward prepandemic patterns (25). As mentioned above, most of the studies on the impact of the pandemic on pediatric respiratory infections include hospitalized patients and/or those affected by RSV or influenza. As the spectrum of viruses responsible for ALRIs in outpatients may be different (including rhinoviruses and parainfluenza viruses) (26), the impact could have been different in these patients. However, our study, which included only outpatient visits, showed similar results, indicating that the impact of the pandemic was similar for all viruses responsible for ALRIs. During the pandemic, the circulation of respiratory viruses was greatly altered, and there were questions regarding whether the usual pattern would re-emerge (27). This study provides evidence that a return to the usual seasonal patterns of viral circulation is occurring. The pandemic highlighted, on several occasions, the need to be prudent in forecasting. In particular, children were affected by the pandemic in an indirect way (not related to the SARS-Cov2 virus) but to a much greater extent (domestic violence, eating disorders, anxiety, etc.) (28). Although there is a return of the circulation of common respiratory viruses to prepandemic patterns, it is unknown whether the immunological debt (29) of children has been fully settled or if a different pattern will emerge next winter. **Conclusion** Outpatient visits for ALRIs decreased significantly in the city of Buenos Aires during the COVID-19 pandemic and currently seem to have recovered their magnitude and seasonality.

References

1. Okomo U, Idoko OT, Kampmann B. The burden of viral respiratory infections in young children in low-resource settings. *Lancet Glob Health*. 2020;8(4): e454-e455.
2. Kruizinga MD, Peeters D, van Veen M, et al. The impact of lockdown on pediatric ED visits and hospital admissions during the COVID19 pandemic: a multicenter analysis and review of the literature. *Eur J Pediatr*. 2021;180(7):2271-2279.
3. Haklai Z, Applbaum Y, Myers V, Saban M, Gordon ES, Luxenburg O, Wilf-Miron R. The effect of the COVID-19 pandemic on non-COVID respiratory ED visits in Israel. *Am J Emerg Med*. 2022; 53:215-221.
4. Guerrero Del Cueto F, Ramos Fernández JM, Leiva Gea I, Reina Moreno E, Ortiz Ortigosa A, Carazo Gallego B, Cordon Martinez AM, Moreno Perez D, Nuñez Cuadros E. Bronchiolitis before and after the SARS-CoV-2 pandemic: Twelve years of experience in a Spanish paediatric hospital. *Pediatr Pulmonol*. 2023; 58(4):1201-1209.
5. Nenna R, Matera L, Pierangeli A, Oliveto G, Viscido A, Petrarca L, La Regina DP, Mancino E, Di Mattia G, Villani A, Midulla F. First COVID-19 lockdown resulted in most respiratory viruses disappearing among hospitalised children, with the exception of rhinoviruses. *Acta Paediatr*. 2022; 111(7):1399-1403.
6. Manti S, Giallongo A, Parisi GF, Papale M, Presti S, Lo Bianco M, Spicuzza L, Leonardi S. Impact of COVID-19 Pandemic and Lockdown on the Epidemiology of RSV-Mediated Bronchiolitis: Experience from Our Centre. *Children (Basel)*. 2022; 9(11):1723.
7. Roth DE, Gaffey MF, Smith-Romero E, Fitzpatrick T, Morris SK. Acute respiratory infection case definitions for young children: a systematic review of community-based epidemiologic studies in South Asia. *Trop Med Int Health*. 2015; 20(12):1607-20.
8. González Bernaldo de Quirós F, Otero C, Luna D. Terminology Services: Standard Terminologies to Control Health Vocabulary. *Yearb Med Inform*. 2018;27(1):227-233.
9. González Pannia P, Rodríguez Tablado M, Esteban S, et al. [An algorithm for identifying visits due to pediatric lower acute respiratory infections in electronic clinical records]. *Rev Fac Cien Med Univ Nac Córdoba*. 2021;78(3):283-286.

10. Gobierno de la Ciudad Autónoma de Buenos Aires. Hospitales y centros de salud. Available from: <https://buenosaires.gob.ar/establecimientos-hospitales-y-centros-de-salud>. Accessed on Apr 04, 2023.
11. Obando-Pacheco P, Justicia-Grande AJ, Rivero-Calle I, Rodríguez-Tenreiro C, Sly P, Ramilo O, Mejías A, Baraldi E, Papadopoulos NG, Nair H, Nunes MC, Kragten-Tabatabaie L, Heikkinen T, Greenough A, Stein RT, Manzoni P, Bont L, Martín-Torres F. Respiratory Syncytial Virus Seasonality: A Global Overview. *J Infect Dis*. 2018; 217(9):1356-1364.
12. Bloom-Feshbach K, Alonso WJ, Charu V, Tamerius J, Simonsen L, Miller MA, Viboud C. Latitudinal variations in seasonal activity of influenza and respiratory syncytial virus (RSV): a global comparative review. *PLoS One*. 2013; 8(2):e54445.
13. Isba R, Edge R, Jenner R, Broughton E, Francis N, Butler J. Where have all the children gone? Decreases in paediatric emergency department attendances at the start of the COVID-19 pandemic of 2020. *Arch Dis Child*. 2020; 105(7):704.
14. Curatola A, Lazzareschi I, Bersani G, Covino M, Gatto A, Chiaretti A. Impact of COVID-19 outbreak in acute bronchiolitis: Lesson from a tertiary Italian emergency department. *Pediatr Pulmonol*. 2021;56(8):2484-8.
15. Willis Z, de St Maurice A. Covid-19 control measures and common paediatric infections. *BMJ*. 2022; 376:n3093.
16. Aislamiento social preventivo y obligatorio. Decreto DNU 297/2020 Poder Ejecutivo Nacional. (PEN), 20 de marzo de 2020. Available from: <https://www.argentina.gob.ar/normativa/nacional/decreto-297-2020-335741>. Accessed on Apr 18, 2023.
17. Nascimento MS, Baggio DM, Fascina LP, do Prado C. Impact of social isolation due to COVID-19 on the seasonality of pediatric respiratory diseases. *PLoS ONE*. 2020; 15(12): e0243694.
18. Foley DA, Yeoh DK, Minney-Smith CA, Martin AC, Mace AO, Sikazwe CT, Le H, Levy A, Moore HC, Blyth CC. The Interseasonal Resurgence of Respiratory Syncytial Virus in Australian Children Following the Reduction of Coronavirus Disease 2019-Related Public Health Measures. *Clin Infect Dis*. 2021; 73(9):e2829-e2830.
19. Faraguna MC, Lepri I, Clavenna A, Bonati M, Vimercati C, Sala D, Cattoni A, Melzi ML, Biondi A. The bronchiolitis epidemic in 2021-2022 during the SARS-CoV-2 pandemic: experience of a third level centre in Northern Italy. *Ital J Pediatr*. 2023; 49(1):26.
20. Bardsley M, Morbey RA, Hughes HE, Beck CR, Watson CH, Zhao H, Ellis J, Smith GE, Elliot AJ. Epidemiology of respiratory syncytial virus in children younger than 5 years in England during the COVID-19 pandemic, measured by laboratory, clinical, and syndromic surveillance: a retrospective observational study. *Lancet Infect Dis*. 2023; 23(1):56-66.
21. Kruizinga MD, Noordzij JG, van Houten MA, Wieringa J, Tramper-Stranders GA, Hira V, Bekhof J, Vet NJ, Driessen GJA, van Veen M. Effect of lockdowns on the epidemiology of pediatric respiratory disease-A retrospective analysis of the 2021 summer epidemic. *Pediatr Pulmonol*. 2023; 58(4):1229-1236.
22. Orqueda AS, Lucion MF, Juárez MV, Barquez R, Stach P, Nievas A, Losi LF, Suárez RF, Romero Bollón L, Pejito MN, Mistchenko AS, Gentile Á. Respiratory syncytial virus and influenza surveillance in schoolchildren seen at a children's hospital over 2 months of the second semester of 2021. *Arch Argent Pediatr*. 2022; 120(4):269-273.
23. Ferrero F, Ossorio MF, Rial MJ. The return of RSV during the COVID-19 pandemic. *Pediatr Pulmonol*. 2022; 57(3):770-771.
24. Delestrain C, Danis K, Hau I, Behillil S, et al. Impact of COVID-19 social distancing on viral infection in France: a delayed outbreak of RSV. *Pediatr Pulmonol*. 2021; 56(12):3669-73.
25. Hamid S, Winn A, Parikh R, Jones JM, McMorrow M, Prill MM, Silk BJ, Scobie HM, Hall AJ. Seasonality of Respiratory Syncytial Virus - United States, 2017-2023. *MMWR Morb Mortal Wkly Rep*. 2023; 72(14):355-361.
26. Marcone DN, Durand LO, Azziz-Baumgartner E, et al. Incidence of viral respiratory infections in a prospective cohort of outpatient and hospitalized children aged [?]5 years and its associated cost in Buenos Aires, Argentina. *BMC Infect Dis*. 2015; 15:447.
27. Di Mattia G, Nenna R, Mancino E, Rizzo V, Pierangeli A, Villani A, Midulla F. During the COVID-19

- pandemic where has respiratory syncytial virus gone? *Pediatr Pulmonol.* 2021; 56(10):3106-3109.
28. Gupta S, Jawanda MK. The impacts of COVID-19 on children. *Acta Paediatr.* 2020; 109(11):2181-2183.
29. Billard MN, Bont LJ. Quantifying the RSV immunity debt following COVID-19: a public health matter. *Lancet Infect Dis.* 2023; 23(1):3-5.

Table 1. Distribution of visits according to cause, by year

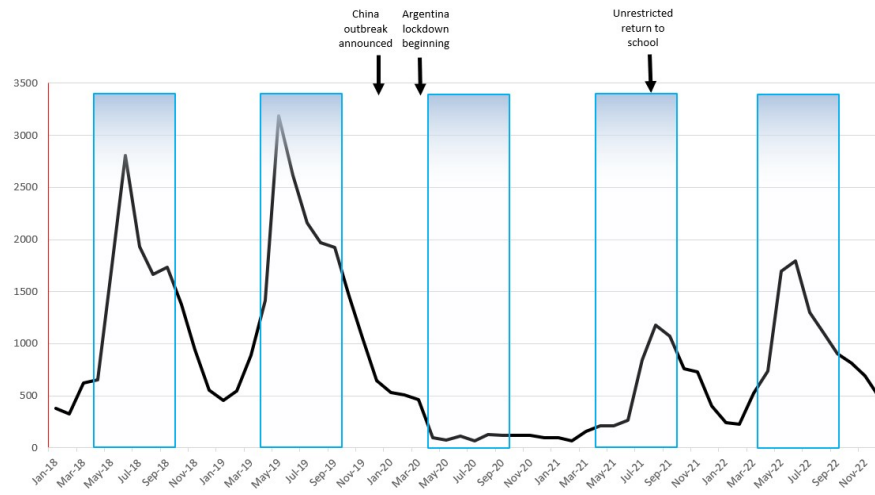
Year	ALRIs n (%)	Other n (%)	Total
2018	14,683 (11.3%)	115,434 (88.7%)	130,117
2019	18,327 (9.7%)	170,575 (90.3%)	188,902
2020	2,441 (2.1%)	118,944 (98.1%)	121,385
2021	5,998 (4.5%)	127,175 (95.5%)	133,173
2022	10,526 (8.1%)	120,323 (92.1%)	130,849
Total	51,975 (7.4%)	652,451 (92.6%)	704,426

ALRIs: Acute lower respiratory infections **Table 2. Distribution of ALRIs-related visits according to seson, by year**

Year (Total n*)	Cold months n (%)	Warm months n (%)	OR (IC 95%)	p
2018 (n = 130,117)	8,742 (15.3)	5,491 (8.2)	1.86 (1.81-1.91)	<0.001
2019 (n = 188,902)	11,349 (13.6)	6,978 (6.6)	2.1 (2.01-2.12)	<0.001
2020 (n = 121,649)	475 (1.1)	1,966 (2.5)	0.4 (0.38-0.47)	<0.001
2021 (n = 133,173)	2,713 (4.6)	3,285 (4.4)	1.04 (0.99-1.09)	0.09
2022 (n = 130,849)	6,645 (10.6)	3,881 (5.7)	1.8 (1.78-1.92)	<0.001
Total (n = 704,426)	29,924 (9.8%)	22,051 (5.5)	1.76 (1.73-1.79)	<0.001

ALRIs: Acute lower respiratory infections***Total n:** ALRI-related visits + other cause visits

Figure 1. Monthly distribution of ALRIs-related vists during the study period



(The shaded boxes indicate the "cold months" period -autumn/winter-)

