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Identification of healthcare visits due to respiratory syncytial virus infection in electronic medical records

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ABSTRACT

Introduction. Acute lower respiratory infections (ALRI) due to respiratory syncytial virus (RSV) are a significant cause of disease. Most of them are treated outpatient without etiological investigation, making it difficult to estimate the disease burden. In 2020, an algorithm was developed to identify consultations for ALRI in electronic health records. We evaluated the algorithm's behavior in patients with RSV ALRI.

Methods. The cross-sectional study included children under 5 years of age who consulted for ALRI with viral screening. The algorithm was applied to their health records, calculating diagnostic capacity to identify RSV ALRI.

Results. We included 133 patients (age 4.9 ± 4.1 years). RSV was identified in 21.8%. The algorithm identified ALRI in 33.8% (95%CI: 26.3-42.2) and showed a limited ability to identify RSV infection (sensitivity: 55.2%, specificity: 72.1%).

Conclusion. An algorithm for identifying ALRI consultations in electronic health records does not adequately distinguish those caused by RSV.

Keywords: *respiratory system infections; bronchiolitis; respiratory syncytial virus.*

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INTRODUCTION

Acute lower respiratory infections (ALRI) are the leading cause of illness and hospitalization in children. Their most frequent etiology is viral, with respiratory syncytial virus (RSV) being the predominant cause.[1]

Viral screening is usually performed in hospitalized patients; however, most patients are treated on an outpatient basis.[2] Thus, estimating the disease burden attributable to these etiologic agents is difficult.

Having a tool that identifies which patients with ALRI attended on an outpatient basis could attribute their disease to RSV, which would allow a more accurate calculation of the burden of disease due to this etiological agent. This is particularly important given the possibility of implementing prevention strategies.[3]

In 2020, an algorithm was developed that, in different scenarios, allows the identification of ARRI consultations from electronic health records.[4] Considering the prevalence of RSV, we can infer that a large part of these consultations is due to RSV disease.[2]

Since 2022, the Autonomous City of Buenos Aires has had a sentinel effector that systematically screens for respiratory viruses in children who consult for respiratory infection under ambulatory management.[5]

We aimed to evaluate the algorithm's diagnostic accuracy in patients with RSV ALRI and compare it with cases without viral diagnosis and with any other virus.

METHODS

Design

Cross-sectional diagnostic test study to evaluate the accuracy of an algorithm in identifying RSV consultations from electronic health records.

POPULATION

Consultations at the Hospital General de Niños Ricardo Gutiérrez (HGNRG) registered in the Hospital Management System of patients under 18 years of age, with a diagnosis of ALRI, under outpatient management, who underwent PCR for viral detection as part of the epidemiological surveillance program between May 1, 2023, and October 31, 2023. Patients were selected according to the criteria established by the national standards for epidemiological surveillance of infections.[6] Screening included respiratory syncytial virus (RSV), *Rhinovirus/Enterovirus*, metapneumovirus, coronavirus, parainfluenza 1, 2 and 3, influenza A and B, and *Mycoplasma pneumoniae*.

Algorithm

A previously developed algorithm was used to identify patients with ALRI in the electronic health records of the Government of the City of Buenos Aires (GCBA). This was constructed by identifying words professionals use to refer to patients with ALRI, the reason for consultation, and the evolution. Thus, an algorithm based on rigid rules was developed, subsequently validated, and adjusted for the prevalence of ALRI in the population, which showed sensitivity (S) of 88.2%, specificity (Sp) of 97.5%, positive predictive value (PPV) of 86.1%, negative predictive value (NPV) of 97.9%, positive likelihood ratio (PLR+) 0.9, and negative likelihood ratio (NLR-) 0.9.[4]

Outcome variable

Diagnosis of RSV by PCR test (dichotomous: positive/negative). Diagnosis of other respiratory viruses by PCR test (dichotomous: positive/negative).

Analysis

The prevalence of consultations for ALRI in the initial sample was estimated by applying the algorithm above (calculating % with its 95%CI); in total and in the established groups (without a viral diagnosis, with any virus, and with RSV), age was compared by the Kruskal Wallis test. To predict viral and RSV infections, we used a chi-square test to evaluate the difference between proportions and the algorithm's diagnostic ability (S, Sp, PPV, NPV, and RV). EPI-INFO 7.2.2.6™ and IBM-SPSS Statistics 21™ were used for data processing.

Ethical considerations

Authorization was obtained from the Research Ethics Committee of the Hospital General de Niños Pedro de Elizalde and the Hospital General de Niños Ricardo Gutiérrez. We complied with the established procedure for requesting health data from the GCABA for research purposes. All the information used in this study was conveniently dissociated from any filiatory information.

RESULTS

Of 172 patients who attended the HGNRG's epidemiological surveillance program, 39 were excluded due to inconsistencies between the

date of swabbing and the date of consultation where the algorithm was applied. Finally, the electronic records of 133 patients were analyzed. Their median (IQR) age was 4.2 (1.4-7.4 years); 50.4% were girls, and 36.8% had one or more comorbidities (the most frequent were chronic respiratory disease and heart disease in 25 and 8 patients, respectively). The time of symptom evolution at sampling was 3.1 ± 1.8 days.

Samples for viral detection were collected between epidemiological weeks 18 and 44 of the year 2023. RSV was identified in 21.8%, other viruses in 48.9%, and 29.3% had negative results (*Table 1*).

According to the microbiological results, there was a significant difference in the patients' ages: with RSV, 2.1 years (IQR: 0.6- 4.7 years); other viruses, 5 years (IQR: 1.5-7.3); and negative, 4.2 years (IQR: 2.2-9) (Kruskal Wallis test $p = 0.02$).

The algorithm identified ALRI in 33.8% (95%CI: 26.3-42.2) of the records analyzed, with differences between those in which RSV and respiratory viruses were identified (55.2% vs. 30.8%, $p = 0.02$). *Table 2* shows the cleavage values for identifying RSV infection and infection by other respiratory viruses.

DISCUSSION

In this study, we evaluated whether an algorithm designed to identify ALRI consultations in electronic health records behaved differently in patients with RSV ALRI.

In its original description, the algorithm performed better (S: 88.2%, Sp: 97.5%) than in our study, both in the total population (S: 38.1%, Sp: 76.9%) and in those for whom RSV was identified (S: 55.2%, Sp: 72.1%).

We believe that this different behavior may be because the algorithm was initially designed to be applied in patients under 2 years of age, a group in which RSV is responsible for most cases of ALRI.[1] In contrast, the population studied was older (4.9 ± 4.1 years).[7] It could also explain, at least in part, that in the sample studied, the proportion of subjects identified as having ALRI by the algorithm was among those identified as having RSV. In addition, the criteria used to select the population eligible for the epidemiological surveillance program to which the subjects belonged could have imposed an extra selection bias, which could also explain the relatively low proportion of subjects identified with ALRI (33.8%).

Table 1. Results of the algorithm for identifying acute lower respiratory infections according to microbiological identification

Microbiological identification	Algorithm result	
	ALRI	No ALRI
RSV	16	13
Other viruses	20	45
Negative	9	30
Total	45	88

RSV: respiratory syncytial virus; ALRI: acute lower respiratory infections.

Table 2. Cleavage values for identification of respiratory syncytial virus and for other viruses in the studied population

	RSV	Any respiratory virus	Respiratory viruses (not RSV)
Sensitivity (%, 95%CI)	55.2 (35.9-73.1)	38.3 (28.6-48.9)	30.7 (20.2-43.6)
Specificity (%, 95%CI)	72.1 (62.3-80.2)	76.9 (60.3-88.3)	76.9 (60.3-88.3)
Positive predictive value (%, 95%CI)	35.6 (22.3-51.3)	80 (64.9-89.9)	68.9 (49.1-84.1)
Negative predictive value (%, 95%CI)	85.2 (75.7-91.6)	34.1 (24.5-45.1)	40 (29.1-51.9)
Positive likelihood ratio (95%CI)	1.9 (1.3-3.1)	1.6 (0.9-3.1)	1.3 (0.7-2.6)
Negative likelihood ratio (95%CI)	0.6 (0.4-0.9)	0.8 (0.6-1.1)	0.9 (0.7-1.1)

RSV: respiratory syncytial virus.

Finally, the low prevalence of RSV in our sample (21.8%) could limit the proportion of true positives, affecting the estimation of the algorithm's sensitivity and generalizability to other populations.

On the other hand, the original algorithm was designed before the COVID-19 pandemic. During the pandemic, measures were taken which significantly affected the circulation of all respiratory viruses, including RSV.[8,9]

This phenomenon may have hindered detection, particularly in children under 5.

The most frequent symptoms of RSV are cough, nasal congestion, respiratory distress, feeding alterations, or fever.[10] These symptoms are similar to those produced by other viruses such as influenza, *Rhinovirus*, parainfluenza, metapneumovirus, adenovirus, *Enterovirus*, or seasonal coronavirus, among others,[11] so it can be difficult to distinguish it from other viruses in a health registry. This fact was evidenced by the slight difference in the diagnostic performance of the algorithm when comparing its performance in patients with RSV and other viruses.

The recent appearance of tools for the prevention of RSV infection (vaccine in pregnant women[12] and nirsevimab[13]) will likely cause changes, at least temporarily, in the development of ARTIs as we know them. However, they will continue to be the leading cause of disease in childhood.

Although accessibility to microbiological diagnosis and diagnostic capacity for ALRI has increased significantly since the COVID-19 pandemic, most of these episodes are managed strictly on an outpatient basis at the first level of care without systematic etiological investigation. That is why having tools based on the epidemiological data available to help identify them continues to be challenging. Optimization and better adjustment of the algorithm used in this study could be helpful.

CONCLUSION

An algorithm to identify ALRI consultations from electronic health records could not adequately discriminate those caused by RSV. ■

REFERENCES

1. Li Y, Wang X, Blau DM, Caballero MT, Feikin DR, Gill CJ, et al. Global, regional, and national disease burden estimates of acute lower respiratory infections due to respiratory syncytial virus in children younger than 5 years in 2019: a systematic analysis. *Lancet*. 2022;399(10340):2047-64.
2. Comité de Neumonología, Comité de Infectología, Comité de Medicina Interna Pediátrica, Comité de Pediatría Ambulatoria. Recomendaciones para el manejo de las infecciones respiratorias agudas bajas en menores de 2 años. Actualización 2021. *Arch Argent Pediatr*. 2021;119(4):S171-97.
3. Lucion MF, Gentile Á. Prevención de las infecciones por virus sincicial respiratorio: un futuro promisorio. *Arch Argent Pediatr*. 2023;121(5):e202310098.
4. González Pannia P, Rodriguez Tablado M, Esteban S, Abrutzky R, Torres FA, Dominguez P, et al. Algoritmo para identificación de consultas por infección respiratoria aguda baja en pediatría en registros clínicos electrónicos. *Rev Fac Cien Med Univ Nac Córdoba*. 2021;78(3):283-6.
5. Orqueda AS, Lucion MF, Juárez MV, Barquez R, Stach P, Nievas A, et al. Vigilancia de virus sincicial respiratorio e influenza en niños escolarizados asistidos en un hospital pediátrico durante 2 meses del segundo semestre de 2021. *Arch Argent Pediatr*. 2022;120(4):269-73.
6. Argentina. Ministerio de Salud. Guía para la vigilancia epidemiológica y recomendaciones para la prevención y control de las infecciones respiratorias agudas 2023. Actualizado junio 2023. [Accessed on: February 4, 2025]. Available from: https://www.argentina.gob.ar/sites/default/files/bancos/2023-06/GUIA-VIGILANCIA_IRA_2023_actualizada_a_junio_2023.pdf
7. Gentile A, Lucion MF, Juarez MDV, Areso MS, Bakir J, Viegas M, et al. Burden of Respiratory Syncytial Virus Disease and Mortality Risk Factors in Argentina: 18 Years of Active Surveillance in a Children's Hospital. *Pediatr Infect Dis J*. 2019;38(6):589-94.
8. Chuang YC, Lin KP, Wang LA, Yeh TK, Liu PY. The Impact of the COVID-19 Pandemic on Respiratory Syncytial Virus Infection: A Narrative Review. *Infect Drug Resist*. 2023;16:661-75.
9. Gonzalez Pannia P, Torres F, Rodriguez Tablado M, Ferrero F. 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. *Pediatr Pulmonol*. 2024;59(1):146-50.
10. Colosia A, Costello J, McQuarrie K, Kato K, Bertzos K. Systematic literature review of the signs and symptoms of respiratory syncytial virus. *Influenza Other Respir Viruses*. 2023;17(2):e13100.
11. Geismar C, Nguyen V, Fragaszy E, Shrotri M, Navaratnam AM, Beale S, et al. Symptom profiles of community cases infected by influenza, RSV, rhinovirus, seasonal coronavirus, and SARS-CoV-2 variants of concern. *Sci Rep*. 2023;13(1):12511.
12. Kampmann B, Madhi SA, Munjal I, Simões EA, Pahud B, Llapur C, et al. Bivalent Prefusion F Vaccine in Pregnancy to Prevent RSV Illness in Infants. *N Engl J Med*. 2023;388(16):1451-64.
13. Hammitt LL, Dagan R, Yuan Y, Baca Cots M, Bosheva M, Madhi SA, et al. Nirsevimab for prevention of RSV in healthy late-preterm and term infants. *N Engl J Med*. 2022;386(9):837-46.