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Characteristics of viral respiratory infections in a Colombian hospital, 2022–2024

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Keywords:
seasons; enterovirus; severe acute respiratory syndrome; respiratory tract infections; respiratory syncytial viruses (Source: MeSH - NLM).

ABSTRACT

Objective. To characterize acute viral respiratory infections diagnosed between March 2022 and June 2024 in a hospital in Colombia. **Methods.** A descriptive, retrospective, cross-sectional study including all patients with respiratory symptoms who had positive nasopharyngeal swab samples. The FilmArray respiratory panel was used to detect respiratory pathogens. The variables analyzed included: sex, type of healthcare affiliation, ethnic background, final condition based on hospital care (discharged, referred, or deceased), area and province of origin. These variables were expressed using absolute and relative frequencies. **Results.** A total of 1,246 respiratory test results were reviewed, with an age range of 0 to 85 years and a median age of 3.1 years (IQR: 0.4–3.0) (SD: 8.7 years). Based on the final condition of each case, 71.1% were discharged and 0.4% died. The most frequently identified microorganisms were human rhinovirus/enterovirus (29.7%) and respiratory syncytial virus (RSV) (20.3%). The highest number of cases was reported during the rainy seasons, especially between May and September. The year 2022 had the highest number of reported cases (67.0%). **Conclusion.** The frequency of detected viruses was associated with age and seasonality, with the most affected age group being 1 to 5 years, and RSV being the main pathogen. Emphasis should be placed on the development of future vaccines, as well as public health intervention strategies and social measures.

Características de las infecciones respiratorias de origen viral en un hospital de Colombia, 2022-2024

Palabras clave:
estaciones del año; enterovirus; síndrome respiratorio agudo grave; infecciones del sistema respiratorio; virus sincitiales respiratorios (Fuente: DeCS - BIREME).

RESUMEN

Objetivo. Caracterizar las infecciones respiratorias agudas virales que fueron diagnosticadas entre marzo de 2022 y junio del 2024 en un hospital de Colombia. **Métodos.** Estudio descriptivo retrospectivo transversal, compuesto por todos los pacientes con síntomas respiratorios que se atendieron con muestras de hisopado nasofaríngeo positivas; para la detección de los patógenos respiratorios se utilizó el panel respiratorio FilmArray. Las variables analizadas fueron: sexo, régimen de afiliación, pertenencia étnica, condición final según la atención hospitalaria (dada de alta, remisión o mortalidad), área de procedencia y provincial, las cuales fueron expresadas por medio de frecuencias absolutas y relativas. **Resultados.** Se revisaron 1246 resultados de las pruebas respiratorias en un rango de edad de 0 a 85 años, con una mediana de 3,1 años (RIQ: 0,4-3,0) (DE: 8,7 años). De acuerdo con la condición final de cada caso, el 71,1 % fue dado de alta y el 0,4 % fallecidos. Los microrganismos con mayor frecuencia fueron human rhinovirus/enterovirus con un 29,7 % y el virus sincitial respiratorio (VSR) con un 20,3 %. En las temporadas de lluvias se tuvo la mayor notificación de casos entre los meses de mayo y septiembre. El año 2022 fue el más notificado con un 67,0 %. **Conclusión.** La frecuencia de los virus detectados estuvo relacionada con la edad y la estacionalidad, mientras que el grupo de edad más afectado se encuentra entre 1 y 5 años, siendo el VRS el principal patógeno. Se debería enfatizar la necesidad de futuras vacunas y las estrategias de intervención en salud pública y medidas sociales.

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INTRODUCTION

Acute respiratory infection (ARI) of viral or bacterial etiology is one of the leading causes of morbidity and mortality worldwide [1,2]. Each year, approximately 4 million people die globally, with 85% of these deaths due to lower respiratory tract infections, particularly among children under 5 years of age and the elderly. In addition, ARIs are among the most frequent causes of hospitalization. In 2019, the World Health Organization (WHO) identified lower respiratory tract infections as the cause of 22% of all deaths in patients under five years of age worldwide [3-5], with the highest concentration occurring during the winter months [6]. These infections are caused by various microorganisms, such as viruses and bacteria, and may last approximately two weeks [7]. They also contribute to significant economic losses [8].

Common symptoms include fever, rhinorrhea, otalgia, dysphonia, odynophagia, cough, dyspnea, or noisy breathing [9]. Transmission occurs through the inhalation of microdroplets containing the causative agent and due to inadequate hand hygiene [10]. Most of these infections, such as the common cold, are mild; however, depending on a person's health status, they may become complicated and life-threatening, as in the case of pneumonia [11]. Commonly identified microbiological agents include respiratory syncytial virus (RSV), influenza A, parainfluenza, enterovirus, adenovirus, and several types of coronaviruses, among others [12]. Throughout the year, different risk factors exist, such as seasonality, including temperature and relative humidity, which can increase ARIs, especially during the winter season [13].

In June 2023, the WHO and the Pan American Health Organization (PAHO) issued an epidemiological alert due to the increase in cases of influenza, RSV, and SARS-CoV-2. Since hospitalizations of children under 2 years old were rising in the Andean and Southern Cone regions, the ARI season began earlier than usual. RSV detection increased across the five subregions of the Region of the Americas starting from week 12 of 2022. In 2023, RSV detection predominated in three subregions, followed by parainfluenza and adenovirus.

Likewise, WHO recommended necessary measures for the prevention and control of severe cases through vaccination in high-risk groups and appropriate clinical management [14]. Throughout the year, there are various risk factors such as seasonality—particularly temperature and relative humidity—that can increase ARIs, especially during the winter [15].

In Colombia, in 2023, the epidemiological surveillance system reported 7,336,806 outpatient and emergency consultations due to ARI, representing 4.4% and showing a 6.0% decrease compared to 2022. The viruses in circulation included SARS-CoV-2, adenovirus, A(H3N2), influenza B, enterovirus, RSV, A(H1N1)pdm09, influenza A, rhinovirus, parainfluenza, and metapneumovirus. The number of reported deaths in children under five years decreased by 10.14% (363 cases) when comparing 2023 to 2022. The national mortality rate in children under five due to ARI was 9.8 deaths per 100,000 children under five years in 2023. The identified etiological agents were RSV, rhinovirus, adenovirus, enterovirus, and SARS-CoV-2 [16,17]. In Casanare, as of week 26 of 2024, 863 consultations have been reported, with a cumulative total of 16,030 and an incidence rate of 3,373.7 per 100,000 inhabitants [18]. No studies have been conducted in the region on the specific characterization of ARIs.

Understanding epidemiological patterns will help improve decision-making and strengthen strategies for infection control and patient safety. Describing the etiology of ARIs mainly helps to guide empirical treatment for the population that attends the Hospital Regional de la Orinoquia. Therefore, the aim of this study was to epidemiologically characterize viral acute respiratory infections diagnosed between 2022 and 2024 in a hospital in Colombia.

METHODS

Type of study area

A descriptive, retrospective, and cross-sectional study was conducted on the epidemiological characteristics of acute respiratory infections. Information was collected from the laboratory on individuals admitted to the Hospital Regional de la Orinoquia, located in the city of Yopal (Colombia). Nasopharyngeal swab samples were obtained from March 2022 to July 2024.

Population and sample

The census population consisted of all recorded cases in the hospital from 2022 to 2024 (1,246 cases); no sample size was established. All patients who met the inclusion criteria were included, such as having a diagnosis of viral acute respiratory infection confirmed by a viral panel, while all patients with negative reports were excluded.

Variables and data collection instrument

The analyzed variables included: sex, type of health insurance affiliation, ethnic background, final condition after hospital care (discharged, referred, or deceased), area of origin, and province. The instruments used for pathogen detection were the FilmArray respiratory panel and a data collection form to record the aforementioned variables.

Data collection techniques and procedures

To detect respiratory pathogens, the FilmArray respiratory panel was used, which operates via real-time polymerase chain reaction (PCR). This method allows the simultaneous detection of 20 respiratory pathogens: respiratory syncytial virus, human rhinovirus/enterovirus, parainfluenza virus 3 (SARS-CoV-2), human metapneumovirus, adenovirus, parainfluenza virus 1, coronavirus OC43, coronavirus NL63, influenza A H1-2009, influenza A H3, parainfluenza virus 2, influenza B, parainfluenza virus 4, coronavirus 229E, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, coronavirus HKU1, and influenza A.

The device performed the analysis of the samples. Once the machine generated the results, the data were validated. The equipment underwent annual maintenance by qualified personnel.

Data analysis

The data generated by the equipment were stored in an Excel 2019 spreadsheet. For this project, the database was cleaned based on the inclusion criteria, and the various variables were analyzed using absolute and relative frequencies.

For numerical variables such as age, data were presented using an asymmetric distribution with median and interquartile range (IQR).

Categorical variables were presented as absolute and relative frequencies. Data were displayed in tables and figures. Processing was carried out according to the institutional protocol AD-LC-PT 10 for FilmArray management and the standards of the Clinical and Laboratory Standards Institute (CLSI). The annual distribution and the months with the highest percentage of detected cases were determined.

Ethical considerations

This research was approved by the Health Research Ethics Committee of the hospital where the study was conducted, in accordance with Act No. 013 of 2024, which authorized the project's development. The study was classified as risk-free since it did not involve any intervention with the research subjects. The ethical principles established in the Declaration of Helsinki were followed.

RESULTS

A total of 1,246 respiratory test results were reviewed during the study period, corresponding to patients admitted from March 2022 to June 2024 at the hospital. Considering the various epidemiological variables, 59.2% of the cases were male. More than half of the cases were under the subsidized social security regime. Regarding the final condition of each case, it was found that 71.1% (886 cases) were discharged, 28.5% (355) were referred to a higher complexity care level, and 0.4% (5) died. The province with the highest frequency of cases was Yopal, the capital city of Casanare; notably, the province of Sacamá—which represents only 0.49% of the total city population—recorded the highest incidence rate with 506.97 cases per 100,000 inhabitants (see Table 1).

Table 1. Sociodemographic characteristics of patients diagnosed with acute respiratory infection at the Hospital Regional de la Orinoquia, 2022–2024

Characteristics	n = 1246	
	fi	%
Type of health insurance		
Subsidized	715	57.4
Contributory	452	36.3
Special	63	5.1
Private	14	1.1
Uninsured	2	0.2
Ethnic group		
Other	1227	98.5
Indigenous	19	1.5
Area of origin		
Urban	1149	92.2
Rural	97	7.8
Province		
Yopal	844	67.7
Paz de Ariporo	71	5.7
Aguazul	46	3.7
Maní	46	3.7
Pore	33	2.7
Villanueva	31	2.5
Hato corozal	24	1.9
Tauramena	23	1.9
Orocué	20	1.6
Támara	19	1.5
Monterrey	18	1.4
Sacamá	12	1.0
Trinidad	10	0.8
Nunchía	8	0.6
San Luis de palenque	6	0.5
Recetor	1	0.1
Sabanalarga	1	0.1

Table 2. Frequencies of detected microorganisms by age group at the Hospital Regional de la Orinoquia, 2022–2024

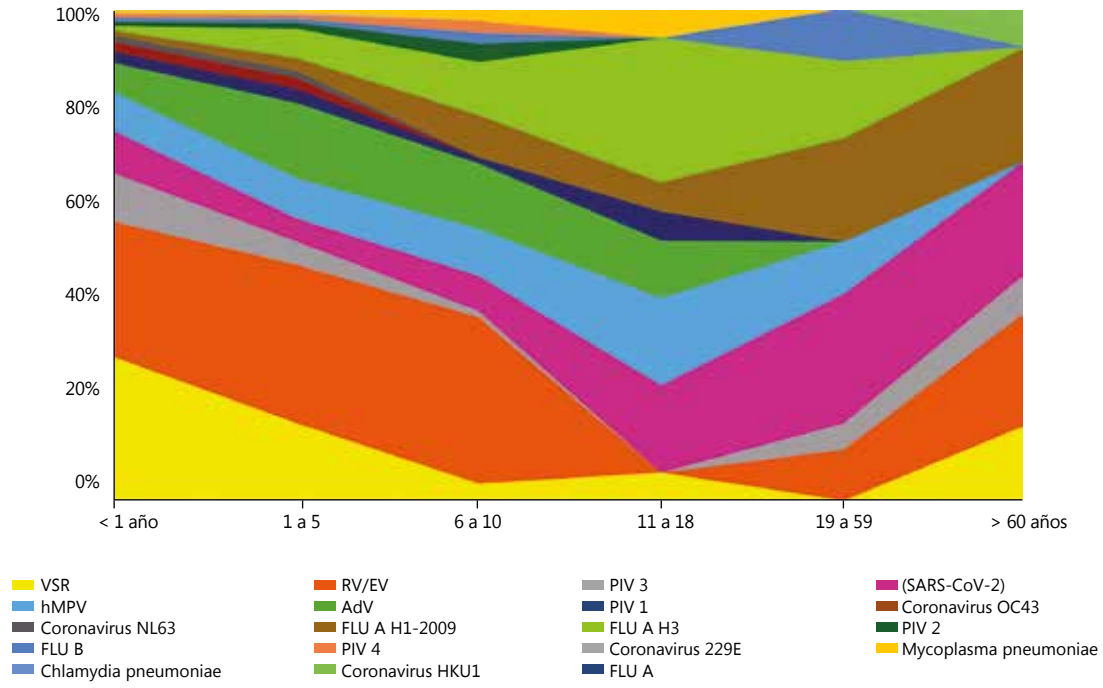
Detected virus	Age group					
	< 1 year	1 to 5 years	6 to 10 years	11 to 18 years	19 to 59 years	> 60 years
	N = 541	N = 573	N = 83	N = 17	N = 19	N = 13
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Respiratory syncytial virus	158 (29.2)	90 (15.7)	3 (3.6)	1 (5.9)	--	2 (15.4)
Human rhinovirus/enterovirus	149 (27.5)	185 (32.3)	28 (33.7)	--	2 (10.5)	3 (23.1)
Parainfluenza virus 3	53 (9.8)	27 (4.7)	1 (1.2)	--	1 (5.3)	1 (7.7)
(SARS-CoV-2)	46 (8.5)	27 (4.7)	6 (7.2)	3 (17.6)	5 (26.3)	3 (23.1)
Human metapneumovirus	43 (7.9)	47 (8.2)	8 (9.6)	3 (17.6)	2 (10.5)	--
Adenovirus	32 (5.9)	87 (15.2)	11 (13.2)	2 (11.8)	--	--
Parainfluenza virus 1	12 (2.2)	16 (2.8)	1 (1.2)	1 (5.9)	--	--
Coronavirus OC43	11 (2.0)	13(2.3)	--	--	--	--
Coronavirus NL63	7 (1.3)	9 (1.6)	--	--	--	--
Influenza A H1-2009	6 (1.1)	15 (2.6)	7 (8.4)	1 (5.9)	4 (21.1)	3 (23.1)
Influenza A H3	5 (0.9)	33 (5.8)	9 (10.8)	5 (29.4)	3 (15.8)	--
Parainfluenza virus 2	5 (0.9)	7 (1.2)	3 (3.6)	--	--	--
Influenza B	4 (0.7)	5 (0.9)	2 (2.4)	--	2 (10.5)	--
Parainfluenza virus 4	4 (0.7)	5 (0.9)	2 (2.4)	--	--	--
Coronavirus 229E	2 (0.4)	2 (0.4)	--	--	--	--
Mycoplasma pneumoniae	2 (0.4)	2 (0.4)	2 (2.4)	1 (5.9)	--	--
Chlamydia pneumoniae	1(0.2)	--	--	--	--	--
Coronavirus HKU1	1 (0.2)	1 (0.2)	--	--	--	1 (7.7)
Influenza A	--	2 (0.4)	--	--	--	--

The microorganisms with the highest relative frequency, in descending order, were: human rhinovirus/enterovirus (29.8%, n = 371), respiratory syncytial virus (RSV) (20.3%, n = 253), adenovirus (10.6%, n = 132), human metapneumovirus (8.0%, n = 100), SARS-CoV-2 (7.1%, n = 89), parainfluenza virus 3 (6.74%, n = 84), influenza A H3 (4.41%, n = 55), and influenza A H1 2009 (2.9%, n = 36). The pathogens with the lowest frequency were: influenza A (0.2%, n = 2) and *Chlamydia pneumoniae* (0.1%, n = 1).

In the age group analysis, 45.9% of the cases occurred in children aged 1 to 5 years, while the lowest percentage was among adults over 60 years old, with 0.9% of cases. The age range of the patients was 0 to 85 years, with a median of 3.15 years (IQR = 0.40–3.00). The most frequently detected virus among patients under 18 years old was human rhinovirus/enterovirus (29.1%, n = 362), whereas among adults the most common was SARS-CoV-2 (0.6%, n = 8) (see Table 2).

To improve understanding of Table 2, a graph is presented to illustrate the distribution by age group and the detected microorganism (see Figure 1).

In the trend of viral circulation among the 1,246 individuals diagnosed with an acute respiratory infection (ARI) at the hospital between March 2022 and June 2024, it was observed that the highest detection rates occurred between May and September. The year with the highest frequency



* Respiratory syncytial virus (RSV), rhinovirus/enterovirus (RV/EV), parainfluenza (PIV), influenza (FLU), human metapneumovirus (hMPV), adenovirus (AdV).

Figure 1. Distribution of detected microorganisms by age group at the Hospital Regional de la Orinoquia, 2022–2024

was 2022 with 67.0% (n = 835), followed by 2023 with 25.0% (n = 312), and 2024 with 7.9% (n = 99). During the last quarter of both 2022 and 2023, a lower number of cases was detected, as shown in Figure 2.

DISCUSSION

This study identified the epidemiological characteristics of patients admitted to the Hospital Regional de la Orinoquia between 2022 and 2024 and diagnosed

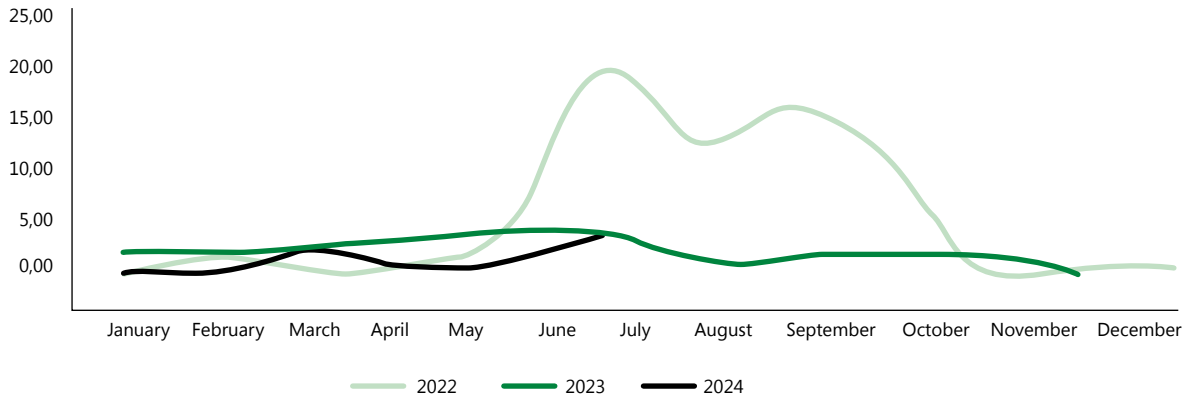


Figure 2. Monthly circulation of viral acute respiratory infections in patients treated at the Hospital Regional de la Orinoquia, 2022–2024

with ARIs, of which between 80% and 90% were of viral etiology. Upper respiratory tract infections were the most frequently occurring. Nevertheless, pneumonia represents a greater public health issue, with RSV being the most common etiological agent within these infections [20,21].

According to the Centers for Disease Control and Prevention (CDC), there are more than 200 respiratory viruses that can cause colds. Rhinoviruses are the most frequent, a finding that aligns with the results of this study, which reported a prevalence of 29.5%. Other viruses include coronaviruses, parainfluenza, adenovirus, enterovirus, and human metapneumovirus, all of which may be severe, particularly among high-risk groups such as children under 5 years, the elderly, or immunocompromised individuals [22].

The greatest viral circulation occurred in pediatric patients, accounting for 97.4% of cases, with RSV being the most frequently detected microorganism in children under one year, at 29.2%. This virus experienced various changes during the COVID-19 pandemic due to public health interventions such as social distancing, hand hygiene, and mandatory mask-wearing [23]. A study in Canada found that social distancing measures, school closures, and the shutdown of elder care facilities contributed to the low incidence of influenza and RSV outbreaks [24]. Similarly, a study from South Africa during the COVID-19 pandemic showed a decrease in influenza virus circulation compared to previous years [25]; however, the relaxation of these measures in 2022 led to a renewed increase in circulation. Other contributing factors may include low maternal immunization and the lack of natural protection, such as breastfeeding in infants under one year of age [26,27]. In the same vein, a study in a hospital in Paraguay most frequently detected SARS-CoV-2 in adults over 60 years old, accounting for 19.5% of cases [28]. Comparing this information to the data in our study—where detection was lower at 0.6%—suggests that during pandemic peaks and surges in cases, diagnoses may have been made based on clinical findings or epidemiological links.

In the study by Qiu Welling et al. [29], prevalence was 13.8%, with RSV surpassing 50.0%, followed by RV/EV at 27.5%. When comparing the 1–5-year age group, RV/EV was the most frequent at 32.3%, followed by RSV at 15.7%. These data are similar to those reported by Dallmeyer Leonie K. et al. [30], where prevalences were 26.06% for RV/EV and 24.2% for RSV in the pediatric age group. Likewise, a study conducted in China found RSV present in 28.1% of cases and RV/EV in 18.3% [31]; these two viruses were the most common, showing similar patterns to those detected in this research.

In the 0–5-year age group, the leading causes of morbidity, mortality, and need for hospital care are ARIs [32]. These infections may range from mild to severe clinical manifestations, resulting in high demand for healthcare services and school or work absenteeism among caregivers [33]. In this study, the 1–5-year age group had the highest number of reported cases, with 45.9% of the total; it was also the group with reported deaths (0.4%), with RSV being responsible for 40.0% of these fatalities. When compared with the study by González García et al., a notable difference was found, as their results reported RSV as the causative agent in 21.6% of cases [34].

The viral detections mostly occurred during the rainy seasons. Consequently, there are environmental factors that facilitate transmission, such as fluctuations in temperature and relative humidity [35]. The trend in viral circulation showed a peak in May and June, which is consistent with reports from the Colombian National Institute of Health in 2022 and 2023 [26,36]. In contrast, lower circulation was observed during school recess months and dry seasons. The geographic area where the study was conducted includes two thermal floors, with a predominance of warm and humid climate in the piedmont plains, tropical climate in the savannahs, and cold climate in the Andean zone, all within a bimodal rainfall pattern [37].

In the study by Colosia et al. [38], it was found that in the elderly population with compromised immune systems or cardiopulmonary conditions, RSV infection prevalence ranges between 8% and 13% during seasonal peaks; their study reported 8.3%. In this study, the adult population showed a 2.5% detection rate of viral agents, and the population over 60 years old accounted for 0.9%. The most frequently detected viruses in this age group were RV/EV, SARS-CoV-2, and Influenza A H1N1, each contributing 25.0%. Before the COVID-19 pandemic, the most frequently detected pathogens were influenza and human rhinovirus, contributing to 20–30% of cases [39].

One of the strengths of this study is that it included all cases detected by respiratory panel over a three-year period. For the last year, the first six months were considered, covering the rainy season or epidemiological periods with the highest respiratory peaks of the year. The database was cleaned and stratified by detected microorganisms, age, sex, age group, type of social security affiliation, and area of origin.

One of the limitations was the inability to analyze the clinical criteria of each patient, such as duration of illness, medications administered before or during hospitalization, comorbidities, and final condition. Another limitation was that data were only obtained from one hospital, and extrapolation to other regions

or hospitals must be made with caution, considering the epidemiological and diagnostic characteristics analyzed in this study.

Conclusions

The frequency of detected viruses was associated with age and seasonality, with RSV being the main pathogen and the most affected age group being children between 1 and 5 years old, while adults over 60 showed the lowest frequency. This study contributes to a better understanding of the characterization of acute respiratory infections (ARIs) in patients at the hospital. Transmission tends to increase during the rainy season, which spans from May to September. The department's capital city contributed three-fourths of the reported cases. The main transmission factors were lack of awareness, self-medication, delays in seeking healthcare, environmental conditions, and socioeconomic factors.

It is recommended to emphasize the need for incorporating future vaccines and public health intervention strategies, as well as social measures, considering the significant role of respiratory syncytial virus (RSV) in lower respiratory tract infections in childhood. Moreover, clinical management guidelines should be updated in accordance with the epidemiological situation of each region. The dissemination and community engagement around preventive measures and epidemic months should be continuous. Finally, the proliferation of other respiratory viruses highlights the need for available diagnostic tests to facilitate the identification of additional viruses responsible for viral acute respiratory infections, providing relevant information for their control.

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