ramr
American Review of Respiratory Medicine
Revista Americana de Medicina Respiratoria

ORIGINAL ARTICLE

ISSN 1852-236X

Respiratory Syncytial Virus Pneumonia in The Hospitalized Adult. Study of Direct Costs in Two Public Hospitals of the City of Buenos Aires

Neumonía por virus sincicial respiratorio en el adulto hospitalizado. Estudio de costos directos en dos hospitales públicos de la Ciudad de Buenos Aires

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Received: 02/26/2025
Accepted: 8/11/2025

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ABSTRACT

Introduction: There are no studies on costs associated with hospitalization in adults with respiratory syncytial virus (RSV) infection in Argentina.

Objectives: To determine the direct cost structure of adults hospitalized for RSV in public hospitals in the Autonomous City of Buenos Aires (CABA).

Materials and Méthods: Patients >18 years hospitalized for RSV infection from January-June 2024 in two Public Hospitals of CABA. Comparisons were made between patients older than 60 years and those younger than 60 years. Diagnosis: viral panel (PCR) positive only for RSV. Direct costs were calculated from the funder's perspective. Hospitalization cost modules were determined by the CABA Government as of June 2024, official exchange rate parity 9.18 pesos/dollar (sale).

Results: 18 patients were enrolled, mean age 65 years (IQR 48.2-79.2); 56% smokers with high comorbidity burden. Three patients were in the Intensive Care Unit (16.6%); case-fatality rate: 27.7%.

The direct cost was 5,278.88 dollars/patient (IQR 2,932.8-1,1131.1) and the total direct cost was 195,202.33 dollars/all patients. When comparing the group of patients older than 60 years with those younger than 60, it was observed that the group over 60 had 63% higher direct costs and a higher case-fatality rate (34.4% vs. 0%).

Conclusion: The majority of patients hospitalized for RSV infection are aged 65 years, with comorbidities, a history of smoking, and a high case-fatality rate. The direct cost from the funder's perspective was USD 5,278.88 per patient. The direct cost for all patients was USD 195,202.33. Patients >60 years had higher direct hospitalization costs and increased case-fatality rates. This is the first study in Argentina on direct costs associated with RSV infection in hospitalized adults at public hospitals.

Key words: Respiratory syncytial virus; Pneumonia; Hospitalizations; Direct costs; Expenses

Rev Am Med Resp 2025;25:124-130. https://doi.org/10.56538/ramr.OZDP7158

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RESUMEN

Introducción: No hay estudios sobre costos asociados a hospitalización en adultos con infección por virus sincicial respiratorio (VSR) en Argentina.
Objetivos: Determinar la estructura de costos directos de adultos hospitalizados por VSR en hospitales públicos de la Ciudad Autónoma de Buenos Aires (CABA).
Materiales y métodos: Pacientes >18 años hospitalizados por infección por VSR desde Enero-Junio 2024 en dos Hospitales Públicos de CABA. Se comparó en < y > 60 años. Diagnóstico: panel viral (PCR) positivo sólo para VSR. Se determinaron costos directos desde la perspectiva del financiador. La modulación de internación fue realizada por Gobierno de CABA a Junio 2024, cotización oficial paridad 9,18 pesos /dólar (venta).
Resultados: Se enrolaron 18 pacientes, edad 65 años (RIQ 48.2-79.2); 56% tabaquistas con alta carga de comorbilidades. Tres pacientes estuvieron en Unidad de Terapia Intensiva (16.6%); Tasa casos fatales: 27.7%.
El costo directo fue 5278,88 dólares/paciente (RIQ 2932.8-11131.1) y el costo directo fue 195202.33 dólares/todos los pacientes. Al comparar > y < de 60 años, se observó en aquéllos 63% mayores costos directos y mayor tasa de casos fatales (34,4% vs 0 %).
Conclusión: La mayoría de los pacientes hospitalizados por infección por VSR tienen 65 años con comorbilidades, tabaquismo y alta letalidad. El costo directo desde la perspectiva del financiador fue 5278.88 dólares/ paciente. El costo directo fue 195202.33 dólares/todos los pacientes. Los pacientes >60 años tuvieron mayores costos directos de hospitalización y letalidad. Es el primer estudio en Argentina sobre costos directos por infección VSR en adultos hospitalizados en hospitales públicos.

Palabras claves: Virus Sincicial Respiratorio; Neumonia; Hospitalizaciones; Costo directo; Gastos

The respiratory syncytial virus (RSV) causes one of the most common acute respiratory diseases in children, leading to hospitalizations and admission to pediatric intensive care units. Currently, it is less recognized in the adult population with comorbidities compared to other respiratory viruses, causing a higher case-fatality rate.[1] It can affect both the upper and lower respiratory tracts, accompanied by fever, headache, myalgia, and asthenia, and can be confused with bacterial pneumonia due to the significant frequency of alveolar patterns in imaging studies.[1] The presentation predominates during autumn/winter but can vary in extent and severity in the at-risk population.[1] It can cause medium- or long-term deterioration, both pulmonary and systemic extrapulmonary.[2-9] Although there is no specific treatment at present, patients should be supported hemodynamically, with oxygen therapy and ventilatory support if required.[1] Less than 30% of acute community-acquired pneumonias in adults are of viral origin.[10] The other most common genera are influenza A, parainfluenza, rhinovirus, metapneumovirus, coronavirus, and adenovirus.[10] Although it has been shown that most adult pneumonias do not have an identified pathogen, the frequency of viral etiology is higher than reported.[11]

In 2019, industrialized countries reported an estimated 5.2 million cases of acute respiratory infection, resulting in 470,000 hospitalizations, and 33,000 deaths among adults over 60 years of age.[1] Immunosenescence starting at age 50 causes a decrease in T lymphocyte response. This situation, along with comorbidities, significantly contributes to increased morbidity and mortality.[12]

It was estimated that in 2019 in Argentina there were 14,604 hospitalizations and 3,518 deaths due to RSV in adults, representing almost 70% in patients over 75 years with multiple comorbidities.[13] In 2024, RSV reached its seasonal peak in week 16 with detection over 14% of samples.[14] In Argentina, there is little information about the impact of severe RSV infection in adults, but a recent multicenter study reported its impact on hospitalized adult patients.[15]

On the other hand, there is no local information about the direct hospitalization costs associated with RSV pneumonia in adults. Therefore, the aim of this study is to describe the direct cost related to hospitalization for RSV pneumonia in adults, stratified by two age groups: patients under 60 years and those over 60 years. This analysis was carried out at two public hospitals in the Autonomous City of Buenos Aires (CABA) during the first half of 2024.

MATERIALS AND METHODS

The medical records of patients hospitalized for community-acquired acute pneumonia (CAP) due to RSV were reviewed from all departments of the Hospital General de Agudos "Dr. J. M. Ramos Mejía and the Hospital "Donación José Santojanni" in CABA between January 1, 2024, and June 30, 2024.

A positive RSV diagnosis was confirmed by PCR viral panel testing of respiratory specimens, with all other respiratory viruses testing negative. The pneumonia diagnosis was based on a combination of clinical symptoms and the presence of pulmonary opacities in chest imaging studies (X-ray and high-resolution computed tomography without contrast).

The study included adults over 18 years of age. Direct costs were determined from the perspective of the funder, based on medication costs and the clinical hospitalization and emergency department cost modules for Public Hospitals provided by the Government of the City of Buenos Aires as of June 1st, 2024.[16-17] The cost module for inpatient care in isolation for infectious disease was 56,750 pesos (USD 269.23) per day; for emergency care with diagnostic studies, the cost was 13,853 pesos (USD 65.72), and the cost for critical emergency care without mechanical respiratory assistance was 78,194 pesos (USD 370.97).[16] Each module included a predetermined number and type of services (biochemical tests, imaging, electrocardiogram, spirometry, mechanical respiratory assistance, oxygen, disposable materials, medications, etc., as well as proportional costs related to salaries, taxes and fees, administrative charges, equipment amortization, food and laundry costs, etc.). When an additional consultation or diagnostic procedure was made, or if some treatment (e.g., medications) outside the module was performed, the cost was determined from the funder's perspective based on the KAIROS Pharmaceutical Manual and the service fee schedule provided by the Government of the City of Buenos Aires.[16-17] All patients were treated within 48 hours of the onset of respiratory symptoms with antibiotics, oseltamivir (75 mg every 12 hours for 5 days), and oxygen therapy.

Due to the fluctuations in the peso/dollar exchange rate, results will be reported in U.S. dollars. The exchange rate used for cost calculation was the official selling rate of Banco Nación as of June 1, 2024 (918 pesos = 1 dollar).

It was planned to analyze the costs in the total adult population, and then compare two groups: those over 60 years old versus those under 60.

Descriptive statistics was used. For quantitative variables with a non-Gaussian distribution, the median was used as the central measure, and the interquartile range (IQR 25%-75%) as the measure of dispersion. For variables with a Gaussian distribution, the mean was used as the central measure, and the standard deviation as the measure of dispersion. Percentages were used for qualitative variables.

RESULTS

General adult population

Eighteen patients were enrolled. The median age was 65 years (IQR 48.2-79.2); 61.1% were female; 56% were former or current smokers (median 50 pack-years, IQR 42-84).

A high prevalence of comorbidities was observed: 61.1% cardiovascular, 33.3% respiratory, and 27.7% oncologic, among the most frequent. Only one patient had no known comorbidities.

The median duration of hospitalization in an emergency room was 1 day (IQR 1-1), and 5 days in the general ward (4-7). Three patients (16.6%) required admission to the Intensive Care Unit (ICU) for 2 to 6 days. The overall case-fatality rate was 27.7% (n = 5).

The median final cost per patient was USD 5,278.88 (IQR 2,932.8–11,131.1), with a total cost of USD 195,202.33 for all 18 patients. 86.54% of those costs were included in the cost-modules, and 13.46% weren't (47.7% from diagnostic studies and 52.6% from medications) (Figure 1).

Population older than 60 years

Of the 18 patients, 14 (77.78%) were older than 60 years. The median age was 77 years (IQR 70.5-90); 72.7% were female; 54.5% were former or current smokers: (median 50 pack-years, IQR 42-108). A high prevalence of comorbidities was found (91% of patients): 63.6% cardiovascular, 27.3% respiratory, and 18.2% oncologic, among others. The median duration of hospitalization in an emergency room was 2 days (IQR 1-2), 14 days in the general ward (5-25) and 27.3% (n=3) in the ICU (range 2-6 days.) Case-fatality rate: 36.4% (n=4).

The final cost per patient was USD 5,575.6, and the total cost for the 14 patients was USD 144,586.9. The direct non-modular cost represented 14.9% of the total (of which 88.8% corresponded to medications and 11.2% to tests).

Population younger than 60 years

Of the 18 patients, 4 (22.22%) were under 60 years old (range 32–57 years), with a median age of 57 years (IQR 50.75–57); 50% were female; 75% were former smokers (median 32 pack-years, IQR 28.5-54). A high prevalence of

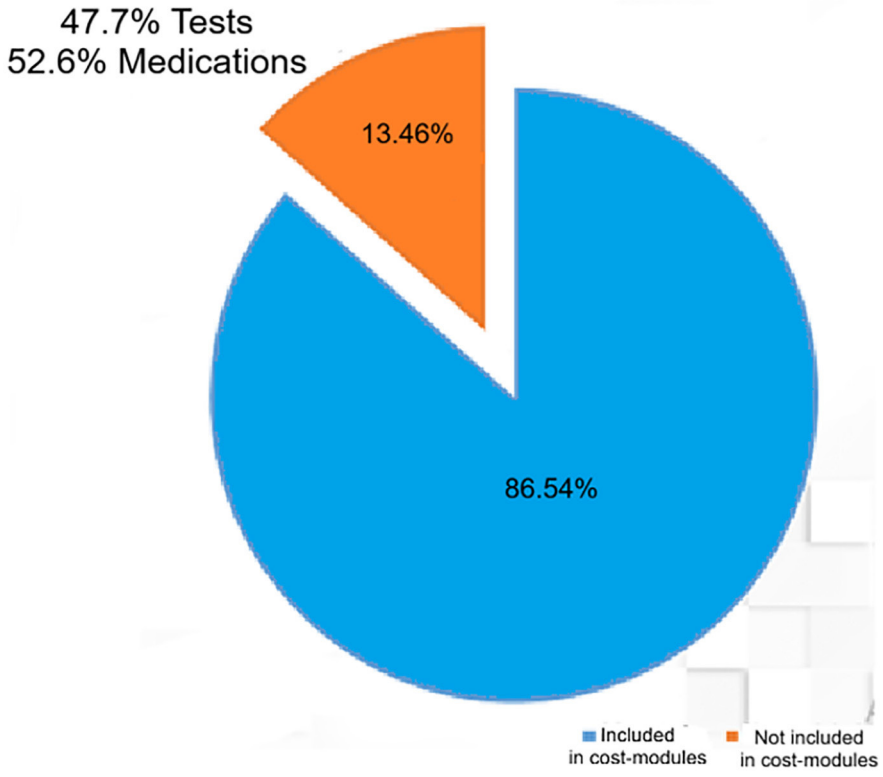

Figure 1. Total direct cost structure

comorbidities was found (100% of patients): 50% cardiovascular, 50% diabetes, 50% COPD (chronic obstructive pulmonary disease), 25% cerebrovascular and 25% obesity. The median stay in the emergency department was 1 day (IQR 1-1), 6.5 days in the general ward (IQR 5-8.5), and 25% required ICU admission (n=1, 12 days). There were no deaths.

The final cost per patient was USD 3,419.37, and the total cost for the 4 patients was USD 16,527.4. The direct non-modular cost represented 10% of the total (of which 90% corresponded to medications and 10% to tests).

Comparison of costs between patients over and under 60 years of age

Table 1 compares both populations (over and under 60 years of age).

The median direct cost for patients over 60 years was USD 5,575.6 (63% higher, p=0.11) compared with USD 3,419.37 for those under 60 years.

The total direct cost for all patients in each group was 5.95 times higher among those over 60 years compared with those under 60 years (USD 98,479.14 vs. USD 16,527.47).

DISCUSSION

The direct hospitalizations costs associated with RSV pneumonia in adults have been determined in two public hospitals in CABA. The sample under evaluation included eighteen patients, most of them female, in their seventies, with a high prevalence of comorbidities and significant smoking history. The total direct hospitalization costs were USD 5,278 per patient, with a high requirement for ICU care and a high case-fatality rate. When comparing patients older than 60 years with those younger than 60, it was observed that the older group used more healthcare resources, had a higher case-fatality rate, and incurred higher direct costs per patient.

The most frequent viruses in community-acquired pneumonia (CAP) are influenza A, parainfluenza, RSV, rhinovirus, metapneumovirus, coronavirus, and adenovirus.[10] The EPIC study

TABLE 1. Demographic data

	Older than 60 years (n = 14)	Younger than 60 years (n = 4)
Age, median (IQR 25- 75%), years	77 (70.5-90)	57 (50.75-57)
Gender, feminine, %	72.7	50
Current smokers, former smokers, %	54.5	75
Packs-year, median(IQR 25-75%)	50 (42-108)	32 (28.5-54)
Comorbidities, %	91	100
Comorbidities, %		
Cardiovascular	63.6	50
Respiratory	27.3	25
Diabetes	0	25
Cerebrovascular	0	25
Neoplasm	18.2	0
Days at emergency room, median (IQR 25-75%)	2 (1-2)	1 (1-1)
Days at general ward, median (IQR 25-75%)	14 (5-25)	6.5 (5-8.5)
ICU, %	27.3 (range 2-6 days)	25% (12 days)
Deceased patients, %	36.4	0
Cost per patient, dollars Median (IQR 25-75%)	5575.6 (3468.7-10369.1)	3419.37 (2140.1-5411)
Total cost, dollars	144586.9	16527.4

Abbreviations: IQR: Interquartile range 25-75%; ICU: Intensive Care Unit

demonstrated that in adults the frequency of viral etiology was higher than previously reported.[11] In a review of 18 studies conducted among older adults in Latin America, it was determined that the detection rate of acute respiratory infection caused by RSV is highly heterogeneous among different countries (0–77.9%).[18] Hospitalizations with co-infections of RSV and influenza were observed (40.9-69.9%), as well as in viral CAP (91.7%).[18] Through the National Laboratory Network (2007-2016), RSV positivity in respiratory samples ranged from 21 to 29%. It was determined that viral circulation began in April, lasted 16 to 18 weeks, and the influenza peak overlapped with the RSV peak during winter.[19] In 2020, due to the SARS-CoV-2 pandemic, an "immunological silence" was observed, with the disappearance of other respiratory viruses.[14] Starting in 2021, a disruption was noted in the timing of peaks of other viral respiratory infections, which, although lower in intensity, persisted until 2023.[14] According to the 2024 National Epidemiological Bulletin from Argentina's Ministry of Health, RSV detections increased from week 16, reaching their peak in week 26.[14]

Acute respiratory disease in adults caused by RSV is more severe, with higher case-fatality rate, and remains underrecognized compared to other respiratory viruses.[1,5-10] As previously mentioned, its clinical presentation can be mistaken for bacterial pneumonia.[1,5-11,15] Immunosenescence beginning around age 50 leads to a reduced T-cell response, which –along with comorbidities (cardiorespiratory, neurological, metabolic, immunocompromised, etc.)– contributes to higher morbidity and mortality.[12] It can cause significant medium- and long-term impairment and systemic extrapulmonary involvement (cognitive, cardiovascular, among others).[2-4] It is important to identify at-risk populations because vaccines are now available for adults in risk groups in Argentina.[20-23]

Underdiagnosis is significant due to the clinical similarity with other respiratory pathogens, lack of medical awareness, delays in ordering diagnostic tests, or unavailability of such tests. There is also a perception that, since there is currently no specific antiviral treatment, diagnosis would not impact clinical outcomes, and this is dangerous due to the risk of in-hospital spread. In a multicenter study conducted across three healthcare centers, the impact of RSV in hospitalized adults in our country has been recently reported.[15] Participants were over 60 years old and had a high burden of

comorbidities, particularly cardiovascular and respiratory.[15] The most common radiological pattern upon admission was alveolar, observed in nearly 70% of the patients.[15] Almost 40% of the patients were admitted to the ICU, and the case-fatality rate was high (19.4%).[15]

The different components of direct and indirect costs of asthma in healthcare have been determined, and they can be extrapolated to other respiratory diseases.[24] A mixed methodology has been used to determine direct costs: cost modules provided by the GCBA (top-down method) and, in addition to the review of each medical record, paying for the patient's expenses outside the cost modules (bottom-up method). In our study, primary data were directly collected from the medical records, which adds a valuable detail.[24] As previously mentioned, we conducted the cost analysis from the perspective of the funder (Government of the City of Buenos Aires, GCBA) in a general acute care public hospital. Therefore, direct comparison with other countries or extrapolation to other institutions is not advisable, since cost structures differ, although this analysis can provide an idea of the magnitude of the problem.[24]

The total direct hospitalization cost was USD 5,278 per patient, and the total cost for the 18 patients in this study conducted across two public hospitals in CABA was USD 195,202. When comparing patients older than 60 years with those younger than 60, it was observed that the older group used more healthcare resources, had a higher case-fatality rate (36.4% vs. 0%), and showed 63% higher direct costs per patient (Table 1).

When compared with hospitalization associated with another virus such as influenza in the same public hospital setting in Buenos Aires, both similarities and differences can be observed. The hospitalized sample of patients with influenza pneumonia was also elderly (in their eighth decade of life) and had a high prevalence of comorbidities and smoking history.[25] However, the total cost per patient hospitalized for influenza was half that of RSV (USD 2,263 per patient), with similar use of emergency and ward hospitalization days. Yet, RSV infection was more severe, requiring ICU care (unlike influenza), and showing double the case-fatality rate (27.7% vs. 14.8%), precisely due to the different clinical profiles of the patients (older and with more comorbidities).[25]

Among the limitations of this study, it should be noted that data collection from medical records was retrospective and the sample size was small, so conclusions should be considered preliminary. Extrapolating the conclusions to other healthcare systems in our country or other regions (external validity) is not advisable. No indirect costs were evaluated (which are presumed to be higher than direct costs based on previously reviewed literature); and costs were not determined from other perspectives (for example, patient or societal perspectives). While costs were initially calculated in pesos, the currency instability and devaluation experienced by our country in recent times led us to report the results in dollars. Finally, the cost modules used by the GCBA did not allow breaking down the internal cost structure to determine which variables have been considered and to what extent. It should also be noted that at the time of conducting the study, the exchange rate gap between the official and parallel dollar rate was significant. If a higher dollar parity value were used, it would likely reduce the cost in dollars.

To conclude, the direct hospitalization costs associated with RSV pneumonia in adults has been determined in two public hospitals in CABA. The sample under evaluation of eighteen patients included mostly females, in their seventies, with a high prevalence of comorbidities and a significant smoking history. The total direct hospitalization cost was USD 5,278 per patient, with a high requirement for ICU care and high case-fatality rate (27%). When comparing patients older than 60 years with those younger than 60, it was observed that the older group used more healthcare resources, had a higher case-fatality rate, and incurred higher direct costs per patient. This is the first study in our country to evaluate the direct costs of hospitalization associated with RSV pneumonia in adults at public hospitals in CABA.

It is imperative to determine the viral etiology of acute respiratory infections in hospitalized adults in order to isolate the patient and prevent in-hospital transmission. There are vaccines available for the at-risk adult population that can help prevent it, due to immunosenescence and a high burden of comorbidities, which lead to high morbidity and mortality. This study would provide additional information to support decision-making in public health. The need to incorporate studies of this kind within the healthcare system is emphasized, as

they enable the collection of data that supports better resource management, allowing for improved planning, organization, and standardization of patient care. This, in turn, enhances efficiency and quality of service while maintaining or even reducing overall healthcare costs.

Conflict of interest

Dr. Martin Sívori has participated in continuous medical education programs for Glaxo SmithKline, Sequirus, and Pfizer.

Dr. Daniel Pascansky has participated in continuous medical education programs for Glaxo SmithKline, Astra Zeneca, Sequirus, ELEA, and SANOFI.

Dr. Saldarini Fernando has participated in medical advisory for GSK.

The other authors have no conflicts of interest to declare

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