RESEARCH ARTICLE

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Impact of RSV Prevention on Paediatric Patients Hospitalized for a Severe Acute Respiratory Infection (SARI): A Single Centre "Pre-Post" Cohort Study

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Keywords

Respiratory syncytial virus; RSV; Immunization; Prevention; Coinfection; Antibiotic treatment

Abstract

Objective

This study aims to evaluate the impact of the first year of respiratory syncytial virus (RSV) prevention on hospitalisations for severe acute respiratory infection (SARI) in a paediatric department.

Methods

During the 2023–24 and 2024–25 winter seasons, 215 and 191 patients were included, respectively, with 105 (49%) and 47 (25%) documented RSV infections, respectively. The proportion of nirsevimab-eligible patients testing positive decreased by 78% between the two seasons. Seven of the 48 (14.6%) patients who received prophylaxis and four of the five (80%) patients who did not received prophylaxis had an RSV infection. The median age of children testing positive for RSV increased from 7.2 months in the 2023–24 season to 20.2 months in the 2024–25 season, and the median length of stay decreased from three to two days, respectively.

Results

The currently licensed vaccines are highly effective in preventing varicella infection and the possible severe complications. They are safe with generally mild adverse effects. Cost-effectiveness studies show a benefit for the society. However, high vaccine coverage rates are needed to prevent the shift in varicella cases to older age groups. This can be achieved when administered in combination with the already established measles mumps rubella (MMR) vaccination at the age of 12 months.

Interpretation / Conclusion

The implementation and reimbursement of nirsevimab significantly affected RSV-related hospitalisations when comparing pre- and post-surveillance years. A significant increase of 13 months in the median age of RSV-positive hospitalized patients and a decrease in the median length of hospital stay were also observed.

Introduction

Respiratory syncytial virus (RSV) is a major cause of upper and lower respiratory tract infections (URTI-LRTI), particularly in infants. Preterm, patients under six months of age, and children with chronic conditions (cardiac, pulmonary, neuromuscular, …) are at highest risk. It is estimated that 5% of infected children develop LRTI, 0.4% require hospitalization, and 0.02% die from the infection (1). In Belgium, despite the absence of a national registry, epidemiological data reveal a substantial RSV burden. Between 5% and 10% of patients seen in primary care in Belgium are hospitalized, with approximately 5% requiring intensive care (2). Most hospitalized children have no identified risk factors except a very young age (67–80%) (2). From the literature, RSV is also known to be associated with an increased risk of bacterial pneumonia (particularly pneumococcus infection) and with the later development of bronchial hyperreactivity (3-6). A recent Belgian study quantified RSV's impact on paediatric departments: at the peak period, RSV-related hospitalizations accounted for up to 95% of paediatric bed occupancy in some hospitals (7). According to the Belgian Health Care Knowledge Centre (KCE), an estimated 116,000 RSV infections occur annually among each birth cohort of children aged 0–59 months, leading to over 8,600 hospitalizations and approximately 400 paediatric intensive care unit (PICU) admissions, half of which occur in infants under two months of age (8). From an economic perspective, the mean cost per RSV episode in Europe is evaluated to be €399.5 and €494.3 from the healthcare payer perspective and societal perspective, respectively (9). The development of nirsevimab (Beyfortus®) has dramatically transformed RSV prevention. Clinical trials have shown an efficacy of 70% in infections among preterm infants and an efficacy of 77% among full-term infants through at least 150 days (10-11). The HARMONIE trial confirmed an efficacy of 83% in hospitalizations (12). Real-world data support these findings, showing effectiveness between 80% and 90% (13-17). Another promising option is maternal vaccination (Abrysvo®). The MATISSE trial demonstrated 82% efficacy against LRTI in infants at 90 days of life, 70% at 180 days (18). Real-world data from the BERNI study confirmed a 71% effectiveness in hospitalizations and a 77% efffectiveness in severe infections in infants under six months in Argentina (19). The main aim of this study is to evaluate the impact of the first year of RSV prevention on severe acute respiratory tract infection (SARI) hospitalizations in a paediatric department. The secondary objectives of the study are the immunization coverage observed in eligible children and the effect of prevention on disease severity and viral co-infections.

Methods

All paediatric patients (0-15 years old) hospitalized at CHU UCL Namur (site Dinant) for SARI during winter epidemic seasons 2023-2024 and 2024-2025 (from October 1 to March 31), were prospectively enrolled, and clinical data were retrospectively analysed, focusing on the impact of RSV preventive measures (from 2024-25) on hospitalization rates, infection severity, and on the prevalence other viral (co-) infections. At the beginning of the immunization campaign in 2024, it was decided that the eligible children were those born from the end of the previous season, i.e. April 1-2024 to March 31-2025. It should be noted that the 2024-25 RSV season was officially declared over by Sciensano on February 18, leading to an early termination of the immunization campaign. For this reason, in order to compare the two seasons, we have defined eligible children born between April 1 and March 31 for both seasons. Patient inclusion continued until March 31, announced theoretical end date of RSV season, to assess any potential effect of this premature end. The SARI hospital network project is a surveillance program coordinated by the Belgian Scientific Institute for Public Health (Sciensano®) and involving nine acute care hospital settings, including CHU UCL Namur (site Godinne/adult population and site Dinant/paediatric population). Main objective is to monitor the impact of seasonal respiratory viruses on SARI paediatric and adult hospitalizations, using standardized enrolment criteria. The SARI paediatric case definition is defined as at least two of the following symptoms: fever > 38°C or history of fever; cough and/or dyspnoea and/or abnormal pulmonary auscultation, apnoea, cyanosis; and an acute onset of symptoms (<10 days prior to hospital admission); and a minimum 24-hour hospital stay. Apnoea and cyanosis only apply to children. The SARI surveillance uses a common clinical questionnaire and collects anonymized data on an electronic platform. Paediatric patients presenting to the emergency department (ED) with respiratory symptoms undergo a nasopharyngeal sampling (aspiration or swab) for viral analysis performed at the CHU UCL Namur laboratory using NeuMoDx™ Flu A-B/RSV/SARS-CoV-2 Vantage Test Strip (Qiagen®, Hilden, Germany) for (FLU-RSV-SARS-CoV-2 RT-PCR and Adeno Respi K-Set (Coris ®, Gembloux, Belgium) for, Adenovirus antigen detection). If the SARI case definition is confirmed (symptoms and hospitalization ≥ 24h), the patient is included in the national surveillance and an aliquot of the respiratory sample is sent to the National Influenza Reference Centre (Sciensano®) for subsequent molecular viral analysis (respiratory panels including FLU A/B, RSV A/B, SARS-CoV-2, picornavirus (PIV 1-2-3-4), human metapneumovirus (hMPV), enterovirus and human rhinovirus (EnV/HrV), human bocavirus (HBoV), seasonal coronaviruses HKU1-NL63-OC43-229E,…). The primary outcome of this study was the number of RSV positive hospitalizations in

TABLE 1: General results 2023-2024 et 2024-2025.

	2023-2024	2024-2025	
Number of SARI [a] patients	215 (44%)	191 (47%)	Reduction of 15%
RSV-positive patients	105/215 (49%)	47/191 (25%)	Reduction of 55% P-value: 0.0000004775 [b]
Co-infections	38/105 (36%)	21/47 (44%)	P-value: 0.3208 [c]
Nirsevimab eligible patients	86/215 (40%)	56/191 (30%)	Reduction of 35% P-value: 0.02662 [b]
RSV-positive patients nirsevimab eligible	50/86 (58.1%)	11/56 (19.6%)	Reduction of 78% P-value: 0.000005926 [b]
RSV-positive patients median age [Q1 – Q3] [d] (months)	7.2 [3 - 18]	20.2 [9.75 – 31.26]	+ 13 months P-value : 0.0005828 [e]
Hospitalizations during RSV season	487	403	Reduction of 18%
Emergency department visits	2269	2158	Reduction of 5%

[a] SARI: Severe Acute Respiratory Infection
[b] Fisher's exact test p-value
[c] Pearsons chi-squared test p-value
[d] interquartile range
[e] Mann-Whitney U test

TABLE 2: Comparison of risk factors and severity of RSV-positive patients between the two seasons.

	2023-2024 (n = 105)	2024-2025 (n = 47)	P-value
Risk factors	19 (18%)	11 (23.4%)	11 (23.4%)
Oxygen therapy	64 (60.9%)	24 (51%)	24 (51%)
High flow oxygen therapy	5 (4.7%)	3 (6.3%)	3 (6.3%)
PICU c admission	6 (5.7%)	3 (6.3%)	3 (6.3%)
Median length of stay [Q1 – Q3] d (days)	3 [2 – 5]	2 [1 – 3]	2 [1 – 3]
Chest X-ray	33 (31%)	11 (23%)	11 (23%)
Antibiotics prescription rate	36 (34%)	14 (29%)	14 (29%)
Patients with chest X-ray/patients having antibiotics f	22/36 (61.1%)	8/14 (57.1%)	8/14 (57.1%)

[a] Pearsons chi-squared test p-value
[b] Fisher's exact test p-value
[c] Paediatric Intensive Care unit
[d] Interquartile range
[e] Wilcoxon rank sum test with continuity correction
[f] Antibiotic prescription rate associated with chest X-ray

children eligible for RSV prevention. The severity outcomes (oxygen requirement, PICU transfer, length of hospital stay, antibiotic use) were compared between two seasons for RSV-positive patients. These severity outcomes were also compared between patients with a single RSV infections vs co-infection on the basis of all patients (both seasons). The nirsevimab eligibility criteria follow the National Institute for Health and Disability Insurance reimbursement conditions, based on the Belgian Superior Health Council recommendations: all infants born after April 1-2024, entering their first season of exposure, regardless of risk factors (20). The immunization campaign within our Paediatric Department was structured around following components:

- Communication: An information campaign was launched, albeit late, through media and posters distributed by the Belgian Academy of Paediatrics.
- Maternity administration: Newborns delivered in the maternity of CHU UCL Namur (site Dinant) between October 1-2024, and February 18-2025, were offered immunization with nirsevimab (Beyfortus®), provided their mother had not received Abrysvo® during pregnancy. Among the identified limitations were exclusion of children without regular health insurance (e.g. refugee children housed in Red Cross Centres because of non-reimbursement),
- Postnatal catch-up: A phone recall system was implemented for all eligible children born in our maternity unit after April 1-2024: parents were contacted and offered an appointment in consultation.

To compare the groups across the two seasons, as well as single infections and co-infections, several statistical approaches were employed. The percentage reduction between the values obtained in the two seasons was first calculated. Categorical variables were analysed using the chi-square test or Fisher's exact test for small samples. For continuous variables, including age and length of hospital stay, normality was first assessed using the Shapiro–Wilk test. Since these variables were not normally distributed, comparisons between groups were performed using the Mann–Whitney test (Wilcoxon rank-sum test with continuity correction). Statistical analyses were performed using R (R Foundation for Statistical Computing, Vienna, Austria).
As part of the SARI surveillance, approval from a coordinating central ethical committee was obtained

Results

From October 1-2024 to March 31-2025, 191 SARI patients were enrolled compared to 215 in season 2023-24 (Table 1). The number of confirmed RSV cases decreased significantly, from 105 in 2023-24 to 47 in 2024-25, representing a global 55% reduction in RSV-related hospitalizations. Among patients eligible for nirsevimab prophylaxis, the proportion of RSV-positive cases dropped markedly, from 50 among 86 eligible patients (58.1%) in 2023-24 to 11 among 56 eligible patients (19.6%) in 2024-25, representing a 78% decrease. A high parental acceptance rate was observed at our maternity, with 92% of newborns immunized with nirsevimab and 3% through maternal vaccination. Overall, in the 2024/2025 season, 48/56 (86%) eligible patients received an RSV preventive measure (46 nirsevimab and 2 maternal immunization). Five eligible patients didn't receive prophylaxis treatment, and immunization status remained undetermined for three others. Among the five non-immunized children, the identified reasons were: organizational barrier (n=1), refugee status (n=2), and parental refusal (n=1) and one patient didn't receive prophylaxis as late birth after February (18). During the 2024-25 season, there were 11 cases of RSV in eligible patients. Of these 7 patients received prevention (6 antibodies, 1 pregnancy vaccine) and 4 didn't. After exclusion of 3 patients with undetermined status, an RSV infection occurred in 7/48 (15%) children who received prophylaxis (6 nirsevimab, 1 maternal immunization) , compared with 4/5 (80%) in the non-immunized children. From the seven patients

TABLE 3: Viral co-infections.

	2023-2024	2024-2025
Number of patients	38/105 (36%)	21/47 (44%)
COVID	11	2
AdV [a]	5	9
EnV/HrV [b]	14	6
FLU [c]	4	6
PIV [d]	4	1
hMPV [e]	1	2
HPeV [f]	1	1
HBoV [g]	4	0
CoNL63 [h]	1	0
CoOC43 [i]	2	0

[a] AdV: adenovirus
[b] EnV: enterovírus, HrV: human rhinovirus
[c] INF: Influenza Virus
[d] PIV: Parainfluenza Virus
[e] hMPV: Human Metapneumovirus
[f] HPeV: Human Parechovirus
[g] HBoV: Human Bocavirus
[h] CoNL63: Human Coronavirus NL63
[i] CoOC43: Human Coronavirus OC43

TABLE 4: Comparison of risk factors and severity between RSV single infections and co-infections (both seasons).

	RSV single infection N = 93	Co-infections N = 59	p-value
Risk factors	21 (22.5%)	9 (15.2%)	0.3032 [b]
Oxygen therapy	64 (68.8%)	24 (40.6%)	0.0006164 [a]
Chest X-ray	32 (34.4%)	18 (30.5%)	0.7236 [b]
Antibiotics	21 (22.5%)	19 (32.2%)	0.2566 [b]
High flow oxygen therapy	4 (4.3%)	4 (6.7%)	0.7117 [b]
PICU	4 (4.3%)	4 (6.7%)	0.7117 [b]
Median age [Q1 – Q3] [c] (months)	10.1 [3 – 23.91]	9.0 [3.6 – 24.78]	0.9652 [d]
Median length of stay [Q1 – Q3] [c] (days)	3 [2 – 4]	2 [2 – 4]	0,1078 [e]

[a] Pearsons chi-squared test p-value

[b] Fisher's exact test p-value

[c] Interquartile range

[d] Mann-Whitney U test

[e] Wilcoxon rank sum test with continuity correction

infected despite immunization, viral coinfection was detected in 4 and 2 patients with single RSV infection were transferred to PICU for severe respiratory deterioration and suspected bacterial pneumonia. These two patients had no specific risk factor. The effectiveness of prevention, based on the test-negative design, is 96%. Interestingly, median age increased, from 7.2 months to 20.2 months, respectively. In term of severity, patients hospitalized for an RSV-associated infections during both seasons, a significant decrease of the median length of hospital stay was found: 3 days in 2023-24 compared to 2 days in 2024-25. No significant difference was found regarding other variables as presence of risk factors, oxygen requirement, PICU transfer, antibiotic prescription rate (Table 2). Among the 7 eligible patients hospitalized with documented RSV infection despite receiving prophylaxis, two required a transfer to an external PICU due to severe pneumonia and four presented with a viral co-infection (adenovirus, influenza virus A, human metapneumovirus). The two patients transferred to the PICU had no specific risk factors. The antibiotic prescription rate for patients with a documented RSV infection ranged from 29 (2024-2025) to 34% (2023-2024). Antibiotic prescription was mainly associated with an abnormal chest X-ray (57 to 61%) (Table 2). Nevertheless because of the decrease of hospitalization due to RSV, important reduction in global antibiotics consumption could be seen. Regarding viral co-infections rates identified by respiratory PCR panels in the context of sentinel surveillance (Table 3), no significant difference was observed between the two seasons. During the 2023/2024 season, 38/105 (36%) RSV-positive patients had a documented viral co-infection mostly rhinovirus/enterovirus, followed by SARS-CoV-2). In 2024/2025, the co-infection rate was 44% (21/47), mostly adenovirus, rhinovirus/enterovirus, and influenza. In terms of severity (Table 4), we observed a significant difference (p-value < 0.05) between the co-infection group and the single-infection group regarding the need for oxygen therapy, with a higher O2 use in the single-infection group (both seasons). No difference was observed for other data analysed: mean/median age, length of hospital stay, high-flow oxygen therapy, PICU transfer, chest X-ray performed, and antibiotic prescription.

Discussion

The results observed at CHU UCL Namur (site Dinant) are consistent with published literature regarding the effectiveness of RSV immunization. A 78% reduction in RSV-related hospitalizations was observed among eligible patients, confirming the favourable impact of this strategy. These results are comparable to those reported by Dessers et al. in a Belgian multicentre study, which documented a 78.8% reduction in RSV hospitalizations among infants under six months of age (21). The effectiveness of prevention in our centre, based on the test negative design, is comparable to that reported in previously published studies (Table 5) (13-17). The Sciensano® report on the impact of nirsevimab during the 2024/2025 season, which includes data from 9 SARI surveillance hospitals, estimates the effectiveness of immunization at 85.6%. The reduction in RSV-related hospitalizations is estimated at 35-45% for children under 5 years of age, corresponding to approximately 4,000 cases (22). The advantage of our study is the rigour of real-life surveillance data, which offers greater precision and allows for a more accurate evaluation of the prevention impact at a local level. In line with international observations, RSV immunization campaign achieved a good acceptance rate among targeted population as 86% of eligible patients received an RSV preventive measure. Nevertheless, several limitations were identified in its implementation. The identified limitations of the catch-up strategy included: non-inclusion of children followed in our paediatric department but born outside our maternity unit, a limited time-window for catch-up administration (October 2024) and cumbersome administrative procedures (completion of Chapter IV Agreement Request System forms, transmission of proof of approval, and submission of the prescription to the pharmacy). The administrative burden associated with this campaign, largely assumed by paediatricians, also represented a barrier to its smooth implementation. This organizational complexity may have contributed to certain lapses in immunization pathways, with the hospitalization of non-immunized eligible patients in our cohort serving as a concrete example. Several aspects remain to be assessed during the next RSV season. Since January 2025, the maternal vaccine (Abrysvo®) is reimbursed for pregnant women whose expected delivery falls between September and January. This vaccine needs to be evaluated in real-world conditions in Belgium, even though literature data demonstrate very good vaccine efficacy (19). For the 2025-2026 season, prevention will also be reimbursed for children aged 12–24 months with high-risk comorbidities (congenital heart disease, chronic lung disease, immunodeficiencies, Down syndrome, etc.), entering their second RSV season. In terms of RSV clinical severity, several recent studies have shown a reduced case severity among immunized versus non-immunized children. This is particularly obvious in the Belgian study by Dessers et al., which reported a reduced use of oxygen therapy (both low- and high-flow O2) and less frequent PICU admission (21). These findings are corroborated by other publications, including Jeziorski et al. and Xu et al. (23,24). No statistically significant difference was observed in terms of severity criteria, except a decrease of length of hospital stay, between the RSV hospitalized children in our cohort. This absence of signal could be explained by the small sample size, which limits the statistical power of the analysis. RSV is a major cause of acute respiratory infection in infants and plays a central role in paediatric respiratory morbidity. Several recent studies have emphasized the role of RSV in bacterial complications, particularly pneumococcal pneumonia, and in antibiotic prescribing in viral contexts (1,3,25). The PROMISE-RESCEU cohort, which followed 9,154 children born between 2017 and 2020 in five European countries, prospectively documented RSV infection episodes and their management. Among children hospitalized for RSV-associated LRTI,

TABLE 5: Comparative table of observational studies on the real-world effectiveness of nirsevimab.

Study	Country	Type	Population	Effectiveness on hospitalizations	Effectiveness on severity	Reduction of emergency department visits
Ares-Gómez et al.	Spain (Galicia)	Prospective	13 000	82%	86,9%	69%
Coma et al.	Spain (Catalonia)	Retrospective	26 525	87,6 %	90,1 %	55%
Carbajal et al.	France (Paris)	Case-control	2786	83 %	91 %	
Moline et al.	USA	Case-control	700	90 %		
Wadia et al.	Australia	Case-control	24 000	88,2 %		

22.8% (33/145) received antibiotics, with a proportion reaching 62% in PICU admissions (5/8). Significant inter-country disparities were observed, with prescription rates ranging from 40% in Spain to 9% in the Netherlands (25). Even though RSV is a known risk factor for pneumococcal superinfection, one would expect the in-hospital rate to exceed 10%, especially outside the PICU (1,3). In our department, the antibiotic prescription rate for RSV-positive patients remains within the margins reported in the literature in other countries but well above the ideal recommended rate of 10% (3). Most of our antibiotic prescriptions were based on a pathological chest X-ray but there is a lack of reliable and reproducible criteria to diagnose a bacterial superinfection. This highlights the need to reassess our practices and that antibiotic prescription could benefit from the development of specific algorithm. The development of RSV prevention strategies, including vaccination and monoclonal antibodies, could represent a major opportunity to reduce viral morbidity and inappropriate antibiotic consumption in young children. The role of viral co-infection(s) in the severity of RSV respiratory infections remains a matter of debate. In our cohort, systematic use of PCR respiratory panels in the context of national sentinel surveillance made possible to identify occurrences of multiple respiratory viruses, in addition to standard analysis performed by our laboratory. Our observations align with variations described in the literature, where RSV viral co-infection rates range from 5% to 42%, most often involving rhinoviruses and adenoviruses. Nevertheless, available data remain heterogeneous and sometimes contradictory regarding the clinical impact of co-infections. Some studies suggest a milder clinical presentation in co-infected cases. For example, Milani et al. reported a shorter duration of oxygen therapy and reduced PICU admission rates among co-infected children (26). Similar findings were reported by Stobbelaar et al., with shorter hospital stays and fewer PICU admissions (27). Gil et al., in Portugal, also observed a reduction in hospitalization length of stay for children under two years of age, with no significant impact on oxygen therapy needs, ventilation, or PICU admission (28). However, co-infected patients more frequently received antibiotic therapy (28). Conversely, other studies have reported an association between viral co-infection and increased clinical severity. Richard et al. notably found a 2.7-fold higher risk of PICU admission among co-infected patients compared with those with isolated RSV infection (29). In contrast, Amarin et al. observed no significant impact of co-infections on clinical severity (30). These discrepancies highlight the complexity of interpreting viral co-infections and the need for further studies—including well-characterized cohorts and standardized diagnostic tools—to better assess their role in RSV-related morbidity. Several limitations should be acknowledged in this study, including its monocentric design, the relatively modest cohort size, and the very small non immunized patient subgroup. Those limitations may restrict the generalizations of the findings and reduce both the statical power and accuracy of the estimates.

Conclusion

The first season with an effective RSV prevention strategy implementation at CHU UCL Namur (site Dinant) demonstrated a clear reduction of RSV infections in our paediatric population, compared to previous winter season. The introduction of nirsevimab resulted in a 55% decrease in confirmed RSV cases and a 78% reduction in RSV infections among eligible patients, in line with national and international data, despite operational barriers affecting coverage. No major differences in disease severity were observed between seasons, except for length of hospital stay, likely due to the modest sample size. The role of viral co-infections remains uncertain and warrants further investigation to determine the potential impact on RSV-associated morbidity. RSV prevention also represents a key opportunity to reduce inappropriate antibiotic prescriptions. Expanding prevention strategies could further enhance impact on paediatric winter RSV-hospitalizations. Future seasons will require ongoing monitoring to confirm observed trends, assess overall impact on hospitalizations and frontline care, and tailor prevention strategies according to epidemiological and clinical data.

Statement

The authors have no conflicts of interest in relation to the subject matter of this manuscript.

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