RWD168

Epidemiology of respiratory syncytial virus (RSV) in Uppsala and Stockholm: a population-based study

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INTRODUCTION

- Respiratory Syncytial Virus (RSV) has been known as a respiratory pathogen that causes severe infections in young children.[1] It has also been recognized as an important pathogen in adults with underlying comorbidities and the elderly (65+ years) as well.[2,3]
- In Sweden, the RSV epidemics occur seasonally, starting in early winter and lasts for several months.
- However, RSV incidence and prevalence in the Swedish population is unclear, as are outcomes assessments among adults with RSV. To date, no comprehensive, population-based, long-term outcome studies on RSV in adults have been conducted in Sweden to understand the epidemiology of RSV.
- This study aims to fill this knowledge gap by providing real-world evidence for both adults and children tested for RSV in Sweden.

OBJECTIVE

- To describe the incidence and prevalence of RSV infections in the study population.
- To describe the comorbidities associated with RSV, incidence of comorbidities at the time of RSV and healthcare resource utilization (HCRU) associated with RSV.

METHODS

Study Design

- Population based retrospective cohort study

Data sources

- The Stockholm Healthcare Data Warehouse of Region Stockholm of Region Stockholm (VAL), includes information on all contacts with healthcare financed by Region Stockholm. Data for patient demographics, migration, mortality, prescription drugs dispensed in addition to primary care, secondary care and hospitalizations are available.[4]
- Electronic Health Records (EHR) from Stockholm (TakeCare) and Uppsala (Cambio Cosmic).[5]
- Statistics Sweden provides population statistics by region.[6]
- Patient level data extracted from above claims and EHR of Stockholm and Uppsala were linked to the Statistics Sweden database.

Study Population

- The study population comprises all patients with at least one RSV and/or influenza laboratory test result (positive yes/no) recorded in the laboratory modules in EHR systems in Stockholm/Uppsala between 01 January 2010 and 31 December 2021.

Analysis

- All results are reported using descriptive statistics including frequency, and proportions for categorical variables and mean and standard deviation for continuous variables. Results are also presented using graphical representations including heat maps, histograms, and line graphs.
- Incidences of RSV+ are reported by age groups, year, RSV season, and region. Comorbidities at time of RSV+ test, incidence of diseases after the RSV+ test, and HCRU including hospitalization were also studied
- All analyses were restricted to a single positive test result per patient within a 30-day period defined as a confirmed RSV+ infection episode and one negative test result per day.

1 Analyses was carried out for all age groups, but we present the results only for age groups 0-5 years and 65+ in this abstract as these age groups presented the highest incidence for RSV.

RESULTS[1]

Selected Patient demographics characteristics

- Selected patient demographic characteristics by RSV tests is shown in **Table 1**
- As expected, higher proportion of infants (<2yrs) present in the RSV + group. We also see meaningful percentage of RSV+ incidence among the elderly.

RSV incidence by calendar year and RSV season

- Overall, clear seasonality of RSV+ was observed with Dec to Mar associated with highest incidences.
- Lower RSV+ rates were observed in the season of 2020-2021, which may be attributable to public health measures imposed during the global COVID-19 pandemic.
- Results shown in FIGURE 1 and 2 correspond to data for children aged 0-5 years. Results are similar for elderly.

Comorbidities at Time of Test for RSV+ Patients

- Overall, age 65+ was associated with many comorbidities at the time of RSV+ test. Heart Failure and Coronary Heart Disease were the most prevalent comorbidities (Table 2).
- In children aged 0-5 years, asthma is the most prevalent comorbidity (11.5% in Uppsala and 15.7% in Stockholm).

Incident Diseases After Test for RSV+ Patients

- Within 90 days after RSV+, commonly reported new diseases for the elderly in Uppsala (U) and Stockholm (S) were non-specific respiratory tract infection (22%,27%), non-viral pneumonia (29%, 28%), and secondary pneumonia (19%, 17%).

TABLE 1: Patient demographic and baseline characteristics

	Uppsala (N=24438)		Stockholm (N=198788)	
	RSV+ n=1297	RSV- n=23141	RSV+ n=9451	RSV- n=189373
Age <2yrs	646 (49.8%)	1497 (6.5%)	4920 (52.1%)	17465 (9.2%)
Age ≥65yrs	307 (23.7%)	10149 (43.9%)	1965 (20.8%)	85829 (45.3%)
Female	657 (50.7%)	11621 (50.2%)	4590 (48.6%)	93182 (49.2%)

Total number of RSV tests in Uppsala (N=24438) and Stockholm (N=198788) correspond to 17743 and 134267 unique patient respectively.
Yrs=years

TABLE 2: Comorbidities of elderly patients (> 65y) at the time of RSV+ test

	Uppsala (N=307)	Stockholm(N=1965)
Heart Failure	111 (36.2%)	669 (34.0%)
Coronary Heart Disease	100 (32.6%)	620 (31.6%)
Diabetes	79 (25.7%)	546 (27.8%)
Chronic Obstructive Pulmonary Disease	68 (22.1%)	608 (30.9%)
Asthma	61 (19.9%)	454 (23.1%)

TABLE 3: Bed days of longest inpatient care visit of any cause overlapping with the RSV+ test

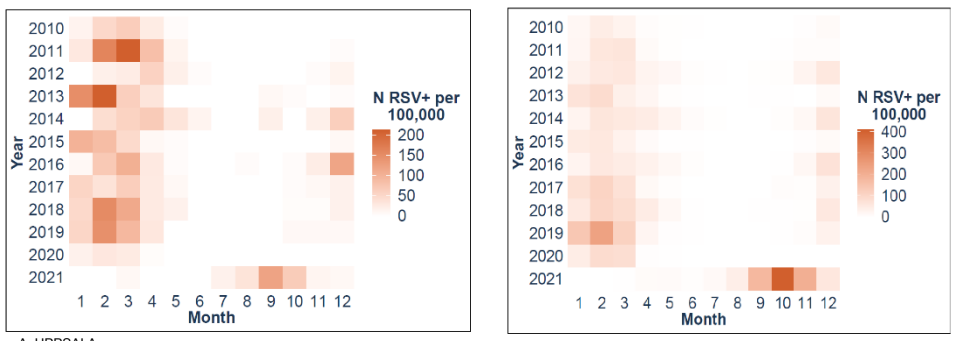
	Uppsala		Stockholm	
Age (in years)	[0-5) (n=755)	[65+] (n=307)	[0-5) (n=5906)	[65+] (n=1965)
Inpatient Care	600 (79.5%)	220 (71.7%)	4661 (78.9%)	1359 (69.2%)
LOS (Mean, SD)	7.0±19.1	10±9.7	5.6±5.3	7.5±8

LOS=Length of Stay (in days); SD=Standard Deviation

Health Resource Utilization

- Young children and elderly had high inpatient rates and the highest mean length of inpatient stay among all age groups (Table 3 and Figure 3). Both inpatient and outpatient visits peak at ±2 weeks around the RSV test.

FIGURE 1: RSV+ Patients by Calendar Year (Age 0-5 years)



Month and week are count from new year

FIGURE 2: RSV+ Patients by RSV Season (Age 0-5 years)

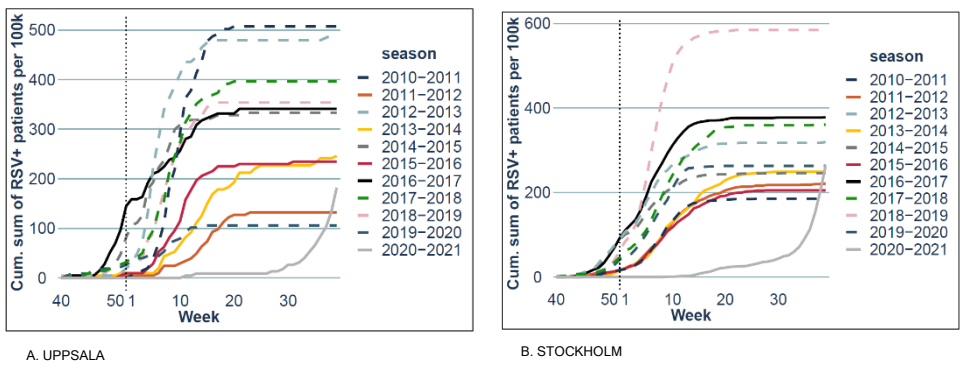
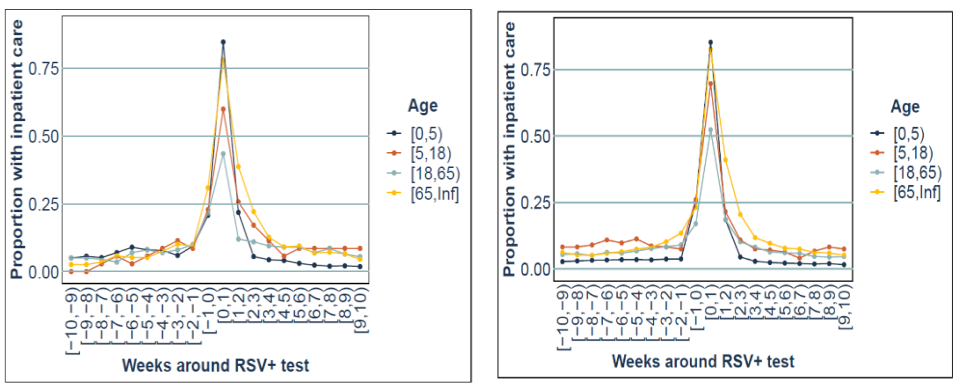


FIGURE 3:RSV+ patients with inpatient care for the weeks around RSV+ test



Presented at the International Society for Pharmacoeconomics and Outcomes Research in Europe (ISPOR EU) Annual Meeting; November 12–15, 2023; Copenhagen, Denmark.

KEY TAKEAWAY

This is the first population-based study in Sweden to delineate the epidemiology of RSV. Elderly and young children have the highest disease burden, calling for research into more effective medical prevention / intervention. It is also imperative to implement existing preventive tools in the region.

CONCLUSIONS

Strong seasonality of RSV+ was observed with winter associated with highest incidence

The elderly (aged 65+) are associated with significant comorbidities at the time of RSV+ test.

Both young children (aged 0-5 years) and elderly (aged 65+) have the highest health resource utilization in terms of inpatient visits and length of stay at the time of RSV+ test.

A remarkable proportion of patients experiences non-specific respiratory tract infections and pneumonia within 90 days after a RSV+ test

Data Management

- This study was approved by the Swedish Ethical Review Authority (reference number 2021-01992).The data are governed by the research authority of Uppsala University. Data management and statistical analyses have been compiled by Sence Research AB (Sence). A data processing agreement, compliant with the General Data Protection Regulation (GDPR) has been established between Uppsala University and Sence. This agreement stipulates and gives documented instructions on how Sence shall handle data on behalf of Uppsala University. Data will be stored and handled according to Sence's Standard Operating Procedures (SOPs). The SOPs follow ISO/IEC 27001:2013 (Information Security Management System) and applicable data security regulations.

Acknowledgement

- This study was funded by Janssen Global Services, LLC.
- The authors also want to acknowledge supports from Elin Ramström and Matilda Almstedt

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