Increase in Reported Respiratory Syncytial Virus Cases Among Adults in the Minneapolis-St. Paul Metropolitan Area, 2014-2018

DEPARTMENT OF HEALTH

Kathy Como-Sabetti, MPH
Minnesota Department of Health
PO Box 64975, St. Paul, MN 55164
651-201-5414, www.health.state.mn.us
kathy.como-sabetti@state.mn.us

Kathryn Como-Sabetti, MPH; Erica Bye, MPH; Anna Strain, PhD; Melissa McMahon, MPH; Ruth Lynfield, MD
Minnesota Department of Health, Infectious Disease Epidemiology, Prevention and Control Division; St. Paul, MN

ABSTRACT

Background: Respiratory syncytial virus (RSV) is a common cause of respiratory infection, typically causing severe disease in young children. We were interested in evaluating trends of severe RSV infections in adults. **Methods**: The Minnesota Department of Health conducts active surveillance for laboratory-confirmed RSV in hospitalized patients in the Minneapolis-St. Paul metropolitan area as part of the CDC Emerging Infections Program. Adult (≥ 18 yrs) cases identified during the RSV seasons (10/1 to 4/30) from 2014 through 2018 were analyzed, and surveys of catchment-area hospital laboratories were conducted regarding respiratory virus panel (RVP) testing. **Results**: 23 catchment area hospitals serve adults. 4 hospitals offered RVP during the 2014-15 and 2015-16 seasons; 8 offered RVP during the 2016-17 and 2017-18 seasons. 350 cases were identified. 312 (89%) were reported from 4 hospitals where RVP was offered throughout the study period. Case increases were observed at 3 hospitals; all of these offered RVP throughout the surveillance period; increases were not observed at hospitals where RVP was added for the 2016-17 and 2017-18 seasons. Cases increased from 42 in 2014-15 to 193 in 2017-18 (X^2=121.08, p<0.01), and breakdown of cases by year was 12%, 15%, 17% and 56% during consecutive seasons. Cases by age group over time generally did not differ; however, cases ≥85 yrs increased from 7% of total cases in 2014-15 to 19% in 2017-18 (X^2=6.84, p=0.01). Overall, 23% of cases were admitted to the ICU and 6% died during hospitalization. The proportions of ICU admissions and deaths did not change over time. **Conclusions**: We found an increase in adult RSV hospitalizations from 2014 to 2018, especially among the oldest age group. This increase was observed only at hospitals where RVP testing was offered throughout the surveillance period. It is unclear if this represents a true increase in RSV hospitalizations or a change in testing practices. However, it does illustrate that RSV should be considered as a cause of severe respiratory illness (SARI) in adults, particularly among the elderly. A more systematic approach in identifying the causes of SARI in adults would be informative, particularly as RSV vaccines and antivirals approach licensure.

BACKGROUND

- RSV causes outbreaks annually during winter and spring months in temperate climates.
- RSV is one of the most common infections of infants and young children causing upper respiratory disease, bronchiolitis, and pneumonia. Almost all children have been infected with RSV by age 2 years.
- Infections in older children and adults are typically less severe and manifest as upper respiratory tract illness. However, pneumonia may develop in older children and adults, especially if there are comorbidities such as cardiopulmonary disease or if the patient is immunocompromised.
- Severe infections are increasingly recognized among elderly patients. However, the burden of severe disease due to RSV in adults, including the elderly, is not well understood because historically adults have been tested for RSV infrequently.
- Respiratory syncytial virus (RSV) has 2 subtypes (A,B) and multiple genotypes within each subtype. Antigenic differences may be associated with susceptibility and possibly with virulence.
- Molecular diagnostic panels using reverse transcriptase polymerase chain reaction (RT-PCR) to detect respiratory viruses, including RSV, have become more widely available in clinical laboratories in recent years and may result in more frequent detection of RSV.

Figure 1. Respiratory syncytial virus (RSV)

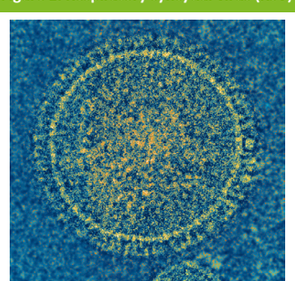


Image courtesy of National Institute of Allergy and Infectious Diseases

METHODS

- Minnesota Department of Health (MDH) conducts active, population-based surveillance in the 7-county Minneapolis-St. Paul metropolitan area among residents who are hospitalized with laboratory-confirmed RSV (reportable disease in catchment area).
- Hospital laboratories in the catchment area are audited to ensure complete case ascertainment.
- RSV surveillance is conducted year-round. This analysis includes only cases occurring during the RSV season defined as having a specimen collection dates from October 1 through April 30.
- MDH conducts an annual survey of clinical hospital laboratories in the catchment area to learn which laboratories offer a PCR respiratory viral panel (RVP) that includes RSV.
- We evaluated the trends and case characteristics of hospitalized adults (≥18 years old) during 2014-2018 RSV seasons (surveillance period) to determine if the availability of RT-PCR panels that include RSV was associated with RSV case reporting.
- Chi-square for trend using EpiInfo 7 was used to determine trends.

RESULTS

Hospital Laboratory Survey

- 23 hospitals in the Minneapolis-St Paul metropolitan area served adult patients.
- 4 hospitals offered RVP during the 2014-2015 and 2015-2016 seasons.
- 8 hospitals offered RVP during the 2016-2017 and 2017-2018 seasons; 4 of these hospitals offered RVP throughout the surveillance period.

RSV Surveillance

- 350 hospitalized RSV cases were identified throughout the surveillance period.
- Median age of cases was 65 years (range 19-101 years), median case age did not change during the surveillance period.
- Overall median length of hospital stay was 4 days, median length of stay differed by surveillance year but there was no significant trend over time.
- Overall, 23% RSV cases were admitted to the ICU, 12% received mechanical ventilation or ECMO, and 6% died. The proportion of cases receiving mechanical ventilation or ECMO decreased during the surveillance period (X^2=5.69; p=0.02), the proportion of cases admitted to an ICU or died did not change over time.
- 98% of RSV cases had co-morbidities (Table 1). Most common co-morbidities were cardiovascular diseases (53%), chronic metabolic diseases (45%), immunocompromised conditions (39%), and chronic lung disease (34%). 53% of cases also had a history of smoking.

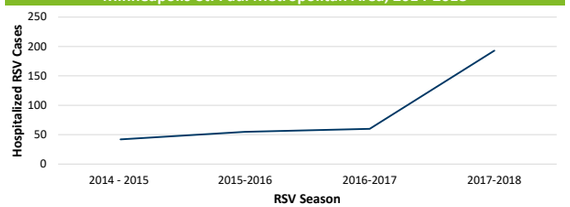
Table 1. Characteristics of RSV Cases by Season, Minneapolis-St. Paul Metropolitan Area, 2014-2018

	2014-2015	2015-2016	2016-2017	2017-2018
Total cases	N = 42 No. (%)	N = 55 No. (%)	N = 60 No. (%)	N = 193 No. (%)
Median age (IQR)	65 yrs (56-73)	61 yrs (43-73)	61 yrs (50-76)	65 yrs (56-82)
Male	23 (55)	19 (35)	22 (37)	79 (41)
Race				
White	30 (71)	40 (73)	40 (67)	149 (77)
Non-White	12 (29)	15 (27)	20 (33)	44 (23)
Co-morbidities				
Presence of Any Co-morbidity	42 (100)	54 (98)	59 (98)	188 (98)
Asthma	6 (14)	14 (25)	10 (17)	32 (17)
Chronic Lung Diseases	16 (38)	22 (40)	11 (18)	71 (37)
Chronic Metabolic Diseases	17 (40)	27 (49)	34 (57)	80 (41)
Cardiovascular Diseases	20 (48)	29 (53)	25 (42)	121 (63)
Neuromuscular/Neurologic Diseases	5 (12)	18 (33)	12 (20)	45 (23)
Immunocompromised Conditions	25 (60)	25 (45)	25 (42)	62 (32)
Renal Diseases	9 (21)	13 (24)	17 (28)	61 (32)
History of Smoking	17 (40)	26 (47)	29 (48)	105 (54)
Other*	16 (38)	27 (49)	25 (42)	28 (15)
Severity of Illness				
Median Length of Stay	5 days	7 days	4 days	4 days
ICU Admission	12 (29)	16 (29)	10 (17)	42 (22)
Mechanical Ventilation/ECMO	8 (19)	10 (18)	6 (10)	17 (9)
Death	4 (10)	4 (7)	6 (10)	8 (4)

IQR =interquartile range
*Other comorbid conditions include liver disease, lupus, obesity, history of IV drug use, blood disorders

- Cases increased from 42 in the 2014-2015 season to 193 in the 2017-2018 season (p <0.01) (Figure 2)
  - 12% of cases were reported in 2014-15
  - 16% in 2015-2016
  - 17% in 2016-2017
  - 55% in 2017-2018

Figure 2. RSV Cases by RSV Season, Minneapolis-St. Paul Metropolitan Area, 2014-2018



- Cases by age group did not differ over seasons for cases age 18-49 years, 50-64 years, 65-74 years, and 75-84 years. (Figure 3)
- Cases ≥ 85 years increased from 7% of total cases in 2014-15 to 19% in 2016-17 (X^2=6.84; p=0.01). (Figure 3)

Figure 3. RSV Cases by Age Group and Season, Minneapolis-St. Paul Metropolitan Area, 2014-2018

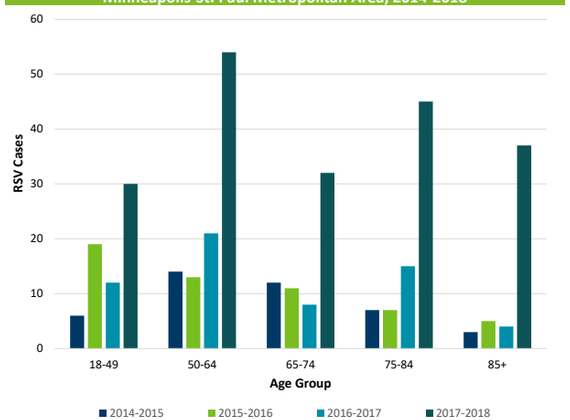


Table 2.Characterists of RSV Isolates and Laboratory Testing by Season, Minneapolis-St. Paul Metropolitan Area, 2014-2018

	2014-2015	2015-2016	2016-2017	2017-2018
Total cases	N = 42 No. (%)	N = 55 No. (%)	N = 60 No. (%)	N = 193 No. (%)
RSV Subtype				
RSV A	21 (50)	2 (4)	25 (42)	12 (6)
RSV B	7 (17)	24 (44)	6 (10)	61 (32)
RSV, Unspecified	14 (33)	29 (53)	29 (48)	119 (62)
RSV Test Method				
Antigen	4 (10)	14 (25)	9 (15)	12 (6)
PCR	33 (78)	41 (75)	51 (85)	181 (94)
Culture	5 (12)	0 (0)	0 (0)	0 (0)

RSV Cases and Laboratory Testing

- 88% (308/350) of cases were reported from the 4 hospitals in which RVP was offered during the surveillance period
  - 3 hospitals observed case increases over time, RVP were offered at these hospitals throughout the surveillance period
  - Increases in RSV cases were not observed at hospitals where RVP were added for the 2016-2017 and 2017-2018 seasons.
- RSV subtype was specified for 45% of cases. The proportion of cases with an unspecified RSV subtype increased over the surveillance period (x^2=12.91, p<0.01). Of RSV cases with a known subtype, 2014-2015 and 2016-2017 RSV A was the dominant subtype, in 2015-2016 and 2017-2018 cases were predominately RSV B. (Table 2)
- 88% of RSV cases were identified by PCR testing, 11% by rapid antigen and 1% by culture. Cases identified by testing method did not change during the surveillance period. (Table 2)

LIMITATIONS

- Cases are tested at the discretion of the clinician. Additional cases may have occurred and were not tested.
- Testing methods can influence results, antigen detection or viral isolation among adult patients can have a lower sensitivity than PCR.
- Test ordering practices and total number of RSV test by test method, facility, and age groups were not available.

CONCLUSIONS

- RSV can result in serious illness among adult patients, especially patients who have co-morbid health conditions or the elderly.
- Cases of hospitalized RSV among adults were much higher during 2017-2018, than during other seasons. The case increase occurred at hospitals using RVP testing throughout the time periods, suggesting that the increase was not due to laboratories switching to RVP.
- Number of cases ≥ 85 years of age and older increased significantly during the surveillance period and accounted for almost one-fifth of adult cases.
- RSV surveillance data among pediatric patients from the same catchment area in Minnesota did not observe a large increase in cases during the 2017-2018 season.
- A better understanding of testing ordering practices, possibly through a clinician survey and data on total number of RSV tests ordered, may be helpful to further determine if the increase in RSV cases is due to a testing artifact or an increase in disease occurrence in adults.
- Characterization and comparison of the RSV strains may provide insight in understanding severe seasons of RSV.
- RSV surveillance among adults is important to understand the burden of disease, ascertain high-risk groups for RSV vaccines and antivirals nearing licensure, and to understand strain differences and virulence factors.

ACKNOWLEDGEMENTS

We gratefully acknowledge the contributions of Sara Bistodeau, Richard Danila, Hannah Friedlander, and Minnesota Infection Preventionists. Funded in part by CDC EIP Cooperative Agreement NU50CK000490-02-00.