



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



The Epidemiology of Respiratory Syncytial Virus in New York City during the Coronavirus Disease-2019 Pandemic Compared with Previous Years

Katia C. Halabi, MD¹, Lisa Saiman, MD, MPH^{1,2}, and Philip Zachariah, MD, MSc^{1,2}

Fewer respiratory syncytial virus infections were observed in 2020-2021 with interseasonal resurgence. Children were more likely to have severe disease with less known risk factors in comparison with controls from 2018-2019. The overall codetection rates were similar, but with higher parainfluenza, rhinovirus/enterovirus, and lower influenza proportions compared with previous seasons. (*J Pediatr* 2022;242:242-4).

Coronavirus disease 2019 (COVID-19) had an impact on the epidemiology of respiratory syncytial virus (RSV) during the 2020-2021 winter season in the US.¹ These epidemiologic changes could be related to interactions between respiratory viruses and/or ongoing COVID-19 mitigation efforts. We describe RSV infections at a children's hospital during the first winter RSV season (2020-2021) since the advent of COVID-19 and compare the epidemiology of these infections with RSV infections in previous seasons. We hypothesized that the public health mitigation measures implemented in response to the pandemic would decrease the overall rates of medically attended RSV, similar to observations made for influenza and RSV in early 2020, but that the characteristics of these patients would be similar to the characteristics of patients with RSV in previous seasons.²

Methods

We conducted a retrospective review of children and adolescents with RSV who presented to the New York-Presbyterian Morgan Stanley Children's Hospital Emergency Department and had a positive test for RSV on nasal swab samples tested by a multiplex reverse transcriptase polymerase chain reaction assay (FilmArray Panel, BioFire Diagnostics, Inc). Children attended only in the emergency department were offered testing with multiplex reverse transcriptase-polymerase chain reaction at the discretion of the treating physician. Testing availability for this assay did not change during the study period.

To assess changes in the epidemiology of medically attended RSV, we identified cases age 21 years or younger from November 1 to April 30 during 3 respiratory viral seasons (2018-2019, 2019-2020, and 2020-2021). A broader age group was selected to fully ascertain potential epidemiologic changes.

We compared the demographic and clinical characteristics of RSV cases identified during the 2020-2021 season and an

equal number of randomly selected RSV cases from 2018-2019. The 2018-2019 season was selected instead of the 2019-2020 because state-wide mitigation measures were implemented in March 2020 and circulation of SARS-CoV-2 in New York City likely occurred before March 2020.³ We excluded patients with codetections of other respiratory pathogens from this analysis. For each patient, we collected presenting symptoms, clinical syndromes (bronchiolitis, croup, asthma/reactive airway disease exacerbation) noted in the electronic medical record by attending physicians, comorbidities (prematurity, cardiac disease, asthma/reactive airway disease), sick contacts if noted, and severity of disease (defined as inpatient hospitalization, oxygen saturation $\leq 94\%$ at presentation, and/or the need for respiratory support).

Second, we graphically compared the number and temporal distribution of cases between years. Last, we compared the overall proportion and distribution of other respiratory virus codetections among all 3 seasons. Categorical and continuous variables were compared using the Fisher exact, χ^2 , and Wilcoxon rank-sum test, as appropriate. The Columbia University Irving Medical Center Institutional Review Board approved the study.

Results

During the 2020-2021 season, 143 children and adolescents had medically attended RSV. Of these, 90 had only RSV detected. The overall number of RSV cases decreased in 2020-2021 compared with both the 2018-2019 and 2019-2020 seasons with differing epidemiologic curves (**Figure**). Compared with RSV cases without codetection identified in 2018-2019 ($n = 90$), RSV cases in 2020-2021 ($n = 90$) had similar median age, proportions of prematurity, and cardiac disease, but less asthma/reactive airway disease and more croup at presentation (**Table 1**). Significantly more

COVID-19	Coronavirus disease 2019
SARS-CoV-2	severe acute respiratory syndrome coronavirus2
RSV	respiratory syncytial virus

From the ¹Department of Pediatrics, Columbia University Irving Medical Center; and the ²Department of Infection Prevention and Control, New York-Presbyterian Hospital, New York, NY

The authors declare no conflicts of interest.

0022-3476/\$ - see front matter. © 2021 Elsevier Inc. All rights reserved.
<https://doi.org/10.1016/j.jpeds.2021.10.057>

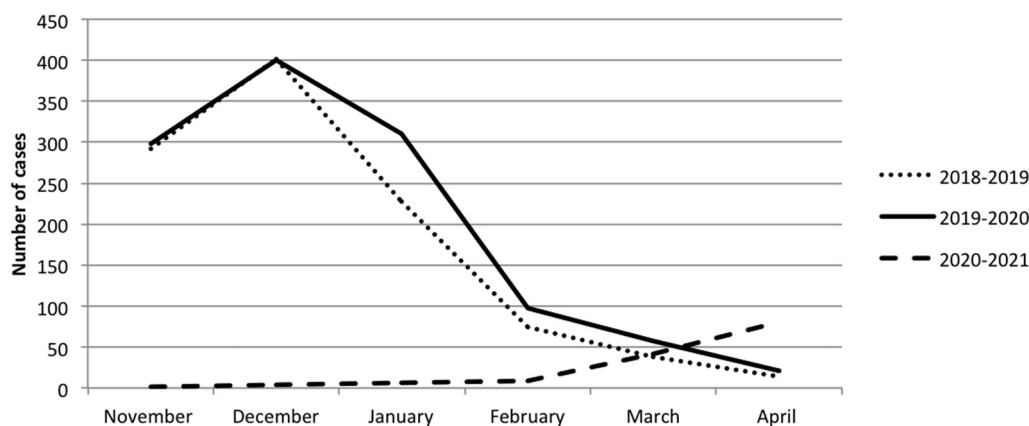


Figure. Comparison of epidemiologic curves of medically attended RSV during 3 winter respiratory viral seasons (2018-2019, 2019-2020, and 2020-2021).

cases in 2020-2021 were hospitalized and required oxygen supplementation.

The overall proportion of viral codetections was similar across the 3 seasons, but the distribution of some pathogens differed (Table II; available at www.jpeds.com). Rhinovirus/enterovirus was most commonly codetected in all 3 seasons, with the highest proportion of rhinovirus/enterovirus noted in 2020-2021. Parainfluenza viruses were detected at a significantly higher rate in 2020-2021 than previous seasons.

Discussion

Lower numbers of medically attended RSV were observed in the first winter since the onset of the COVID-19 pandemic in New York City, as described in the southern hemisphere.⁴

Possibly consistent with our hypothesis, that anti-severe acute respiratory syndrome coronavirus (SARS-CoV-2) mitigation measures were instrumental in this decrease, current and comparator season were similar in multiple aspects (median age, bronchiolitis as the predominant syndrome, and proportion of viral codetections). However, there were some epidemiologic differences. Despite lack of known risk factors, a greater proportion of children had severe disease in 2020-2021. This finding could potentially reflect families' avoiding emergency room care for milder illness during the pandemic. Lower rates of asthma exacerbations have been noted during COVID-19, so it is intriguing that in the 2020-2021 RSV cohort, asthma was a less common presentation.⁵

Differences in the distribution of some codetected viruses were observed. Parainfluenza was significantly higher and lower proportions of influenza and higher proportions of rhinovirus/enterovirus were observed. This could arise from the varying impact of mitigation measures on transmission of specific viruses or the interaction of SARS-CoV-2 with these viruses in the larger population. The increase in RSV cases at the end of winter into early spring has been observed throughout New York state and suggests interseasonal RSV resurgence associated with the relaxation of COVID-19 preventive efforts similar to observations in Australia.^{1,6} This finding has implications for the duration of palivizumab prophylaxis that may need to be tailored more specifically to local epidemiology of RSV. In our institution, palivizumab prophylaxis was extended as per the recommendation of the department of health. Limitations of this study include possible differences in health seeking behavior or testing biases between seasons. Ongoing RSV surveillance is essential to fully explore the continuing impact of the COVID-19 pandemic. ■

Table I. Characteristics of patients with RSV during the 2020-2021 season vs the 2018-2019 season

Characteristics	RSV cases (2020-2021), n = 90	RSV cases (2018-2019), n = 90	P value
Median age in months (IQR)	9.5 (1-28)	8.5 (4-24)	.61*
Age categories			.03
≤12 months	49 (54.4%)	58 (64.4%)	
13-24 months	17 (18.9%)	14 (15.6%)	
25-35 months	8 (8.9%)	1 (1.1%)	
3-6 years	11 (12.2%)	13 (14.4%)	
7-11 years	5 (5.6%)	1 (1.1%)	
12-17 years	0 (0%)	3 (3.3%)	
Reported sick contacts	40 (44.4%)	34 (37.8%)	.36
Comorbid conditions			
Prematurity	7 (7.8%)	13 (14.4%)	.16
Asthma/reactive airway disease	4 (4.4%)	13 (14.4%)	.02
Congenital cardiac disease	4 (4.4%)	3 (3.3%)	.63
Clinical syndromes			
Bronchiolitis	61 (67.8%)	52 (57.8%)	.58
Croup	5 (5.6%)	0 (0.0%)	.019
Asthma exacerbation	0 (0%)	9 (10.0%)	.02
Hospital admission	59 (65.6%)	42 (46.7%)	.01
Hypoxemia/oxygen requirement	44 (48.9%)	25 (27.8%)	.04

Values are number (%).

*Wilcoxon signed-rank test.

Submitted for publication Jul 23, 2021; last revision received Oct 25, 2021; accepted Oct 27, 2021.

Reprint requests: Philip Zachariah, MD, MSc, 650 West 168th St PH4, New York, NY 10032. E-mail: pz2177@cumc.columbia.edu

References

1. The National Respiratory and Enteric Virus Surveillance System (NREVSS)-Respiratory Syncytial Virus Surveillance RSV State Trends Web site. Accessed June 11, 2021. <https://www.cdc.gov/surveillance/nrevss/rsv/state.html> - NY
2. Sherman AC, Babiker A, Sieben AJ, Pyden A, Steinberg J, Kraft CS, et al. The effect of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) mitigation strategies on seasonal respiratory viruses: a tale of 2 large metropolitan centers in the United States. *Clin Infect Dis* 2021;72:e154-7.
3. Stadlbauer D, Tan J, Jiang K, Hernandez MM, Fabre S, Amanat F, et al. Repeated cross-sectional sero-monitoring of SARS-CoV-2 in New York City. *Nature* 2021;590:146-50.
4. Yeoh DK, Foley DA, Minney-Smith CA, Martin AC, Mace AO, Sikazwe CT, et al. The impact of coronavirus disease 2019 public health measures on detections of influenza and respiratory syncytial virus in children during the 2020 Australian winter. *Clin Infect Dis* 2021;72:2199-202.
5. Shah SA, Quint JK, Nwaru BI, Sheikh A. Impact of COVID-19 national lockdown on asthma exacerbations: interrupted time-series analysis of English primary care data. *Thorax* 2021;76:860-6.
6. Foley DA, Yeoh DK, Minney-Smith CA, Martin AC, Mace AO, Sikazwe CT, et al. The interseasonal resurgence of respiratory syncytial virus in Australian children following the reduction of coronavirus disease 2019-related public health measures. *Clin Infect Dis* 2021;73:e2829-30.

Table II. Codetection of another respiratory virus with RSV each season*

	Season 2018-2019	Season 2019-2020	Season 2020-2021
Total cases positive for RSV	1036	1162	143
Codetection of another respiratory virus	354 (34.2%)	368 (31.7%)	50 (34.9%)
Rhinovirus/enterovirus	157 (15.2%)	148 (12.7%) [†]	29 (20.3%)
Influenza	30 (2.9%)	41 (3.5%)	0 (0%)
Coronavirus	96 (9.3%)	108 (9.3%)	11 (7.7%)
Parainfluenza	19 (1.8%) [†]	13 (1.1%) [†]	8 (5.6%)
Human metapneumovirus	13 (1.3%)	6 (0.5%)	0 (0%)
Adenovirus	67 (6.5%)	87 (7.5%)	13 (9.1%)
SARS-CoV-2	0 (0%)	0 (0%)	1 (1.6%)

RSV, respiratory syncytial virus; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

*Children had coinfections with >1 virus.

[†]Comparator season proportion significantly different from the 2020 to the 2021 season ($P < .05$).