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Features of an Atypical RSV Surge During the COVID-19 Pandemic

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Abstract

This study describes the clinical features, severity, and outcomes in children <5 years of age with respiratory syncytial virus (RSV) infection during an atypical summer surge during the coronavirus disease 2019 (COVID-19) pandemic. Although timing was uncharacteristic, clinical features and illness severity were representative of a typical RSV season. Co-infection with SARS-CoV-2 was low.

Keywords

RSV, COVID-19, pandemic, season, children

Introduction

Respiratory syncytial virus (RSV) is a well-known cause of respiratory illness in children, accounting for >500,000 emergency department (ED) visits and >50,000 hospitalizations in the United States annually.[1,2] As surveillance data indicate, RSV season for most of the United States typically begins October-November, peaks December-February, and ends April-May.[1] However, during the coronavirus disease 2019 (COVID-19) pandemic, RSV infection rates were unusually low in the winter of 2020.[3-8] Some reasons postulated for low infection rates included implementation of restrictive measures such as social distancing, stay-at-home orders, and nonpharmaceutical interventions like face mask mandates.[3-8]

Recent studies have reported atypical surges of RSV infection during the 2021 spring and summer seasons, coinciding with relaxation of physical distancing measures. Though these studies reported RSV incidence,[4-8] there is paucity of data on clinical characteristics, especially in the United States. Agha and Avner[4] reported increased hospitalization rates and intensive care unit (ICU) admissions during New York's atypical surge, but this was not noted in similar studies from Australia.[8,9] Our objective is to describe clinical features, illness severity, risk factors for severe illness, and outcomes in children <5-years-old with RSV infection during an uncharacteristic summer surge at a tertiary care children's hospital.

Methods

We performed a retrospective chart review of all children <18-years-old who tested positive for RSV via polymerase chain reaction (PCR) nasopharyngeal swab in the ED and inpatient settings at Children's Hospital of Michigan in Detroit between March-September 2021. During this study period, an institutional policy required testing for RSV, SARS-CoV-2, and influenza in all children with respiratory symptoms and those who required admission. We included only children <5-years-old as this group has been reported to have the highest disease burden with RSV.[2] We abstracted information on demographics, past medical history, ED disposition, interventions performed, return visit within a week, and outcomes. We defined severe disease as ICU admission,

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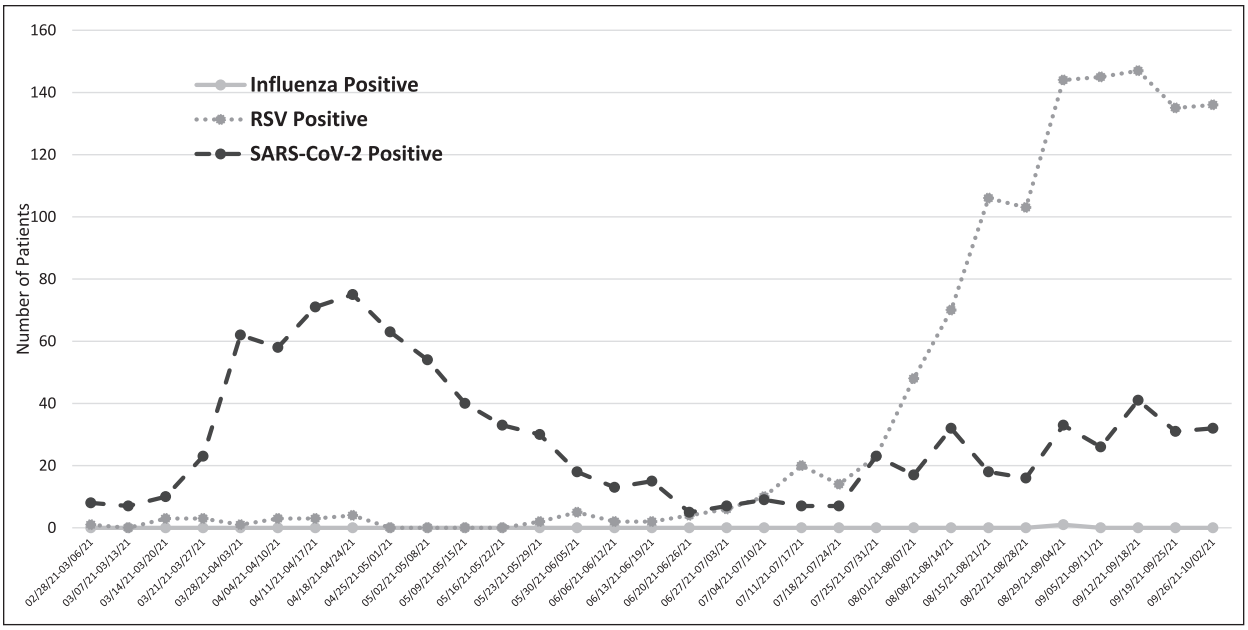

Figure 1. Weekly test positives for RSV, influenza, and SARS-CoV-2 during the study period.

positive pressure ventilation (PPV) requirement, or death. This study was approved by the Central Michigan University Institutional Review Board.

Data variables were systematically coded and entered by trained abstractors in a standardized collection form in REDCap database. Data were input into SPSS for descriptive and bivariate analysis. Adjusted odds ratios and confidence intervals reported were computed from cross-tabulations for hospitalizations and severe disease by age, prematurity, and risk status.

Results

During the study period, 6531 children underwent testing for RSV at our institution of whom 1100 (16.8%) tested positive. Weekly test results for RSV, influenza, and SARS-CoV-2 during the study period are shown in Figure 1. We analyzed 1039 patients with RSV infection who were <5-years-old. Majority of those infected were male (n = 562; 54.1%), African American (n = 615; 59.2%), and non-Hispanic (n = 685; 66.0%), and a minority of patients had a history of prematurity (n = 130;12.5%) and chronic medical conditions (n = 171; 16.5%). Asthma was the most common comorbidity noted in 104 patients (60.8%), with chronic lung disease and congenital heart disease noted in 12 (7.0%) and 23 (13.5%) patients, respectively. Preschool children and toddlers made up over half of our study cohort (0-2 months [n = 129; 12.5%], 3-5 months [n = 114; 11.0%], 6-11 months [n = 172; 16.6%], 12-23 months [n = 254; 24.4%], and 2-5 years old [n = 370; 35.6%]). Only 13 children (1.3%) had co-infection with SARS-CoV-2. An expanded respiratory viral panel was performed in 13 patients, and of these one each tested positive for rhinovirus, rhino/enterovirus, and adenovirus. Two-thirds (63.6%) of patients were discharged home from the ED.

Among the 378 patients hospitalized for RSV infection, 71.3% were infants 0 to 2 months of age. The adjusted odds ratio of hospitalization among age groups is shown in Figure 2A. The most common intervention performed during hospitalization was oxygen supplementation (low flow; <6 L, n = 93; 24.6%, high flow nasal cannula; >6 L/min, n = 251; 66.4%). A minority (n = 79; 7.6%) had severe disease requiring either ICU admission (n = 77; 7.4%) or both ICU admission and PPV (n = 36; 3.5%). Figure 2B shows the risk of severe disease among age groups, with infants 0 to 2 months of age having the highest odds of severe disease. Children who were born premature and those with chronic medical conditions had higher odds of severe disease (prematurity: odds ratio [OR] = 2.16; 95% confidence interval [CI]: 1.22-3.83; chronic medical condition: OR = 4.00; 95% CI: 2.18-7.34) when compared to those who were born at term and those who did not have a chronic medical condition. None of the children with RSV and SARS CoV-2 co-infection had severe disease. There were no deaths noted in our cohort. Among the 73 patients (7.0%) who had a return visit to the ED within a week, 32 were hospitalized and 6 had severe disease (ICU admission: 5, PPV: 3) on readmission. There was no significant difference in the mean age (6.94 vs. 6.11; P = .36), proportion of children with

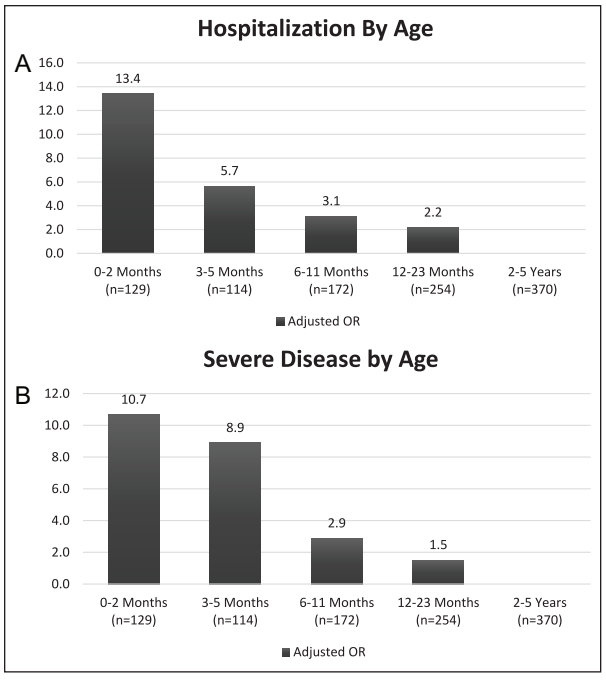

Figure 2. Risk of hospitalization and severe disease by age group.

prematurity (10.9% vs. 6.5%; $P = .72$), or proportion of children with chronic medical condition (7.2% vs. 3.6%, $P = .05$) among those who had a return visit and were hospitalized when compared to those who did not have a return visit.

Discussion

Our results illustrate that during this atypical RSV season a higher proportion of infection was noted among children 2 to 5 years of age. However, young infants, those with prematurity, and those with a chronic medical condition had a higher risk of hospitalization and severe disease. These risks for hospitalization and severe disease are comparable to those reported in previous studies.[2,9]

Prior to the pandemic, atypical seasonality of RSV infections has rarely been reported in the United States, with one summer outbreak in Minnesota in 2017 secondary to a new genetic lineage of the RSV strain.[10] More recently, Agha and Avner[4] and Foley et al[8] have reported an atypical summer surge of RSV infections during the pandemic in New York and Australia, respectively. The primary reason proposed for these atypical surges was relaxation of pandemic-related physical distancing measures.

Our results of higher positivity rate in preschool children are consistent with that reported by Saravanos et al,[9] who noted similar findings during Australia's summer surge. They postulated that this increased positivity rate may be secondary to immune-naive older children and increased testing rates in this population. Foley et al[8] reported a similar increase in median age of RSV positive patients to 18.4 months during the pandemic when compared to the range of 7.3 to 12.5 months during pre-pandemic years. These results contrast with those reported by Agha and Avner[4] where the median age of the cohort was noted to be 6 months (range: 12 days to 9 years). However, the study period for the latter study extended until May 2021, when most of the day care centers were still closed and virtual schooling was still in effect.

Agha and Avner[4] reported a higher hospitalization rate (two thirds of cohort required admission) and Foley et al[8] reported a 2.5-fold higher admission rate during their atypical RSV surges. Agha and Avner[4] also reported that most of their hospitalized cohort required admission to the ICU. This contrasts with our cohort as most patients were discharged home (63.6%) and a minority (7.4%) required ICU care. The reason for this difference is unclear. However, Saravanos et al[9] reported an overall decrease in hospitalization frequency and ICU admission compared to the expected value. Other studies from France[11] and Western Australia[8] have demonstrated findings like ours, with atypical surges of RSV that were not severe compared to previous seasons. Hall et al[2] and Ramilo and Mejias[10] reported hospitalization rates of 17 per 1000 and 14.4 per 1000 in young infants, with premature children accounting for one half of hospitalizations. Coinfection with SARS-CoV-2 in these studies, like ours, were noted to be exceptionally low, with no severe disease burden in these patients.[4-8]

Our study has several limitations. It is a single center study with a small sample size, and its retrospective nature could have limited the information that was available. We did not compare this atypical surge with prior typical surges. PCR testing was performed at the discretion of the clinician, and school SARS-CoV-2 testing mandates could have resulted in overperformance of testing, possibly influencing positivity rates. Only those children who presented to the hospital were tested, thus our results do not reflect RSV positivity in the community.

Conclusion

Although RSV infection during the COVID-19 pandemic had an atypical seasonal surge, clinical features were representative of a typical RSV season. Though a higher rate of infection was seen in pre-school children, timing of infection did not change demographics and

risks for hospitalization and severe disease. Continued ongoing surveillance for viral pathogens is needed for timely recognition of seasonality changes and preparedness to manage atypical surges.

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Author Contributions

TA and NK conceptualized and designed the study, provided supervision and oversight for conduct of the study, drafted the initial manuscript and edited and revised the manuscript. AW conceptualized and designed the study, provided supervision and oversight for conduct of the study, edited and revised the manuscript. PS provided supervision, oversight for conduct of the study, data curation and verification and edited and revised the manuscript. KL performed data curation and verification and edited and revised the manuscript. HS performed data curation and edited and revised the manuscript. DM performed the statistical analysis and edited and revised the manuscript. All authors have reviewed and approve the final manuscript as submitted.

Declaration of Conflicting Interests

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