

# Population-Based Incidence, Healthcare Resource Utilization, and Cost Among Children <5 Years of Age Hospitalized With RSV, Salt Lake County, Utah, 2019-2020

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## BACKGROUND

- Respiratory syncytial virus (RSV) is one of the most common causes of childhood lower respiratory tract infection (LRTI) worldwide
- Moderate and severe RSV infections are associated with significant healthcare resource utilization in outpatient and inpatient settings
- Accurate data on the burden and cost of hospitalizations in children for RSV are critical to inform the rationale for RSV vaccine and immunoprophylaxis development

## METHODS

- Salt Lake County resident children (<5 years of age) hospitalized with laboratory-confirmed RSV LRTI at Primary Children's and Riverton Hospitals in Salt Lake City, Utah, for the 2019-2020 RSV season were prospectively identified
- Patients were identified using Intermountain Healthcare electronic data warehouse
- Multiplex PCR for 17 respiratory viruses, including RSV, was performed for all children admitted with respiratory illness
- We evaluated the following outcomes:
  - Demographics
  - Healthcare resource utilization (HCRU) among hospitalized children, intensive care unit (ICU) stays, mechanical ventilation, length of stay (LOS), and hospital costs
  - Salt Lake County RSV hospitalization rates, adjusted for market share (i.e., %children ≤5 years that use the hospitals among those living in SLC)
- Palivizumab utilization was only identifiable among children who were covered by SelectHealth insurance. We extrapolated the utilization rate to other insurance beneficiaries and calculated palivizumab exposure adjusted incidence.

## RESULTS

**Table 1. Demographic and Clinical Characteristics of Children Hospitalized With Community-Acquired Laboratory-Confirmed RSV Infection (N = 284)**

Characteristics	No. of Patients (%)
<b>Age (months)</b>	
Mean	14.1
Median	9.7
(IQR)	3.5-21.3
<6 months	106 (37)
6-<12 months	49 (17)
12-<24 months	69 (24)
24-<36 months	41 (14)
36-<48 months	10 (4)
48-<60 months	9 (3)
<b>Female (%)</b>	133 (47)
<b>Race</b>	
White	191 (67)
Pacific Islander/Native Hawaiian	24 (9)
Asian	11 (4)
Black	2 (2)
Other	52 (18)
<b>Insurance</b>	
Private	260 (91)
SelectHealth (IH insurance)	57 (20)
Medicaid	16 (6)
Self-pay	8 (3)
<b>Any chronic medical conditions (CMC) (%)<sup>a</sup></b>	67 (24)
≥2 CMCs (%)	33 (12)
Neurological/neuromuscular (%)	12 (4)
Cardiovascular (%)	39 (14)
Respiratory (%)	15 (5)
Renal (%)	9 (3)
Gastrointestinal (%)	15 (5)
Hematologic (%)	4 (1)
Genetic/metabolic (%)	34 (12)
Malignancy (%)	1 (0.4)
H/o prematurity <37 weeks (%)	17 (12)
Transplant (%)	1 (0.4)
<b>RSV alone</b>	198 (70)

<sup>a</sup>Based on Feudtner classification (Feudtner C, et al. *Pediatrics*. 2000;106(1 pt 2):205-209) and identified if present any time prior to current hospitalization or on admission. IH, Intermountain Healthcare

### Palivizumab Use Adjustment

- Palivizumab utilization rate: 4.9% (2 of 41) among IH-covered children <2 years of age who were hospitalized due to RSV
- Extrapolation found 11 of 224 RSV hospitalizations to be exposed to palivizumab
- Palivizumab exposure adjusted incidence calculation  

$$213 \text{ (unexposed)} + 11 \text{ (exposed)} \times 1/0.5 \text{ (palivizumab efficacy)} = 34754 \times 0.71 \text{ (market share adjusted denominator)} = 952/100,000/\text{yr}$$

**Table 2. Healthcare Resource Utilization, and Hospital Cost Among Children Hospitalized With Community-Acquired Laboratory-Confirmed RSV Infection**

Age (n)	LOS (d) Mean Median (IQR)	Hospital Cost (\$) Mean Median (SD)	ICU Admission (%)	Mechanical Ventilation (%)	Chronic Medical Condition (%)	Antibiotics (%)	Steroids (PO/IH) (%)	Bronchodilator (%)	Other <sup>a</sup> (%)
<b>&lt;6 mo (106)</b>	3.5 2.2 1.6-4.0 (3.5)	14,856.07 6,338.70 4,155.76-13,334.35 (20,022.62)	30 (28)	14 (13)	14 (13)	49 (46)	11 (10)	23 (22)	93 (88)
<b>6 mo to &lt;1 yr (49)</b>	3.8 2.7 1.9-3.6 (4.1)	15,458.55 7,031.34 4,092.06-14,878.67 (22,601.77)	14 (29)	4 (8)	14 (29)	23 (47)	6 (12)	19 (39)	49 (100)
<b>1 to &lt;2 yr (69)</b>	3.5 2.7 1.5-3.7 (4.7)	12,154.55 6,475.83 3,962.80-10,334.02 (24,076.07)	14 (20)	—	17 (25)	31 (45)	15 (22)	35 (51)	69 (100)
<b>2 to &lt;3 yr (41)</b>	2.6 1.9 1.4-3.1 (1.8)	8,294.04 5,405.98 3,225.72-9,133.67 (7,283.43)	8 (20)	—	13 (32)	22 (54)	14 (34)	21 (51)	41 (100)
<b>3 to &lt;4 yr (10)</b>	2.6 1.8 1.1-3.1 (2.0)	7,169.84 4,237.36 3,523.00-7,183.20 (6,118.69)	1 (10)	—	4 (40)	3 (30)	3 (30)	5 (50)	10 (100)
<b>4 to &lt;5 yr (9)</b>	2.8 2.2 1.1-2.8 (2.3)	11,339.42 5,177.60 3,806.77-11,490.15 (12,525.51)	3 (30)	—	5 (56)	4 (44)	7 (78)	8 (89)	8 (89)
<b>All (284)</b>	<b>3.4</b> <b>2.3</b> <b>1.6-3.6 (3.7)</b>	<b>12,974.56</b> <b>6,338.70</b> <b>3,963-11,490.97 (19,863.33)</b>	<b>70 (25)</b>	<b>18 (6)</b>	<b>67 (24)</b>	<b>132 (46)</b>	<b>56 (20)</b>	<b>111 (39)</b>	<b>268 (94)</b>

<sup>a</sup>Antipyretics; d, days; SD, standard deviation; LOS, length of stay; ICU, intensive care unit; PO, per os; IH, inhaled.

**Table 3. Population-Based Incidence of RSV Hospitalization per 100,000 Among Salt Lake County Resident Children (2019-2020)**

Age	2018 Salt Lake County Population	Uncorrected		Corrected for Market Share (71%)	
		Number Hospitalized	Hospitalization/100,000/yr (95% CI)	Number Hospitalized	Hospitalization/100,000/yr (95% CI)
<b>&lt;6 mo*</b>	8695 <sup>b</sup>	106	1180 (980-1440)	149	1700 (1450-2000)
<b>6 mo to &lt;1 yr*</b>	8695 <sup>b</sup>	49	560 (430-750)	69	790 (630-1000)
<b>1 to &lt;2 yr*</b>	17364	69	400 (180-850)	97	558 (180-850)
<b>2 to &lt;3 yr</b>	17158	41	230 (70-620)	58	338 (140-780)
<b>3 to &lt;4 yr</b>	17184	10	60 (10-360)	14	81 (10-360)
<b>4 to &lt;5 yr</b>	17467	9	60 (10-360)	13	74 (10-360)
<b>&lt;2 yr*</b>	34754	224	645 (560-730)	315	906 (820-1020)
<b>All (&lt;5 yr)</b>	<b>85562</b>	<b>284</b>	<b>331 (220-470)</b>	<b>400</b>	<b>460 (340-640)</b>

<sup>a</sup>Riverton Hospital and Primary Children's Hospital market share of 71%. <sup>b</sup>Assumes <1 year of age is divided almost equally between <6 months and 6 months to 1 year.

\*Palivizumab exposure-adjusted population-based incidence was available for an aggregated sub-cohort of children age <2. The incidence was updated from 906 per 100,000 to 952 per 100,000, when estimating 50% of palivizumab efficacy and 4.9% of palivizumab utilization among the RSV hospitalization cohort. See the left box for more detail.

## RESULTS

- Of the 284 children <5 years hospitalized with RSV, the majority (78%) were <2 years
- During hospitalization, 25% were admitted to the ICU, 6% required mechanical ventilation, and 46% received antibiotics. Median hospital LOS was 2.3 days (IQR 1.6- 3.6)
- Mean hospital cost was \$12,975, totaling \$3.7 million for the study cohort; 42% was accounted for by children <6 months
- Children with CMC's were significantly older than healthy children (median age 18.7 mon vs. 12.7 mon;  $p=0.001$ ) but had comparable mean hospital costs (\$14,208 vs. \$12,593) and median hospital LOS (2.4 vs. 2.3)
- Population-based incidence rates of RSV hospitalization were 4.6/1000 and 9.1/1000 for children <5 years and <2 years respectively
- Extrapolation of palivizumab utilization rate (based on children < 2 years who are covered by IH insurance) identified ~11 of 242 (4.9%) RSV hospitalizations could have been exposed to Palivizumab
- Adjusting for palivizumab, efficacy and utilization among the hospitalized RSV cohort, population-based RSV hospitalization in children <2 years would be 9.5/1000

## LIMITATIONS

- We might have missed a few suspected RSV cases. However, reparatory virus testing at study sites is widely used (~ 95% of children < 5 years admitted for febrile respiratory illness), resulting in a low false-negative rate
- Generalizability of study findings can be limited due to clinical practices, and data documentation in the Electronic health record that may vary by institution

## CONCLUSIONS

- RSV LRTI in children continues to cause substantial hospitalization burden and consume healthcare resource, especially in those younger than 2 years of age
- With extrapolation of our data to the US, we estimate that 91,000 children <5 years of age were hospitalized with RSV at a mean total hospital cost of \$1.1 billion during the 2019-2020 season
- Our data support the need for RSV vaccines and immunoprophylaxis to prevent RSV hospitalization

