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Costs of RSV-Associated Hospitalizations in Young Children With Underlying Medical Conditions

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INTRODUCTION

Respiratory syncytial virus (RSV) long-acting monoclonal antibodies (mAb) are recommended for infants aged younger than 8 months in their first RSV season to protect against severe RSV disease and for some children aged 8 to 19 months in their second season with certain underlying medical conditions (UMCs).[1,2] Cost-benefit analyses for mAb use in children in their second season assumed standard costs per hospitalization irrespective of UMC type.[3] Few studies have examined medical costs of RSV-associated hospitalizations for children with specific UMCs.[4] More precise estimates of RSV cost of illness for different risk conditions could inform RSV prevention recommendations for children in their second RSV season and beyond. We expanded previous work[5] to characterize hospitalization outcomes and estimate direct medical costs among children aged younger than 2 years by specific UMCs.

METHODS

Prospective surveillance from the New Vaccine Surveillance Network and accounting data collection has been previously described.[5,6] Briefly, children aged younger than 2 years hospitalized at 6 pediatric medical centers with laboratory-confirmed RSV during December 1, 2016 to October 31, 2019 were included. Respiratory samples were tested for RSV by reverse transcription polymerase chain reaction. Clinical outcomes and UMCs were collected through medical record review.

Direct medical costs for hospitalized children were collected as previously described,[5] adjusted to 2025 dollars.[7] We used Wilcoxon rank-sum test to compare median length of hospital stay (LOS) and chi-square tests to compare proportion requiring intensive care unit (ICU) admission and mechanical ventilation and calculated the ratio of median hospitalization costs for children with and without specific conditions stratified by age (6–11 months and 12–23 months). 95% CIs for cost ratios were computed by generating 10 000 bootstrap samples using unrestricted random sampling with replacement and estimating the 2.5th and 97.5th percentiles from this distribution. Small sample sizes precluded analysis of children aged 0 to 5 months with UMCs. Analyses used SAS software version 9.4 (SAS Institute).

Written informed consent was obtained from parent or legal guardian. The surveillance protocol was reviewed and approved by the institutional review boards at the Centers for Disease Control and Prevention and each of the 7 study sites (45 CFR part 46 and 21 CFR part 56).

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L Goldstein conceptualized and designed the study, drafted the initial manuscript, and carried out the initial analyses. B Clopper conceptualized and designed the study, conducted statistical analysis, and critically reviewed and revised the manuscript. RE Rutkowski conducted statistical analysis and critically reviewed and revised the manuscript. JA Boom, R Selvarangan, NB Halasa, DC Payne, PG Szilagyi, GA Weinberg, EJ Klein, LC Sahni, LS Stewart, CJ Harrison, MA Staat, and JA Englund conceptualized and designed the study, obtained funding, coordinated and supervised data collection, and critically reviewed and revised the manuscript. FS Dawood drafted the initial manuscript, conceptualized and designed the study, obtained funding, and critically reviewed and revised the manuscript. (Continued)

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RESULTS

Of 1715 hospitalized RSV-positive children aged younger than 24 months with available cost data, 1157 (67.5%) had no UMCs or history of prematurity. Among children aged 6 to 23 months with 1 or more of the 7 selected conditions, 52 (36%) were 6 to 11 months, and 93 (64%) were 12 to 23 months (Supplemental Tables S1 and S2). Median hospitalization cost was higher among children with certain UMCs compared with those without, although some cost ratios did not reach statistical significance (Table 1; Figures 1 and 2).

Among children aged 6 to 11 months, cost ratios comparing children with UMCs with those without ranged from 1.3 (95% CI, 0.7–2.7; blood disorders) to 4.4 (95% CI, 1.4–16.6; neurological or neuromuscular disorders) (Table 1; Figure 2). Conditions with the highest median costs had longer median LOS (neurological or neuromuscular disorders: 6.5 days [IQR, 3–19]; chronic lung disease of prematurity: 6 days [IQR, 4–11]; and other chronic lung disease: 3.5 days [IQR, 3–8]) than children without UMCs (median, 2 days; IQR, 1–3) and were more likely to be admitted to the ICU and require mechanical ventilation (Table 1; Figure 2; Supplemental Table S1). Of 52 children with any of the selected conditions, 45 (87%) had just one condition (Supplemental Table S1; Supplemental Figure S1).

Among children aged 12 to 23 months, the cost ratio was 1 (95% CI, 0.7–1.3) for children with asthma compared with children without UMCs and other conditions ranged from 1.2 (95% CI, 0.8–9.3; blood disorders) to 3.7 (95% CI, 0.7–6.7; other chronic lung disease) (Table 1; Figure 2). Of 93 children with any selected UMC, 79 (85%) had just one condition (Supplemental Table S1; Supplemental Figure S1).

DISCUSSION

Children with certain UMCs such as severe chronic lung disease of prematurity, immunocompromise, or cystic fibrosis are eligible to receive mAbs during their second RSV season

TABLE 1. Hospitalization Costs[1] in 2025 US Dollars by Age and Underlying Medical Condition in New Vaccine Surveillance Network in 2016 to 2019

Characteristics	n	Mean	SD	Median	IQR	Total Cost	Cost Ratio[2] (95% CI)
No underlying medical conditions							
Age, months							
0–2	474	$13 497.16	$19 939.38	$7399.88	$3955.71–$13 930.30	$6 397 653.70	–
3–5	229	$12 353.36	$16 451.06	$6598.21	$3828.34–$13 221.40	$2 828 920.14	–
6–11	240	$10 947.73	$18 019.39	$6456.86	$3906.62–$11 387.00	$2 627 455.55	–
12–23	214	$11 701.93	$17 296.17	$7545.46	$4292.30–$12 510.43	$2 504 212.84	–
Underlying medical conditions[3] (6–11 months)							
Chronic lung disease of prematurity	9	$57 066.80	$74 500.97	$25 803.60	$13 906.05–$44 834.10	$513 601.22	4.00 (1.69–15.28)[8]
Reactive airway disease or asthma[4]	8	$16 106.38	$15 995.75	$11 292.19	$3989.85–$22 830.08	$128 851.07	1.75 (0.56–3.70)
Other chronic lung disease	6	$37 351.38	$47 350.30	$18 279.13	$9167.63–$39 809.87	$224 108.27	2.83 (1.29–9.57)[8]
Cardiovascular conditions[5]	20	$26 837.04	$36 438.90	$9993.12	$5672.42–$28 826.28	$536 740.83	1.55 (1.04–3.59)[8]
Neurological or neuromuscular disorders[6]	6	$48 879.71	$48 400.49	$28 457.17	$9094.30–$108 114.08	$293 278.24	4.41 (1.35–16.60)[8]
Blood disorders[7]	9	$10 102.55	$6556.04	$8133.66	$5026.60–$16 777.40	$90 922.91	1.26 (0.71–2.72)
Underlying medical conditions[3] (12–23 months)							
Chronic lung disease of prematurity	21	$17 750.10	$21 684.41	$10 218.27	$7097.15–$16 689.69	$372 752.15	1.35 (1.05–1.99)[8]
Reactive airway disease or asthma[4]	30	$2015.43	$12 061.07	$7333.22	$4662.32–$12 847.76	$360 462.98	0.97 (0.68–1.32)
Other chronic lung disease	7	$27 278.53	$21 868.36	$27 563.48	$4567.49–$51 031.88	$190 949.68	3.65 (0.66–6.73)
Cardiovascular conditions[5]	19	$16 835.83	$15 589.94	$10 746.95	$7790.83–$27 563.48	$319 880.73	1.42 (1.13–1.94)[8]
Neurological or neuromuscular disorders[6]	30	$17 324.03	$20 388.87	$10 483.76	$6285.19–$15 621.44	$519 720.99	1.39 (0.99–1.81)
Blood disorders[7]	7	$57 559.74	$128 187.93	$9180.45	$5998.53–$14 682.64	$402 918.20	1.22 (0.80–9.28)

Cost estimates were restricted to categories containing 5 or more children.

[1] Direct medical costs for hospitalized children were adjusted to 2025 dollars using month and year–specific inflation factors from the Gross Domestic Product Implicit Price Deflator.

[2] Ratio of median cost compared with same age group with no underlying conditions.

[3] Underlying condition categories are not mutually exclusive.

[4] Excludes premature children.

[5] Heart defect from birth or other heart disease.

[6] Cerebral palsy, seizure disorder, or other neurologic or neuromuscular disorder.

[7] Sickle cell disease or other blood disorder.

[8] Indicates significant difference (compared with same age group with no underlying conditions) at $\alpha < .05$, based on cost ratio CIs that exclude the null value (1.0).

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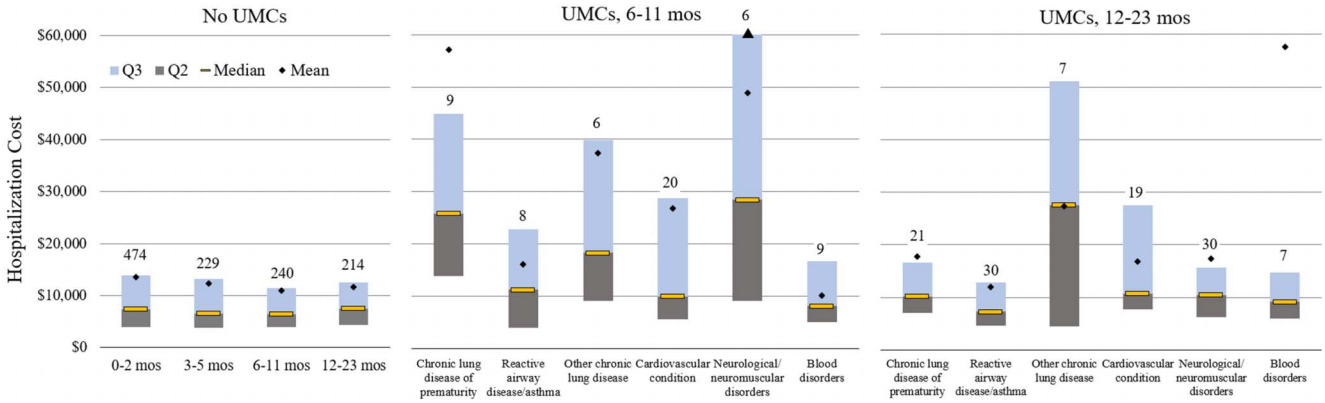
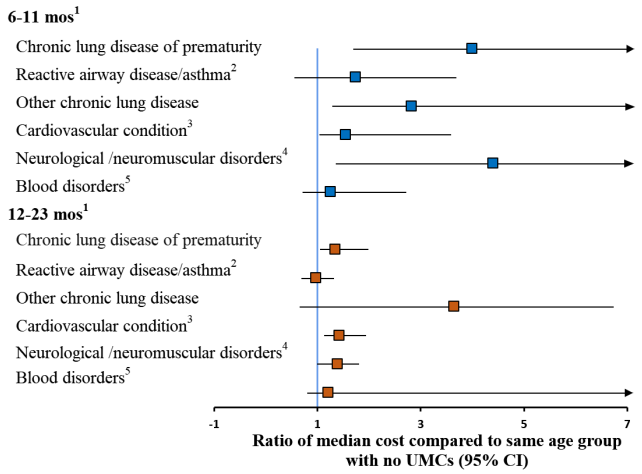


FIGURE 1.
Hospitalization costs in 2025 US dollars by age and UMC according to New Vaccine Surveillance Network.
Abbreviations: Q, quartile; UMC, underlying medical condition.



UMCs=Underlying medical conditions
1 Underlying condition categories are not mutually exclusive
2 Excludes premature children
3 Heart defect from birth, other heart disease
4 Cerebral palsy, seizure disorder, other neurologic or neuromuscular disorder
5 Sickle cell disease, other blood disorder

FIGURE 2.
Ratio of median hospital costs for children with UMCs compared with same age group with no underlying conditions.
Abbreviation: UMC, underlying medical condition.

under current guidelines.[2] Although small sample size of some conditions (precluding cost estimation or generating imprecise estimates) and co-occurrence of conditions (possibly influencing cost estimates) are limitations of this study, we found medical costs for children with certain UMCs, including some outside of current recommendations, were higher than for otherwise healthy children. These conditions were also often associated with longer stays and more frequent ICU admission and mechanical ventilation.

Median costs per hospitalization differed by condition. Among children aged 12 to 23 months, median costs were highest among children with other chronic lung disease, followed by children with chronic lung disease of prematurity, cardiovascular conditions, and neurological and neuromuscular conditions. Total costs in children aged 12 to 23 months were highest among children with neurological and neuromuscular conditions or blood disorders. This corroborates literature identifying highest costs among children with comorbidities such as chronic lung disease and neurological conditons.[4] The cost-benefit for RSV prophylaxis in children with UMCs, including those beyond current recommendations, may be even greater than predicted.

ABBREVIATIONS

ICU: intensive care unit
LOS: length of hospital stay
mAb: monoclonal antibody
RSV: respiratory syncytial virus
UMC: underlying medical condition

H Moline drafted the initial manuscript, conceptualized and designed the study, obtained funding, coordinated and supervised data collection, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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