Cost-Effectiveness of Respiratory Syncytial Virus (RSV) Immunization Using Monoclonal Antibodies (mAb) in United States Infants: An Analysis of in-Season and out-of-Season Birth Cohorts

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Background

- Increasing chronological age decreases risk of RSV hospitalization in infants.[1]
- Infants born in April would be ≥6 months old as they enter their first RSV season (about October) compared to October-born infants, who are born in-season.
- This preliminary study assessed the cost effectiveness of immunization at the start of the RSV season for hypothetical cohorts of 100,000 low-risk infants against RSV using mAb passive prophylaxis[2] in October-born (in-season) infants and April-born (out-of-season) infants.

Methods

Immunization scenarios:

- *At-birth:* October-born infants may be immunized at-birth during the birth hospitalization.
- *Existing visit:* April-born infants may be immunized during a routine 6-month well-child visit and /or co-administered with other vaccines.
- *Additional visit:* April-born infants may require an additional visit if co-administration were proven unsafe or if well-child visits did not align.

Events and costs by settings:

- Age- and calendar month-specific proportion of events were standardized for a 100,000 cohort.[3]
- Events averted were calculated using product efficacy in target population.[2]
- Costs of treatment by setting and product administration costs were extracted from literature.[4,5]

Disability-adjusted life year (DALY) elements:

- DALYs averted due to RSV events and deaths avoided.
- DALYs lost due product-related adverse effects.[6]
- DALYs lost due to COVID-19 and influenza exposure during additional visit or during future RSV-related encounters.[6]
- Sensitivity analyses explored small probabilities that the 3 deaths in the product arm were product-related.

Key assumptions:

- Product price ($117.80) assumed to be midpoint of prices of innovative pediatric vaccines recommended by the Centers for Disease Control and Prevention (CDC).[7]
- RSV season assumed to be October-March.[3]
- Product efficacy assumed to last throughout RSV season.
- Reduction in deaths assumed to be proportional to reduction in hospitalizations from immunization.

Results

Fig 1. Healthcare utilization per 100,000 low-risk infants at baseline (BL) and averted during the RSV season in the two cohorts.

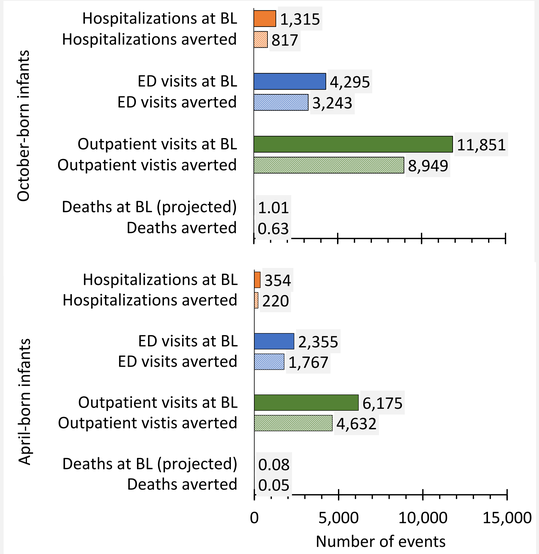
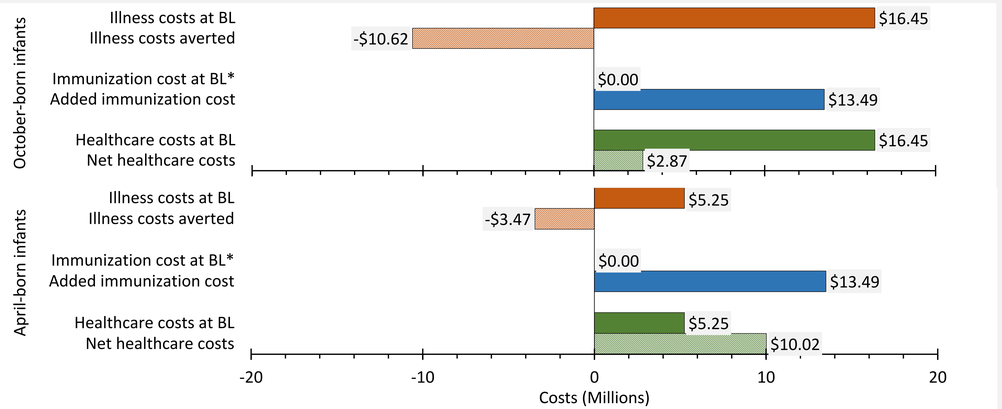


Fig 2. Healthcare costs per 100,000 low-risk infants at baseline (BL) and net costs including immunization in the two cohorts.



*$0 for the no intervention arm. Assumed price for intervention = $117.78; administration cost=$17.1.

Fig 3. Incremental cost-effectiveness ratios (ICERs) for each immunization scenario for the two cohorts of 100,000 infants each.

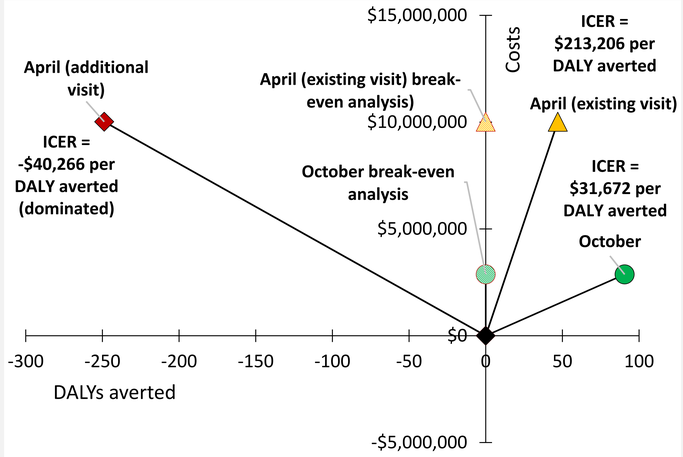


Table 1. Disability-adjusted life years (DALYs) averted per 100,000 low-risk infants due to RSV immunization.

Variable	October-born infants	April-born infants (existing visit)	April-born infants (additional visit)
(A) Non-fatal DALYs averted from RSV events avoided	20.66	10.50	10.50
(B) Deaths averted due to RSV immunization	0.63	0.05	0.05
(C) Discounted years of life lost from RSV events avoided	18.87	1.54	1.54
(D) DALYs averted from RSV avoided	39.50	12.05	12.05
(E) Non-fatal DALYs averted from product-related events	18.04	18.04	18.04
(F) DALYs averted from related to RSV events avoided and product-related adverse effects (D+E)	57.54	30.09	30.09
(G) DALYs averted from COVID exposure and expected cases during immunization visit	0.00	0.00	-237.40
(H) DALYs averted from COVID avoided due to reduced RSV-related encounters	27.20	13.90	13.90
(I) DALYs averted from influenza exposure and expected cases during immunization visit	0.00	0.00	-58.40
(J) DALYs averted from influenza cases avoided due to reduced RSV-related encounters	5.90	3.00	3.00
(K) DALYs averted from COVID and flu exposure-related events (G+H+I+J)	33.10	16.90	-278.90
(L) Base case: Total DALYs averted (F+K)	90.64	46.99	-248.81
(M) Break-even analysis, April cohort (existing visit): Fatal DALYs averted from product-related events assuming 0.514% chance of the 3 deaths in the product arm out of 987 infants in that arm being product related	-46.99	-46.99	-46.99
(N) Break-even analysis, October cohort: Fatal DALYs averted from product-related events assuming 0.9914% chance of the 3 deaths in the product arm out of 987 infants in that arm being product related	-90.64	-90.64	-90.64
(O) Break-even analysis: April cohort (existing visit): Total DALYs averted (L+M)	43.65	**0.00**	-295.80
(P) Break-even analysis: October cohort: Total DALYs averted (L+N)	**0.00**	-43.65	-339.45

Base case (ignoring any product-related deaths):

- Immunization benefits were substantially lower in the April cohort compared to the October cohort ($3,469,449 vs $10,617,262 averted and 12.05 vs 39.50 DALYs averted) **(Fig 2, Table 1)**.
- Inclusion of product-related adverse effects, and DALYs related to COVID and flu made immunization in the April cohort unfavorable (net DALYs: -248.81) **(Table 1)**.
- For the October cohort, immunization was very cost-effective at the assumed product price of $117.78 with $17.1 administration cost (ICER = $31,672 per DALY averted) **(Fig 3)**.
- Immunization for the April cohort, at a routine existing visit was not cost-effective (ICER = $213,206 per DALY averted, > 3 times the US Gross Domestic Product [GDP] per capita).
- ICER for the additional visit scenario for the April cohort was strongly dominated, with lower health and higher costs than no immunization (ICER = -$40,266).

Sensitivity analysis (with possible product-related deaths):

- Net immunization benefits become 0 with possible product-related deaths.
- Break-even probabilities were 0.9914% for the October cohort and 0.514% for the April cohort (existing visit).

Key updates added to original abstract:

- Product efficacy updated based on the recent results of the phase 3 trial.[2]
- Product price assumptions changed.
- Partial offsets to COVID and flu risks from future RSV-related events incorporated.

Conclusions

- Benefits of RSV immunization differ between birth cohorts as infants who are older when entering the RSV season face lower risk.
- For infants born in October and immunized during the birth hospitalization, protection is cost-effective.
- However, for those born in April, immunization potentially presents more harm than benefits.
- Their immunization would not be recommended if it requires an additional visit.
- Even a small probability of product-related deaths could make the immunization unfavorable.

References:
1. Shepard DS, et al. 1708. Impacts of age and season on rates of hospitalization for respiratory syncytial virus (RSV) in infants in the United States and their use of mechanical ventilation and charges. *Virology: Studies of the Epidemiology of Viral Infections*. Vol 7(Suppl 1),S837; 2020. doi:https://doi.org/10.1093/ofid/ofaa439.1886
2. Hammitt LL, et al. Nirsevimab for Prevention of RSV in Healthy Late-Preterm and Term Infants. *N Engl J Med*. 2022;386(9):837-846. doi:10.1056/NEJMoa2110275
3. Rainisch G, et al. Estimating the impact of multiple immunization products on medically-attended respiratory syncytial virus (RSV) infections in infants. *Vaccine*. 2019;38. doi:10.1016/j.vaccine.2019.10.023
4. Bowser DM, et al. Cost of Respiratory Syncytial Virus (RSV) Infections in US Infants: Systematic Literature Review and Analysis. *J Infect Dis* (In press).
5. Glazner JE, Beaty B, Berman S. Cost of Vaccine Administration Among Pediatric Practices. *Pediatrics*. 2009;124(Supplement_5):S492-S498. doi:10.1542/peds.2009-1542H.
5. Farid AT, et al. Potential adverse effects of passive immunization against respiratory syncytial virus (RSV) in low-risk infants in the United States (EPH72). ISPOR 2022, Washington, DC (May 2022). Value Health 2022; 25 (6, S1).
7. VFC | Current CDC Vaccine Price List | CDC. Published March 24, 2022. Accessed April 21, 2022. https://www.cdc.gov/vaccines/programs/vfc/awardees/vaccine-management/price-list/index.html

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