Assessing the Cost-Effectiveness of an mRNA-Based RSV Vaccine (mRNA-1345) Among Canadian Adults Aged ≥60 Years

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BACKGROUND

- Although underdiagnosed, respiratory syncytial virus (RSV) infections are a leading cause of acute respiratory disease (ARD), lower respiratory tract disease (LRTD), hospitalizations, and healthcare expenditure among older adults in Canada[1]
- A phase 3 pivotal trial evaluated the efficacy of an mRNA-based RSV vaccine (mRNA-1345 50 µg) in adults aged ≥60 years (ConquerRSV trial)
  - The vaccine efficacy (VE) of a single dose after a median follow-up of 3.7 months was 83.7% (95% CI, 66.0-92.2; *P*<0.0001) and 82.4% (95% CI, 34.8-95.3; *P*=0.0078) in preventing a first episode of RSV-associated LRTD with ≥2 symptoms and ≥3 symptoms, respectively[2]
  - At a median of 8.6 months, the corresponding VE for these endpoints was 63.3% and 63.0%[2,3]
- With the VE of mRNA-1345 in older adults now established, an estimation of its economic value in Canada is needed

OBJECTIVES

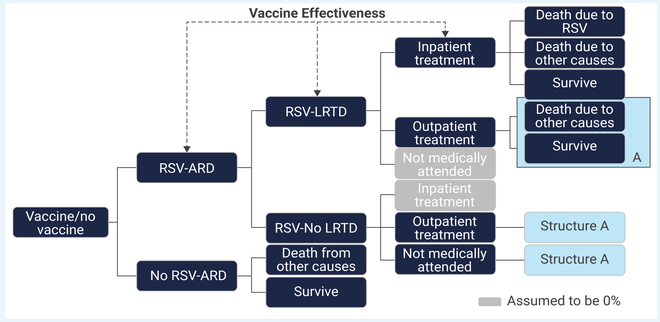
- To estimate the cost-effectiveness of vaccination with a single dose of mRNA-1345 against RSV-associated outcomes compared with no vaccination in adults aged ≥60 years in Canada

METHODS

Study Design

- Reference case analyses were performed from the public healthcare payer's perspective in Canada using a 2-year time frame, while lifetime consequences of infection were incorporated (eg, loss of life expectancy due to RSV-related mortality was discounted to present value)
- All costs (2020 Canadian values) and outcomes beyond the first year were discounted by an annual rate of 1.5%
- A static, cohort-based, decision-tree was developed to assess the cost-effectiveness of mRNA-1345 compared with no vaccination over a 2-year time-frame in Canada (**Figure 1**)
  - Following no vaccination or vaccination with mRNA-1345, participants could develop RSV-ARD
  - Those with RSV-ARD (symptomatic cases) were split into those with ≥2 lower respiratory symptoms (RSV-LRTD) and those with <2 symptoms (RSV No-LRTD)
  - Patients were further categorized into those requiring outpatient care (including emergency department and/or general practitioner visits) and those not medically-attended

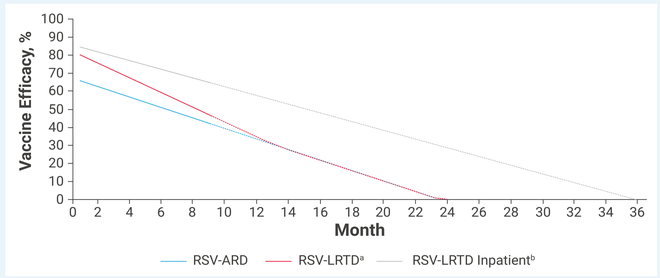
Figure 1. Model Diagram of the Decision Tree Comparing mRNA-1345 Vaccination to No Vaccination[a]



ARD, acute respiratory disease; LRTD, lower respiratory tract disease; RSV, respiratory syncytial virus.
[a]Patients in the vaccine arm were eligible for vaccination, but receipt of the vaccine depended on coverage rates.[4]

- The protective effects of mRNA-1345 against RSV-ARD, RSV-LRTD, and associated hospitalizations, which aligned with the ConquerRSV trial's primary endpoints, were adjusted by Canadian seasonality data and waned over 24 months
  - Efficacy curves for all 3 endpoints are presented in **Figure 2**

Figure 2. Model Input: Vaccine Efficacy



ARD, acute respiratory disease; LRTD, lower respiratory tract disease; RSV, respiratory syncytial virus; VE, vaccine efficacy.
[a]Example VE assumptions for RSV-LRTD with ≥2 symptoms: VE at Month 0 was 83.7%. At Months 1-9, VE followed a linear decline based on a calibration exercise such that the average VE over 9 months was 63.3% (Month 1 = 79.6%; Month 9 = 47.0%), corresponding with the average VE for RSV-LRTD with ≥2 symptoms from the additional clinical trial analysis. The slope from Months 1-9 was applied to project a decline in VE to 0% at 24 months.
[b]VE against RSV-LRTD requiring inpatient care was based on shortness of breath, a key driver in seeking a higher level of medical care for RSV disease[5,6] and was evaluated as an additional surrogate marker of severity in an exploratory analysis of clinical trial data.

Model Inputs

- Model inputs were estimated using published data and through calibration when direct inputs were not available (**Supplemental Table 1**, accessible via the QR code)

Model Outcomes

- Clinical outcomes over the 2-year time-frame include the number of RSV-ARD, RSV-LRTD, and RSV-No LRTD cases; RSV-LRTD hospitalizations; and in-hospital deaths
  - Number needed to vaccinate (NNV), defined as the expected number of people who need to receive the vaccine to prevent 1 event, was estimated as the number of vaccinations divided by the difference in the number of outcomes between the no vaccine cohorts and the mRNA-1345 cohort
- Economic outcomes include total costs, total life-years (LYs) lost/saved, total quality-adjusted life-years (QALYs) lost, incremental cost per LY saved, and incremental cost per QALY gained
- Deterministic and probabilistic sensitivity analyses (1000 simulations) were performed to assess the impact of parameter uncertainty on model results

RESULTS

Clinical Outcomes

RSV-LRTD

- Compared with no vaccination, mRNA-1345 prevented 94,968 RSV-LRTD cases (29% reduction), 79,761 RSV-related outpatient visits (28% reduction), 15,207 RSV-related hospitalizations (44% reduction), and 1663 RSV-related deaths (45% reduction)
  - The NNV to prevent 1 RSV-LRTD case, outpatient visit, hospitalization, or death was 69, 82, 430, and 3934, respectively

RSV No-LRTD

- Compared with no vaccine, mRNA-1345 prevented 236,404 RSV No-LRTD cases (24% reduction) and 40,579 RSV No-LRTD outpatients visits (25% reduction)
  - The NNV to prevent 1 RSV No-LRTD case or outpatient visit was 28 and 161, respectively

Economic Outcomes

- Compared with no vaccination, mRNA-1345 was $882,116,101 more costly, saved 13,195 life-years, and yielded 18,333 additional QALYs based on deterministic analyses (**Table 1** and **Supplemental Table 2**, accessible via the QR code)
  - Based on the corresponding ICER of $48,118/QALY gained, mRNA-1345 represents a cost-effective strategy at a $50,000/QALY willingness-to-pay threshold

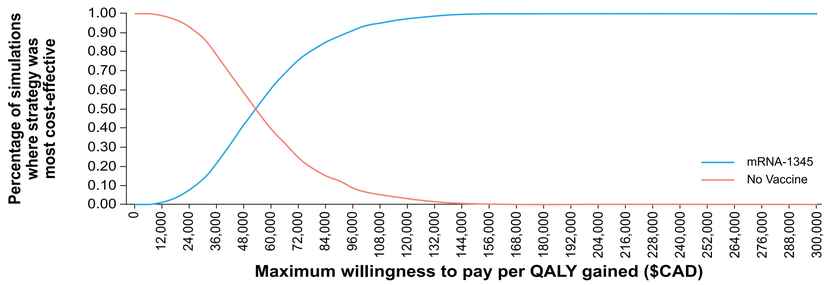
Table 1. Economic Outcomes

Vaccination Strategy	Total Costs ($)	Total QALYs Lost	Δ Costs ($)	QALYs Saved	ICER (Δ Costs/QALY Saved) ($)
Deterministic Analyses					
Reference case incremental cost per QALY gained					
No vaccine	1,661,498,061	4,165,410	-	-	Reference
mRNA-1345	2,543,614,161	4,147,077	882,116,101	18,333	48,118
Probabilistic Analyses					
Probabilistic incremental cost per QALY gained					
No vaccine	1,657,153,154	4,166,049	-	-	Reference
mRNA-1345	2,557,655,795	4,147,940	900,502,642	18,110	49,725

ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year.

- Probabilistic analyses results were similar (<5% greater) to the deterministic analysis (**Table 1**, **Figure 3**, and **Supplemental Figure 1**, accessible via the QR code)

Figure 3. Cost-Effectiveness Acceptability Curve



CAD, Canadian dollar.

- Model results were most sensitive to RSV-ARD incidence, QALY losses for outpatient care and no treatment, and hospitalization rate calibration targets (**Supplemental Figure 2**)

Limitations

- Due to lack of data specific to Canada for certain model inputs (RSV-ARD incidence, percentage of RSV-LRTD patients requiring inpatient care, QALY losses for patients requiring no treatment or received outpatient treatment), US data were used
- There is uncertainty and variation in the incidence of RSV due to the sample size of the source[6] used in the reference case analysis
- Estimates of the economic value of RSV vaccines depend on the severity of the RSV season
- The duration of protection of mRNA-1345 is still being evaluated in clinical trials

CONCLUSIONS

- Routine vaccination against RSV with a single dose of mRNA-1345 could have a considerable public health impact in adults aged ≥60 years in Canada, with substantial model-predicted reductions of RSV-LRTD hospitalizations and death compared with no vaccination
- At the willingness-to-pay threshold of $50,000/QALY, a single dose of mRNA-1345 is a cost-effective intervention for reducing RSV-LRTD, RSV-associated mortality, and healthcare resource use in adults aged ≥60 years in Canada compared with no vaccination

ADDITIONAL INFORMATION

Please scan the QR code for a PDF copy of the poster and supplemental material. Copies of the poster and supplemental material obtained through this QR code are for personal use only and may not be reproduced without written permission of the authors.

For additional information, please contact Michelle Blake (Michelle.Blake@modernatx.com).

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Disclosures

MK is a shareholder in Quadrant Health Economics, Inc., which was contracted by Moderna, Inc., to conduct this study. KF is a consultant at Quadrant Health Economics, Inc. PG, K Joshi, K Jayasundara, NVDV, and MB are employed by Moderna, Inc., and hold stock/stock options in the company.

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