Population-level Model of the Health and Economic Impact of NVX-CoV2373 as a Potential COVID-19 Booster Vaccine Option for Adults in the United States

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BACKGROUND

- The introduction of the Novavax vaccine (NVX-CoV2373) to the coronavirus disease 2019 (COVID-19) vaccine market has the potential to increase vaccine coverage in the United States (US), where primary and booster vaccine coverage has lagged compared with other high-income countries.
- The Novavax COVID-19 vaccine was shown to have clinical efficacy as a primary vaccination for the prevention of COVID-19 in phase 3 trials in the United Kingdom[1] and in the US and Mexico[2].
- Investigation of homologous and heterologous COVID-19 boosting with the Novavax COVID-19 vaccine and other approved or authorized vaccines is ongoing to determine the immunogenicity, safety, and efficacy of COVID-19 booster vaccination[3].
- Vaccine decision makers and stakeholders in the US rely on health economic analyses to guide the development of booster vaccination policies and support access to care.
- Novavax COVID-19 Vaccine, Adjuvanted has not been authorized by the FDA as a booster dose.

OBJECTIVE

- To estimate the potential population-level health and economic impact of including the Novavax COVID-19 vaccine as a booster vaccine option for adults (aged 18 years or older) in the US who completed their primary vaccination series.

DISCLOSURES

KP, WLH and JM are employees of RTI Health Solutions, which received funding to conduct this study. HB, MR, and ST are employees of Novavax, Inc. This study was sponsored by Novavax, Inc. Layout support for the poster was provided by Allison Saviano, of Sephirus Communications, Inc.

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METHODS

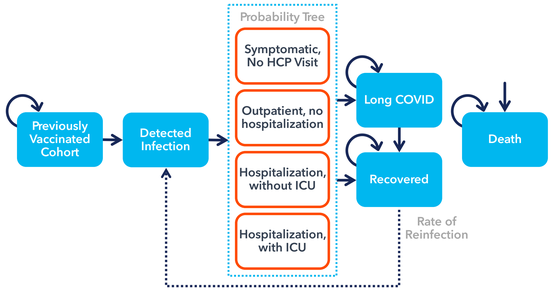
Modeling Approach

- A decision-analytic model, informed by the literature[4,5], was developed to estimate COVID-19–related cases, hospitalizations, and deaths with and without the Novavax COVID-19 vaccine as a booster vaccine option for adults in the US.
- The model population was stratified by age and all COVID-19 vaccine options approved or authorized in the US, including no booster vaccination, were included.
- For all age and vaccine combinations, cohort-level outcomes were estimated using a Markov-based approach with health states for susceptible, detected infection, long COVID-19, and recovered. The severity of COVID-19 outcomes within the detected infection state was modeled based on the highest level of care required **(Figure 1)**.
- Population-level outcomes were estimated by combining cohort-level outcomes from age and vaccine specific cohorts using coverage and market share parameters.
- The portfolio-driven analysis compares the population-level outcomes for a mix of booster vaccines that includes the Novavax COVID-19 vaccine vs. a booster vaccine mix without the Novavax COVID-19 vaccine across a range of coverage and market share values.

Model Parameters and Data Sources

- Vaccine efficacy was sourced from published pivotal phase 3 clinical trials. Efficacy waning rates based on real-world observations were used to estimate the remaining efficacy from prior vaccination and the efficacy of booster vaccination over time **(Table 1)**.
- Due to the placebo-controlled nature of the phase 3 efficacy data, the incidence of COVID-19 was derived from publicly available data on unvaccinated individuals. Case severity data, including mortality, were sourced from published literature. Costs per case were determined based on the highest level of care required **(Table 2)**.
- For the portfolio with the Novavax COVID-19 vaccine, we assumed that the availability of a protein-based vaccine as a booster option would increase booster vaccination coverage rates.

Figure 1. Model Structure for an Age- and Vaccine-Specific Cohort



ICU = intensive care unit; HCP = healthcare provider.

Note: Assumed transition to death from detected infection requiring an HCP visit or hospitalization is due to COVID-19, whereas transition to death from all other health states is due to other causes.

Table 1. Vaccine Attributes

Parameter	Novavax[6]	Moderna[7]	Pfizer[8]	J&J[9]
Efficacy against infection	**90.4%**	**94.1%**	**95.0%**	**72.0%**
Waning rate per month[10,11] and efficacy floor	7.5% and 10% respectively, for all vaccines			
Efficacy against hospitalization	**100.0%**	**100.0%**	**100.0%**	**93.0%**
Waning rate per month and efficacy floor	6.5% and 20% respectively, for all vaccines			
Cost per dose[12]	$56.12 for all vaccines (assumption)			
Distribution of primary vaccination series[13]	**0%**	**39%**	**53%**	**8%**
Total coverage of booster eligible population and market shares				
Without the Novavax COVID-19 vaccine (coverage = 51.2%)	0%	28.6%	22.6%	0%
With the Novavax COVID-19 vaccine (coverage = 56.2%)	5%	28.6%	22.6%	0%

Note: Efficacy against hospitalization is based on published efficacy data against severe disease as defined in respective trials. Waning rate for efficacy against hospitalization and both efficacy floors are assumptions. Median time since prior vaccination was assumed to be 6 months.

Table 2. Epidemiology, Outcomes, Mortality, and Costs in Population by Age and Highest Level of Care Required Before Adjustment for Efficacy and Waning Based on Time Since Prior or New Booster Vaccination

Input Parameter	Hospitalization, With ICU	Hospitalization, Without ICU	Outpatient, no Hospitalization	Symptomatic, No HCP Visit
Weekly probability of COVID-19[13]				
0.154% across all age groups				
Level of care distributions[14,15,16]				
18–64 years, low risk	2.4%	3.2%	36.0%	58.4%
18–64 years, high risk	8.4%	21.2%	62.0%	8.4%
≥ 65 years	8.4%	21.2%	62.0%	8.4%
COVID-19–related mortality[4,17]				
18–64 years, low risk	3.6%	0.5%	0.1%	0%
18–64 years, high risk	5.6%	0.7%	0.1%	0%
≥ 65 years	33.0%	18.3%	5.7%	0%
Cost per case[4,18,19]				
Direct costs	$37,429	$13,282	$164	$0

RESULTS

Base-Case Results

- **Table 3** presents predicted model outcomes over a 1-year time horizon for the mix of booster vaccines currently approved or authorized in the US and a vaccine mix including the Novavax COVID-19 vaccine as a booster option.
- A five-percentage point increase in booster vaccine coverage among the 200 million fully vaccinated adults in the US, allocated to the Novavax COVID-19 vaccine market share, reduced hospitalizations and deaths due to COVID-19 by approximately 26,239 and 4,515, respectively.
- The increase in coverage resulted in additional vaccination costs of $566 million but reduced COVID-19–related direct medical costs by $562 million **(Table 3)**.

Table 3. Base-Case Results

	With Novavax Booster in Vaccine Mix	Without Novavax Booster in Vaccine Mix	Incremental Difference
Health outcomes			
Number of cases	7,527,634	7,701,734	−174,101
Number of hospitalizations	946,980	973,219	−26,239
Number of deaths	162,708	167,223	−4,515
Cost outcomes (in $MM)			
Vaccine costs	$6,360.7	$5,794.4	$566.3
Health state costs	$20,429.2	$20,991.3	−$562.1
Total costs	$26,789.9	$26,785.7	$4.1

Scenario Analysis

- Population-level outcomes, such as hospitalizations avoided, were predicted to improve as the COVID-19 booster vaccine coverage was increased due to including the Novavax COVID-19 vaccine in the mix. Outcomes were similar across variations in market share assumptions due to similar efficacy levels across booster vaccine options **(Figure 2)**.
- Including the Novavax COVID-19 vaccine as a booster vaccine option improved population-level outcomes in scenarios which evaluated the emergence of new Omicron-like variants in the model **(Table 4)**.

Figure 2. Hospitalizations Avoided Due to Increases in Booster Vaccine Coverage and Market Share

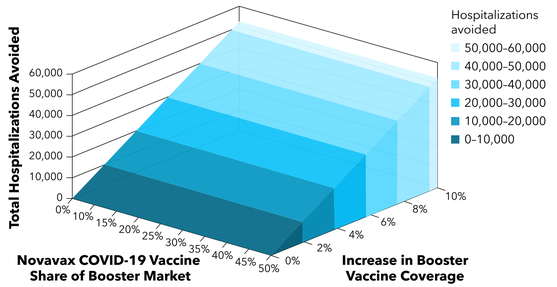


Table 4. Variant Introduction Scenarios to Evaluate Cost Savings and Population-Level Health Impacts

	Incremental Cases	Incremental Hospitalizations	Incremental Deaths	Incremental Costs ($MM)
Omicron-like variant emerging during months 4-6	−321,306	−29,222	−6,579	−$71.9
Two Omicron-like variants emerging during months 2-4 and 6-8	−379,167	−30,081	−7,379	−$95.3

Note: We estimated the Omicron-like variant to have 200% higher incidence and 58% lower hospitalization rate than baseline[20,21]. Remaining vaccine efficacy was reduced by ten percentage points for each new variant.

CONCLUSIONS

- Model results suggest that including the Novavax COVID-19 vaccine as a COVID-19 booster vaccine option for adults in the US has the potential to reduce hospitalizations and deaths because of the anticipated increase in vaccine coverage.
- Increases in vaccination costs due to higher coverage were predicted to be almost completely offset by reductions in direct medical costs.

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