EPH104

Public Health Impact of Pediatric BNT162b2 XBB.1.5-adapted COVID-19 Vaccine in the United States

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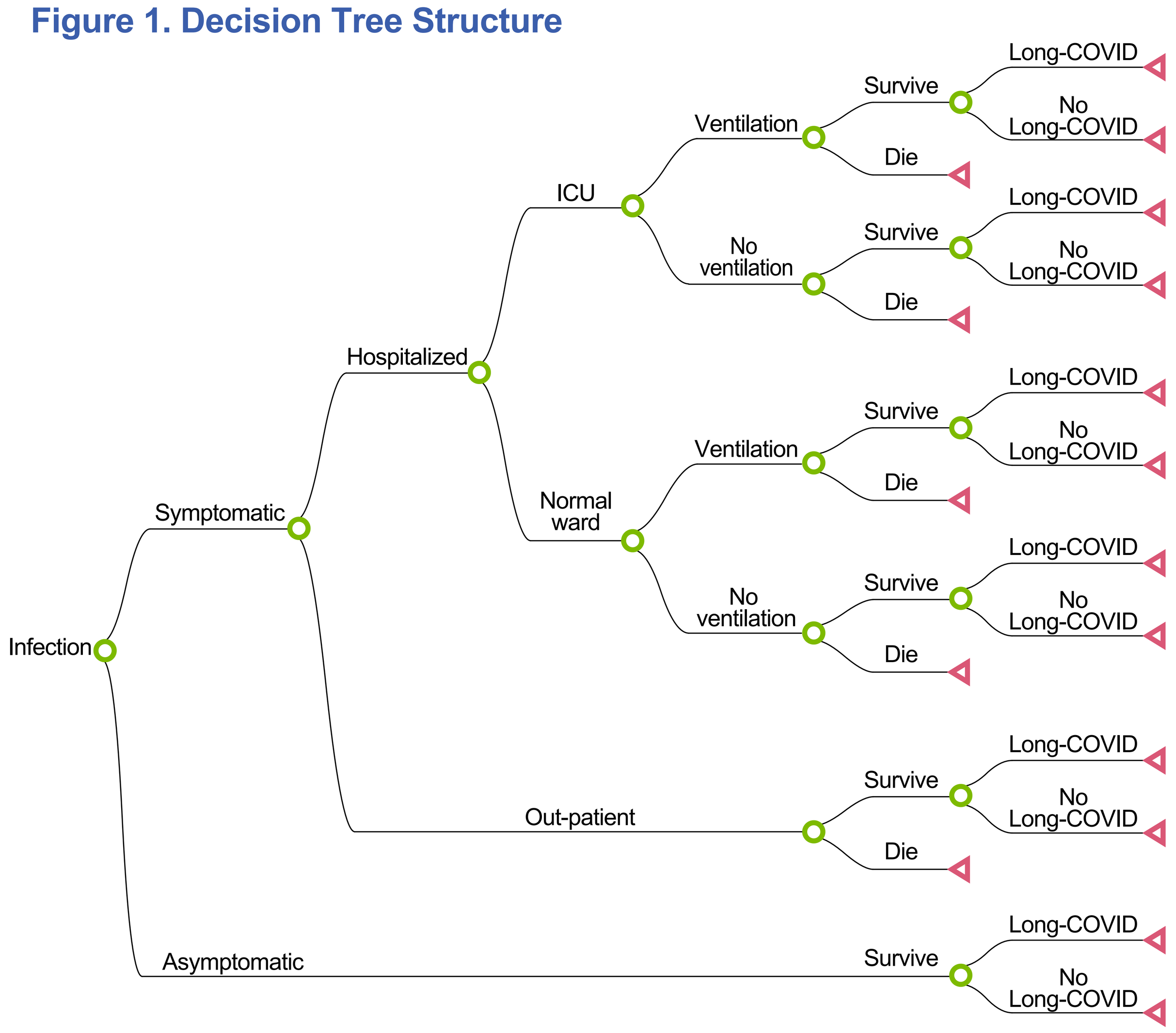
INTRODUCTION

- As of March 2024, there have been more than 169,000 COVID-19 hospitalizations and 4,200 deaths among the population age <18 years in the US.[1,2]
- Vaccination can help mitigate COVID-19 burden; however, uptake among the pediatric population in the US has been low. This has been especially true for the updated BNT161b2 XBB.1.5-adapted COVID-19 vaccine, which has had an uptake between 6.5% and 8.5% among the pediatric population age <18 years.[3]
- The objective of this study was to assess the public health impact of BNT162b2 XBB.1.5-adapted COVID-19 vaccination in the population age <18 years compared with no vaccination in the US.

METHODS

- A previously published integrated Markov cohort decision tree model[4] was adapted to assess the impact of BNT162b2 XBB.1.-adapted COVID-19 vaccination in the pediatric population on symptomatic cases, hospitalizations, deaths, and healthcare costs
- The Markov component of the model tracked the target population through mutually exclusive health states, using a Susceptible-Infected-Recovered (SIR) structure, and the decision tree modeled disease severity and treatment pathways (e.g., outpatient, inpatient, intensive care unit) and related outcomes (**Figure 1**).

Figure 1. Decision Tree Structure



Abbreviations: ICU = intensive care unit

Inputs

- Epidemiological model inputs were based on data from Centers for Disease Control and Prevention (CDC) or published in the literature (**Table 1**)
- Cost inputs were based on the literature and healthcare resource use assumptions (**Table 2**)
- Vaccine coverage was based on uptake of the BNT162b2 XBB.1.5-adapted COVID-19 vaccine (updated) (**Table 3**)
- Vaccine effectiveness and an assumed 6-month duration of protection were based on a real-world evidence study of vaccine effectiveness in the pediatric population (**Table 3**).[5]

METHODS (continued)

Table 1. Epidemiology and Clinical Inputs

Input	Age 6 months to 4 years	Age 5–11 years	Age 12–17 years	Source
Total population	17,433,787	28,384,878	25,135,943	US Census[6]
Attack rate (any infection)	5.3%	3.6%	5.6%	CDC[7]
Probability Infection is Symptomatic	51.1%			Average of Accorsi et al.[8] and US studies identified by Sah et al.[9 b]
Hospitalization proportion among symptomatic infections	4.13%	1.40%	1.34%	CDC[10]
ICU proportion among hospitalized	22.1%	29.7%	29.7%	Di Fusco et al.[11]
Ventilation proportion among ICU	8.5%	27.6%	27.6%	
Long COVID				
Proportion of outpatient or asymptomatic cases that develop long COVID[a]	1.6%	6.2%	7.9%	Funk et al.[12]
Proportion of inpatient cases that develop Long COVID [a]	5.8%	7.8%	20.4%	
Mortality rate				
Regular ward	0.52%	0.00%	0.13%	McGrath et al.[13]
ICU without ventilation	0.52%	0.29%	0.00%	
ICU with ventilation	0.52%	7.29%	9.09%	

Abbreviations: CDC = Center for Disease Control and Prevention. ICU = Intensive Care Unit
[a] The probability of long COVID was stratified by vaccination status based on reported differences between vaccinated and unvaccinated patients[14]; [b] The probability that an infection is symptomatic was assumed to be the same for children and adults.

Table 2. Cost Inputs

Input	Value	Source
Cost of outpatient treatment	$663	Sum of GP visits and medications
Cost of GP visit	$229	Kohli et al. [15]
Number of GP visits	2	Scott et al.[16]
Medication	$205	Scott et al.[16]
Regular ward cost [a]	$14,325	Di Fusco et al.[11]
ICU without ventilation cost [a]	$25,688	
ICU with ventilation cost [a]	$78,245	
Long COVID cost	$5,969	Sum of GP visits, tests, specialist visits, hospitalizations, and medications
Number of GP visits	11	Scott et al.[16]
Number of tests	6	Scott et al.[16]
Cost of specialist visit for long COVID	$1,967	Scott et al.[16]
Number of specialist visits for long COVID	1	Assumption
Percentage of patients hospitalized with long COVID	7%	Lavery et al.[17]
Medications	$219	Scott et al.[16]

Abbreviations: GP = general practitioner; ICU = intensive care unit
[a] Inpatient costs were stratified by vaccination status based on reported differences in length of stay between vaccinated and unvaccinated patients[18]

Table 3. Vaccine Coverage and Effectiveness Inputs

Input	Age 6 months to 4 years	Age 5–11 years	Age 12–17 years	Source
Vaccine coverage [a]	3.4%	6.0%	11.9%	CDC[3]
Vaccine effectiveness				
against infection	60%			Lin et al.[5]
against symptomatic infection	60%			
against hospitalization	70%			

Abbreviation: CDC = Centers for Disease Control and Prevention
[a] Coverage rates have been updated to reflect the reported uptake of the XBB.1.5 adapted COVID-19 vaccine. Results reported in the abstract were based on coverage estimates of the first booster (i.e., the third dose of the original monovalent vaccine).

RESULTS

- For those age 6 months to 17 years, the model projected that, compared with no vaccination, the NT162b2 XBB.1.5-adapted COVID-19 vaccine resulted in 33,045 fewer symptomatic cases, 653 fewer hospitalizations, five fewer deaths, and $77,994,843 in direct treatment cost savings (**Table 4**). Incorporating caregiver productivity losses contributed an additional $8,362,282 in cost savings.
- Despite not being the largest group, most of the impact was among those age 12–17 years (64% of cases, 51% of hospitalizations, 60% of deaths, and 55% of treatment costs) due to higher vaccine coverage in this group (11.9% vs. 6.0% and 3.4% among those age 6 months to 4 years and 5–11 years, respectively).

Table 4. Incremental Impact of Vaccination

Outcome	Age 6 months to 17 years*	Age 6 months to 4 years	Age 5–11 years	Age 12–17 years
Symptomatic cases averted	33,045	3,966	7,777	21,303
Hospitalizations averted	653	192	128	334
Deaths averted	5	1	1	3
Direct medical treatment costs averted	$77,994,843	$8,059,443	$16,497,533	$53,437,867
Caregiver productivity losses averted	$8,362,282	$1,151,576	$1,932,481	$5,278,224

*Overall Pediatric Population

- Increasing vaccine coverage to 25% in all three groups resulted in 106,316 fewer symptomatic cases, 2,642 fewer hospitalizations, 17 fewer deaths, and $240,264,756 in direct treatment cost savings, as well as $27,608,184 in savings from reduced caregiver productivity losses (**Table 5**).

Table 5. Scenario Analysis: Incremental Impact of Increasing Vaccination Coverage to 25%

Outcome	Age 6 months to 17 years*	Age 6 months to 4 years	Age 5–11 years	Age 12–17 years
Symptomatic cases averted	106,316	29,159	32,403	44,755
Hospitalizations averted	2,642	1,409	531	702
Deaths averted	17	7	4	6
Direct medical treatment costs averted	$240,264,756	$59,260,608	$68,739,723	$112,264,426
Caregiver productivity losses averted	$27,608,184	$8,467,472	$8,052,006	$11,088,706

*Overall Pediatric Population

- Results were sensitive to variation in symptomatic rate of infection, hospitalization rate, and vaccine coverage.
- Results are likely conservative, because they do not include potential indirect effects on transmission or broader societal benefits such as spillover effects on caregivers or the value of lost school days.

CONCLUSIONS

- **Increasing BNT162b2 XBB.1.5-adapted COVID-19 vaccination coverage among those age 6 months to 17 years in the US could generate notable reductions in symptomatic cases, hospitalizations, and deaths and result in medical treatment costs saved. Because there are limited treatment options for the pediatric population, vaccination is the primary tool available to help reduce the burden of COVID-19 in this population. Therefore, increasing pediatric vaccination coverage should be an important public health goal.**

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Acknowledgments

Graphic design and editorial support were provided by Kawthar Nakayima and Michael Grossi of Evidera, a business unit of PPD, part of Thermo Fisher Scientific, and was funded by Pfizer.

Disclosures

This study was funded by Pfizer Inc. AY, MDF, SL, AR, and ET are employees of and may hold shares in Pfizer. BY and KF are employees of Evidera, a business unit of PPD, part of Thermo Fisher Scientific, which was contracted by Pfizer to conduct this study.

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Presented at the Professional Society for Health Economics and Outcomes Research (ISPOR) 2024; May 5-8, 2024; Atlanta, Georgia