

Modeling the Potential Public Health and Economic Impact of COVID-19 Vaccination in Taiwan

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- A vaccination strategy targeting adults ≥65 years old and immunocompromised adults 18–64 old years was estimated to provide substantial annual public health and economic gains in Taiwan.
- Broader age-based vaccination strategies averted additional total cases, hospitalizations, and lost QALYs and produced additional direct medical and societal cost savings.
- These results support ongoing evaluation of COVID-19 booster strategies for older adults and immunocompromised populations in Taiwan, with broader adult vaccination offering additional public health value.



Introduction

- COVID-19 continues to impose a public health burden in Taiwan, particularly among older adults and people with immunocompromising or high-risk conditions.
- Because SARS-CoV-2 variants and population immunity continue to evolve, the WHO has maintained a vaccine composition advisory process for COVID-19 vaccines to support updated formulations.¹

Objective

- To assess the annual public health and economic impact of COVID-19 booster vaccination strategies in Taiwan at current observed levels of uptake.

Methods

- A previously published integrated Markov cohort decision-tree model² was adapted to the Taiwan setting to compare booster vaccination with no additional vaccination over a 1-year time horizon.
- The Markov component tracked the target population through susceptible, infected, booster-vaccinated, recovered, and death states; the decision-tree component captured disease severity, treatment pathways, long COVID, and related outcomes (Figure 1, Figure 2).

- The base case evaluated vaccination for adults ≥65 years old and immunocompromised adults 18–64 years old. Scenarios evaluated adults ≥50 years old, immunocompromised adults 18–49 years old, and the total adult population ≥18 years old.
- The analysis used a Taiwan healthcare payer perspective; societal costs were evaluated through indirect productivity costs.

INPUTS

- Epidemiology and clinical inputs were primarily based on Taiwan surveillance data and published literature, with local sources used where available (Table 1, Table 2).
- Population projections, immunocompromised prevalence, and high-risk proportions were informed by Taiwan population projections and published sources.³⁻⁵
- Vaccine uptake reflected first JN.1 vaccine dose receipt from October 1, 2024 to September 7, 2025.⁶
- The attack rate was calculated using 2023 Taiwan Centers for Disease Control case data multiplied by an underreporting factor of 3.6.^{7,8}
- The model incorporated a vaccine profile based on a synthesis of real-world evidence,⁹⁻¹⁶ with effectiveness rates of 40% against infection, 50% against symptomatic infection, and 65% against hospitalization. Vaccine effectiveness waned exponentially at a rate of 1/duration of protection (DoP) per month. The DoP was assumed to be 6 months.

Results

- In the base case, vaccination of adults ≥65 years old and immunocompromised adults 18–64 years old was estimated to avert 11,987 symptomatic cases, 1,014 hospitalizations, and 66 COVID-19 deaths at current observed uptake (see Table 1 for uptake).
- Expanding the strategy to adults ≥50 years old and immunocompromised adults 18–49 years old increased the estimated impact, averting 19,491 symptomatic cases, 1,414 hospitalizations, and 69 deaths.
- A vaccination strategy for all adults ≥18 old years generated the largest estimated impact, averting 30,402 symptomatic cases, 1,698 hospitalizations, and 69 deaths.
- Across the modeled strategies, direct medical cost savings ranged from US\$9.9 million to US\$20.6 million, and total societal cost savings ranged from US\$13.0 million to US\$67.5 million, excluding vaccination costs.

Table 3. Incremental Results Versus No Additional Vaccination

Outcome	Base case: ≥65 years + 18–64 IC	Scenario 1: ≥50 years + 18–49 IC	Scenario 2: ≥18 years total population
Total population	23,342,839	23,342,839	23,342,839
Eligible population	6,954,481	10,095,404	19,392,417
Doses administered	979,500	1,444,579	1,868,650
Health outcomes			
Symptomatic cases avoided	11,987	19,491	30,402
COVID-19 deaths avoided	66	69	69
Outpatient cases avoided	10,973	18,078	28,704
Hospitalizations avoided	1,014	1,414	1,698
Economic outcomes (USD)			
Testing cost	-\$42,492	-\$69,094	-\$107,771
Inpatient treatment cost	-\$4,011,621	-\$5,537,847	-\$6,592,004
Outpatient treatment cost	-\$175,678	-\$289,431	-\$459,564
Long-COVID treatment cost	-\$5,968,756	-\$8,611,659	-\$14,082,110
Total direct cost	-\$9,857,419	-\$14,004,930	-\$20,590,657
Discounted productivity loss	-\$3,130,607	-\$17,812,084	-\$46,937,185
Total societal cost	-\$12,988,027	-\$31,817,014	-\$67,527,842
Abbreviations: IC = immunocompromised; Costs exclude vaccination acquisition and administration costs.			

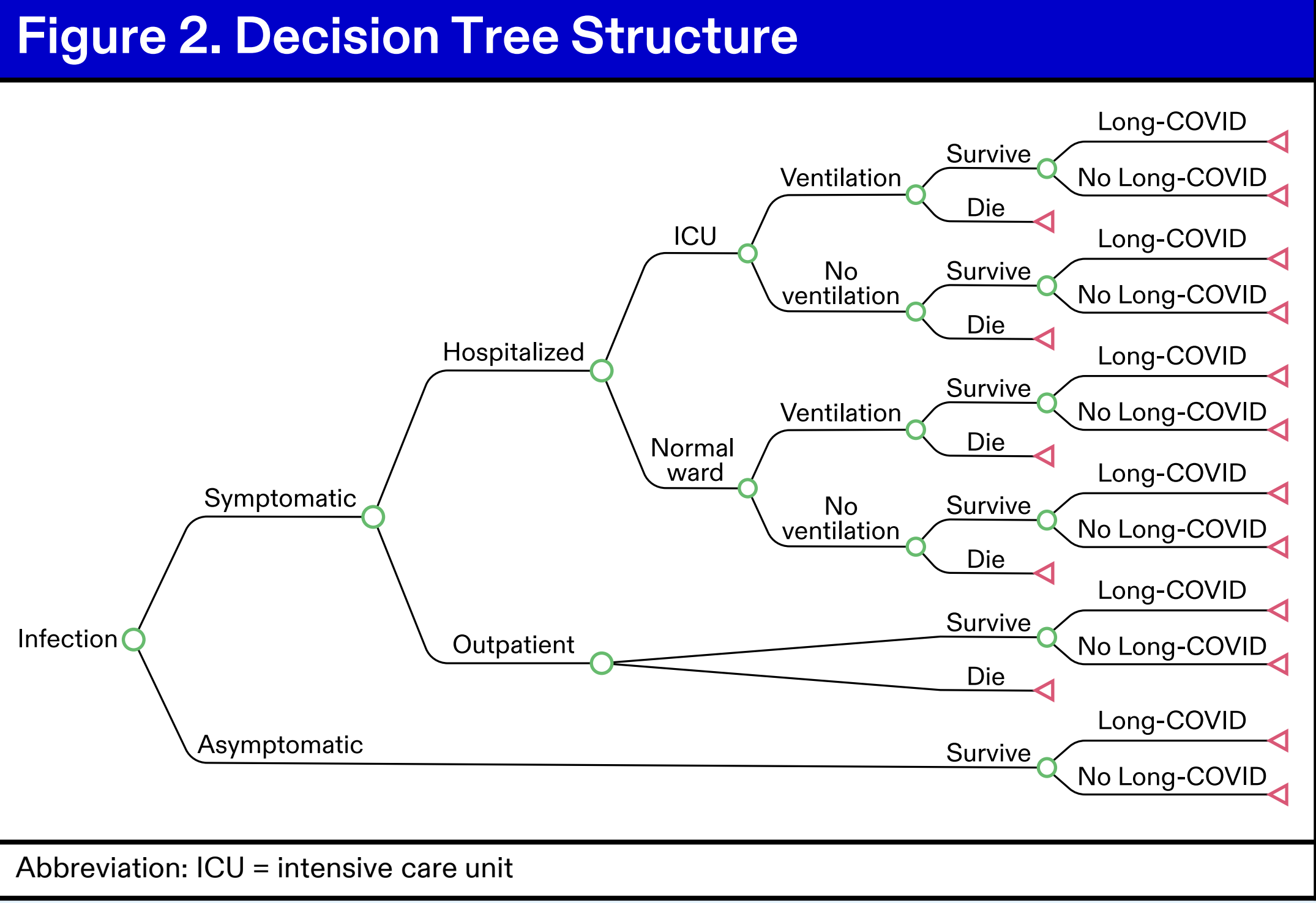
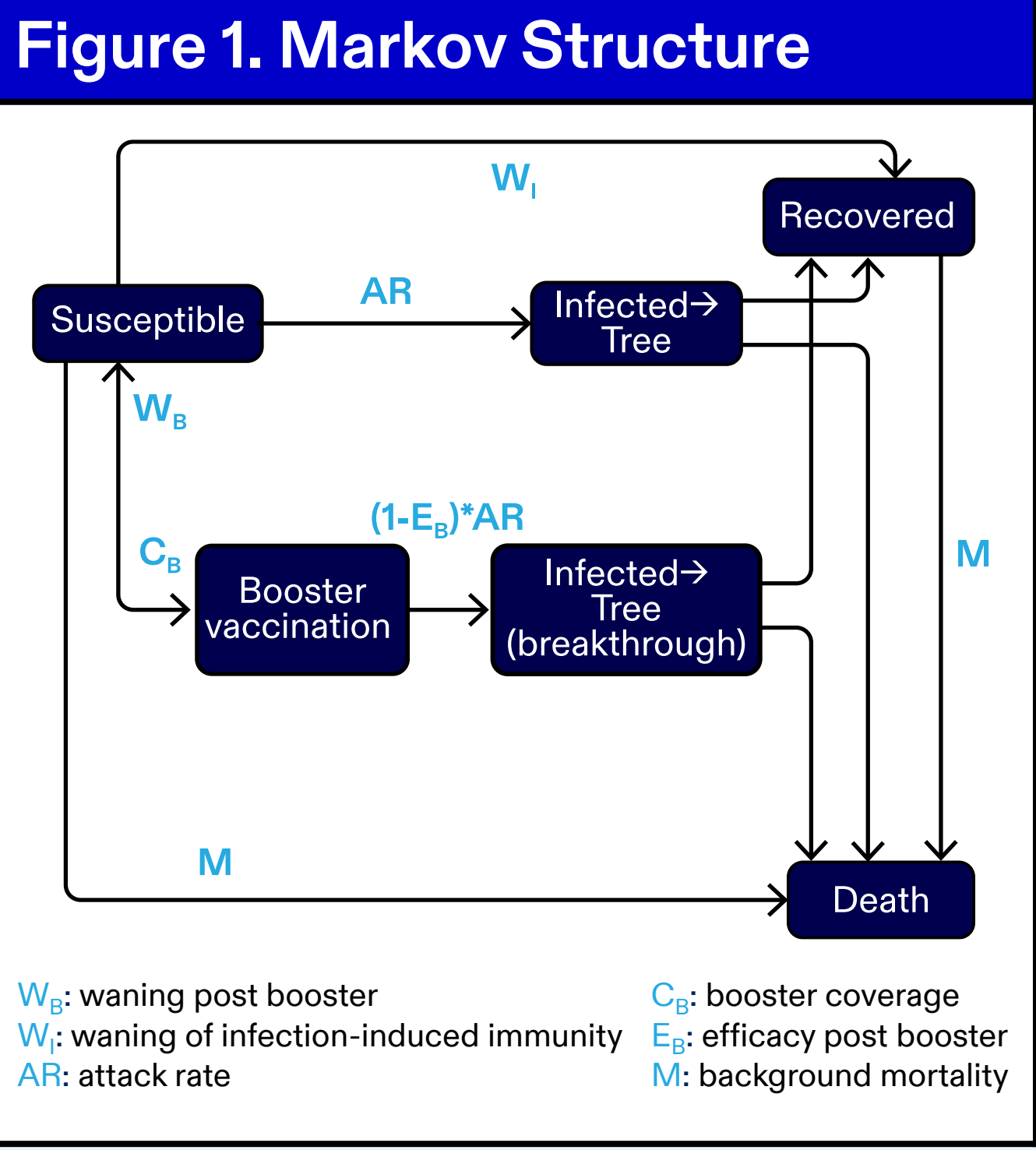


Table 1. Epidemiology and Clinical Inputs

Input description	6mo-4	5-11	12-17	18-29	30-49	50-64	65-74	≥75	References / Notes
Population size (2025)	643,201	1,370,408	1,199,447	3,057,605	7,071,270	5,265,188	2,936,345	1,737,158	National Development Council ³
Proportion immunocompromised (%)	1.1%	0.4%	0.4%	0.5%	2.0%	4.3%	6.1%	6.5%	Clark et al. ⁴
Vaccine uptake (%)	4.7%	14.9%	16.7%	3.4%	4.6%	9.2%	20.4%	20.4%	Taiwan CDC JN.1 vaccination statistics ⁶
Annual attack rate in susceptible population (%)	26.75%	23.45%	23.66%	31.75%	26.16%	17.45%	10.93%	22.45%	Taiwan CDC 2023 case data ⁷ ; underreporting from Mustapha et al. ⁸
Probability infection is symptomatic (%)	40.3%	40.3%	40.3%	41.6%	41.7%	41.7%	35.1%	36.5%	Lin et al. ¹⁷
Hospitalization rate among symptomatic patients (%)	0.65%	0.60%	0.59%	1.97%	1.98%	4.06%	9.27%	4.51%	Taiwan CDC weekly report ¹⁸ ; adjusted using Kuo et al. ¹⁹
ICU admission among hospitalized patients (%)	2.30%	0.80%	0.80%	1.20%	3.31%	11.30%	20.80%	23.24%	Kuo et al. ¹⁹
Ventilation among ICU patients (%)	0.00%	0.00%	0.00%	15.38%	19.14%	35.00%	45.23%	39.97%	Kuo et al. ¹⁹ ; adjusted for ventilation conditional on ICU admission
Death among hospitalized patients (%)	0.00%	0.00%	0.01%	0.00%	0.11%	0.70%	3.54%	7.74%	Taiwan CDC death statistics ^{20,21}
Probability of long COVID (%)	13.50%	13.50%	13.50%	12.60%	15.78%	10.40%	11.77%	13.55%	Qin et al. ²² ; WHO long COVID definition ²³
Abbreviations: CDC = Centers for Disease Control; ICU = intensive care unit. Notes: Age groups <18 years are reported for completeness, but the base-case eligible population begins at 18 years old for immunocompromised adults.									

Table 2. Cost Inputs

Input category	Value / assumption	References / Notes
Outpatient costs	One test and one GP visit assumed per outpatient case COVID-19 test US\$3.54; GP visit US\$15.54; OTC pain medication US\$0.47;	Bank of Taiwan ²⁴ ; Taiwan CDC ²⁵ ; Focus Taiwan ²⁶ ; Yang et al. ⁵ ; Focus Taiwan ²⁷
Hospitalization costs	Inpatient admission without ventilation: US\$3,672; ICU admission without ventilation: US\$4,794	MSD ²⁸ ; Bank of Taiwan ²⁴
Long COVID costs	Four GP visits, four COVID-19 tests, and three specialist/ED visits assumed; 42.4% of patients with PASC hospitalized Specialist visit US\$49.83; Long COVID hospitalization US\$3,672.	Tan et al. ²⁹ ; Chia-Ying et al. ³⁰ ; Cheng Hsin General Hospital ³¹ ; Bank of Taiwan ²⁴
Abbreviations: CDC = Centers for Disease Control; ED = emergency department; GP = general practitioner; ICU = intensive care unit; MSD = Merck, Sharp, and Dohme; OTC = over the counter; PASC = post-acute sequelae of COVID-19;		

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