Supplementary Material

Public Health and Economic Impact of Periodic COVID-19 Vaccination with BNT162b2 for Old Adults and High-Risk Patients in an Illustrative Prefecture of Japan: A Budget Impact Analysis

Author name and affiliations

Mitsuhiro Nagano [1†], Kosuke Tanabe [2†], Kazumasa Kamei [1], Sooyeol Lim [3], Honoka Nakamura [3], Shuhei Ito [2]

† Mitsuhiro Nagano and Kosuke Tanabe are co-first authors of the article.

[1] Japan Access and Value, Pfizer Japan Inc., Tokyo, Japan

[2] Vaccine Medical Affairs, Pfizer Japan Inc., Tokyo, Japan

[3] HEOR, Value and Access, INTAGE Healthcare Inc., Tokyo, Japan

Corresponding author

Name: Mitsuhiro Nagano

Address: Japan Access and Value, Pfizer Japan Inc., 3-22-7, Yoyogi, Shibuya-ku, Tokyo 151-8589, Japan

Email: mitsuhiro.nagano@pfizer.com

Supplementary tables

Table S1. Age-specific population demographics of Prefecture X and 3 municipalities (City A, City B, City C) in Prefecture X

Age Group (years)	Prefecture X	City A	City B	City C
<5 years	58,113 (4.1%)	3,771 (5.5%)	13,954 (4.0%)	1,409 (3.0%)
5-11 years	95,185 (6.7%)	5,187 (7.5%)	22,497 (6.5%)	2,436 (5.3%)
12-17 years	85,272 (6.0%)	4,857 (7.1%)	20,632 (6.0%)	2,351 (5.1%)
18-29 years	169,733 (12.0%)	9,070 (13.2%)	39,472 (11.4%)	4,275 (9.2%)
30-59 years	550,553 (38.9%)	29,848 (43.4%)	135,127 (39.2%)	15,778 (34.0%)
60-64 years	80,941 (5.7%)	2,884 (4.2%)	20,427 (5.9%)	3,363 (7.3%)
65-74 years	187,020 (13.2%)	6,947 (10.1%)	47,006 (13.6%)	7,827 (16.9%)
≥75 years	186,793 (13.2%)	6,259 (9.1%)	45,951 (13.3%)	8,935 (19.3%)
≥65 years	373,813 (26.4%)	13,206 (19.2%)	92,957 (26.9%)	16,762 (36.1%)

Source: e-Stat (Portal Site of Official Statistics of Japan). National Census 2020 Basic Tabulation of Population ([46] in References).

Table S2. Distribution of included population at the start of the model

Age Group (years)	Percentage of population included in the analysis	Percentage of population susceptible to COVID-19 at the start of the model horizon (A)	Percentage of population with infection-induced immunity at the start of the model horizon (B)	Percentage of population vaccinated at the start of the model horizon (C)	Total at the start of the model horizon (A)+(B)+(C)
5-11 years	18.3%	39.5%	30.3%	30.3%	100%
12-17 years	71.7%	39.5%	30.3%	30.3%	100%
18-29 years	79.8%	45.8%	27.1%	27.1%	100%
30-59 years	85.1%	55.5%	22.3%	22.3%	100%
60-64 years	92.7%	71.2%	14.4%	14.4%	100%
65-74 years	91.3%	71.2%	14.4%	14.4%	100%
≥75 years	96.7%	71.2%	14.4%	14.4%	100%

Source: Ministry of Health, Labour, and Welfare. Survey of Antibody Possession Rates of New Coronavirus Using Residual Blood Samples for Testing at the Second Blood Donation ([49] in References) and Nagano et al. 2024 ([21] in References)

Note: The percentage of Japanese population included in the analysis are those who completed the two injections of the primary dose of the vaccine.

Table S3. Subgroup analysis 1: results of cumulative public health and economic impact of COVID-19 vaccination in 3 municipalities in Prefecture X under different vaccination rates across 3 years

Municipality	Outcomes	50% vaccination (A)	90% vaccination (B)	Difference (90% vs. 50%) (B-A) (%)	10% vaccination (C)	Difference (10% vs. 50%) (C-A) (%)
City A	Number of symptomatic cases (n)	28,402	28,147	-256 (-0.9%)	28,677	275 (1.0%)
	Number of hospitalizations (n)	627	586	-41 (-6.5%)	670	44 (7.0%)
	Number of COVID-19-related deaths (n)	37	34	-4 (-10.5%)	42	4 (11.3%)
	Vaccine-related cost (JPY)	268,188,537	484,214,942	216,026,404 (80.6%)	53,473,430	-214,715,107 (-80.1%)
	Non-vaccine-related medical cost (JPY)	3,798,765,635	3,704,687,071	-94,078,564 (-2.5%)	3,899,775,911	101,010,276 (2.7%)
	Productivity loss (JPY)	12,179,896,908	11,885,792,283	-294,104,625 (-2.4%)	12,495,817,094	315,920,186 (2.6%)
	Total cost (JPY)	16,246,851,081	16,074,694,296	-172,156,785 (-1.1%)	16,449,066,436	202,215,355 (1.2%)
City B	Number of symptomatic cases (n)	134,748	132,952	-1,796 (-1.3%)	136,679	1,931 (1.4%)
	Number of hospitalizations (n)	3,738	3,444	-294 (-7.9%)	4,053	315 (8.4%)
	Number of COVID-19-related deaths (n)	261	233	-28 (-10.8%)	292	30 (11.6%)
	Vaccine-related cost (JPY)	1,886,323,877	3,405,764,783	1,519,440,906 (80.6%)	376,108,935	-1,510,214,942 (-80.1%)

	Non-vaccine-related medical cost (JPY)	19,331,423,940	18,657,619,332	-673,804,608 (-3.5%)	20,054,826,438	723,402,498 (3.7%)
	Productivity loss (JPY)	61,958,292,818	59,896,564,290	-2,061,728,528 (-3.3%)	64,172,837,161	2,214,544,343 (3.6%)
	Total cost (JPY)	83,176,040,635	81,959,948,405	-1,216,092,230 (-1.5%)	84,603,772,534	1,427,731,899 (1.7%)
City C	Number of symptomatic cases (n)	16,812	16,489	-323 (-1.9%)	17,158	347 (2.1%)
	Number of hospitalizations (n)	606	551	-55 (-9.1%)	665	59 (9.8%)
	Number of COVID-19-related deaths (n)	48	43	-5 (-11.1%)	54	6 (11.9%)
	Vaccine-related cost (JPY)	339,593,822	613,139,293	273,545,471 (80.6%)	67,710,517	-271,883,305 (-80.1%)
	Non-vaccine-related medical cost (JPY)	2,652,195,298	2,526,733,791	-125,461,507 (-4.7%)	2,786,876,395	134,681,097 (5.1%)
	Productivity loss (JPY)	8,413,557,278	8,044,190,646	-369,366,632 (-4.4%)	8,810,264,080	396,706,802 (4.7%)
	Total cost (JPY)	11,405,346,398	11,184,063,729	-221,282,668 (-1.9%)	11,664,850,992	259,504,594 (2.3%)

Note: The target population for vaccination is individuals ≥ 65 years old and individuals at high risk at the age of 60 to 64 years old in Prefecture X.

The time horizon is over 3 years.

Abbreviations: COVID-19, coronavirus disease 2019; JPY, Japanese Yen

Table S4. Subgroup analysis 2: results of cumulative public health and economic impact of COVID-19 vaccination for all individuals ≥ 65 years old in Prefecture X, under different vaccination rates across 3 years

Outcomes	50% vaccination (A)	90% vaccination (B)	Difference (90% vs. 50%) (B-A) (%)	10% vaccination (C)	Difference (10% vs. 50%) (C-A) (%)
Number of symptomatic cases (n)	69,295	62,091	-7,204 (-10.4%)	77,039	7,744 (11.2%)
Number of hospitalizations (n)	9,343	8,156	-1,187 (-12.7%)	10,618	1,274 (13.6%)
Number of COVID-19-related deaths (n)	972	858	-115 (-11.8%)	1,095	123 (12.6%)
Vaccine-related cost (JPY)	7,572,850,789	13,672,874,891	6,100,024,102 (80.6%)	1,509,922,694	-6,062,928,095 (-80.1%)
Non-vaccine-related medical cost (JPY)	22,636,921,894	19,917,252,557	-2,719,669,337 (-12.0%)	25,556,894,870	2,919,972,976 (12.9%)
Testing cost (JPY)	747,846,894	666,428,917	-81,417,977 (-10.9%)	835,333,286	87,486,392 (11.7%)
Inpatient treatment cost (JPY)	15,835,565,687	13,822,932,692	-2,012,632,995 (-12.7%)	17,995,493,020	2,159,927,334 (13.6%)
Outpatient treatment cost (JPY)	3,363,788,315	3,026,198,943	-337,589,372 (-10.0%)	3,726,792,469	363,004,154 (10.8%)
Long-COVID treatment cost (JPY)	2,689,720,998	2,401,692,005	-288,028,993 (-10.7%)	2,999,276,094	309,555,096 (11.5%)
Productivity loss (JPY)	72,965,509,962	64,705,270,827	-8,260,239,134 (-11.3%)	81,838,452,434	8,872,942,472 (12.2%)
Total cost (JPY)	103,175,282,645	98,295,398,275	-4,879,884,370 (-4.7%)	108,905,269,998	5,729,987,353 (5.6%)

Note: The target population for vaccination is individuals ≥ 65 years old in Prefecture X. The time horizon is over 3 years.

Abbreviations: COVID-19, coronavirus disease 2019; JPY, Japanese Yen

Table S5. Model inputs for scenario analysis

Input description	Base scenario A (reference)	Scenario analysis
Vaccine effectiveness (VE) (infection/symptomatic/hospitalization)		
Scenario 1	50%/ 60%/ 70%	40%/50%/50%
Scenario 2		60%/70%/80%
Vaccine-induced duration of protection against infection		
Scenario 3	6 months	3 months
Scenario 4		9 months
Annual attack rate (%)		
Scenario 5	5–11 years: 32.70%, 12-17 years: 30.51%, 18-29 years: 27.74%, 30-59 years: 21.09%, 60-64 years: 11.07%, 65-74 years: 9.09%, ≥ 75 years: 9.13%	30%
Scenario 6: -25% (75% of the base case)		5–11 years: 24.52%, 12-17 years: 22.88%, 18-29 years: 20.43%, 30-59 years: 15.82%, 60-64 years: 8.30%, 65-74 years: 6.82%, ≥75 years: 6.85%

Scenario 7: +25% (125% of the base case)		5–11 years: 40.87%, 12-17 years: 38.14%, 18-29 years: 34.05%, 30-59 years: 26.37%, 60-64 years: 13.84%, 65-74 years: 11.36%, ≥75 years: 11.41%
Hospitalization rate among symptomatic patients (%)		
Scenario 8: -25% (75% of the base case)	5–11 years: 0.80%, 12-17 years: 0.60%, 18-29 years: 1.10%, 30-59 years: 1.30%, 60-64 years: 2.90%, 65-74 years: 6.00%, ≥ 75 years: 22.80%	5–11 years: 0.60%, 12-17 years: 0.45%, 18-29 years: 0.83%, 30-59 years: 0.95%, 60-64 years: 2.18%, 65-74 years: 4.46%, ≥75 years: 17.10%
Scenario 9: +25% (125% of the base case)		5–11 years: 1.00%, 12-17 years: 0.75%, 18-29 years: 1.38%, 30-59 years: 1.58%, 60-64 years: 3.63%, 65-74 years: 7.44%, ≥75 years: 28.50%
Long COVID incidence rate (outpatient)		
Scenario 10	29.90%	10%
Scenario 11		30%
Long COVID incidence rate (inpatient)		
Scenario 12	66.70%	50%

Scenario 13		70%
Workforce participation rate (%)		
Scenario 14: Consideration of productivity loss from patients only	100%	5–11 years: 0.00%, 12-17 years: 23.96%, 18-29 years: 63.14%, 30-59 years: 86.15%, 60-64 years: 74.00%, 65-74 years: 42.52%, ≥75 years: 11.40%