Alternative dose allocation strategies to increase benefits from constrained COVID-19 vaccine supply

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Overview

How can vaccine supply be allocated in order to balance availability of timely second doses with the urgent need to supply partially protective first doses to as many people as possible?

The answer to this question likely depends on the following factors:

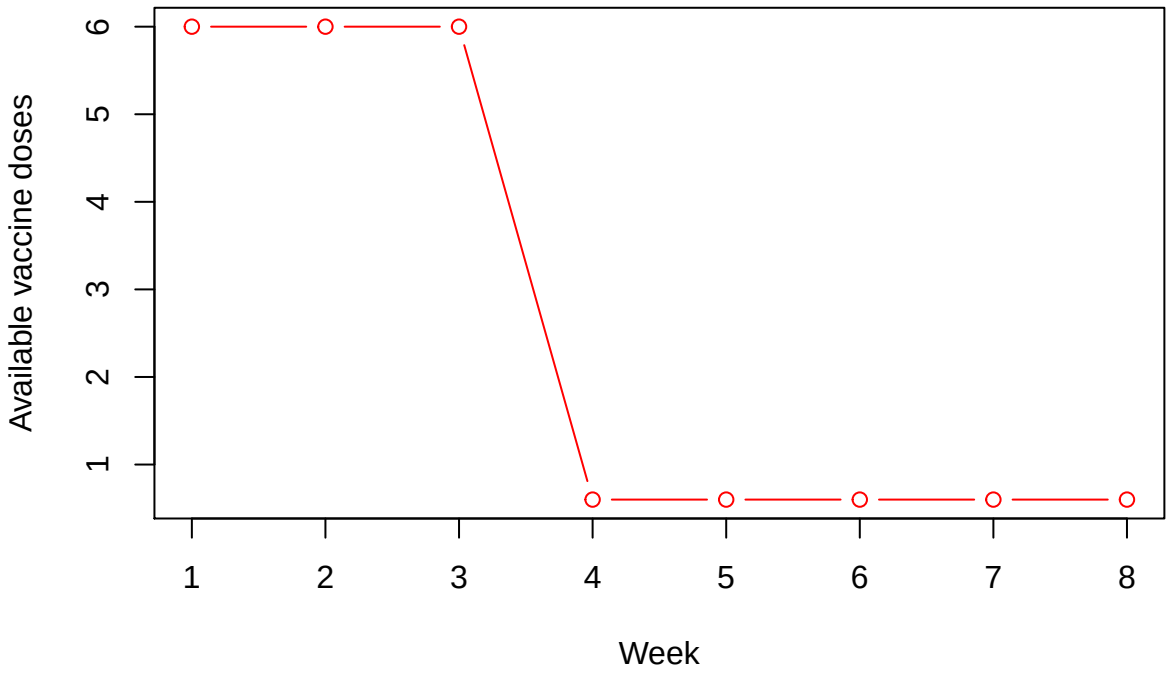
- Vaccine supply over time: does it increase, remain flat, or decline (due to supply chain/distribution issues)
- Infection rates: are infection rates rising, stable, or declining?
- Protection with one dose: data from the Pfizer and Moderna trials indicate that there is partial protection against COVID-19 disease with a single dose of vaccine but the trial was not designed to evaluate the efficacy of a single dose, and the time course of protection is uncertain.

Vaccine availability

Availability of vaccine is assumed to follow a step function. A vaccine availability function representing a drop in supply at week 4 is shown below:

Table 1: Key model input parameters

Parameter	Value
Model time horizon (weeks)	8
Initial number of vaccine doses (millions)	6
Minimum delay between doses (weeks)	3
Vaccine efficacy (2 doses)	0.948
Vaccine efficacy (1 dose)	0.524
Delay from first vaccine to development of protection (weeks)	0
Waning factor if 2nd dose is delayed (per week)	0.9
Weekly incidence at model start (%)	0.01

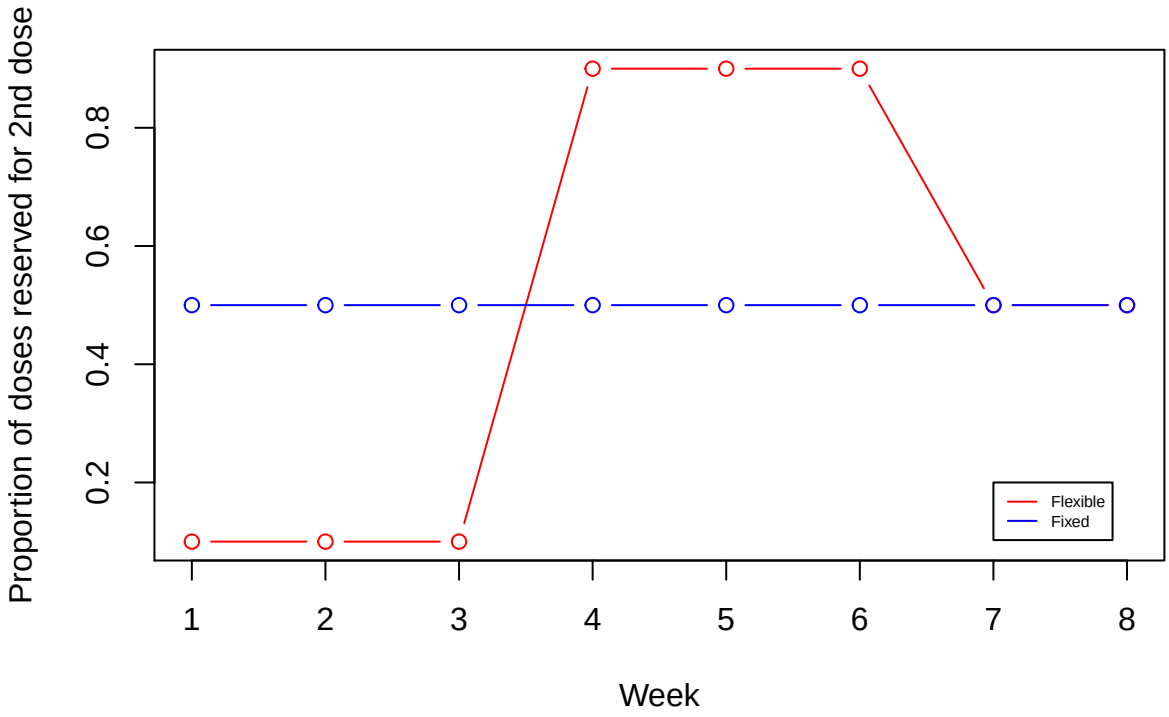


Vaccine allocation

Allocation of vaccine (i.e., the decision to withhold currently available doses to ensure a second dose is available for those receiving an initial dose) is also modeled using a step function. Here, a value of 0.5 means that a dose is set aside for each person receiving their first dose (the current recommendation). A value of <0.5 means that more doses are being distributed immediately. A value of >0.5 would mean that vaccine is being stockpiled for future use.

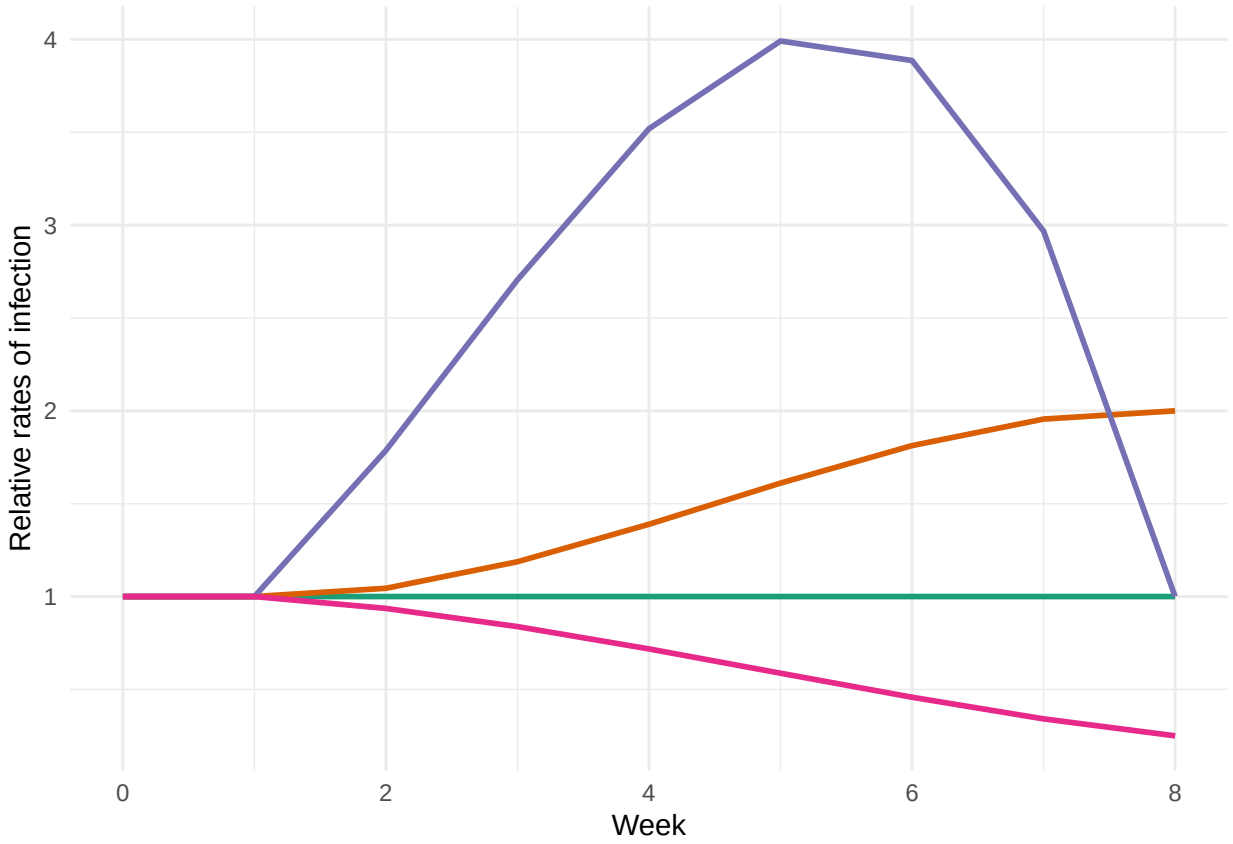
We currently evaluating two options:

1. FIXED: set aside 50% of vaccine supply for 2nd dose
2. FLEXIBLE: For the first 3 weeks, set aside 10% of vaccine supply for 2nd dose, next 3 weeks, set aside 90% of supply for 2nd dose, remainder of time split doses 50:50



Infection risk

Cumulative benefits from vaccines will depend to an extent on the time trend in incidence. We use a flexible function to produce a range of different incidence curves. Manuscript uses two simple examples: flat or increasing and one example of a rising and falling trend, that were defined using a Bezier curve. Some sample trajectories are show below:



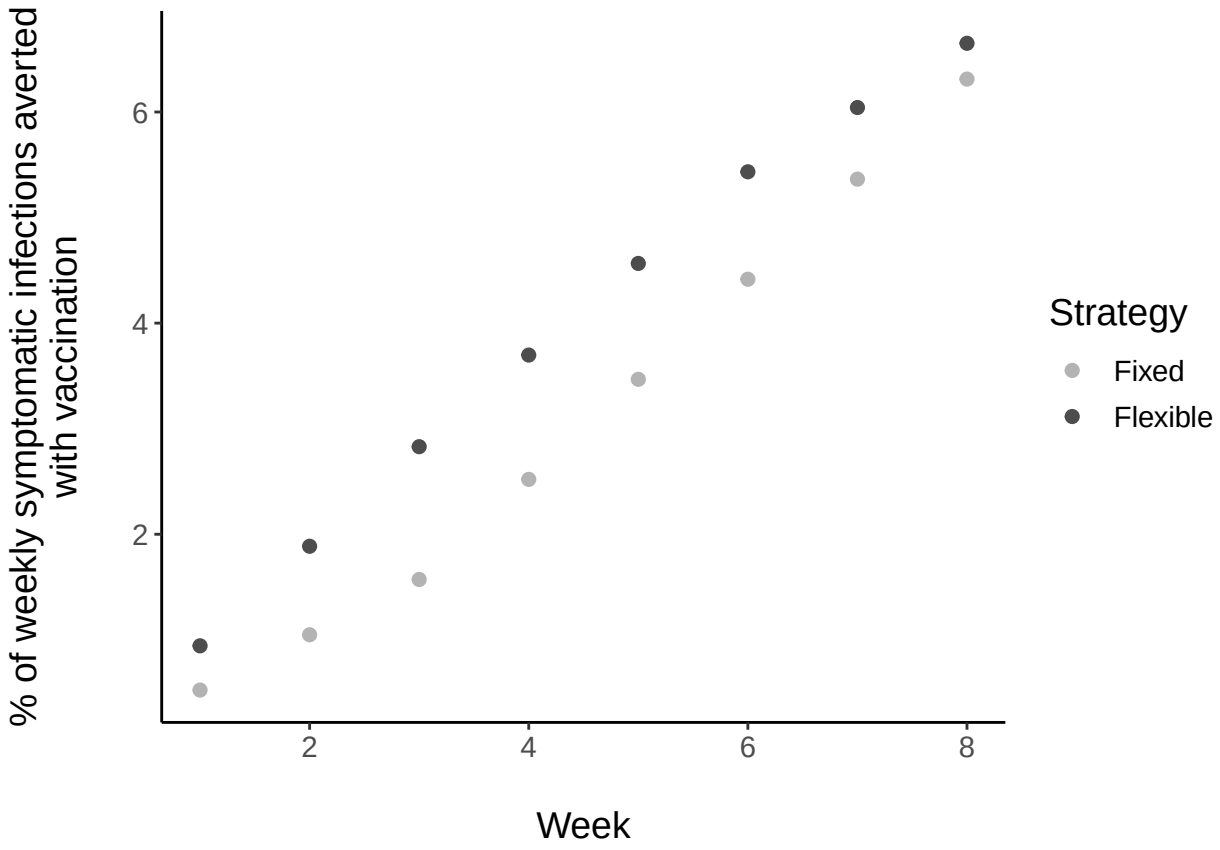
Other assumptions

We are assuming a baseline vaccine efficacy in those fully vaccinated of 0.948, and assume that those who receive a single dose have reduced protection (base case assumes a value of 0.5527426 x the efficacy with 2 doses of vaccine). After the first dose is received, it is assumed to take 0 weeks until the development of protection. There is a minimum 3 week between receipt of first and second doses. Once a person receives the second dose, protection is assumed to increase to 0.948. Protection is assumed to wane (base case value of weekly waning factor of 0.9) in those who do not receive their scheduled second dose, with amount of protection calculated at any given point in time as baseline protection with 1 dose * waning factorˆ(number of weeks past due for second dose). We assume that all people who receive two doses have the same level of protection, regardless of the delays in receiving the second dose.

Scenarios

Scenario 1: Stable vaccine supply

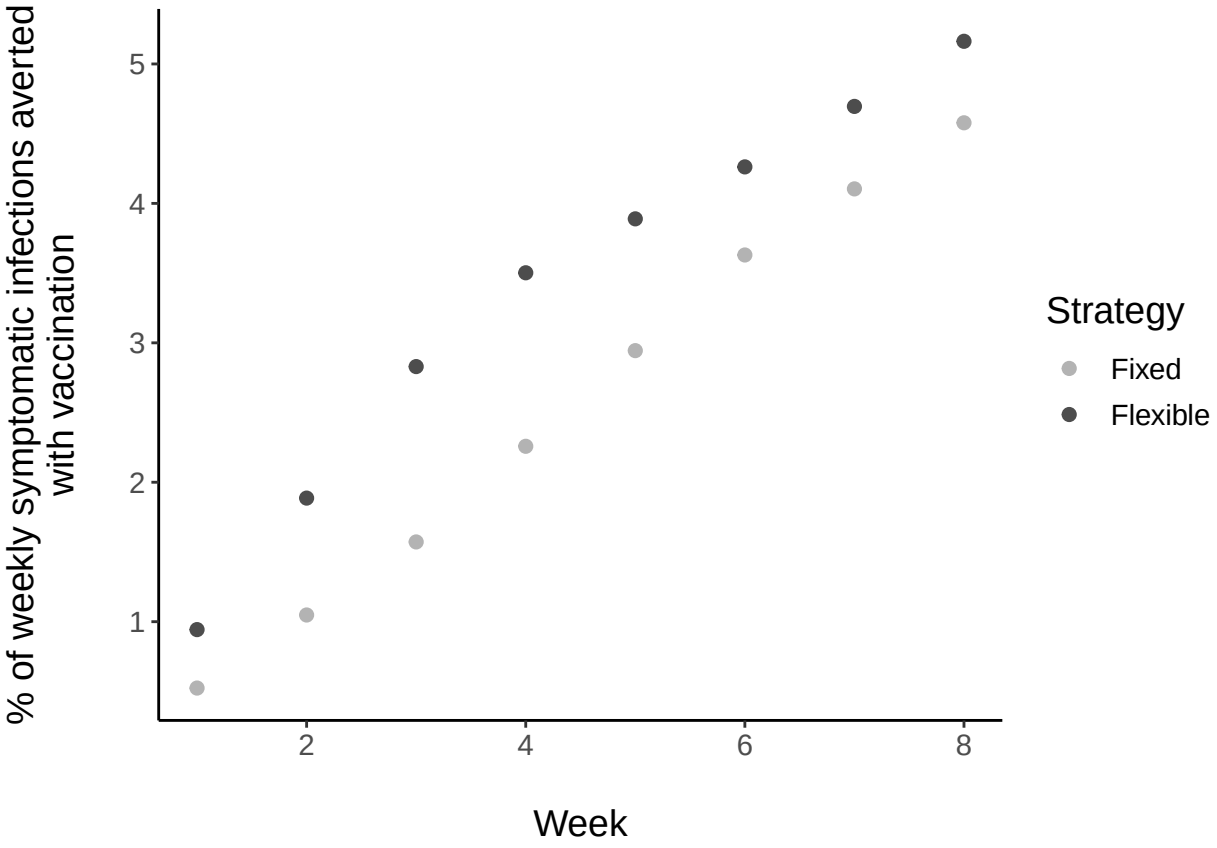
Compare the current recommendation (fixed, set aside 50% of doses for 2nd dose) to a 3-week period of administering 1st doses in as many people as possible (reserving 10% of doses), which then switches to a 10% 1st dose / 90% 2nd dose scheme for a 3-week period, with the remainder of the time reverting back to 50:50 allocation of doses (flexible).



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
1	Fixed	Stable	24	15.0	15.0	15.0	15.0	18.94	
1	Flexible	Stable	24	17.4	17.4	17.4	17.4	19.95	27.1
1	Fixed	Increasing	24	15.0	15.0	15.0	15.0	18.94	
1	Flexible	Increasing	24	17.4	17.4	17.4	17.4	19.95	23.0
1	Fixed	Peaking	24	15.0	15.0	15.0	15.0	18.94	
1	Flexible	Peaking	24	17.4	17.4	17.4	17.4	19.95	29.3

Scenario 2: Interrupted vaccine supply - moderate reduction

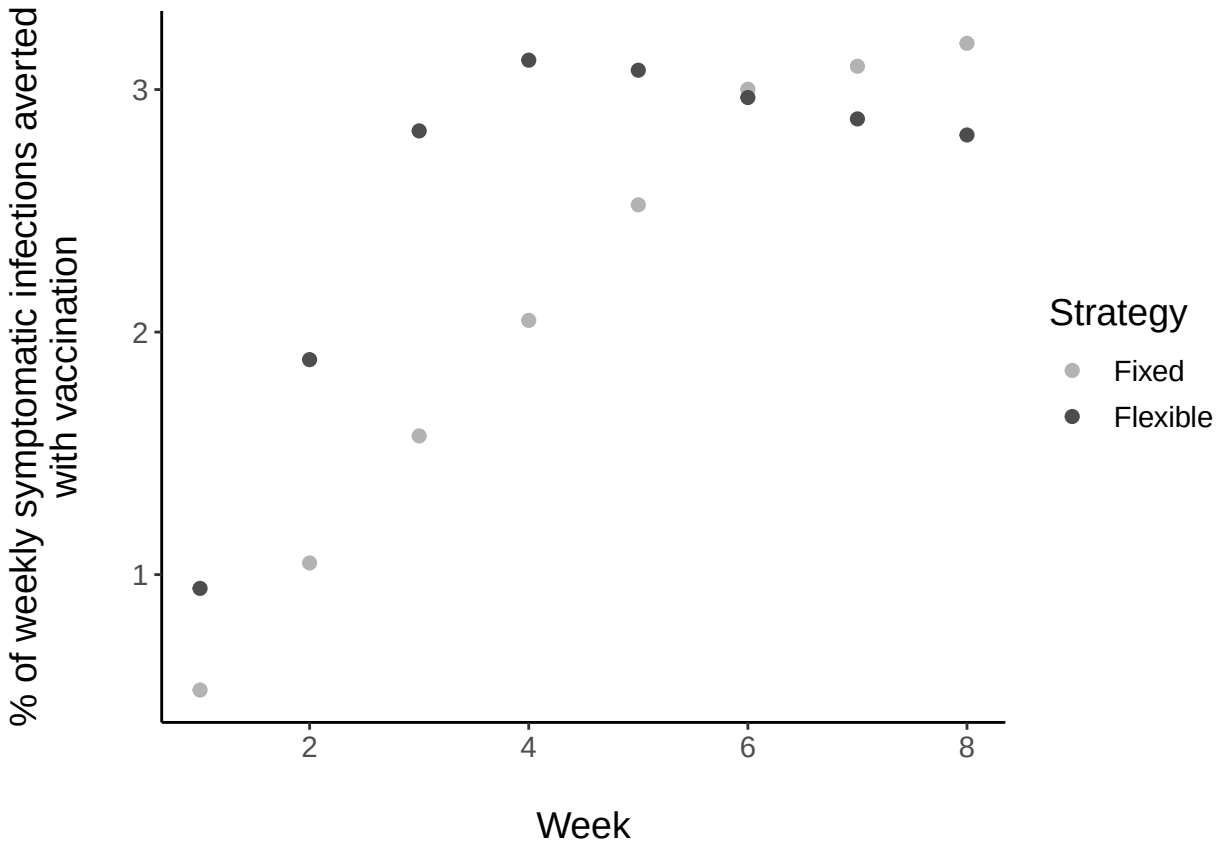
Next we can at the effect of a disrupted vaccine supply on week 4 (with vaccine supply reduced by a factor of 2 from initial levels and remaining at this reduced level for the duration of the simulation).



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
2	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	13.73	
2	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	15.49	31.5
2	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	13.73	
2	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	15.49	27.1
2	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	13.73	
2	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	15.49	31.9

Scenario 3: Interrupted vaccine supply - large disruption

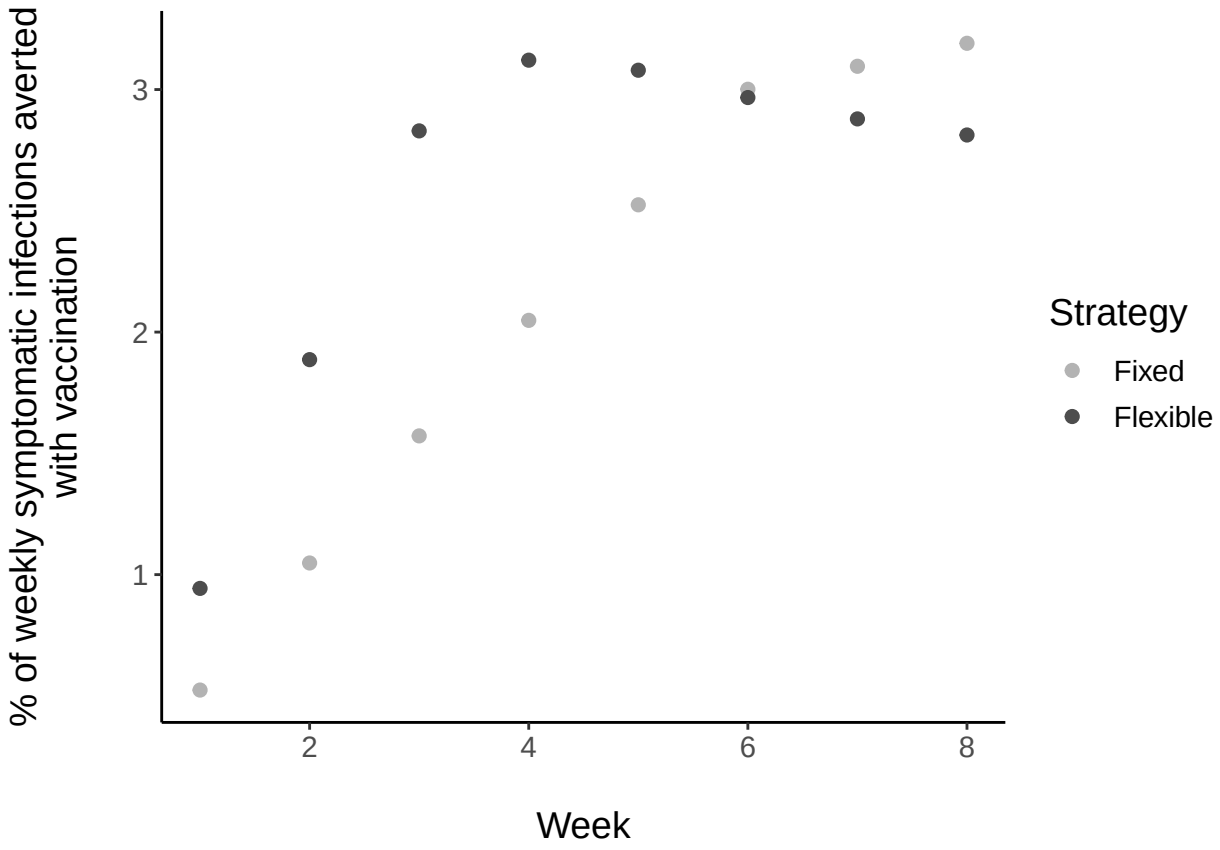
Next we can at the effect of a disrupted vaccine supply on week 4 (with vaccine supply reduced by a factor of 10 from initial levels and remaining at this reduced level for the duration of the simulation).



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
3	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.57	
3	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	8.44	20.7
3	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.57	
3	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	8.44	13.9
3	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.57	
3	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	8.44	21.2

Scenario 4: Interrupted vaccine supply and no protection after 6 weeks

Next we can look at the effect of a disrupted vaccine supply on week 4 (with vaccine supply reduced by a factor of 10 from initial levels and remaining at this reduced level for the duration of the simulation) and protection drops to 0 if time to receipt of 2nd dose passes 6 weeks.



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
4	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.57	
4	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	5.65	13.6
4	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.57	
4	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	5.65	5.4
4	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.57	
4	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	5.65	17.5

Summary of results

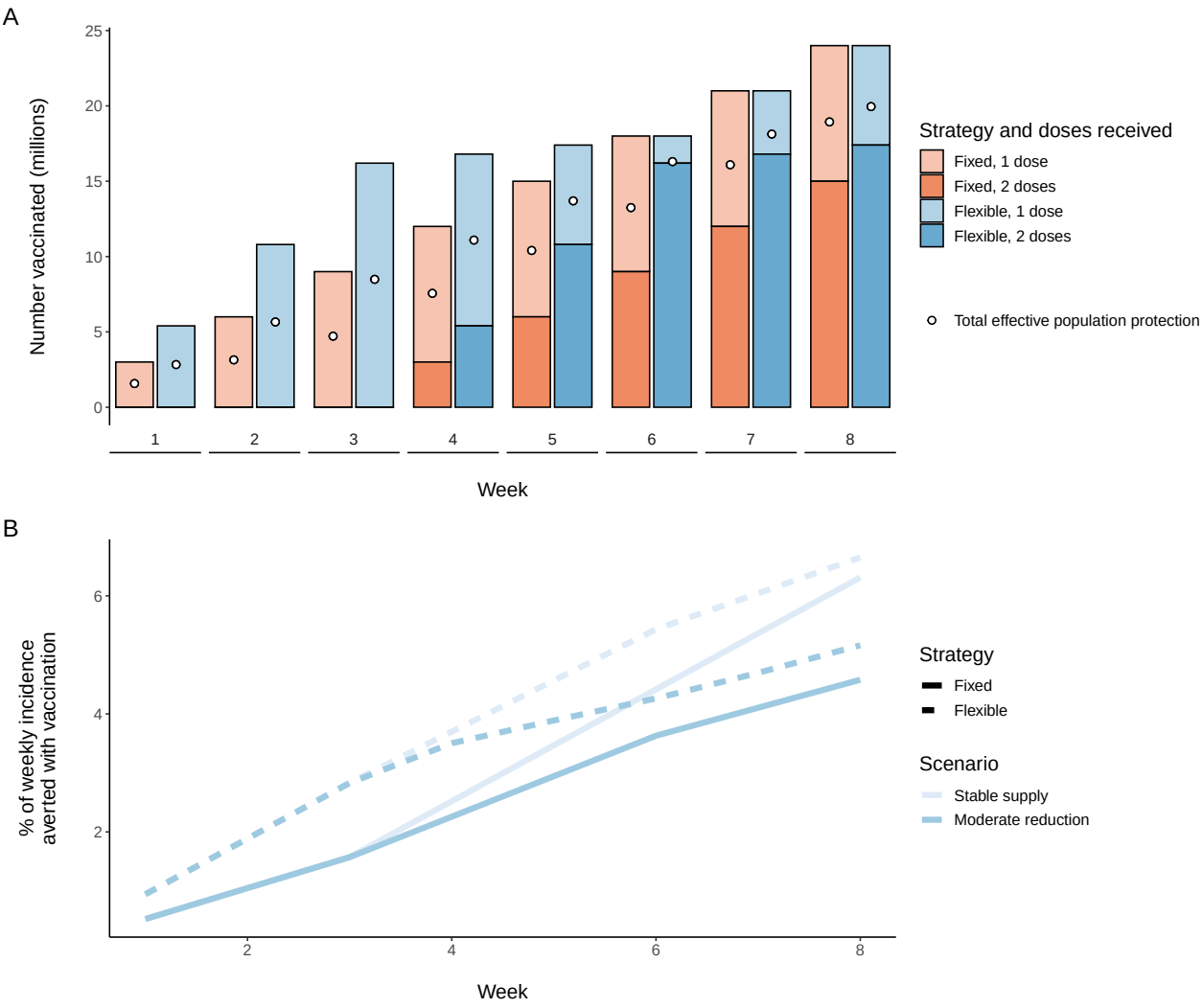


Figure 1: Vaccine allocation and protection over time for base case scenario with 2 strategies.

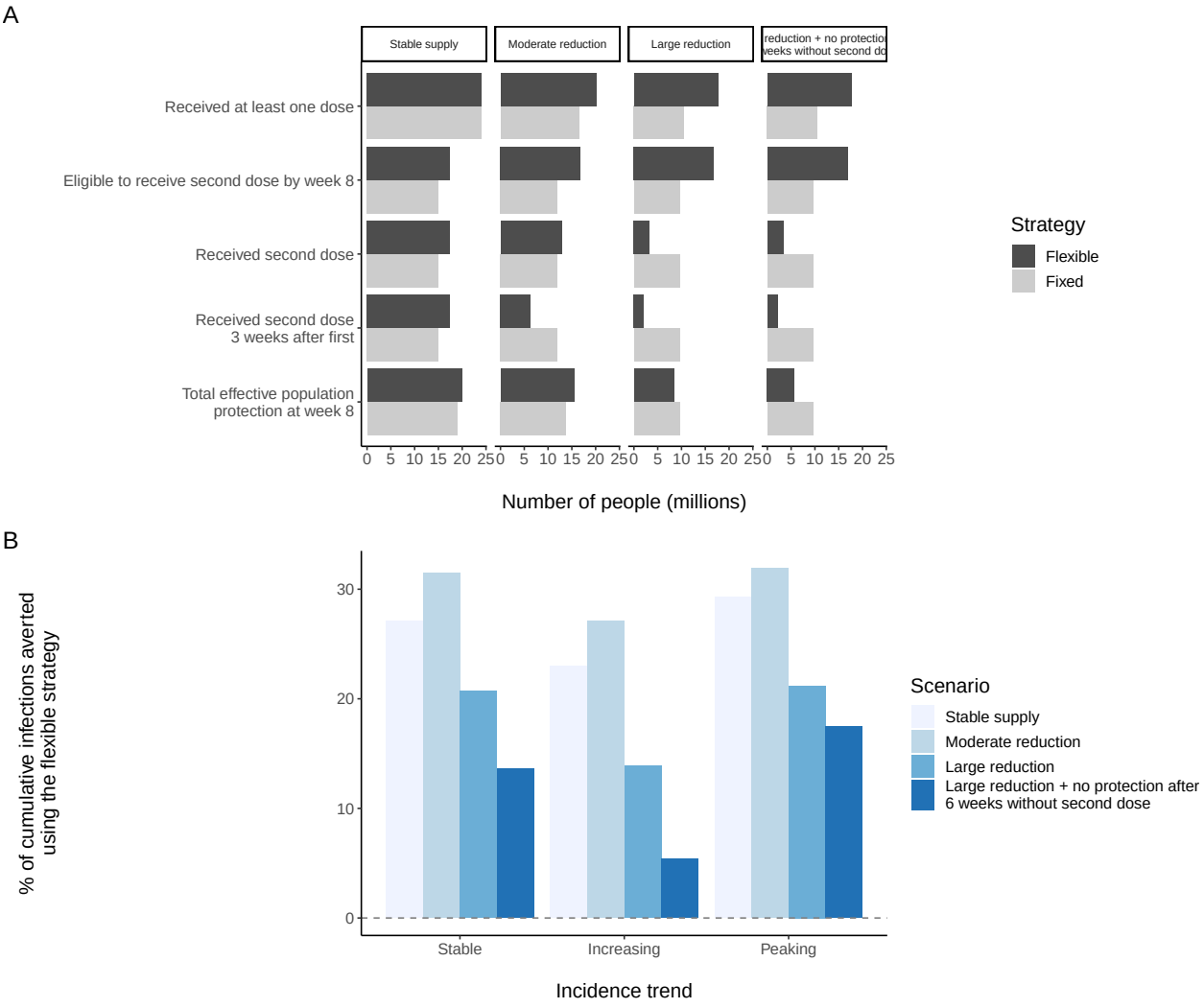
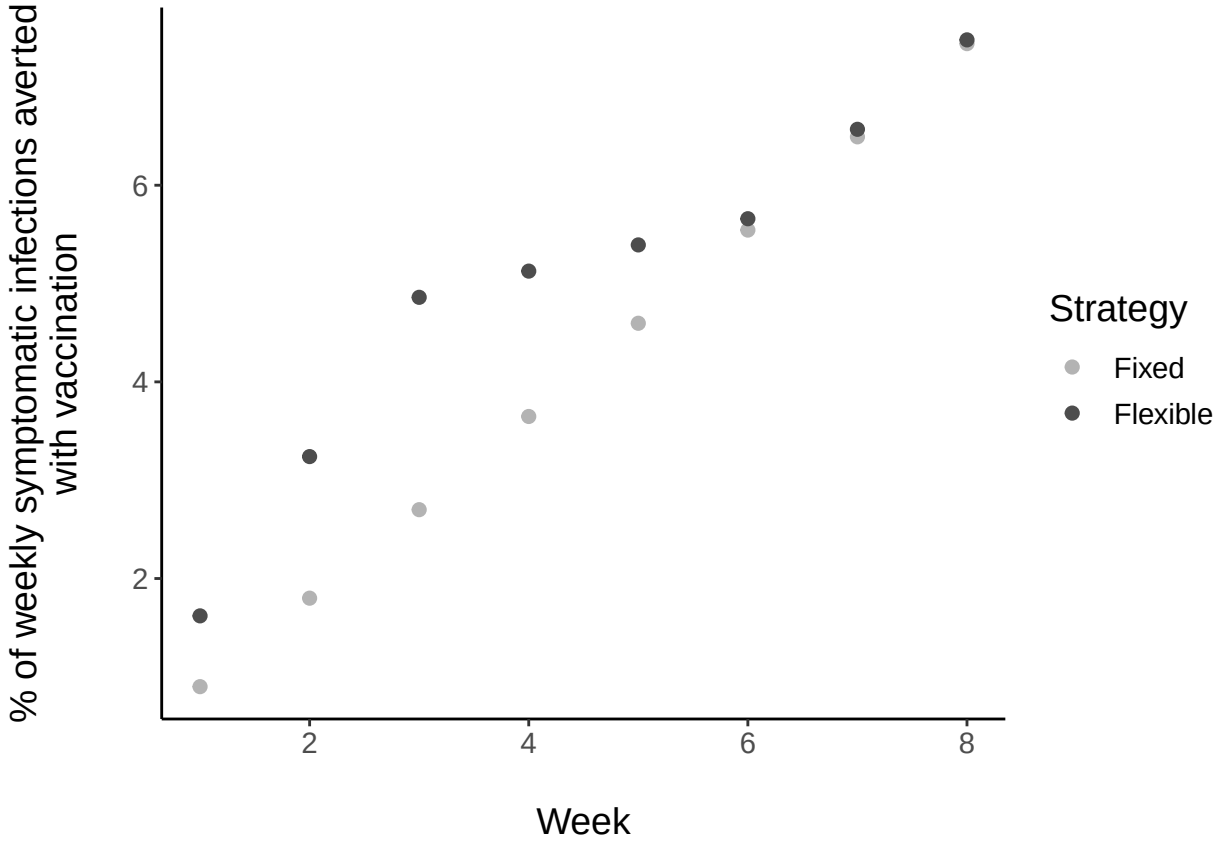


Figure 2: Model-projected outcomes of alternative vaccine allocation strategies under varying assumptions of vaccine supply, incidence, and vaccine characteristics.

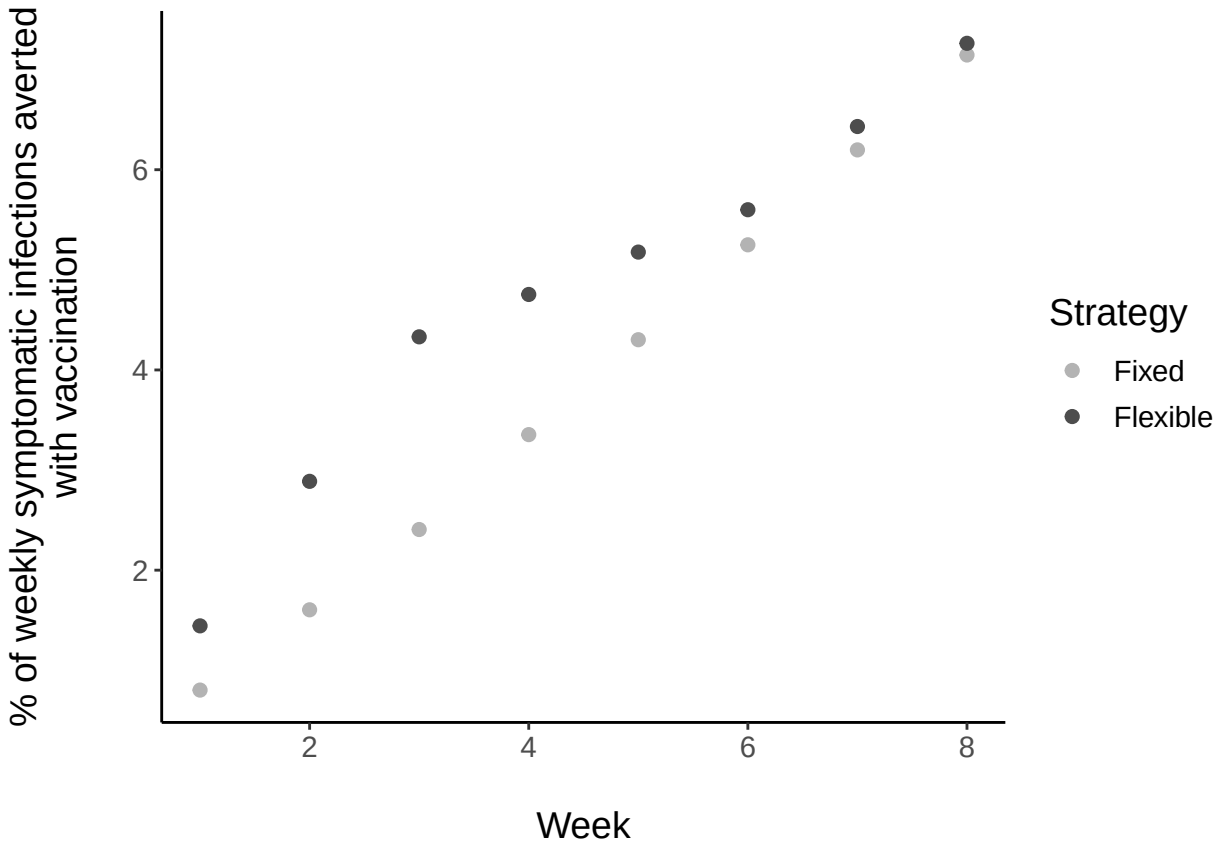
Efficacy sensitivity analyses

First dose efficacy sensitivity analysis: 90% efficacy



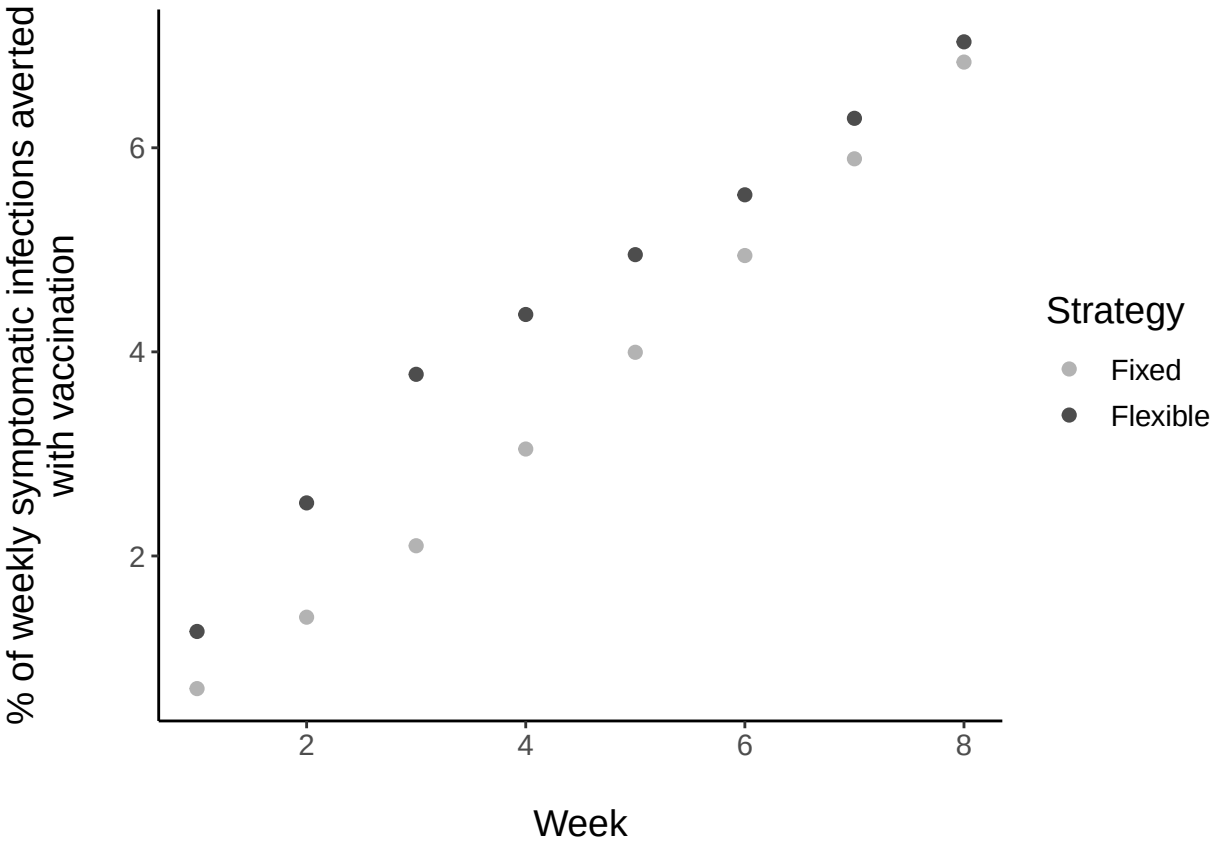
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	22.32	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	22.44	20.6
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	22.32	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	22.44	15.3
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	22.32	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	22.44	20.1

First dose efficacy sensitivity analysis: 80.2% efficacy (Moderna)



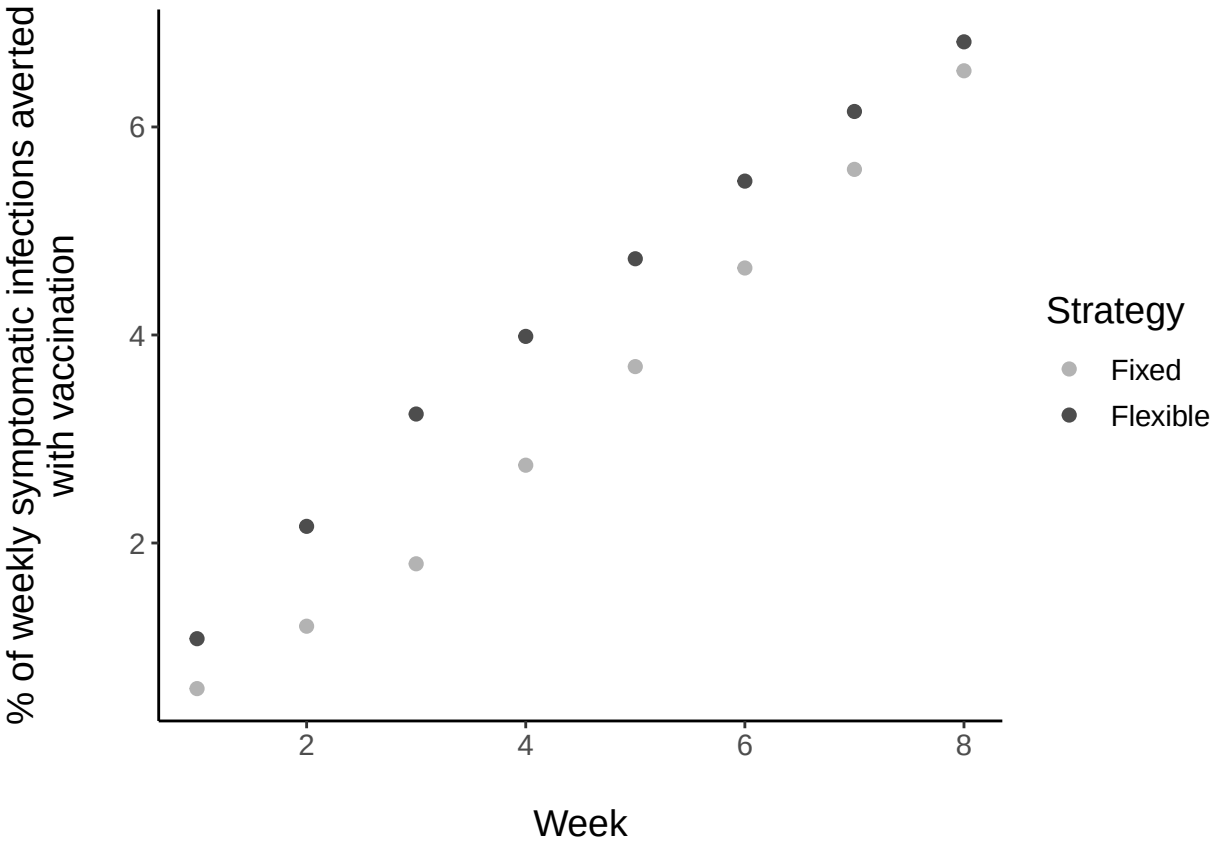
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	21.44	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	21.79	22.0
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	21.44	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	21.79	16.9
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	21.44	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	21.79	22.0

First dose efficacy sensitivity analysis: 70% efficacy



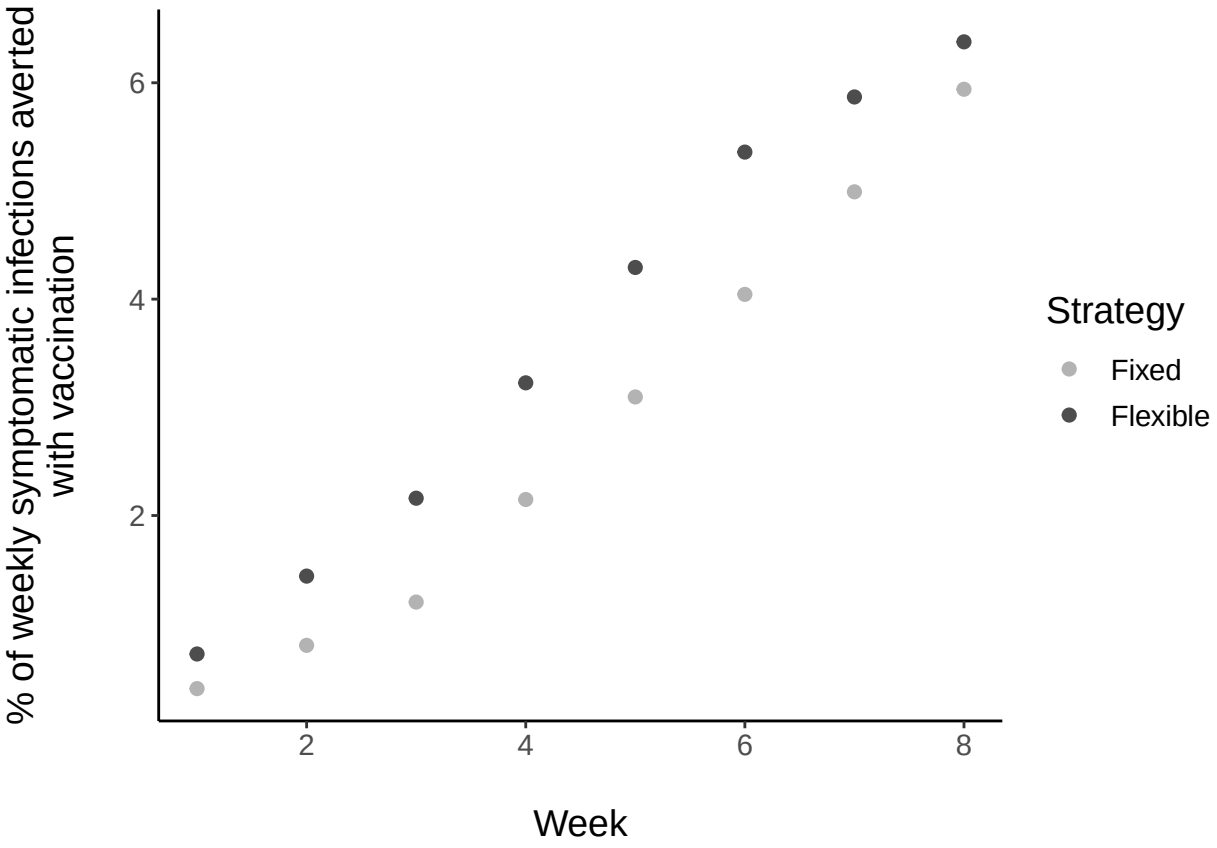
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	20.52	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	21.12	23.6
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	20.52	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	21.12	18.9
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	20.52	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	21.12	24.3

First dose efficacy sensitivity analysis: 60% efficacy



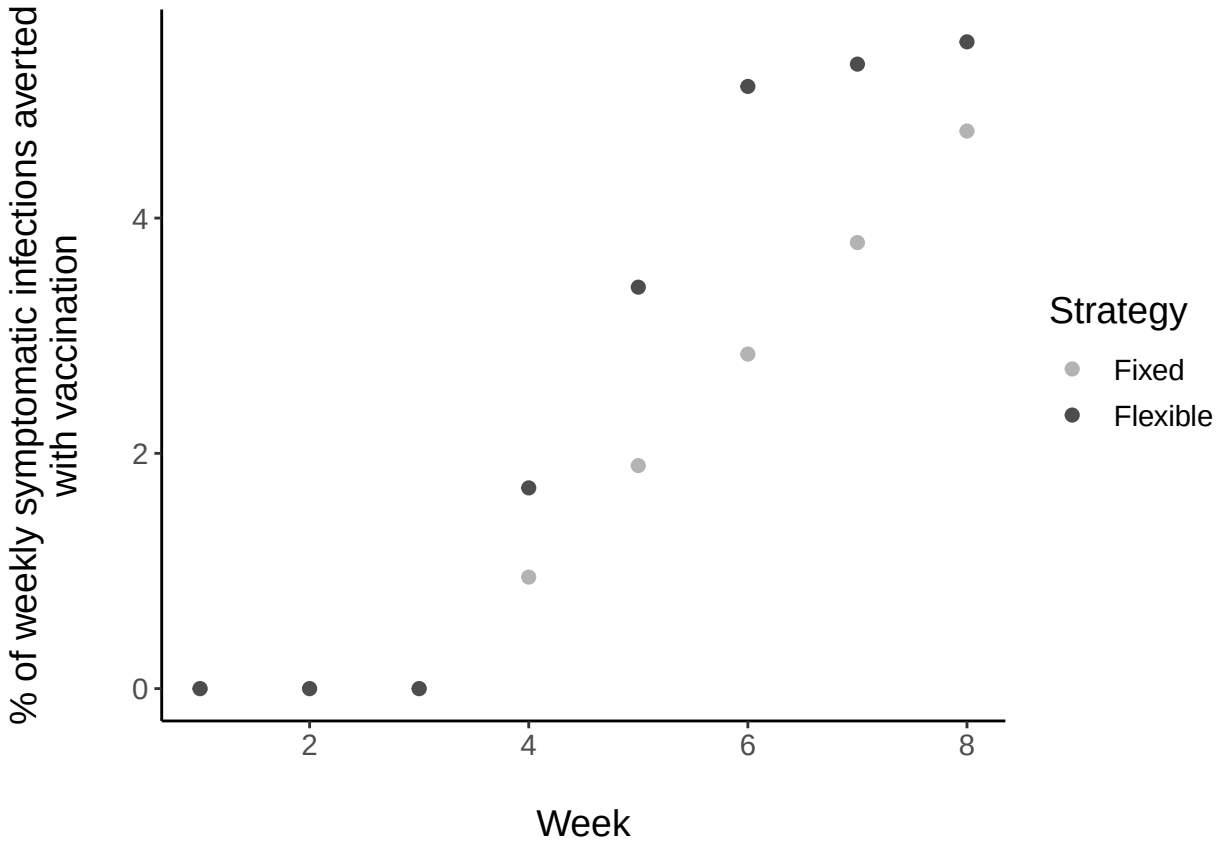
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	19.62	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	20.46	25.4
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	19.62	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	20.46	21.1
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	19.62	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	20.46	27.0

First dose efficacy sensitivity analysis: 40% efficacy



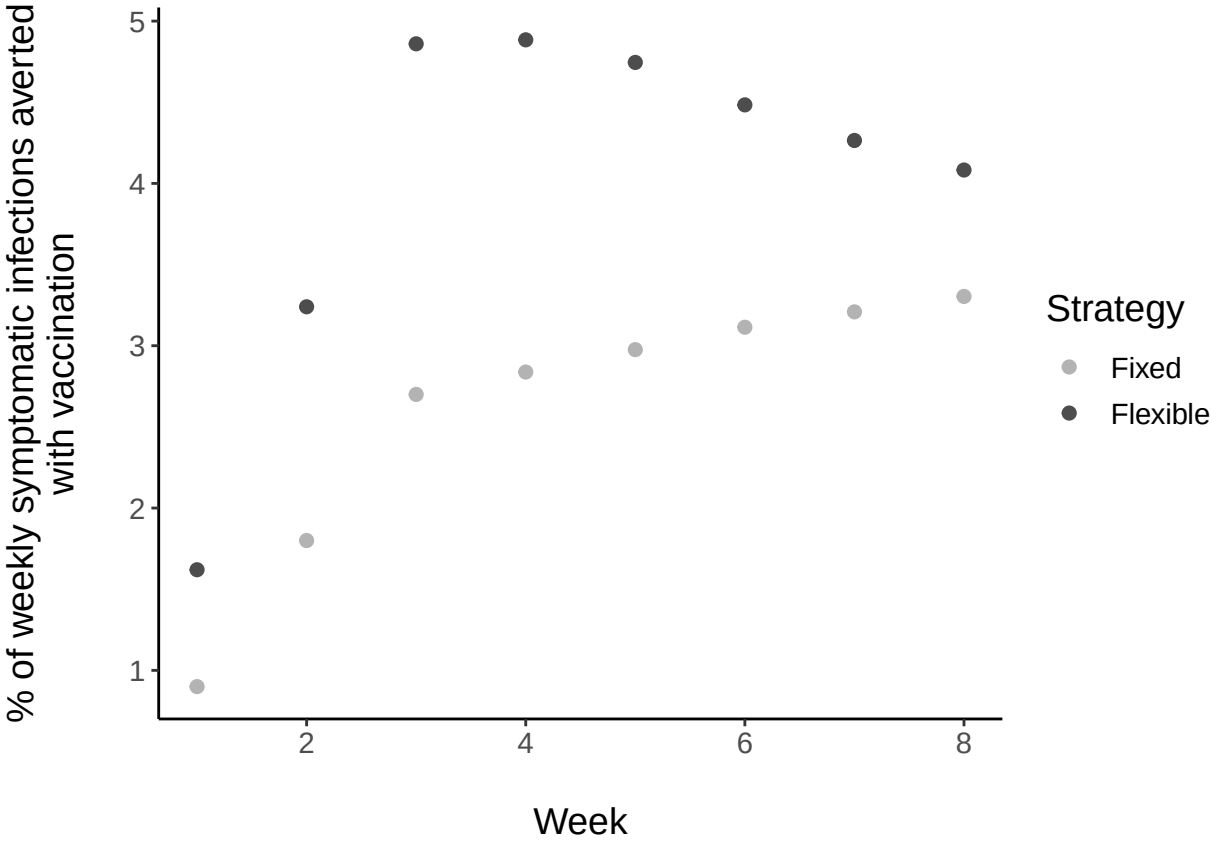
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	17.82	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	19.14	30.2
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	17.82	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	19.14	26.6
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	17.82	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	19.14	33.8

First dose efficacy sensitivity analysis: 0% efficacy



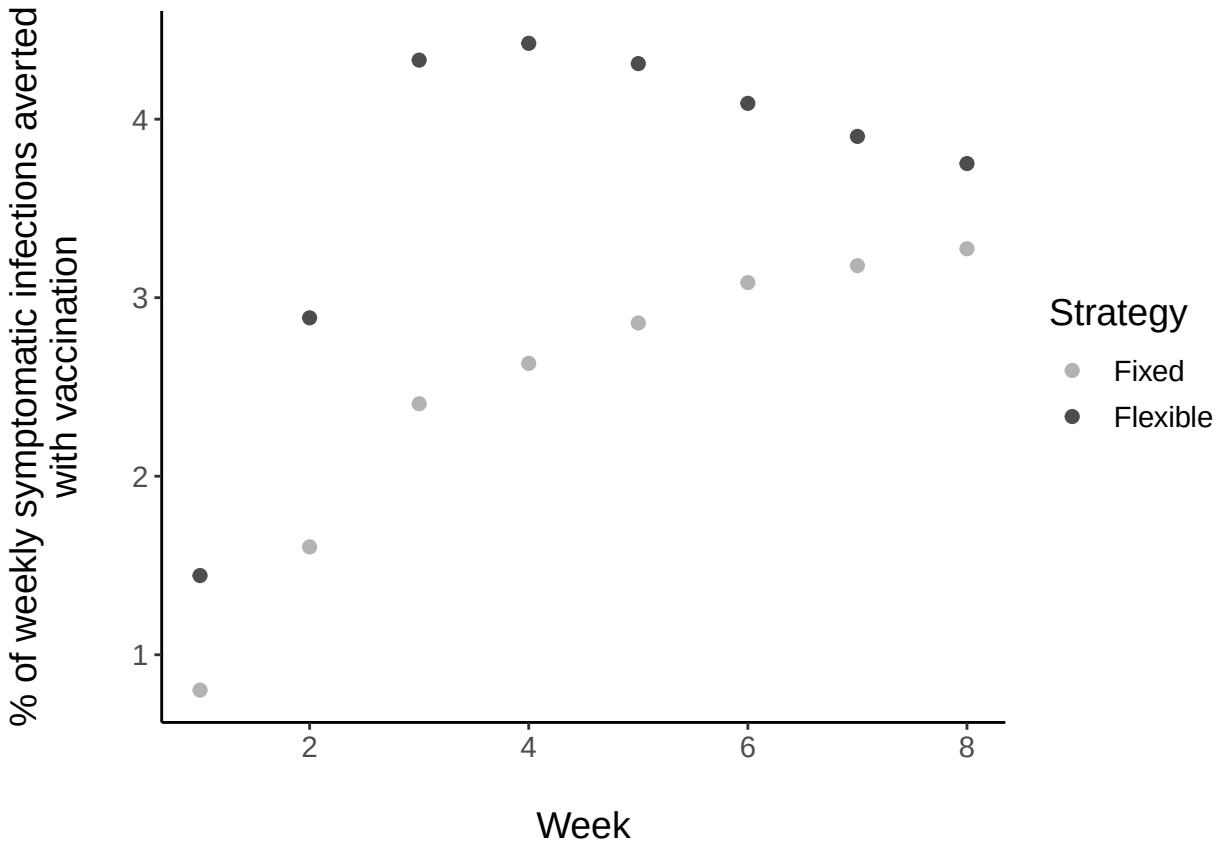
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	24	15.0	15.0	15.0	15.0	14.22	
5	Flexible	Stable	24	17.4	17.4	17.4	17.4	16.50	48.0
5	Fixed	Increasing	24	15.0	15.0	15.0	15.0	14.22	
5	Flexible	Increasing	24	17.4	17.4	17.4	17.4	16.50	45.8
5	Fixed	Peaking	24	15.0	15.0	15.0	15.0	14.22	
5	Flexible	Peaking	24	17.4	17.4	17.4	17.4	16.50	60.1

First dose efficacy sensitivity analysis: 90% efficacy + large supply disruption



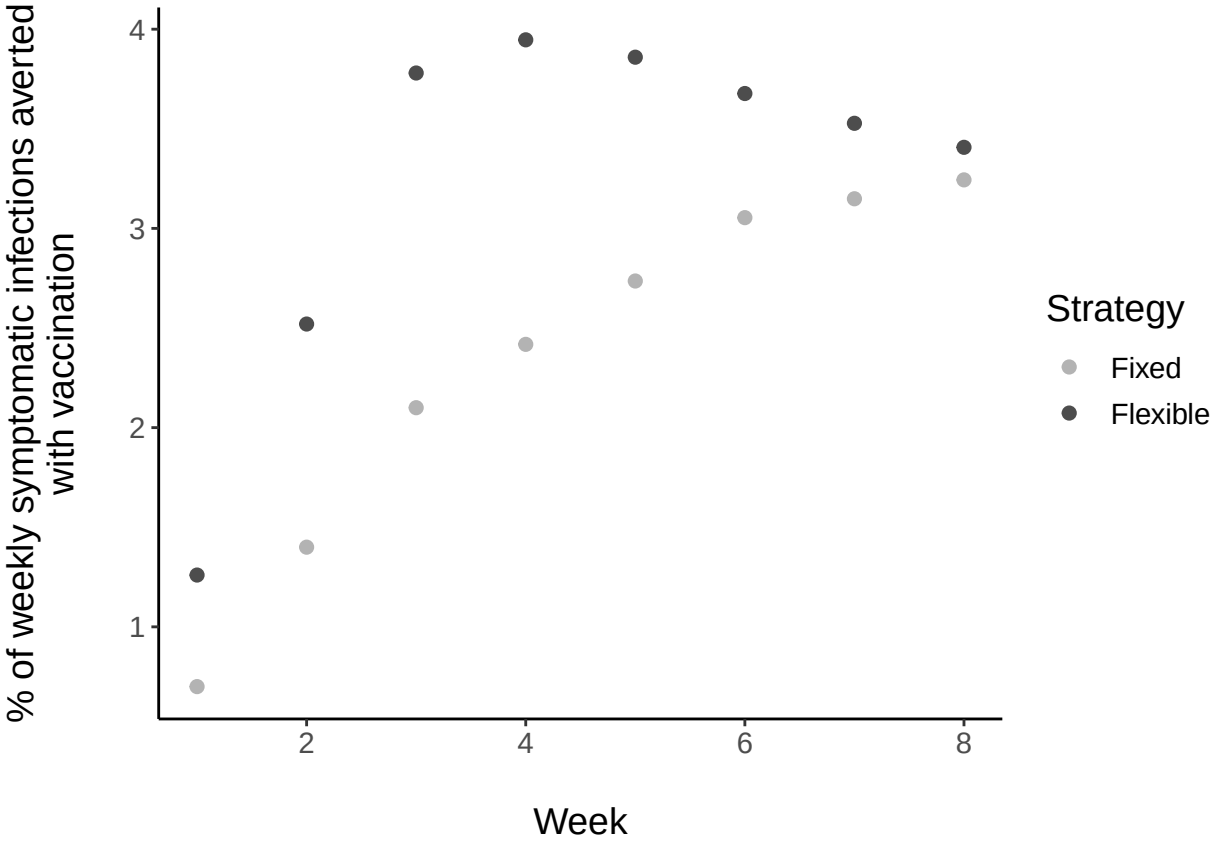
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.91	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	12.25	54.4
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.91	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	12.25	49.9
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.91	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	12.25	56.1

First dose efficacy sensitivity analysis: 80.2% efficacy (Moderna) + large supply reduction



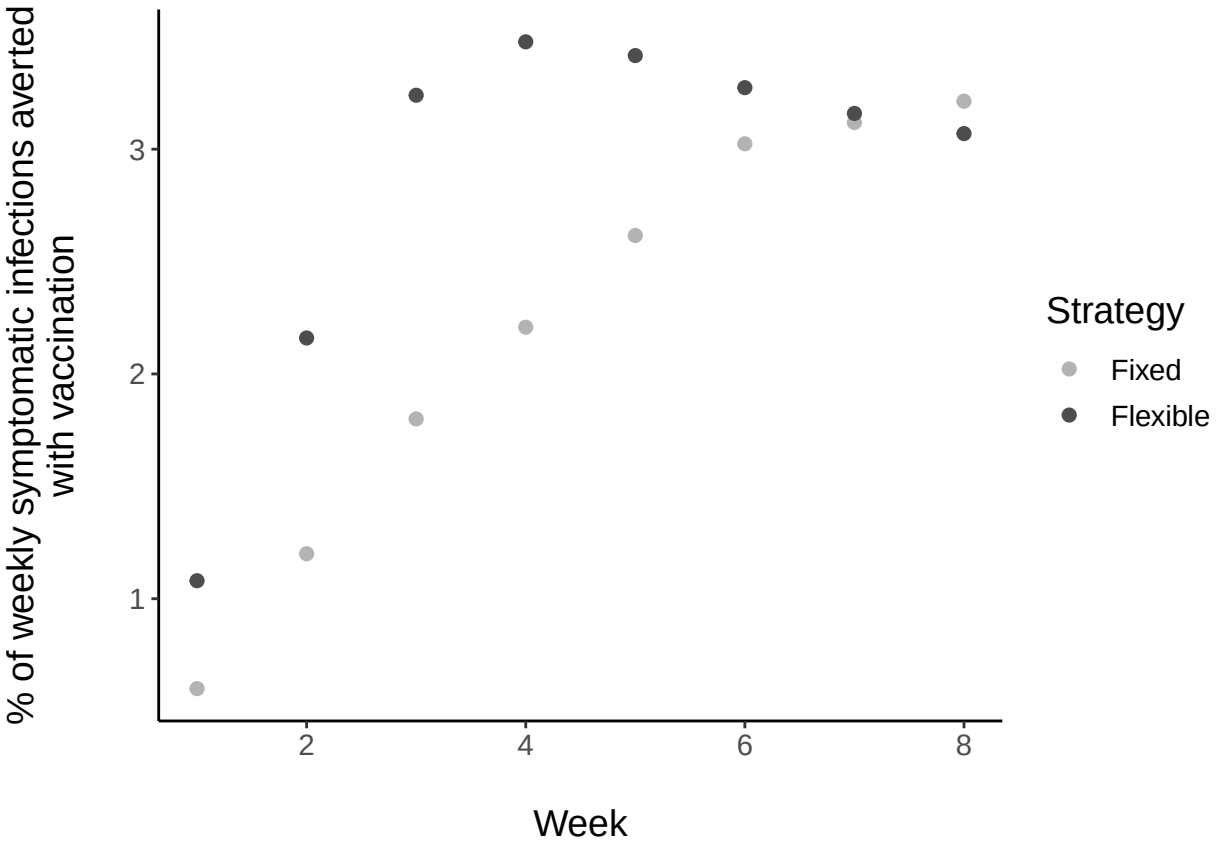
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.82	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	11.25	46.9
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.82	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	11.25	41.6
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.82	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	11.25	48.2

First dose efficacy sensitivity analysis: 70% efficacy + large supply reduction



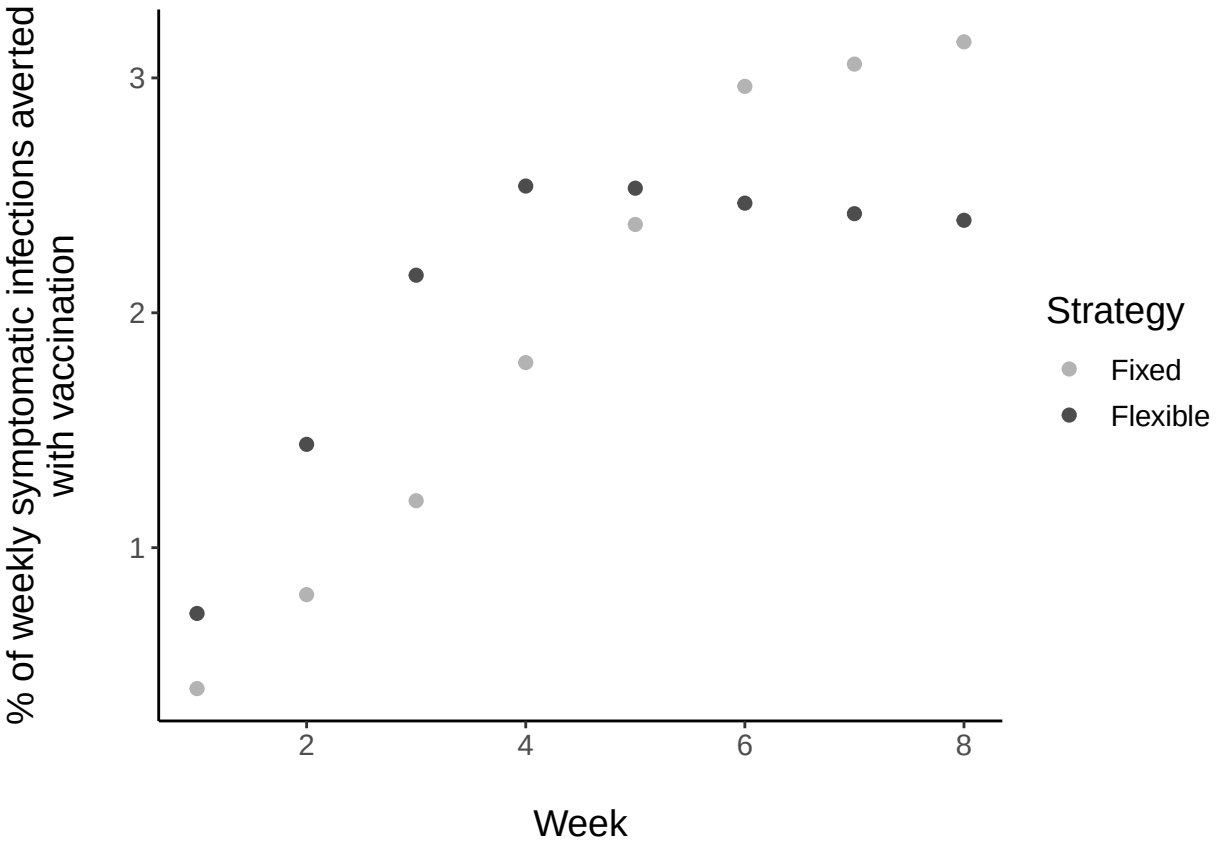
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.73	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	10.22	38.2
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.73	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	10.22	32.2
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.73	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	10.22	39.2

First dose efficacy sensitivity analysis: 60% efficacy + large supply reduction



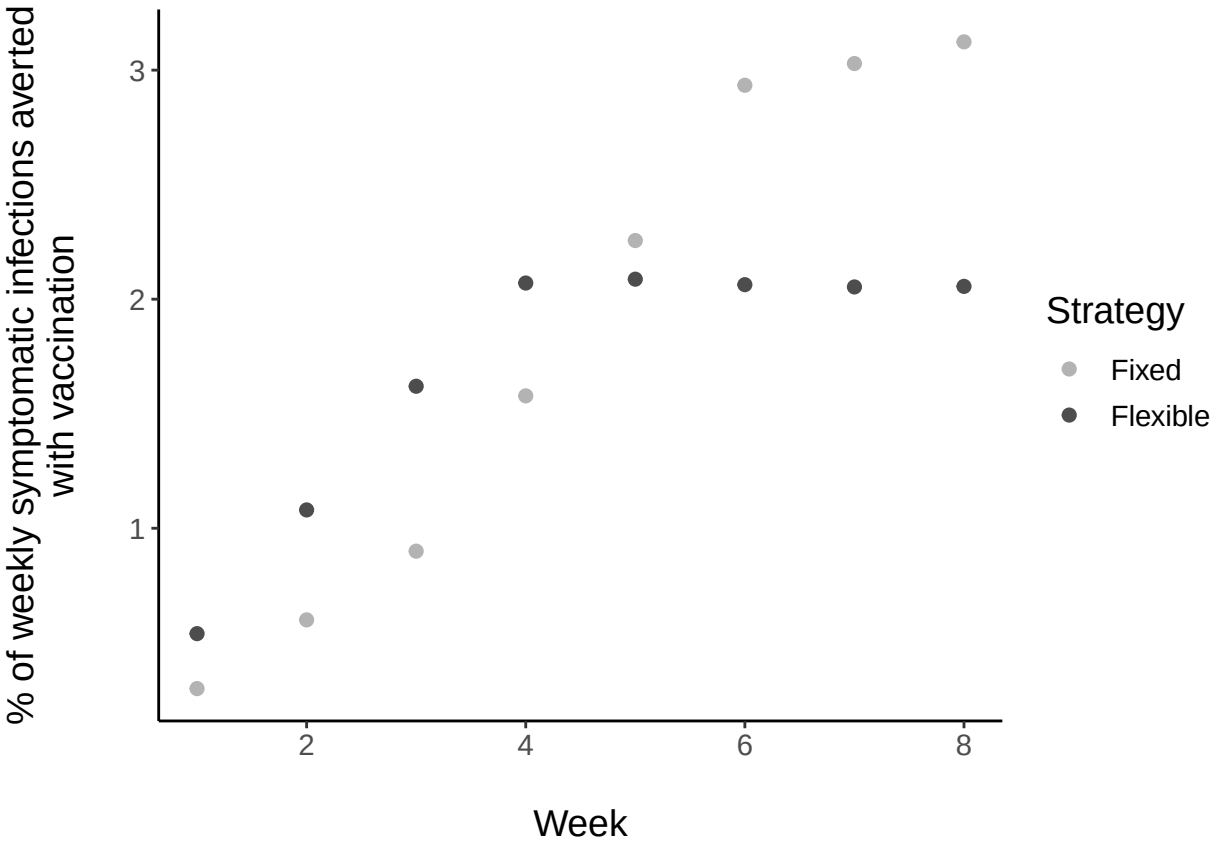
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.64	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	9.21	28.7
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.64	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	9.21	22.2
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.64	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	9.21	29.4

First dose efficacy sensitivity analysis: 40% efficacy + large supply reduction



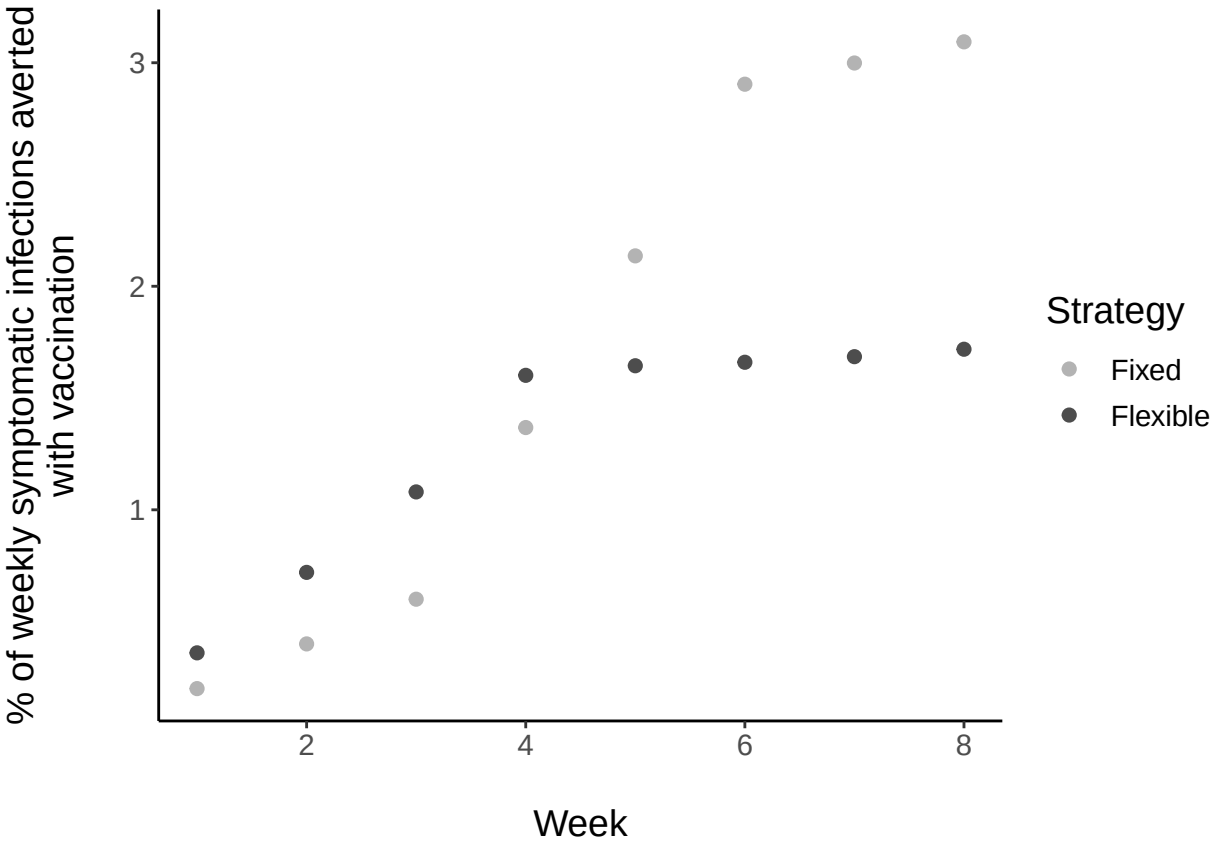
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.46	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	7.18	5.9
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.46	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	7.18	-0.9
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.46	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	7.18	6.1

First dose efficacy sensitivity analysis: 30% efficacy + large supply reduction



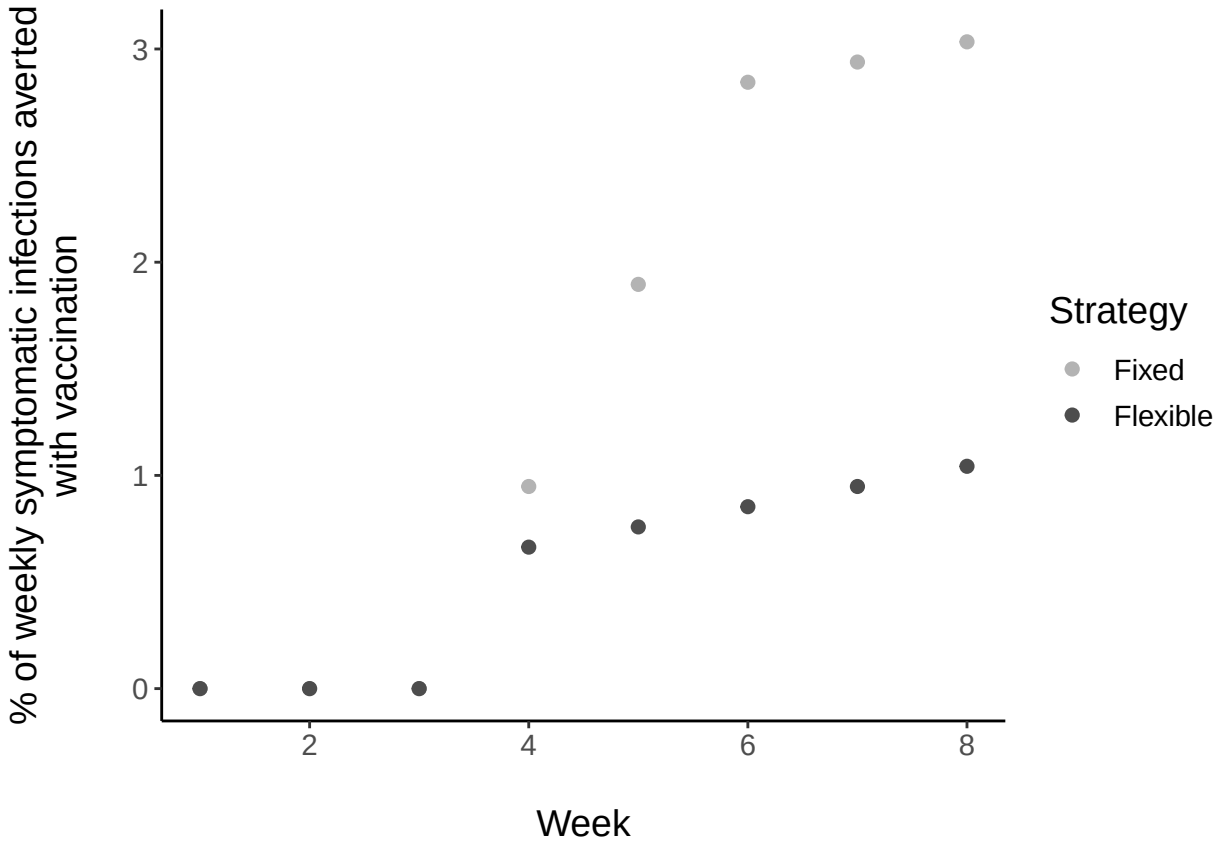
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.37	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	6.17	-7.8
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.37	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	6.17	-14.3
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.37	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	6.17	-7.7

First dose efficacy sensitivity analysis: 20% efficacy + large supply reduction



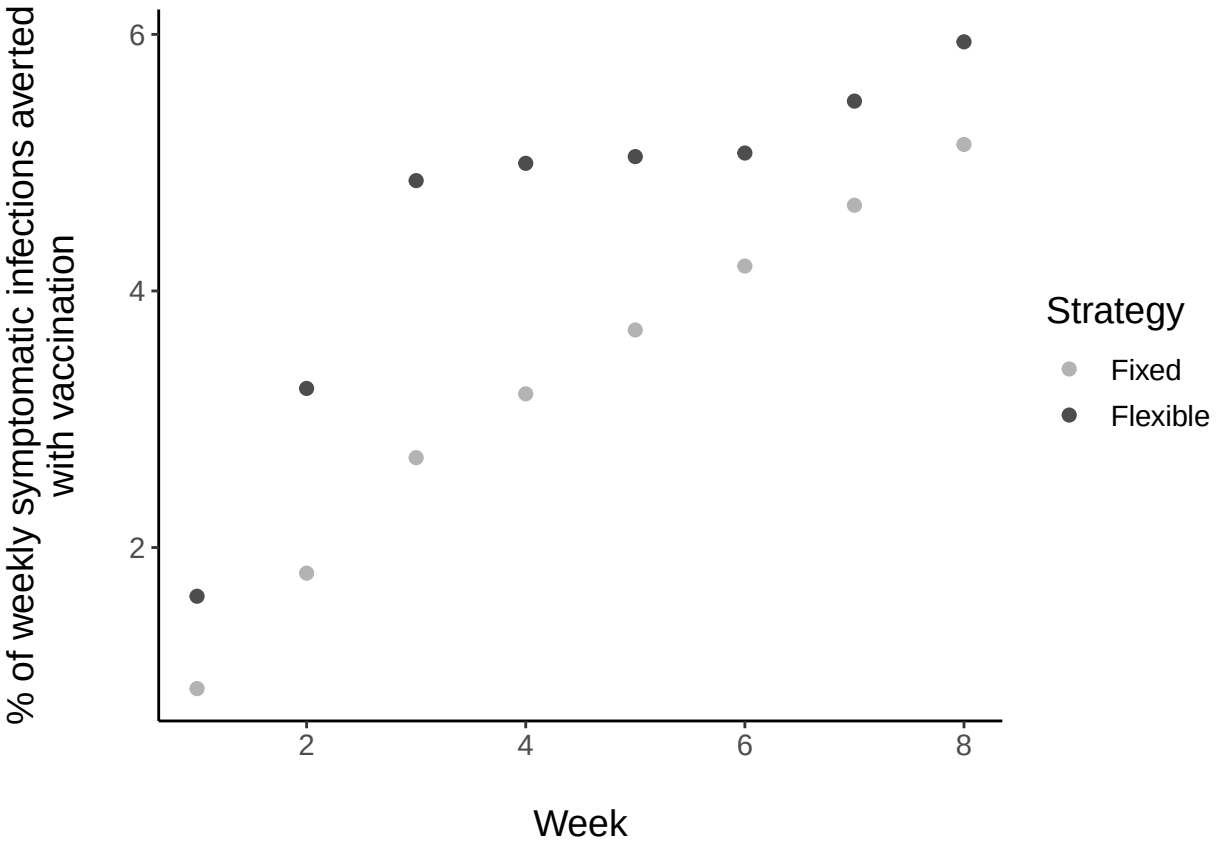
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.28	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	5.15	-23.6
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.28	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	5.15	-29.1
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.28	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	5.15	-23.5

First dose efficacy sensitivity analysis: 0% efficacy + large supply reduction



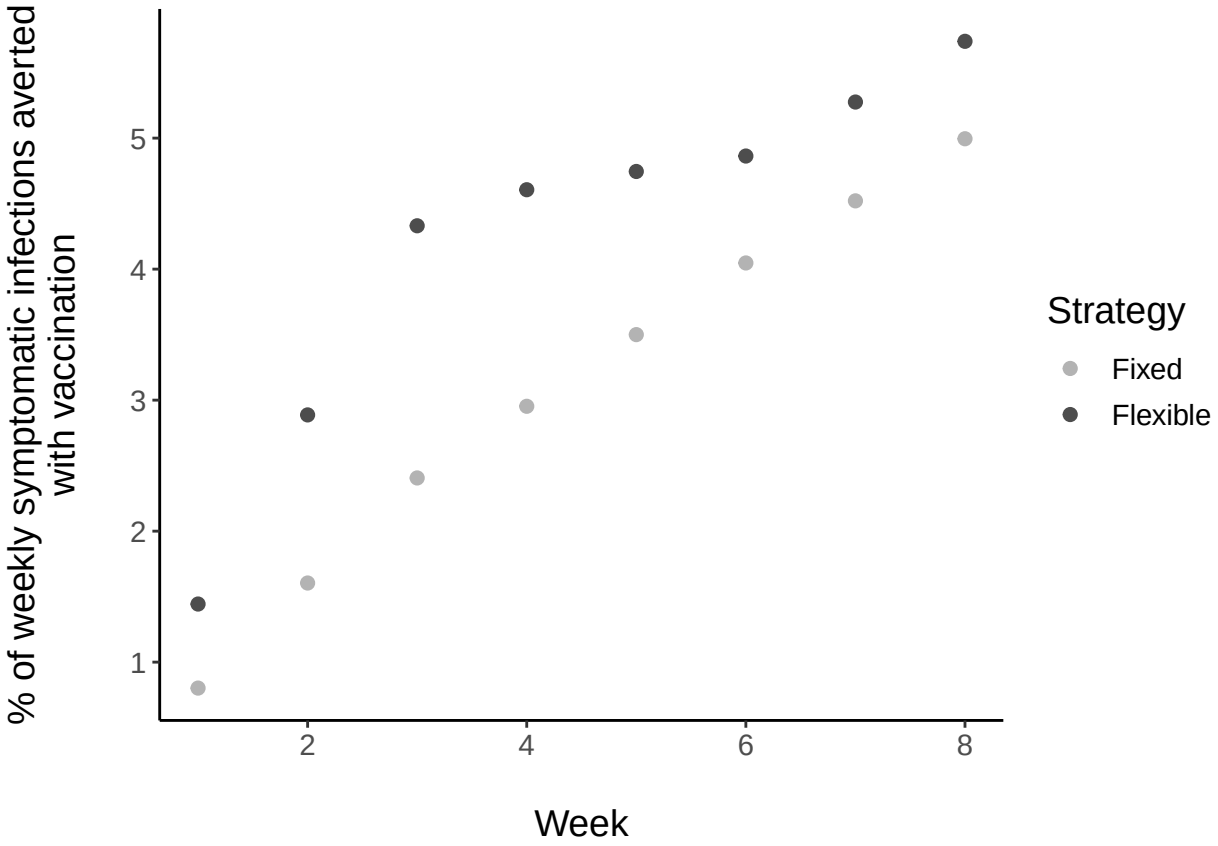
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	10.5	9.6	9.6	9.6	9.6	9.10	
5	Flexible	Stable	17.7	16.8	3.3	3.0	2.1	3.13	-63.4
5	Fixed	Increasing	10.5	9.6	9.6	9.6	9.6	9.10	
5	Flexible	Increasing	17.7	16.8	3.3	3.0	2.1	3.13	-64.2
5	Fixed	Peaking	10.5	9.6	9.6	9.6	9.6	9.10	
5	Flexible	Peaking	17.7	16.8	3.3	3.0	2.1	3.13	-62.8

First dose efficacy sensitivity analysis: 90% efficacy + moderate supply disruption



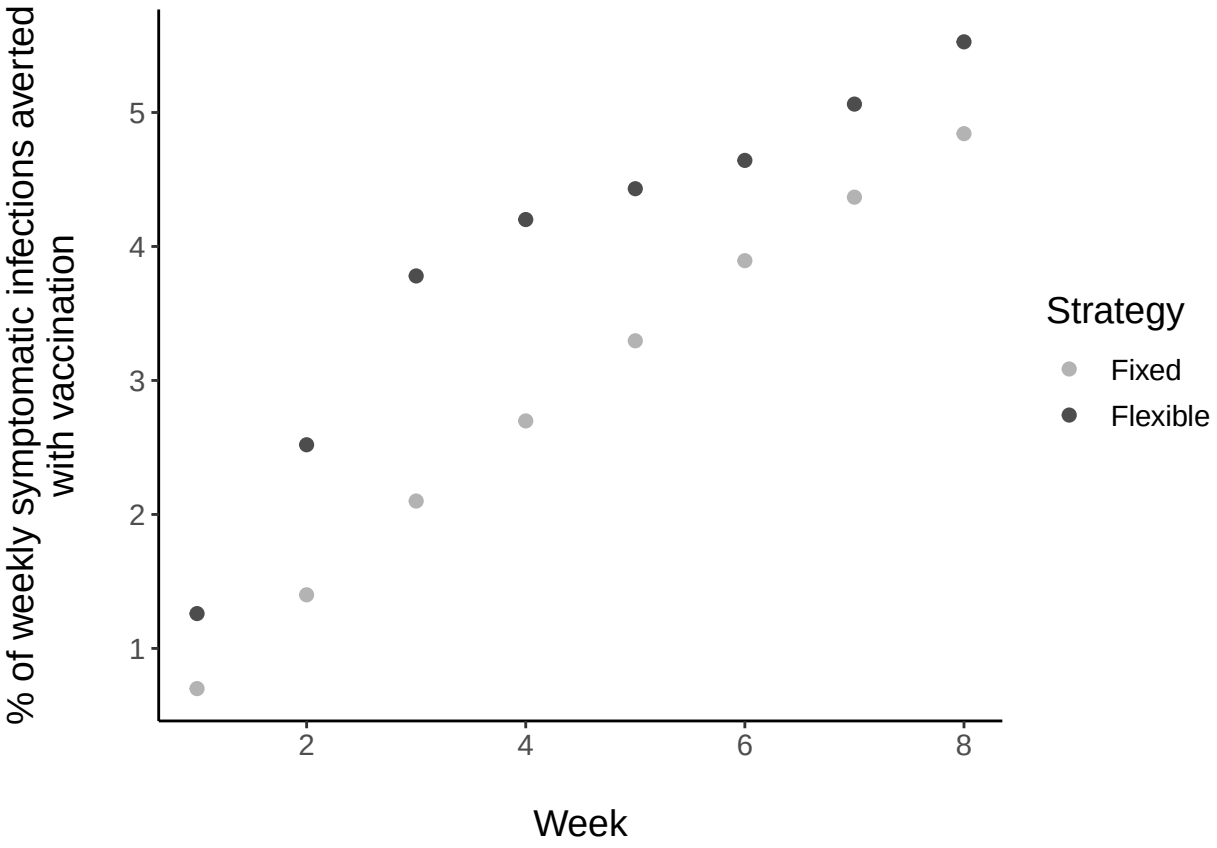
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	15.43	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	17.83	37.9
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	15.43	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	17.83	32.8
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	15.43	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	17.83	37.8

First dose efficacy sensitivity analysis: 80.2% efficacy (Moderna) + moderate supply reduction



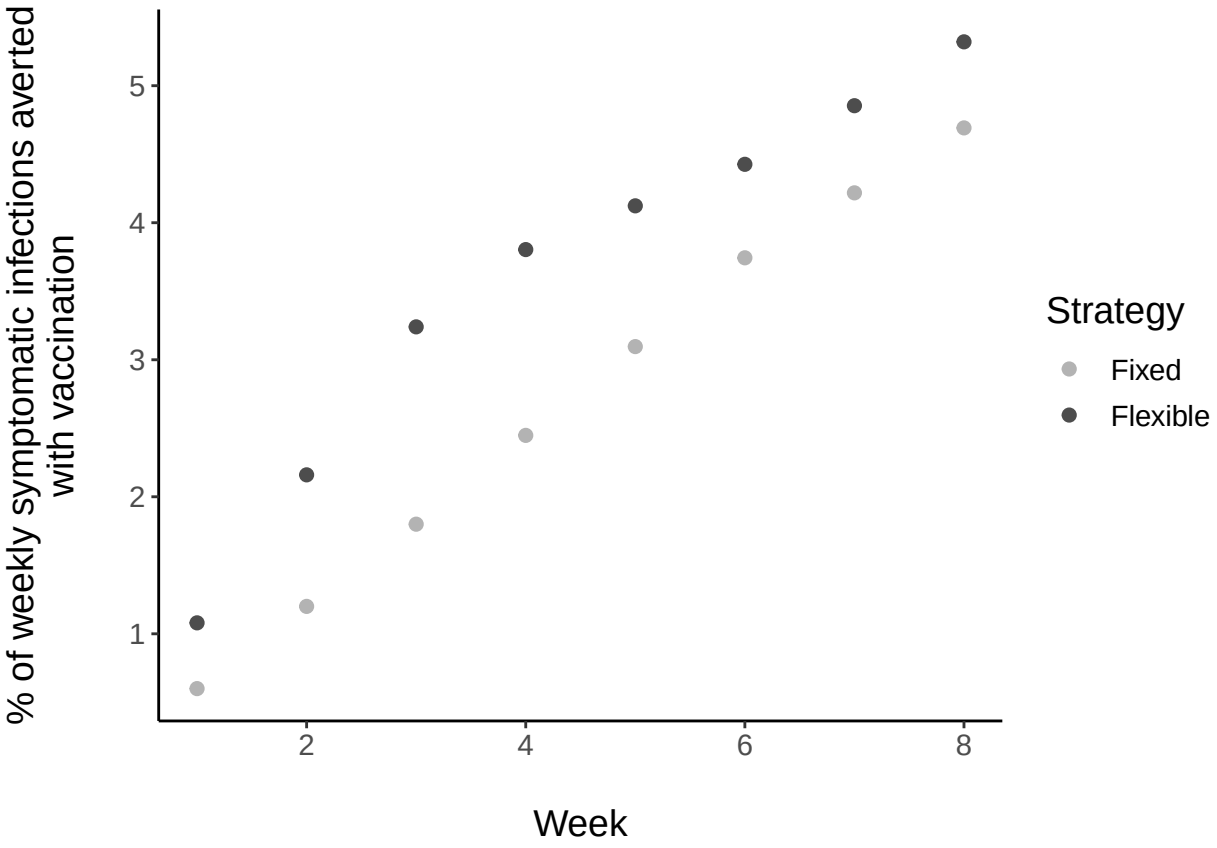
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	14.98	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	17.22	36.5
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	14.98	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	17.22	31.6
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	14.98	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	17.22	36.5

First dose efficacy sensitivity analysis: 70% efficacy + moderate supply reduction



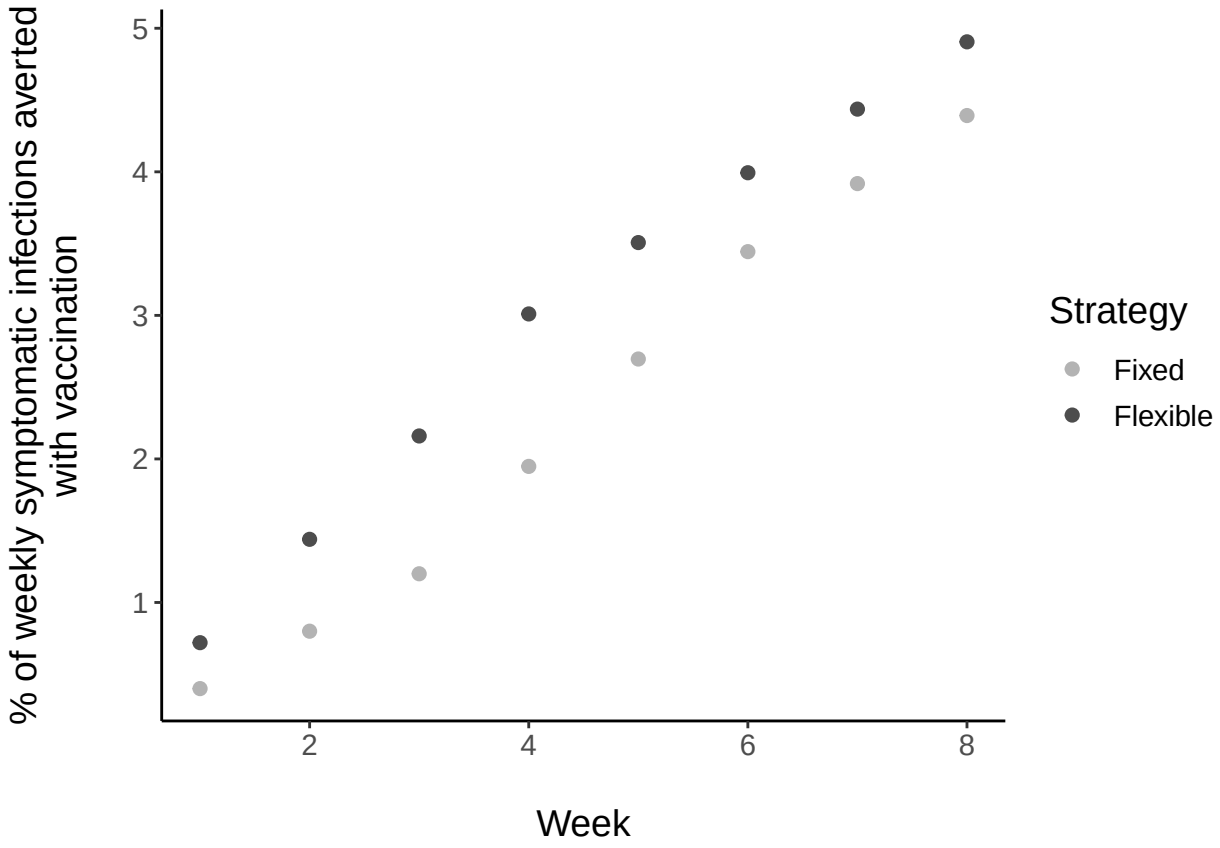
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	14.53	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	16.58	34.9
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	14.53	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	16.58	30.1
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	14.53	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	16.58	35.0

First dose efficacy sensitivity analysis: 60% efficacy + moderate supply reduction



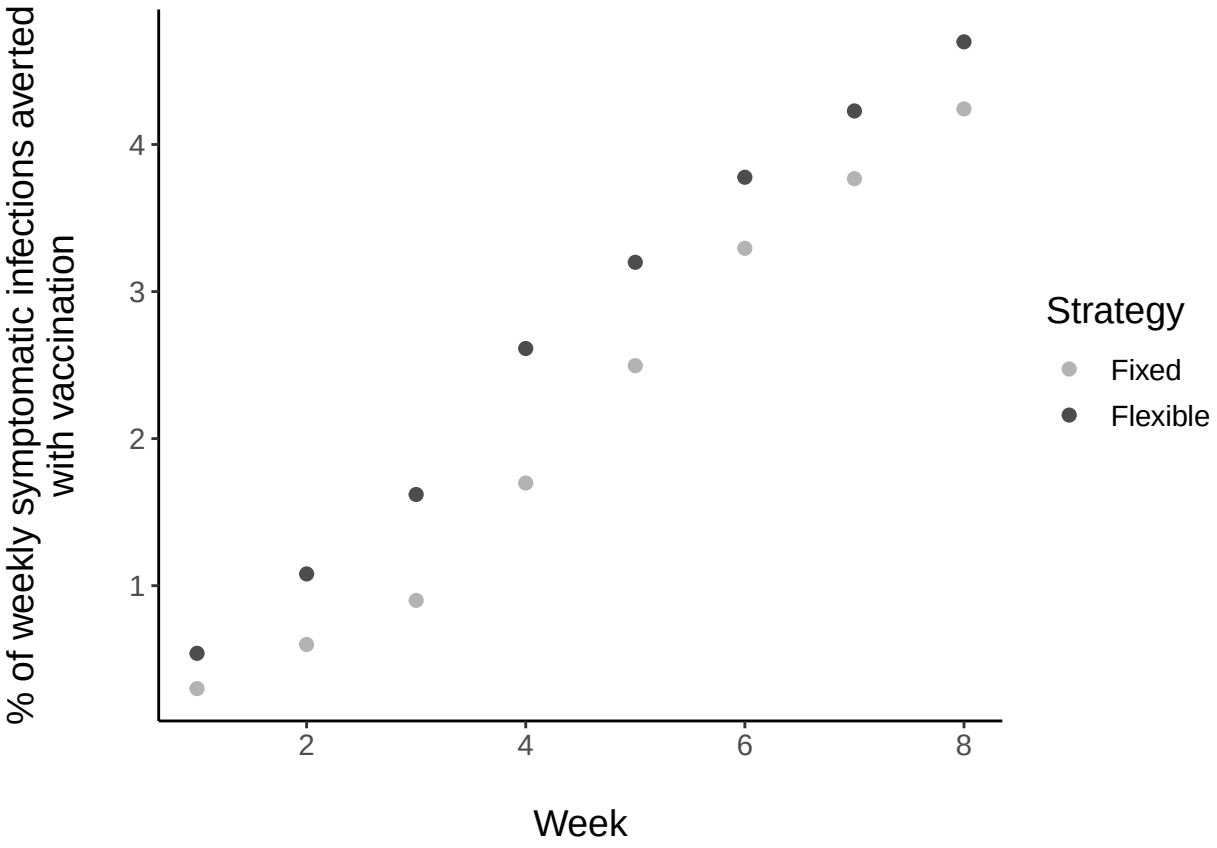
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	14.08	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	15.96	33.1
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	14.08	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	15.96	28.4
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	14.08	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	15.96	33.4

First dose efficacy sensitivity analysis: 40% efficacy + moderate supply reduction



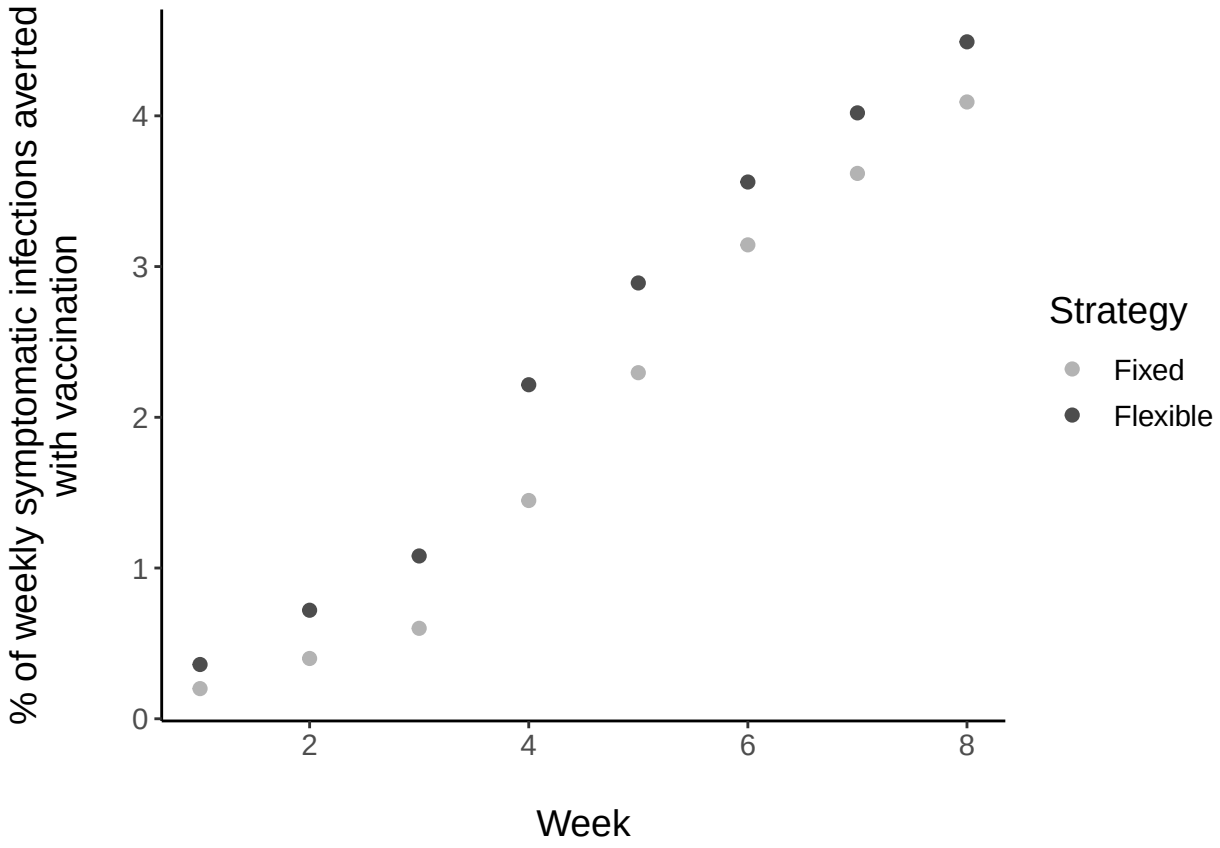
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	13.18	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	14.72	28.6
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	13.18	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	14.72	24.5
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	13.18	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	14.72	29.2

First dose efficacy sensitivity analysis: 30% efficacy + moderate supply reduction



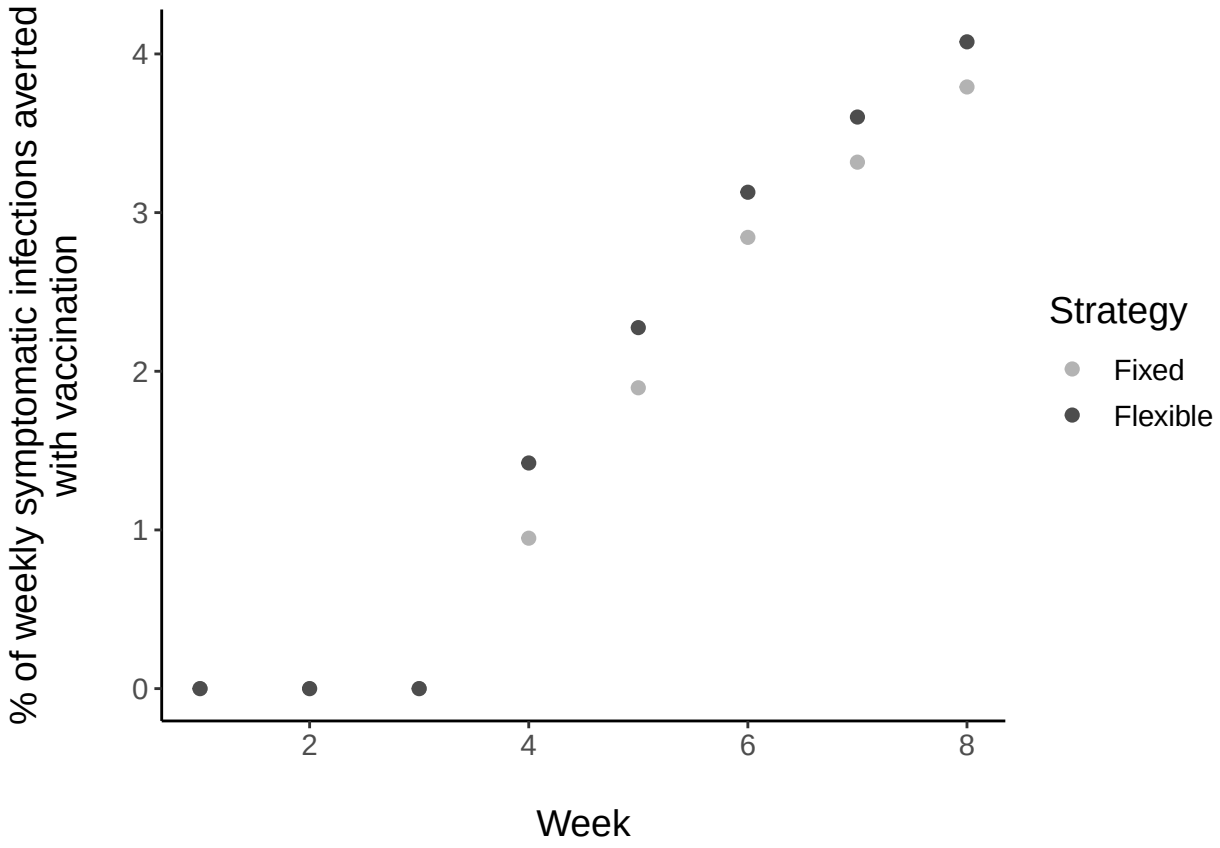
Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	12.73	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	14.09	25.8
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	12.73	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	14.09	22.1
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	12.73	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	14.09	26.6

First dose efficacy sensitivity analysis: 20% efficacy + moderate supply reduction



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	12.28	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	13.47	22.4
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	12.28	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	13.47	19.4
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	12.28	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	13.47	23.5

First dose efficacy sensitivity analysis: 0% efficacy + moderate supply reduction



Scenario	Allocation scheme	Incidence trend	# receiving at least one dose (millions)	# eligible to receive second dose (millions)	# receiving second dose (millions)	# receiving second dose within 6 weeks (millions)	# receiving second dose on week 3 (millions)	Total effective vaccine protection (millions)	% averted (flexible compared to fixed)
5	Fixed	Stable	16.5	12.0	12.0	12.0	12.0	11.38	
5	Flexible	Stable	20.1	16.8	12.9	12.9	6.3	12.23	13.3
5	Fixed	Increasing	16.5	12.0	12.0	12.0	12.0	11.38	
5	Flexible	Increasing	20.1	16.8	12.9	12.9	6.3	12.23	12.3
5	Fixed	Peaking	16.5	12.0	12.0	12.0	12.0	11.38	
5	Flexible	Peaking	20.1	16.8	12.9	12.9	6.3	12.23	15.2