Supplementary Material for:

How will mass-vaccination change COVID-19 lockdown requirements in Australia?

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Appendix

Constraints on vaccine efficacy

The efficacy of a vaccine can be decomposed into three components:

- the efficacy for susceptibility (VEs) which determines the level of immunity induced in susceptible individuals
- the efficacy for disease (VEd) which determines protection against symptomatic illness if a vaccinated individual is infected
- efficacy against infectiousness (VEi) which determines how contagious a vaccinated individual will be if they become infected

The clinical efficacy (VEc), which is measured in stage-3 clinical trials and corresponds to the reported efficacy numbers for both vaccines, is a function of VEs and VEd, neither of which are directly measured:

$$\text{VEc} = \text{VEd} + \text{VEs} - \text{VEsVEd}, \tag{S1}$$

while the efficacy for transmission, VE, which is the value of interest for computing herd immunity is a function of vaccine coverage (c), VEi, VEs, and VEd. Because VEi is not constrained by VEc through Equation S1, the population-level effectiveness is currently uncertain for both vaccines.

In the worst-case scenario, the factor VEd would account for 100% of the clinical efficacy (VEd = VEc, VEs = 0), and the efficacy against transmission would be negligible (VEi = 0), which would leave all unvaccinated individuals unprotected. In this scenario, herd immunity is not possible per se (though complete coverage would provide clinical protection to the entire population). In the best-case scenario, efficacy against symptoms would be maximised (VEd = VEc), protecting all vaccinated individuals regardless of their infection status, while the unknown parameter VEi would take a value of 1, and all transmission from vaccinated individuals would cease, protecting both vaccinated and unvaccinated subpopulations. In reality, the true efficacy values will lie between these extremes, and may be correlated. For example, because symptoms may increase the contagiousness of those infected, VEd can positively influence VEi. On the other hand, symptoms can also lead to case detection and behavioural change, which may produce a negative relationship between VEd and VEi.

Vaccine efficacy: homogeneous approximation

Here, we give a homogeneous approximation for vaccine efficacy and the associated herd immunity thresholds as functions of VEs, VEi, and VEd. We derive an expression for overall reduction to force of infection provided by a vaccination program with coverage $c \in [0, 1]$ as follows:

$$\text{VE} = 1 - F_{vax}/F_o\,, \tag{S2}$$

where F_o is proportional to the overall force of infection when none of the population is vaccinated, and F_{vax} is the relative reduction to force of infection produced through vaccination. For a given prevalence of infection $p(\text{infected}) = N_{\text{infected}}/N_{\text{tot}} << 1 = 1 - p(\text{susceptible})$, and assuming a negligible recovered population, we compute F_o as:

$$F_o = \beta_o^2\; p(\text{infected})\; p(\text{susceptible})\,, \tag{S3}$$

in which β_o is the average force of infection produced by an infected individual who is unvaccinated:

$$\beta_o = \beta(p_s + a(1 - p_s)) \tag{S4}$$

in which β is the force of infection from a symptomatic individual, p_s is the probability of expressing symptoms if infected and unvaccinated (in this work we assumed a symptomatic fraction of 2/3) and a is the factor by which force of infection is reduced if an infected agent is asymptomatic (for this work $a = 0.3$).

The p(infected)p(susceptible) term in Eq. (S3) captures the potential for interaction between susceptible and infected individuals, the potential for transmission given interaction is given by one of the β_o terms, and the infectious potential of the newly infected individual, should transmission take place, is given by the second β_o term.

The relative force of infection with vaccination, F_{vax}, can be found similarly by summing the potential for contact and transmission between individuals with different vaccination status:

$$F_{\text{vax}} = F_{\text{unvax}\to\text{unvax}} + F_{\text{unvax}\to\text{vax}} + F_{\text{vax}\to\text{unvax}} + F_{\text{vax}\to\text{vax.}}\,, \tag{S5}$$

where

$$F_{\text{unvax}\to\text{vax}} = \beta\beta_{\text{vax}}(1-\text{VEs})\ p(\text{infected, unvaccinated})\ p(\text{susceptible, vaccinated})\,, \tag{S6}$$

in which

$$\beta_{\text{vax}} = \beta(1-\text{VEi})\ [p_s(1-\text{VEd}) + a(1-p_s(1-\text{VEd}))]\,, \tag{S7}$$

is the average force of infection from a vaccinated individual who becomes infected. Note that both VEi and VEd play a role in computing β_{vax}. The remaining terms of Eq. (S5) are:

$$F_{\text{vax}\to\text{unvax}} = \beta_{\text{vax}}\ \beta_o\ p(\text{infected, vaccinated})\ p(\text{susceptible, unvaccinated})\,, \tag{S8}$$

and

$$F_{\text{vax}\to\text{vax}} = \beta_{\text{vax}}^2\ (1-\text{VEs})\ p(\text{infected, vaccinated})\ p(\text{susceptible, vaccinated})\,. \tag{S9}$$

The joint probabilities

- p(infected, unvaccinated),
- p(infected, vaccinated),
- p(susceptible, unvaccinated), and
- p(susceptible, vaccinated)

can be represented as products of the conditional and independent probabilities of infection, vaccination, and infection given vaccination:

$$p(\text{infected, unvaccinated}) = p(\text{infected} \mid \text{unvaccinated})\ p(\text{unvaccinated})\,, \tag{S10}$$

$$p(\text{susceptible, unvaccinated}) = p(\text{susceptible} \mid \text{unvaccinated})\ p(\text{unvaccinated})\,, \tag{S11}$$

$$p(\text{infected, vaccinated}) = p(\text{infected} \mid \text{vaccinated})\ p(\text{vaccinated})\,, \tag{S12}$$

$$p(\text{susceptible, vaccinated}) = p(\text{susceptible} \mid \text{vaccinated})\ p(\text{vaccinated})\,, \tag{S13}$$

where

$$p(\text{vaccinated}) = c\,, \tag{S14}$$

$$p(\text{unvaccinated}) = 1-c\,, \tag{S15}$$

$$p(\text{susceptible} \mid \text{unvaccinated}) = 1 - p(\text{infected} \mid \text{unvaccinated})\,, \tag{S16}$$

$$p(\text{susceptible} \mid \text{vaccinated}) = 1 - p(\text{infected} \mid \text{vaccinated})\,, \tag{S17}$$

$$p(\text{infected} \mid \text{unvaccinated}) = \frac{p(\text{infected}) - p(\text{infected} \mid \text{vaccinated})\ p(\text{vaccinated})}{1-p(\text{vaccinated})}\,, \tag{S18}$$

and

$$p(\text{infected} \mid \text{vaccinated}) = p(\text{infected})\ (1-\text{VEs})\ \frac{\beta_{\text{vax}}}{\beta}\,, \tag{S19}$$

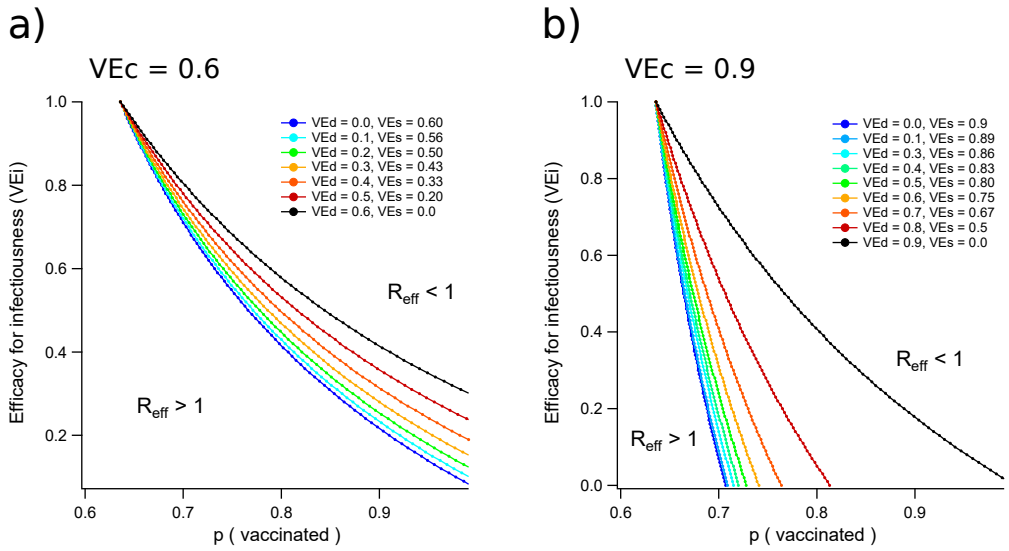

Figure S1: Herd immunity thresholds as functions of efficacy for infectiousness (VEi) and vaccine coverage (p(vaccinated)) computed through a homogeneous approximation of vaccine effectiveness taking into account three forms of vaccine efficacy (VEs, VEd, and VEi). Subplot (a) shows thresholds for the general vaccine, with clinical efficacy VEc = 0.6, while subplot (a) shows thresholds for the priority vaccine with clinical efficacy VEc = 0.9.

where the ratio β_{vax}/β gives the effect of VEd and VEi on infectiousness of vaccinated individuals (Eq. (S7)). Here, the state denoted "infected" would more precisely be described as "infectious", because VEi and VEd reduce transmission potential without reducing the infection probability of vaccinated individuals.

Assuming that the effective reproductive ratio R is proportional to the force of infection F_{vax}, it can be computed from the total efficacy, VE, as

$$R = R_0(1 - \text{VE}), \tag{S20}$$

where R_0 is the basic reproductive number for the epidemic, which we set to $R_0 = 2.75$ in the present work. Using $R_0 = 2.75$, Fig. S1 demonstrates the coverage threshold for herd immunity as a function of VEi, VEs, and VEd given VEc = 0.6 (Fig. S1a), and VEc = 0.9 (Fig.S1b).

The homogeneous approximation corresponds qualitatively to the results of the ABM which demonstrates a dramatic decrease in growth rate after increasing coverage crosses the $R = 1$ boundary estimated by evaluating Eq. (S20) for $R_0 = 2.75$ (Fig. S2, Fig. S3). However, due to heterogeneity in population structure and vaccine allocation we still observed substantial epidemic growth for parameter combinations which correspond to $R < 1$ based on the homogeneous approximation. For the priority vaccine (VEc = 0.9), the threshold computed through the homogeneous approximation matched the observed nonlinear decrease in growth rate more closely (Fig. S2b), but finite epidemics were still observed for coverage $\leq 79\%$. The boundary computed by the homogeneous approximation should therefore be viewed as an optimistic estimate of coverage threshold.

Epidemic severity as measured by peak prevalence follows the expected trend based on the homogeneous approximation (Fig. S3 and Fig. S4). However, for simulations with growth rates less than ≈ 0.06, peak prevalence was not reached within the simulation time frame of 194 days (these scenarios are indicated as open black circles in Fig. S3 and Fig. S4). The correspondence between the herd immunity threshold computed through the homogeneous approximation and the tendency for simulations to reach peak prevalence within 194 days is an artefact of the choice of simulation horizon.

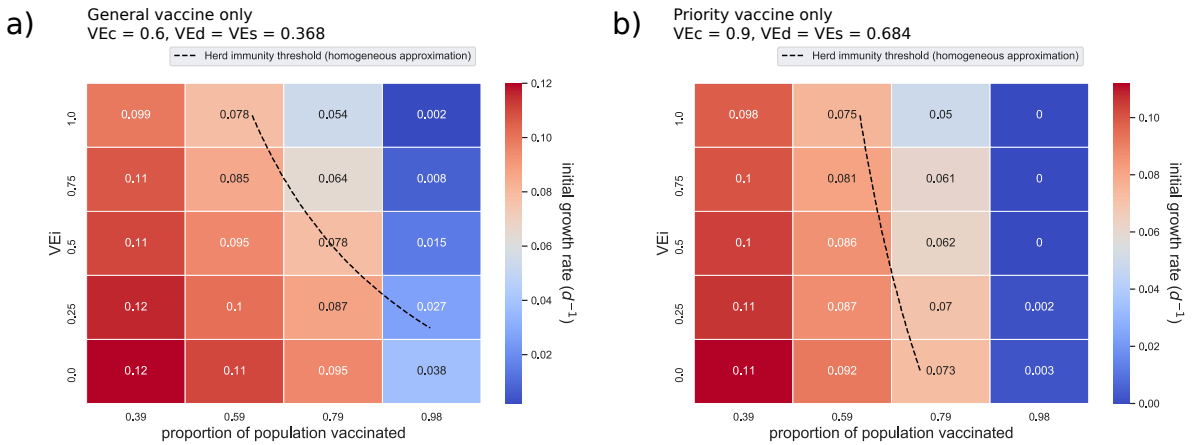

Figure S2: Alignment of ABM results with homogeneous approximation of herd immunity thresholds for the general (a) and priority (b) vaccines. The growth rates were computed from results generated by the ABM over a range of values for coverage and vaccine efficacy against infectiousness. The dashed black lines give the coverage thresholds for herd immunity estimated by the homogeneous approximation. Here, central values of efficacy against disease and susceptibility were used (VEd = VEs = $1 - \sqrt{1 - \text{VEc}}$).

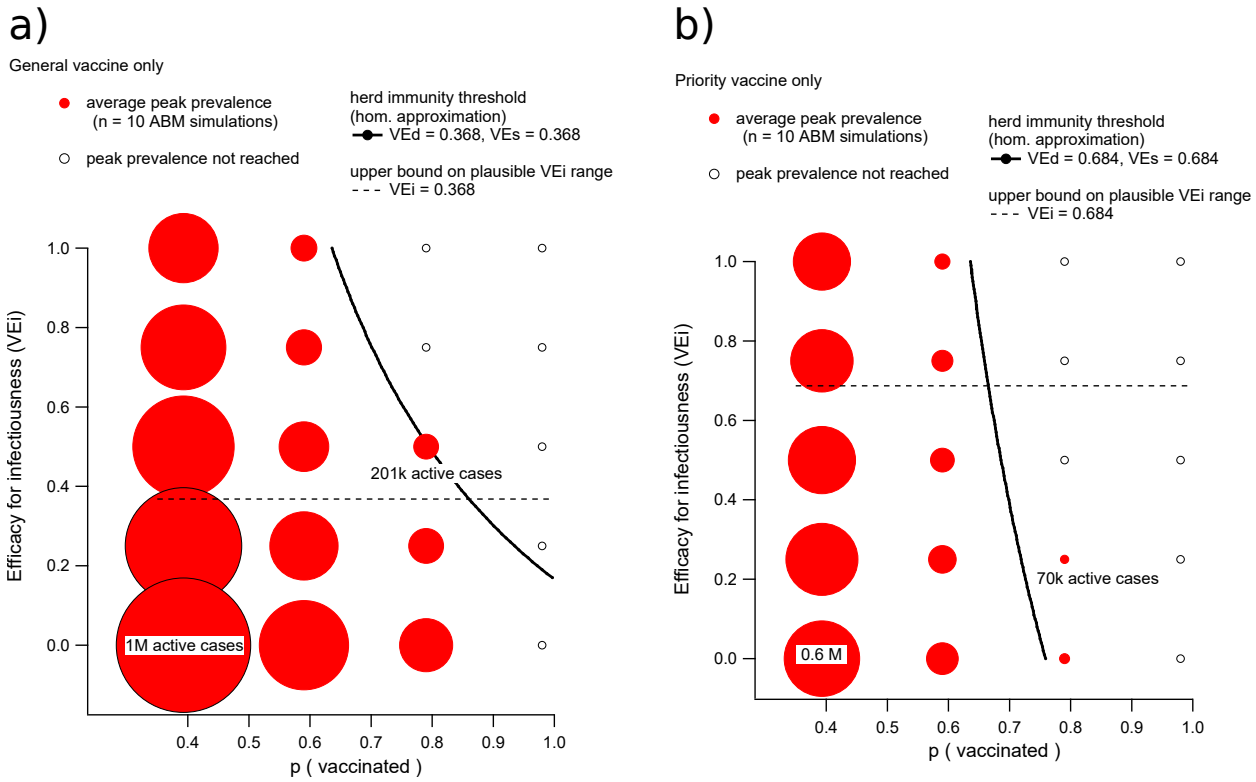

Figure S3: Alignment of ABM results with homogeneous approximation of herd immunity thresholds for the general (a) and priority (b) vaccines. The peak prevalence values shown here (red circles) generated by the ABM over a range of values for coverage and vaccine efficacy against infectiousness. The solid black lines give the coverage thresholds for herd immunity estimated by the homogeneous approximation, and the dashed lines illustrate conservative practical upper bounds on VEi. Here, central values of efficacy against disease and susceptibility were used (VEd = VEs = $1 - \sqrt{1 - \text{VEc}}$). Open black dots indicate simulation sets that did not consistently reach a defined prevalence maximum before the endpoint of 194 days.

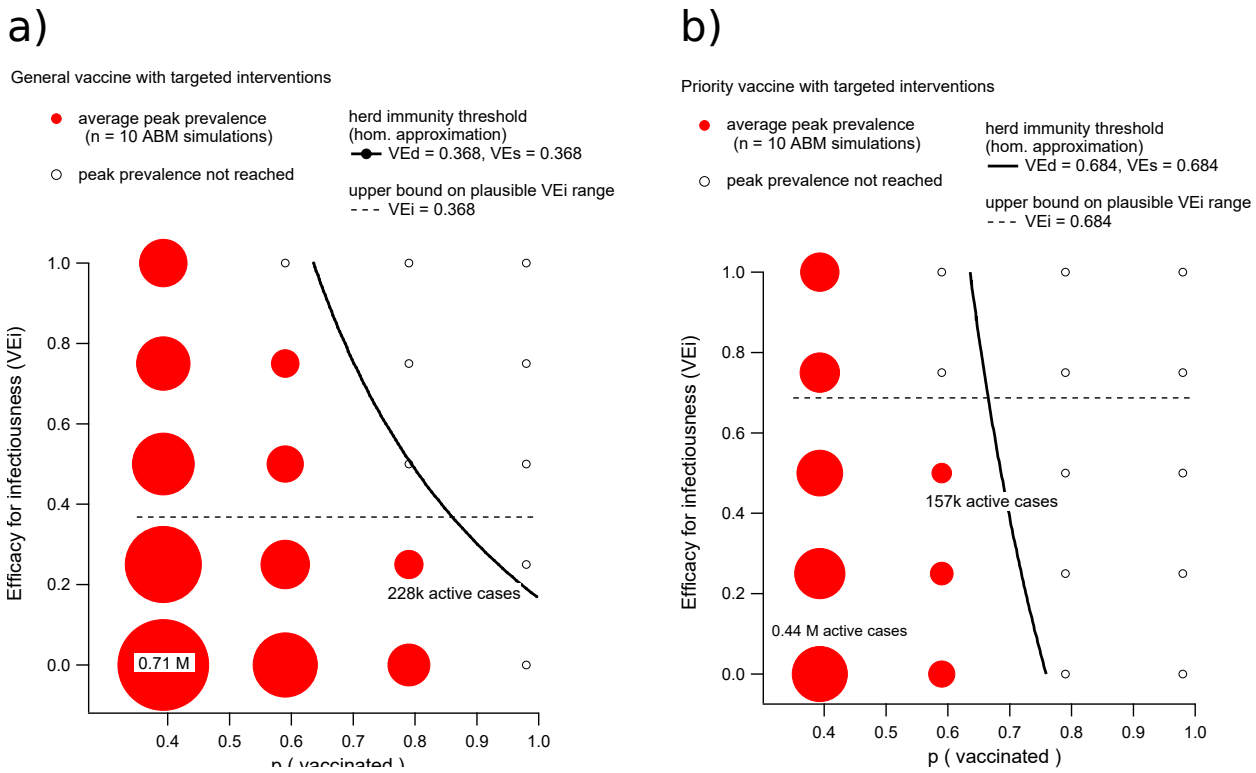

Figure S4: Alignment of ABM results with homogeneous approximation of herd immunity thresholds for the general (a) and priority (b) vaccines, combined with case-targeted nonpharmaceutical interventions. The peak prevalence values shown here (red circles) generated by the ABM over a range of values for coverage and vaccine efficacy against infectiousness. The solid black lines give the coverage thresholds for herd immunity estimated by the homogeneous approximation, and the dashed lines illustrate conservative practical upper bounds on VEi. Here, central values of efficacy against disease and susceptibility were used (VEd = VEs = $1 - \sqrt{1 - \text{VEc}}$). Open black dots indicate simulation sets that did not consistently reach a defined prevalence maximum before the endpoint of 194 days.

Model calibration

Primary calibration was performed by first tuning disease parameters κ, and the bounds of T_{symp} for a basic reproductive number falling within the range specified in literature reports [1]. To compute R_0 for a given set of parameters, we performed an age-group biased micro-simulation Monte Carlo estimate of secondary cases produced by a typical index case as described in our previous studies [2,3].

We then tuned the parameters defining case-targeted NPIs to match the early incidence data issued in Australia during the initial wave of COVID-19 in March 2020. The resulting incidence growth rates generated by our ABM (growth rate ≈ 0.118) lie between the plausible values estimated for the first wave of COVID-19 (growth rate $\approx$ [0.1, 0.2] Fig. S5a). If the first three cases are ignored when determining the growth rate for the first wave, the calculated rate doubles (Fig. S5a), but provides a better fit to the remaining case data. It is unclear whether this discrepancy occurred due to ineffective case ascertainment (due to e.g., delays to initial surveillance efforts), or to stochastic die-out of the outbreak that produced the first recorded cases.

On the other hand, the growth rate produced by our ABM closely matches the rate estimated for the second wave, which began in early June, 2020, was confined to the state of Victoria, and occurred mostly within the urban area of Greater Melbourne [4] (growth rate ≈ 0.123, Fig. S5b). While our ABM simulates the entirety of Australia, early cases mostly arise in urban centres which contain the international airports from which importations are generated [5]. Therefore, a close match between the growth rates generated by our model and the rate observed during the beginning of the second wave in Greater Melbourne indicates that our simulations produce reasonable approximations to the early disease dynamics of an Australian outbreak.

The parameters defining population-scale NPIs (lockdown) were chosen to match the peak incidence and prevalence data produced during the first wave, which was suppressed with a national-scale lockdown (Fig. S6). While the initial incidence growth dynamics of our model are qualitatively similar to observations from the 1st wave (Fig. S5b, Fig. S6a), and well-matched to those observed during the second wave (Fig. S5b), there are some aspects of the observed data from the first wave that are not reproduced well by our model. In particular, simulated case prevalence is substantially lower than the number of active cases reported during the first wave. This is a direct consequence of our decision to model the infectious period after symptom onset in accordance to the period of replication competent viral shedding rather than the period over which a case may test positive (which can be longer by 1-2 weeks [6]). Therefore, in our model a case recovers and is no longer included in the prevalence count substantially earlier than it would be removed from an active case count ascertained through PCR tests. In addition, the cumulative incidence produced by our model is higher than what was observed in the first wave during March 2020 (Fig. S6b). However, this discrepancy only becomes substantial during the period after lockdown was implemented, so it can be interpreted as the consequence of our conservative estimates in the efficacy of lockdown on transmission in various contexts (Table S3). We chose conservative values for these parameters, so that our estimates of lockdown thresholds would err on the side of caution.

parameter	value	distribution	notes
κ	2.4	NA	global transmission scalar
T_{inc}	5.5 days (mean)	lognormal($\mu = 1.62,\ \sigma = 0.418$)	incubation period
T_{symp}	10.5 days (mean)	uniform [7, 14]	symptomatic (or asymptomatic) period
a	0.3	NA	asymptomatic transmission scalar
$p_{\text{ symptomatic}}$ | adult	0.67	NA	probability of symptoms (age < 18)
$p_{\text{ symptomatic}}$ | child	0.134	NA	probability of symptoms (age 18+)
$p_{\text{ detect}}$ | symptomatic	0.227	NA	daily case detection prob. (symptomatic)
$p_{\text{ detect}}$ | asymptomatic	0.01	NA	daily case detection prob. (asymptomatic)

Table S1: Key control parameters for COVID-19 transmission model.

parameter	value	distribution	notes
p_{CI}	0.7	NA	case isolation compliance rate
p_{HQ}	0.5	NA	home quarantine compliance rate
T_{HQ}	14 d	NA	home quarantine duration
$f_{\mathrm{home}}(\mathrm{HQ})$	2	NA	NPI transmission scalar (HQ, home)
$f_{\mathrm{community}}(\mathrm{HQ})$	0.25	NA	NPI transmission scalar (HQ, community)
$f_{\mathrm{workplace}}(\mathrm{HQ})$	0.25	NA	NPI transmission scalar (HQ, workplace)
$f_{\mathrm{home}}(\mathrm{CI})$	1	NA	NPI transmission scalar (CI, home)
$f_{\mathrm{community}}(\mathrm{CI})$	0.25	NA	NPI transmission scalar (CI, community)
$f_{\mathrm{workplace}}(\mathrm{CI})$	0.25	NA	NPI transmission scalar (CI, workplace)

Table S2: Key control parameters for targeted NPIs. NPI transmission scalars multiply the force of infection produced by infected individuals in the specified contexts. Compliance rates determine the proportion of individuals who act in accordance with the specified measures (case isolation, CI; home-quarantine of household contacts, HQ).

parameter	value	distribution	notes
p_{LD}	variable	[0, 1]	lockdown compliance rate
T_{LD}	91 d	NA	lockdown duration
$f_{\mathrm{home}}(\mathrm{LD})$	1	NA	NPI transmission scalar factor (LD, home)
$f_{\mathrm{community}}(\mathrm{LD})$	0.25	NA	NPI transmission scalar factor (LD, community)
$f_{\mathrm{workplace}}(\mathrm{LD})$	0.1	NA	NPI transmission scalar (LD, workplace)
$\mathrm{AR}_{\mathrm{trigger}}(\mathrm{LD})$	2000	NA	cum. incidence triggering population-level NPIs

Table S3: Key control parameters for population-level NPIs (lockdown, LD).

parameter	value from ABM	target value	notes
R_0	2.75 [2.71, 2.80]	2.9 [2.39, 3.44]	basic reproductive ratio[1]
T_{gen}	7.14 [7.05, 7.23]	7.0 days [5.8, 8.1]	generation/serial interval[7]
growth rate	0.118 [0.110, 0.127]	0.10 [0.097, 0.103]	growth rate of case incidence (1st wave)
growth rate	0.118 [0.110, 0.127]	0.201 [0.170, 0.233]	growth rate of case incidence (1st wave, from day 21)
growth rate	0.118 [0.110, 0.127]	0.123 [0.102, 0.143]	growth rate of case incidence (2nd wave, VIC)
peak prevalence	2790, range [2623, 3059]	4935	peak case prevalence (1st wave)
peak incidence	377, range [336, 415]	497	peak case incidence (1st wave)

Table S4: Calibration targets for key model outputs.

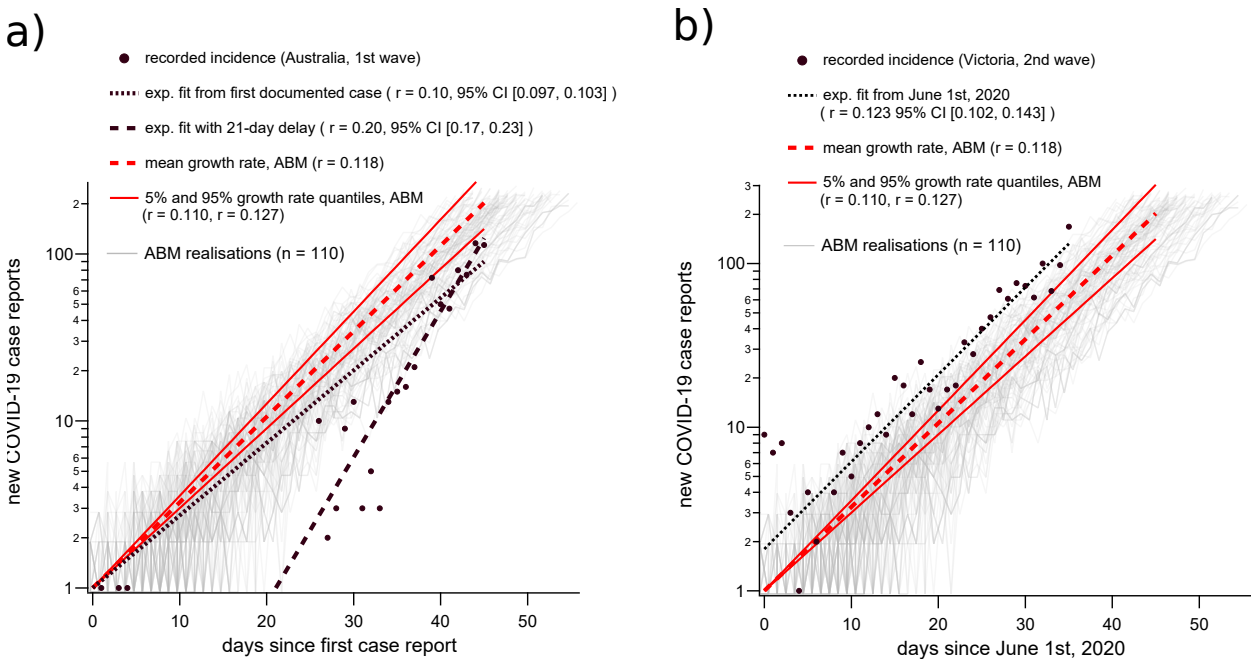

Figure S5: The growth rate computed by the ABM with case-targeted NPIs approximately matches the rate computed for the 2nd wave of COVID-19 in Victoria. Incidence growth rates computed by the model are compared to case data recorded by the Australian Department of Health for the 1st wave of COVID-19 (beginning on Feb. 3rd, 2020) (a), and case data recorded by the Victorian Department of Health and Human Services for the 2nd wave of COVID-19 (b).

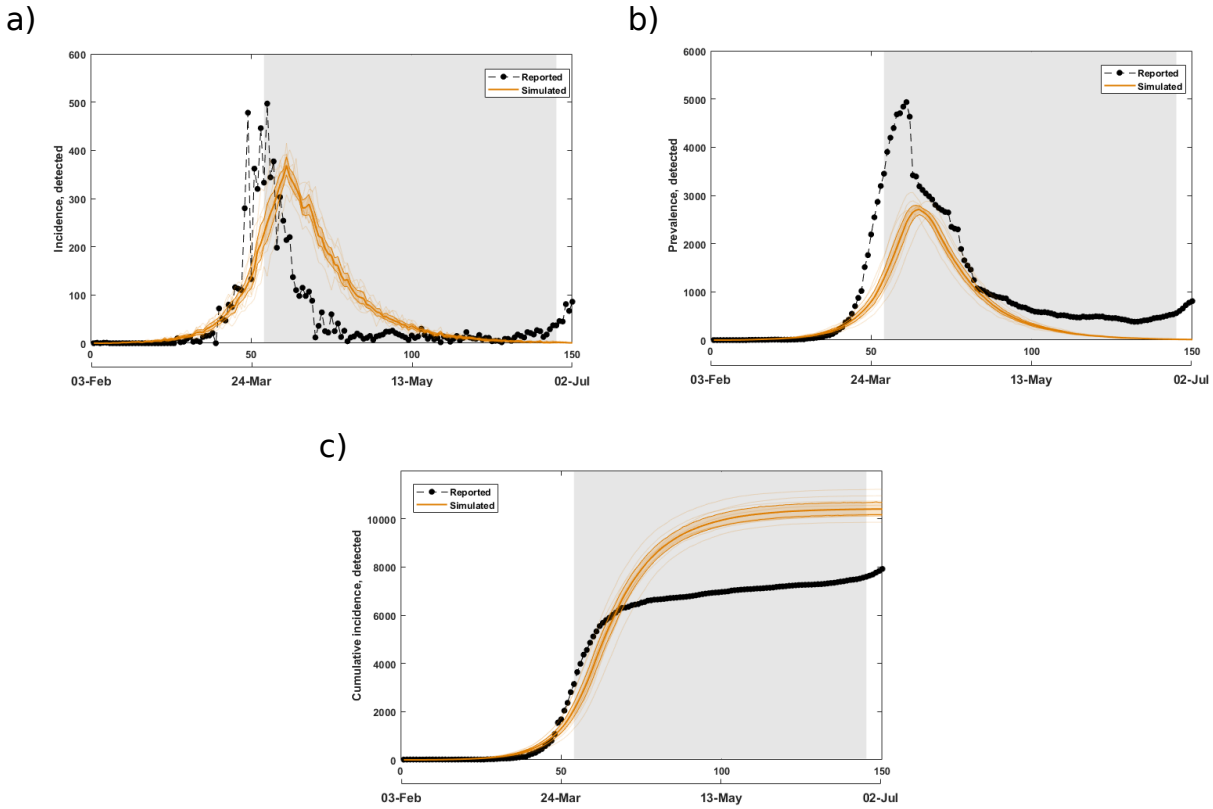

Figure S6: Alignment of model results with recorded case data from the first wave of COVID-19 in Australia. Daily case incidence is shown in (a), with reported case data shown as black dots connected by dashed lines and mean case incidence produced by the ABM shown as a solid yellow line (shaded bands represent 95% bootstrap CI bounds). The output of individual instances of the ABM (n = 10) are shown as transparent yellow traces. Case prevalence (active case counts) are shown in (b), and cumulative case incidence is shown in (c). The grey shaded region corresponds to the lockdown period used in the ABM, which utilised a lockdown compliance level of 90% to match the conditions used in our previous work [3].

Sensitivity of lockdown threshold to vaccine efficacy and age-specific priority

Figures S7 and S8 present results of a sensitivity analysis with respect to vaccine efficacy and vaccine allocation priority among the three age groups used in our model. Vaccine efficacies and vaccine age-group priority specifications are given in the figure legends. Rollout ratios listed in the legends $[x_1 : x_2 : x_3]$ correspond to age groups [65+ : 18-64 : <18], the revised rollout numbers [2547:30000:1000] were chosen in order to invert the priority vaccine distribution between 65+ and 18-64 age groups, while holding constant the overall number of vaccines distributed to each age group as allocated by the original 100:10:1 priority system.

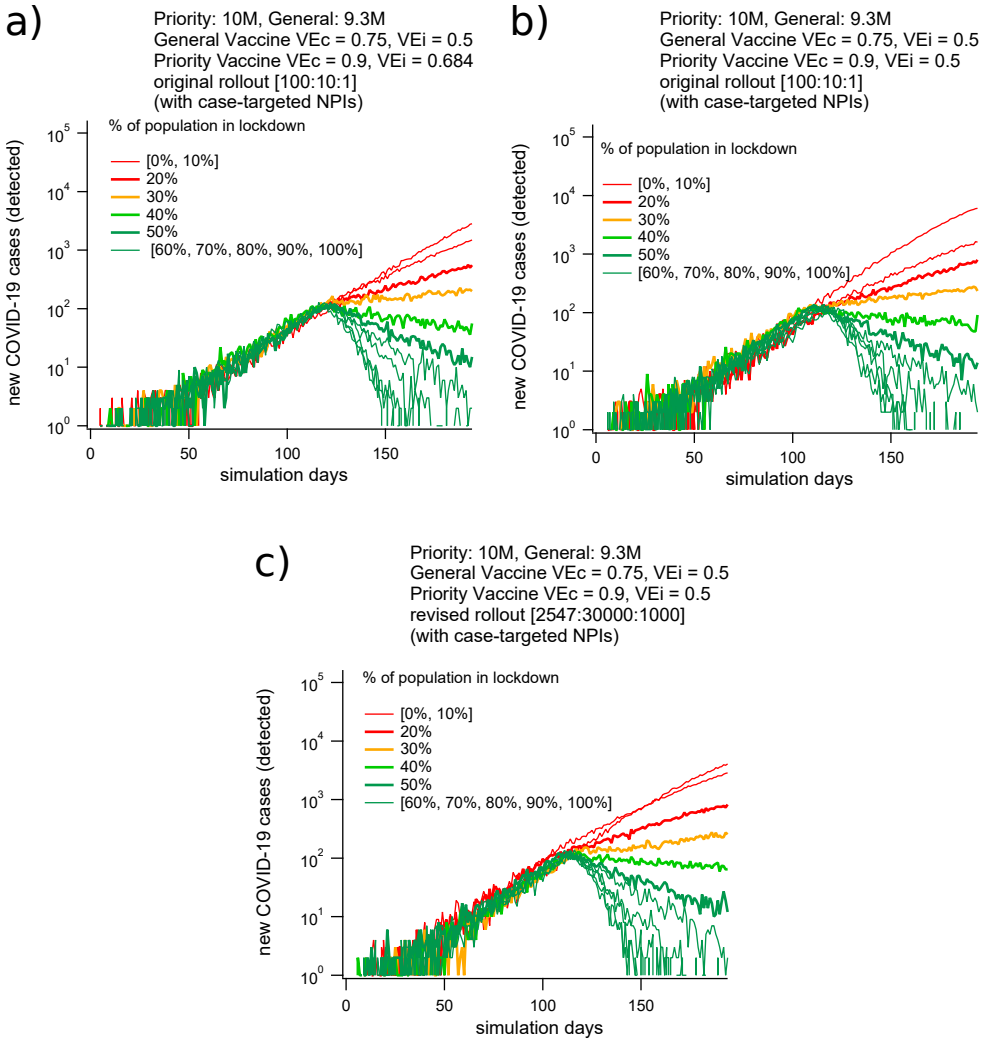

Figure S7: Within realistic parameter ranges, the lockdown compliance thresholds for elimination are not sensitive to vaccine efficacy assumptions or vaccine priority for different age groups. Representative incidence trajectories for different lockdown compliance rates demonstrate an elimination threshold between 30% and 40% for three alternative vaccine rollout scenarios. The trajectories in (a) correspond to increasing the three efficacy components for the general vaccine from 0.368 to 0.5, to approximate estimates from recent population-scale trial data. The trajectories in (b) further modify the efficacy of the priority vaccine against infectiousness from 0.684 to 0.5, reducing it in line with recent estimates. In (c), an alternate priority schedule is tested, in which adults between the ages of 18 and 64 are prioritised over those aged 65+, to approximate recent changes to recommendations against the use of general vaccine, ChAdOx1 nCoV-19 (Oxford/AstraZeneca), in younger adults.

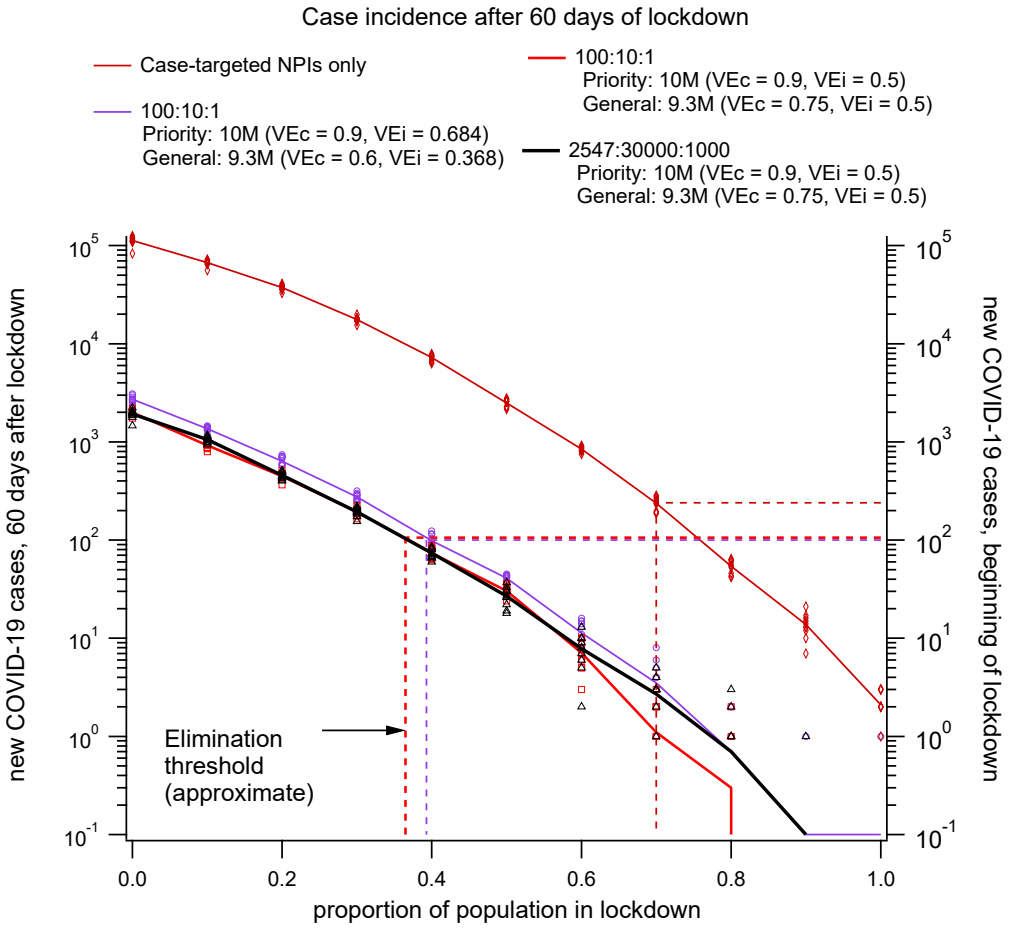

Figure S8: The intensity of lockdown required for gradual elimination of the virus is not sensitive to revised vaccine efficacy estimates or to a revised priority schedule. Solid lines connect ensemble averages of case incidence 60 days into the lockdown period for each scenario (left y-axis) while the values recorded from each individual simulation are shown as symbols. Each horizontal dashed line corresponds to the average incidence at the onset of lockdown (right y axis) for the vaccination scenario labelled with the same colour. The vertical dashed lines correspond to the approximate proportion of the population in lockdown required for case incidence to decrease, in each vaccination scenario. We omitted black dashed lines corresponding to the revised scenario with updated vaccine efficacy because they overlap closely with the red dashed lines corresponding to the original priority schedule with updated vaccine efficacy.

Epidemic severity as a function of vaccine efficacy and coverage

Here we provide full ABM results for epidemic severity as measured by initial incidence growth rates, peak prevalence levels and the timing of the prevalence peaks from the start of the epidemic as functions of VEi, VEs, VEd, and coverage. Incidence growth rate is computed from the first detected case to the time at which cumulative cases exceed 2000, or the end of the simulation after 194 days.

General Vaccination Only (no case-targeted NPIs), VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.36E-01	1.31E-01	1.41E-01	1.30E-01	1.26E-01	1.33E-01	1.31E-01	1.28E-01	1.34E-01	1.31E-01	1.26E-01	1.36E-01	1.28E-01	1.24E-01	1.33E-01
0.15	0.529	1.35E-01	1.30E-01	1.39E-01	1.34E-01	1.29E-01	1.39E-01	1.31E-01	1.27E-01	1.35E-01	1.30E-01	1.26E-01	1.34E-01	1.26E-01	1.22E-01	1.31E-01
0.368	0.368	1.33E-01	1.28E-01	1.38E-01	1.29E-01	1.24E-01	1.34E-01	1.35E-01	1.30E-01	1.38E-01	1.28E-01	1.23E-01	1.32E-01	1.27E-01	1.22E-01	1.32E-01
0.529	0.15	1.31E-01	1.25E-01	1.37E-01	1.31E-01	1.27E-01	1.35E-01	1.26E-01	1.23E-01	1.29E-01	1.28E-01	1.25E-01	1.30E-01	1.23E-01	1.20E-01	1.27E-01
0.6	0	1.32E-01	1.28E-01	1.37E-01	1.30E-01	1.24E-01	1.38E-01	1.30E-01	1.26E-01	1.33E-01	1.29E-01	1.26E-01	1.31E-01	1.31E-01	1.27E-01	1.35E-01

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.30E-01	1.25E-01	1.35E-01	1.28E-01	1.24E-01	1.34E-01	1.24E-01	1.20E-01	1.28E-01	1.23E-01	1.20E-01	1.26E-01	1.20E-01	1.17E-01	1.23E-01
0.15	0.529	1.30E-01	1.26E-01	1.34E-01	1.24E-01	1.21E-01	1.28E-01	1.24E-01	1.21E-01	1.27E-01	1.23E-01	1.21E-01	1.26E-01	1.24E-01	1.20E-01	1.28E-01
0.368	0.368	1.32E-01	1.28E-01	1.36E-01	1.23E-01	1.20E-01	1.29E-01	1.29E-01	1.24E-01	1.33E-01	1.22E-01	1.18E-01	1.25E-01	1.25E-01	1.22E-01	1.27E-01
0.529	0.15	1.23E-01	1.20E-01	1.27E-01	1.26E-01	1.23E-01	1.29E-01	1.20E-01	1.17E-01	1.23E-01	1.22E-01	1.19E-01	1.26E-01	1.24E-01	1.20E-01	1.28E-01
0.6	0	1.26E-01	1.23E-01	1.29E-01	1.23E-01	1.20E-01	1.26E-01	1.25E-01	1.21E-01	1.29E-01	1.23E-01	1.19E-01	1.29E-01	1.22E-01	1.19E-01	1.26E-01

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.26E-01	1.23E-01	1.30E-01	1.18E-01	1.13E-01	1.23E-01	1.11E-01	1.08E-01	1.14E-01	1.06E-01	1.02E-01	1.11E-01	1.03E-01	1.01E-01	1.06E-01
0.15	0.529	1.19E-01	1.13E-01	1.24E-01	1.18E-01	1.16E-01	1.21E-01	1.11E-01	1.07E-01	1.15E-01	1.07E-01	1.03E-01	1.13E-01	9.98E-02	9.69E-02	1.03E-01
0.368	0.368	1.20E-01	1.16E-01	1.24E-01	1.16E-01	1.13E-01	1.20E-01	1.10E-01	1.06E-01	1.13E-01	1.07E-01	1.03E-01	1.11E-01	9.95E-02	9.63E-02	1.02E-01
0.529	0.15	1.16E-01	1.11E-01	1.20E-01	1.13E-01	1.10E-01	1.18E-01	1.07E-01	1.04E-01	1.12E-01	1.05E-01	1.02E-01	1.08E-01	9.93E-02	9.61E-02	1.03E-01
0.6	0	1.15E-01	1.09E-01	1.20E-01	1.11E-01	1.07E-01	1.14E-01	1.04E-01	1.02E-01	1.07E-01	1.04E-01	1.01E-01	1.07E-01	9.89E-02	9.68E-02	1.01E-01

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.19E-01	1.15E-01	1.23E-01	1.10E-01	1.08E-01	1.13E-01	1.00E-01	9.70E-02	1.03E-01	9.26E-02	8.85E-02	9.69E-02	7.70E-02	7.46E-02	7.94E-02
0.15	0.529	1.17E-01	1.13E-01	1.20E-01	1.06E-01	1.03E-01	1.08E-01	9.91E-02	9.60E-02	1.02E-01	8.88E-02	8.62E-02	9.19E-02	7.60E-02	7.31E-02	7.86E-02
0.368	0.368	1.10E-01	1.06E-01	1.14E-01	1.01E-01	9.71E-02	1.04E-01	9.50E-02	9.28E-02	9.75E-02	8.47E-02	8.24E-02	8.82E-02	7.83E-02	7.62E-02	8.06E-02
0.529	0.15	1.04E-01	1.02E-01	1.08E-01	9.73E-02	9.35E-02	1.01E-01	9.20E-02	8.90E-02	9.53E-02	8.44E-02	8.12E-02	8.73E-02	7.54E-02	7.28E-02	7.74E-02
0.6	0	1.04E-01	1.01E-01	1.06E-01	9.53E-02	9.29E-02	9.75E-02	9.08E-02	8.82E-02	9.32E-02	8.57E-02	8.31E-02	8.81E-02	7.58E-02	7.35E-02	7.83E-02

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.12E-01	1.11E-01	1.14E-01	9.89E-02	9.38E-02	1.04E-01	8.74E-02	8.61E-02	8.86E-02	7.05E-02	6.86E-02	7.25E-02	5.38E-02	5.12E-02	5.58E-02
0.15	0.529	1.08E-01	1.03E-01	1.12E-01	9.25E-02	8.98E-02	9.52E-02	8.36E-02	8.08E-02	8.63E-02	6.90E-02	6.73E-02	7.05E-02	5.04E-02	4.82E-02	5.24E-02
0.368	0.368	9.50E-02	9.17E-02	9.82E-02	8.68E-02	8.41E-02	8.94E-02	7.82E-02	7.58E-02	8.10E-02	6.41E-02	6.14E-02	6.71E-02	5.41E-02	5.16E-02	5.72E-02
0.529	0.15	9.28E-02	9.06E-02	9.59E-02	8.26E-02	8.02E-02	8.49E-02	7.27E-02	7.05E-02	7.48E-02	6.22E-02	6.02E-02	6.39E-02	5.04E-02	4.79E-02	5.29E-02
0.6	0	8.80E-02	8.55E-02	9.10E-02	8.37E-02	7.97E-02	8.73E-02	6.98E-02	6.77E-02	7.26E-02	6.53E-02	6.30E-02	6.80E-02	5.08E-02	4.93E-02	5.25E-02

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	3.78E-02	3.63E-02	3.98E-02	2.53E-02	2.35E-02	2.71E-02	1.52E-02	1.44E-02	1.60E-02	8.67E-03	7.75E-03	9.53E-03	1.98E-03	7.09E-04	3.59E-03
0.15	0.529	3.93E-02	3.69E-02	4.20E-02	2.81E-02	2.63E-02	2.97E-02	1.55E-02	1.47E-02	1.63E-02	9.66E-03	8.86E-03	1.06E-02	2.32E-03	1.04E-03	3.68E-03
0.368	0.368	3.81E-02	3.66E-02	4.00E-02	2.68E-02	2.58E-02	2.76E-02	1.54E-02	1.46E-02	1.63E-02	7.81E-03	6.72E-03	8.72E-03	1.95E-03	1.19E-03	2.64E-03
0.529	0.15	3.75E-02	3.53E-02	4.04E-02	2.84E-02	2.70E-02	2.99E-02	1.54E-02	1.41E-02	1.66E-02	8.46E-03	7.84E-03	9.23E-03	1.76E-03	1.03E-03	2.56E-03
0.6	0	3.74E-02	3.49E-02	4.01E-02	2.70E-02	2.51E-02	2.94E-02	1.59E-02	1.51E-02	1.66E-02	8.98E-03	8.37E-03	9.68E-03	1.27E-03	4.74E-04	2.32E-03

Table S5: Mean incidence growth rate values and 95% ensemble CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and no case-targeted NPIs (n = 10 instances per scenario).

General Vaccination Only (no case-targeted NPIs), VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	1.70E+06	1.62E+06	1.75E+06	1.65E+06	1.59E+06	1.70E+06	1.63E+06	1.60E+06	1.67E+06	1.61E+06	1.57E+06	1.65E+06	1.54E+06	1.50E+06	1.58E+06
0.15	0.529	1.73E+06	1.67E+06	1.77E+06	1.58E+06	1.48E+06	1.64E+06	1.64E+06	1.56E+06	1.70E+06	1.61E+06	1.57E+06	1.65E+06	1.48E+06	1.45E+06	1.51E+06
0.368	0.368	1.66E+06	1.60E+06	1.73E+06	1.69E+06	1.63E+06	1.73E+06	1.55E+06	1.50E+06	1.58E+06	1.55E+06	1.49E+06	1.61E+06	1.52E+06	1.47E+06	1.58E+06
0.529	0.15	1.70E+06	1.63E+06	1.75E+06	1.65E+06	1.57E+06	1.72E+06	1.58E+06	1.51E+06	1.63E+06	1.56E+06	1.49E+06	1.62E+06	1.53E+06	1.48E+06	1.57E+06
0.6	0	1.71E+06	1.65E+06	1.76E+06	1.60E+06	1.53E+06	1.65E+06	1.66E+06	1.60E+06	1.72E+06	1.56E+06	1.50E+06	1.60E+06	1.55E+06	1.47E+06	1.61E+06

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	1.51E+06	1.43E+06	1.57E+06	1.37E+06	1.32E+06	1.42E+06	1.30E+06	1.26E+06	1.35E+06	1.25E+06	1.21E+06	1.30E+06	1.17E+06	1.13E+06	1.21E+06
0.15	0.529	1.52E+06	1.50E+06	1.55E+06	1.41E+06	1.38E+06	1.44E+06	1.36E+06	1.31E+06	1.41E+06	1.24E+06	1.19E+06	1.27E+06	1.20E+06	1.18E+06	1.23E+06
0.368	0.368	1.45E+06	1.36E+06	1.52E+06	1.41E+06	1.38E+06	1.45E+06	1.34E+06	1.30E+06	1.39E+06	1.27E+06	1.21E+06	1.31E+06	1.18E+06	1.15E+06	1.20E+06
0.529	0.15	1.48E+06	1.44E+06	1.53E+06	1.37E+06	1.29E+06	1.43E+06	1.38E+06	1.34E+06	1.40E+06	1.29E+06	1.27E+06	1.31E+06	1.22E+06	1.18E+06	1.25E+06
0.6	0	1.48E+06	1.42E+06	1.53E+06	1.42E+06	1.37E+06	1.47E+06	1.33E+06	1.30E+06	1.36E+06	1.30E+06	1.24E+06	1.34E+06	1.22E+06	1.18E+06	1.25E+06

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	1.13E+06	1.10E+06	1.15E+06	9.92E+05	9.77E+05	1.01E+06	8.28E+05	8.03E+05	8.50E+05	6.73E+05	6.56E+05	6.86E+05	5.30E+05	5.08E+05	5.49E+05
0.15	0.529	1.13E+06	1.09E+06	1.16E+06	9.47E+05	9.28E+05	9.68E+05	8.22E+05	7.94E+05	8.48E+05	6.77E+05	6.55E+05	7.00E+05	5.18E+05	4.92E+05	5.44E+05
0.368	0.368	1.07E+06	1.04E+06	1.11E+06	9.30E+05	9.17E+05	9.43E+05	8.09E+05	7.89E+05	8.28E+05	6.72E+05	6.44E+05	6.96E+05	5.57E+05	5.12E+05	5.90E+05
0.529	0.15	1.03E+06	1.00E+06	1.06E+06	9.07E+05	8.74E+05	9.41E+05	8.04E+05	7.74E+05	8.30E+05	6.50E+05	6.19E+05	6.77E+05	5.68E+05	5.55E+05	5.86E+05
0.6	0	1.03E+06	1.01E+06	1.06E+06	9.21E+05	9.06E+05	9.41E+05	7.86E+05	7.63E+05	8.07E+05	6.77E+05	6.38E+05	6.98E+05	5.61E+05	5.40E+05	5.84E+05

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	7.82E+05	7.55E+05	8.08E+05	5.94E+05	5.77E+05	6.16E+05	4.56E+05	4.46E+05	4.66E+05	2.94E+05	2.80E+05	3.09E+05	2.01E+05	1.86E+05	2.10E+05
0.15	0.529	7.57E+05	7.39E+05	7.73E+05	5.84E+05	5.60E+05	6.09E+05	4.17E+05	3.95E+05	4.39E+05	2.98E+05	2.91E+05	3.05E+05	2.02E+05	1.88E+05	2.13E+05
0.368	0.368	7.15E+05	6.85E+05	7.42E+05	5.45E+05	5.35E+05	5.59E+05	4.02E+05	3.88E+05	4.16E+05	2.92E+05	2.79E+05	3.07E+05	2.10E+05	1.96E+05	2.21E+05
0.529	0.15	6.68E+05	6.48E+05	6.87E+05	5.38E+05	5.21E+05	5.51E+05	3.95E+05	3.80E+05	4.12E+05	2.91E+05	2.74E+05	3.04E+05	2.20E+05	2.09E+05	2.30E+05
0.6	0	6.51E+05	6.32E+05	6.69E+05	4.92E+05	4.60E+05	5.14E+05	3.95E+05	3.85E+05	4.06E+05	2.82E+05	2.65E+05	2.97E+05	2.05E+05	1.92E+05	2.17E+05

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	4.93E+05	4.69E+05	5.10E+05	3.40E+05	3.31E+05	3.50E+05	2.12E+05	1.99E+05	2.22E+05	1.20E+05	1.15E+05	1.26E+05	3.30E+04	2.72E+04	3.97E+04
0.15	0.529	4.81E+05	4.61E+05	5.00E+05	3.08E+05	2.83E+05	3.24E+05	2.05E+05	1.97E+05	2.12E+05	1.11E+05	1.04E+05	1.19E+05	2.90E+04	2.25E+04	3.63E+04
0.368	0.368	4.28E+05	4.20E+05	4.35E+05	2.83E+05	2.67E+05	2.97E+05	2.01E+05	1.95E+05	2.08E+05	1.03E+05	9.16E+04	1.13E+05	3.80E+04	3.11E+04	4.58E+04
0.529	0.15	3.95E+05	3.86E+05	4.04E+05	2.61E+05	2.51E+05	2.70E+05	1.74E+05	1.68E+05	1.81E+05	1.03E+05	8.95E+04	1.11E+05	3.10E+04	2.40E+04	3.64E+04
0.6	0	3.63E+05	3.52E+05	3.72E+05	2.62E+05	2.53E+05	2.71E+05	1.57E+05	1.46E+05	1.66E+05	1.10E+05	1.05E+05	1.16E+05	3.30E+04	2.80E+04	3.84E+04

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	4.25E+03	3.83E+03	4.75E+03	737	591	896	134	113	154	44	36	51	19	15	23.7
0.15	0.529	5.31E+03	4.43E+03	6.26E+03	979	801	1147	142	123	162	52	47	61	20	17	23.6
0.368	0.368	4.54E+03	3.92E+03	5.33E+03	761	675	821	133	112	159	38	33	44	20	17	22.7
0.529	0.15	4.62E+03	3.69E+03	5.63E+03	895	777	1010	141	113	169	43	38	49	18	16	20.3
0.6	0	4.51E+03	3.77E+03	5.43E+03	810	684	936	151	131	170	47	42	52	17	15	19.5

Table S6: Mean peak prevalence values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and no case-targeted NPIs (n = 10 instances per scenario).

General Vaccination Only (no case-targeted NPIs), VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	121	119.6	121.5	121	120.4	122.0	123	121.6	125.3	124	121.3	126.6	123	121.4	124.7
0.15	0.529	120	117.8	121.0	121	118.1	123.3	122	120.7	122.3	122	120.7	123.7	124	122.5	126.6
0.368	0.368	121	120.2	121.8	122	120.3	123.5	121	120.0	121.3	124	121.9	126.4	124	121.7	126.1
0.529	0.15	121	119.8	123.0	122	120.8	123.8	124	122.4	126.1	125	122.7	126.5	124	122.8	126.0
0.6	0	121	120.2	121.6	124	120.9	126.7	123	121.7	125.1	123	121.4	124.3	125	122.5	127.3

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	124	122.4	125.6	126	123.6	127.4	128	126.1	131.2	130	128.9	130.0	132	130.0	133.7
0.15	0.529	124	122.4	126.1	126	124.0	128.3	126	124.0	127.7	128	125.8	128.8	129	125.9	130.5
0.368	0.368	124	121.8	126.7	125	122.9	126.7	128	125.6	129.4	127	124.6	130.4	130	128.5	131.2
0.529	0.15	125	123.0	126.7	127	124.3	128.3	129	127.3	131.2	129	126.5	130.4	131	129.8	132.8
0.6	0	124	122.5	125.5	126	124.2	128.4	128	125.7	130.4	130	128.5	133.0	130	128.7	132.7

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	127	124.6	128.4	133	130.5	135.5	138	134.6	140.2	145	141.7	148.2	152	148.7	155.9
0.15	0.529	130	127.6	132.8	134	131.3	135.8	139	136.4	141.7	145	143.0	147.2	150	147.8	152.3
0.368	0.368	134	132.1	135.7	137	136.4	137.6	141	138.9	142.9	147	145.4	149.0	152	147.6	157.0
0.529	0.15	135	132.4	137.9	141	138.3	143.2	143	140.4	144.6	150	145.3	154.2	151	148.0	152.6
0.6	0	136	134.7	137.3	138	135.4	139.7	144	141.1	146.7	147	145.4	149.0	154	151.6	158.1

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	133	130.2	137.7	141	138.6	143.0	149	146.3	151.0	161	157.7	165.1	180	173.6	186.1
0.15	0.529	137	134.8	138.3	144	142.4	145.3	154	150.2	158.2	167	162.2	172.3	185	180.7	188.9
0.368	0.368	144	141.4	146.5	153	149.5	155.7	156	154.3	158.7	167	161.9	172.6	182	177.5	185.6
0.529	0.15	148	145.9	150.2	151	148.9	153.0	160	155.4	163.8	167	163.5	171.3	179	174.1	183.8
0.6	0	146	145.3	147.9	153	150.2	154.7	162	161.2	161.8	169	164.6	176.3	182	179.2	185.8

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	138	134.8	140.9	153	149.1	156.1	169	163.1	176.5	186	182.7	189.8	195	195.0	195.0
0.15	0.529	145	143.5	147.3	156	153.3	157.9	169	165.8	172.2	190	187.8	192.6	195	195.0	195.0
0.368	0.368	153	149.5	155.8	165	162.9	167.7	177	174.0	179.0	193	191.5	194.5	195	195.0	195.0
0.529	0.15	160	157.1	162.7	173	169.6	177.3	181	176.1	186.0	195	194.3	194.9	195	195.0	195.0
0.6	0	163	159.7	167.0	169	166.3	172.4	188	183.6	191.3	194	191.7	194.6	195	195.0	195.0

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	195	195	195	195	194.7	195	191.9	186.3	194	176.9	167.8	185.1	150	125.3	172.7
0.15	0.529	195	195	195	195	194.6	195	189.6	186.9	192	183.7	177.3	189.4	136	114.3	159.7
0.368	0.368	195	195	195	195	194.4	194.9	189.1	182.1	193	160.4	144.5	174.8	153	137.9	167.2
0.529	0.15	195	195	195	195	194.5	195	187.7	182.2	192	179.6	166.2	189.9	143	111.2	169.3
0.6	0	195	195	195	195	194.5	195	190.9	187.6	193	168.8	153.4	180.9	150	123.8	174.2

Table S7: Prevalence peak times (means and 95% ensemble bootstrap CIs) produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and no case-targeted NPIs (n = 10 instances per scenario).

Priority Vaccination Only (no case-targeted NPIs), VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	1.32E-01	1.27E-01	1.37E-01	1.32E-01	1.29E-01	1.37E-01	1.30E-01	1.25E-01	1.35E-01	1.27E-01	1.24E-01	1.30E-01	1.28E-01	1.26E-01	1.31E-01	
0.225	0.871	1.34E-01	1.30E-01	1.38E-01	1.29E-01	1.27E-01	1.32E-01	1.29E-01	1.27E-01	1.31E-01	1.30E-01	1.27E-01	1.32E-01	1.30E-01	1.26E-01	1.34E-01	
0.684	0.684	1.27E-01	1.24E-01	1.30E-01	1.29E-01	1.25E-01	1.33E-01	1.31E-01	1.28E-01	1.34E-01	1.24E-01	1.22E-01	1.28E-01	1.27E-01	1.23E-01	1.31E-01	
0.871	0.225	1.29E-01	1.24E-01	1.34E-01	1.26E-01	1.21E-01	1.30E-01	1.29E-01	1.24E-01	1.33E-01	1.28E-01	1.24E-01	1.31E-01	1.24E-01	1.21E-01	1.27E-01	
0.9	0	1.26E-01	1.23E-01	1.30E-01	1.28E-01	1.24E-01	1.33E-01	1.31E-01	1.27E-01	1.37E-01	1.25E-01	1.23E-01	1.28E-01	1.24E-01	1.21E-01	1.28E-01	

population vaccinated: 4.6 M (~20%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	1.29E-01	1.24E-01	1.34E-01	1.25E-01	1.23E-01	1.28E-01	1.25E-01	1.22E-01	1.29E-01	1.28E-01	1.23E-01	1.32E-01	1.18E-01	1.14E-01	1.23E-01	
0.225	0.871	1.27E-01	1.23E-01	1.31E-01	1.25E-01	1.22E-01	1.29E-01	1.27E-01	1.23E-01	1.31E-01	1.22E-01	1.18E-01	1.25E-01	1.24E-01	1.21E-01	1.26E-01	
0.684	0.684	1.22E-01	1.20E-01	1.25E-01	1.22E-01	1.18E-01	1.25E-01	1.22E-01	1.17E-01	1.27E-01	1.23E-01	1.19E-01	1.27E-01	1.21E-01	1.17E-01	1.25E-01	
0.871	0.225	1.23E-01	1.17E-01	1.29E-01	1.23E-01	1.20E-01	1.27E-01	1.21E-01	1.17E-01	1.24E-01	1.23E-01	1.19E-01	1.27E-01	1.19E-01	1.16E-01	1.22E-01	
0.9	0	1.21E-01	1.18E-01	1.24E-01	1.21E-01	1.17E-01	1.24E-01	1.23E-01	1.20E-01	1.25E-01	1.21E-01	1.15E-01	1.27E-01	1.24E-01	1.21E-01	1.27E-01	

population vaccinated: 9.2 M (~40%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	1.20E-01	1.18E-01	1.23E-01	1.15E-01	1.12E-01	1.18E-01	1.09E-01	1.08E-01	1.12E-01	1.06E-01	1.02E-01	1.09E-01	1.04E-01	1.01E-01	1.07E-01	
0.225	0.871	1.19E-01	1.15E-01	1.25E-01	1.14E-01	1.11E-01	1.16E-01	1.08E-01	1.06E-01	1.12E-01	1.06E-01	1.03E-01	1.08E-01	9.77E-02	9.43E-02	1.01E-01	
0.684	0.684	1.12E-01	1.09E-01	1.15E-01	1.06E-01	1.02E-01	1.10E-01	1.04E-01	1.00E-01	1.07E-01	9.98E-02	9.60E-02	1.03E-01	9.81E-02	9.42E-02	1.03E-01	
0.871	0.225	1.04E-01	1.02E-01	1.07E-01	1.06E-01	1.04E-01	1.09E-01	1.03E-01	9.92E-02	1.07E-01	1.01E-01	9.79E-02	1.05E-01	1.03E-01	9.99E-02	1.05E-01	
0.9	0	1.06E-01	1.03E-01	1.10E-01	1.01E-01	9.83E-02	1.04E-01	1.04E-01	9.94E-02	1.07E-01	1.03E-01	9.96E-02	1.06E-01	9.98E-02	9.79E-02	1.02E-01	

population vaccinated: 13.8 M (~60%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	1.14E-01	1.09E-01	1.19E-01	1.02E-01	9.85E-02	1.06E-01	9.50E-02	9.30E-02	9.70E-02	8.57E-02	8.20E-02	8.93E-02	7.89E-02	7.67E-02	8.14E-02	
0.225	0.871	1.05E-01	1.03E-01	1.07E-01	9.89E-02	9.59E-02	1.02E-01	9.15E-02	8.98E-02	9.33E-02	8.95E-02	8.67E-02	9.19E-02	7.86E-02	7.54E-02	8.21E-02	
0.684	0.684	9.18E-02	8.96E-02	9.37E-02	8.72E-02	8.32E-02	9.07E-02	8.55E-02	8.24E-02	8.98E-02	8.13E-02	7.83E-02	8.42E-02	7.54E-02	7.27E-02	7.80E-02	
0.871	0.225	8.65E-02	8.51E-02	8.79E-02	8.24E-02	7.95E-02	8.52E-02	8.25E-02	8.05E-02	8.47E-02	7.74E-02	7.48E-02	8.00E-02	7.69E-02	7.39E-02	7.98E-02	
0.9	0	8.13E-02	7.91E-02	8.34E-02	8.34E-02	8.09E-02	8.57E-02	7.98E-02	7.76E-02	8.27E-02	8.00E-02	7.80E-02	8.22E-02	7.61E-02	7.37E-02	7.88E-02	

population vaccinated: 18.4 M (~80%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	1.06E-01	1.02E-01	1.09E-01	9.31E-02	9.00E-02	9.73E-02	8.11E-02	7.85E-02	8.35E-02	6.44E-02	6.25E-02	6.61E-02	4.99E-02	4.68E-02	5.26E-02	
0.225	0.871	9.37E-02	9.07E-02	9.68E-02	8.67E-02	8.36E-02	8.97E-02	7.47E-02	7.31E-02	7.64E-02	6.37E-02	6.14E-02	6.57E-02	5.01E-02	4.85E-02	5.17E-02	
0.684	0.684	7.34E-02	7.09E-02	7.57E-02	6.98E-02	6.82E-02	7.11E-02	6.24E-02	6.08E-02	6.45E-02	6.05E-02	5.88E-02	6.22E-02	5.02E-02	4.74E-02	5.26E-02	
0.871	0.225	6.42E-02	6.27E-02	6.62E-02	5.95E-02	5.72E-02	6.24E-02	5.66E-02	5.40E-02	5.85E-02	5.59E-02	5.46E-02	5.73E-02	5.03E-02	4.71E-02	5.29E-02	
0.9	0	6.27E-02	6.09E-02	6.47E-02	5.85E-02	5.64E-02	6.04E-02	5.67E-02	5.52E-02	5.80E-02	5.34E-02	5.21E-02	5.50E-02	4.86E-02	4.53E-02	5.16E-02	

population vaccinated: 23 M (~100%)

		VEi															
VEs	VEd	0			0.25			0.5			0.75			1			
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		
0	0.9	3.32E-03	2.74E-03	3.89E-03	1.54E-03	1.13E-03	1.93E-03	4.64E-05	2.08E-11	1.39E-04	4.35E-11	1.10E-11	8.36E-11	2.29E-11	1.74E-12	5.51E-11	
0.225	0.871	3.45E-03	3.11E-03	3.83E-03	1.50E-03	9.89E-04	1.94E-03	8.81E-05	2.87E-11	3.52E-04	5.57E-12	7.96E-13	1.67E-11	1.39E-11	2.68E-12	3.01E-11	
0.684	0.684	2.94E-03	2.60E-03	3.27E-03	1.77E-03	1.33E-03	2.35E-03	3.61E-05	3.81E-11	1.20E-04	1.01E-11	3.97E-12	1.89E-11	1.41E-11	3.09E-12	3.58E-11	
0.871	0.225	3.38E-03	3.01E-03	3.63E-03	1.78E-03	1.24E-03	2.33E-03	9.90E-11	1.77E-11	2.19E-10	3.28E-12	7.62E-13	7.89E-12	4.25E-12	9.34E-13	9.63E-12	
0.9	0	3.55E-03	3.34E-03	3.78E-03	2.01E-03	1.45E-03	2.70E-03	7.28E-05	7.34E-11	2.91E-04	2.84E-12	2.83E-13	7.32E-12	3.02E-11	7.49E-12	6.07E-11	

Table S8: Mean incidence growth rate values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and no case-targeted NPIs (n = 10 instances per scenario).

Priority Vaccination Only (no case-targeted NPIs), VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	1.63E+06	1.56E+06	1.70E+06	1.56E+06	1.51E+06	1.61E+06	1.51E+06	1.48E+06	1.55E+06	1.55E+06	1.51E+06	1.60E+06	1.51E+06	1.47E+06	1.54E+06
0.225	0.871	1.62E+06	1.55E+06	1.66E+06	1.57E+06	1.52E+06	1.61E+06	1.54E+06	1.48E+06	1.61E+06	1.51E+06	1.43E+06	1.58E+06	1.48E+06	1.39E+06	1.56E+06
0.684	0.684	1.60E+06	1.56E+06	1.64E+06	1.57E+06	1.50E+06	1.61E+06	1.54E+06	1.48E+06	1.60E+06	1.52E+06	1.46E+06	1.58E+06	1.46E+06	1.41E+06	1.51E+06
0.871	0.225	1.55E+06	1.49E+06	1.60E+06	1.53E+06	1.46E+06	1.58E+06	1.45E+06	1.38E+06	1.50E+06	1.52E+06	1.46E+06	1.57E+06	1.47E+06	1.41E+06	1.53E+06
0.9	0	1.55E+06	1.51E+06	1.58E+06	1.53E+06	1.50E+06	1.58E+06	1.47E+06	1.42E+06	1.51E+06	1.49E+06	1.46E+06	1.53E+06	1.51E+06	1.46E+06	1.56E+06

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	1.32E+06	1.29E+06	1.34E+06	1.27E+06	1.19E+06	1.33E+06	1.19E+06	1.13E+06	1.25E+06	1.13E+06	1.08E+06	1.17E+06	1.01E+06	9.81E+05	1.05E+06
0.225	0.871	1.25E+06	1.23E+06	1.29E+06	1.23E+06	1.19E+06	1.28E+06	1.19E+06	1.15E+06	1.23E+06	1.15E+06	1.12E+06	1.18E+06	1.11E+06	1.05E+06	1.15E+06
0.684	0.684	1.25E+06	1.22E+06	1.28E+06	1.16E+06	1.12E+06	1.19E+06	1.17E+06	1.11E+06	1.21E+06	1.11E+06	1.07E+06	1.15E+06	1.06E+06	1.02E+06	1.09E+06
0.871	0.225	1.16E+06	1.11E+06	1.21E+06	1.13E+06	1.08E+06	1.17E+06	1.12E+06	1.07E+06	1.16E+06	1.13E+06	1.11E+06	1.16E+06	1.04E+06	9.60E+05	1.11E+06
0.9	0	1.19E+06	1.16E+06	1.22E+06	1.15E+06	1.10E+06	1.19E+06	1.19E+06	1.17E+06	1.21E+06	1.13E+06	1.08E+06	1.17E+06	1.12E+06	1.08E+06	1.16E+06

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	7.86E+05	7.58E+05	8.18E+05	6.76E+05	6.51E+05	6.97E+05	5.89E+05	5.44E+05	6.23E+05	4.98E+05	4.69E+05	5.22E+05	4.50E+05	4.33E+05	4.66E+05
0.225	0.871	7.38E+05	7.16E+05	7.57E+05	6.36E+05	6.11E+05	6.59E+05	6.17E+05	6.03E+05	6.33E+05	5.28E+05	5.14E+05	5.43E+05	4.30E+05	4.15E+05	4.44E+05
0.684	0.684	6.06E+05	5.85E+05	6.28E+05	5.79E+05	5.57E+05	5.99E+05	5.38E+05	5.16E+05	5.56E+05	5.01E+05	4.83E+05	5.20E+05	4.60E+05	4.44E+05	4.80E+05
0.871	0.225	5.63E+05	5.47E+05	5.78E+05	5.40E+05	5.16E+05	5.56E+05	5.09E+05	4.83E+05	5.30E+05	4.86E+05	4.55E+05	5.09E+05	4.73E+05	4.55E+05	4.89E+05
0.9	0	5.59E+05	5.46E+05	5.71E+05	5.33E+05	5.07E+05	5.58E+05	5.06E+05	4.80E+05	5.27E+05	4.79E+05	4.53E+05	5.02E+05	4.73E+05	4.51E+05	4.89E+05

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	3.97E+05	3.84E+05	4.13E+05	3.13E+05	2.99E+05	3.25E+05	2.53E+05	2.41E+05	2.63E+05	1.92E+05	1.84E+05	2.00E+05	1.38E+05	1.27E+05	1.45E+05
0.225	0.871	3.65E+05	3.55E+05	3.77E+05	2.92E+05	2.88E+05	2.98E+05	2.40E+05	2.28E+05	2.50E+05	1.86E+05	1.80E+05	1.92E+05	1.30E+05	1.19E+05	1.40E+05
0.684	0.684	2.57E+05	2.46E+05	2.65E+05	2.25E+05	2.11E+05	2.33E+05	1.94E+05	1.86E+05	2.03E+05	1.73E+05	1.64E+05	1.80E+05	1.28E+05	1.19E+05	1.36E+05
0.871	0.225	2.10E+05	1.98E+05	2.18E+05	1.92E+05	1.85E+05	2.00E+05	1.69E+05	1.62E+05	1.76E+05	1.73E+05	1.67E+05	1.79E+05	1.40E+05	1.35E+05	1.46E+05
0.9	0	2.02E+05	1.93E+05	2.09E+05	1.94E+05	1.83E+05	2.01E+05	1.79E+05	1.72E+05	1.85E+05	1.60E+05	1.49E+05	1.70E+05	1.49E+05	1.40E+05	1.57E+05

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	1.47E+05	1.40E+05	1.54E+05	1.12E+05	1.08E+05	1.17E+05	8.20E+04	7.83E+04	8.62E+04	5.50E+04	5.08E+04	5.96E+04	1.90E+04	1.40E+04	2.37E+04
0.225	0.871	1.31E+05	1.27E+05	1.35E+05	9.90E+04	9.22E+04	1.05E+05	7.50E+04	7.10E+04	7.90E+04	5.40E+04	5.13E+04	5.58E+04	1.70E+04	1.44E+04	1.90E+04
0.684	0.684	8.60E+04	8.22E+04	8.89E+04	7.00E+04	6.50E+04	7.26E+04	5.30E+04	5.04E+04	5.55E+04	4.20E+04	3.67E+04	4.72E+04	2.10E+04	1.63E+04	2.56E+04
0.871	0.225	6.70E+04	6.29E+04	7.01E+04	5.70E+04	5.35E+04	5.91E+04	4.50E+04	3.92E+04	5.13E+04	3.40E+04	3.00E+04	3.84E+04	2.10E+04	1.64E+04	2.56E+04
0.9	0	6.10E+04	5.82E+04	6.34E+04	5.40E+04	5.16E+04	5.66E+04	4.60E+04	4.30E+04	4.99E+04	3.20E+04	2.87E+04	3.57E+04	1.80E+04	1.48E+04	2.06E+04

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	23	21	26	19	17	20	15	13	17	12	11	13	7	7	8
0.225	0.871	22	20	24	19	18	20	15	13	16	12	12	13	9	8	10
0.684	0.684	22	21	23	18	17	19	14	13	15	12	11	13	8	7	10
0.871	0.225	21	20	22	18	17	19	15	15	16	12	11	13	8	7	8
0.9	0	23	22	24	19	17	20	15	13	16	12	11	13	7	7	8

Table S9: Mean peak prevalence values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and no case-targeted NPIs (n = 10 instances per scenario).

Priority Vaccination Only (no case-targeted NPIs), VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	121	119.2	121.4	122	120.9	124.1	124	122.4	125.8	123	121.4	124.7	123	121.9	124.5
0.225	0.871	121	118.2	123.0	122	120.6	123.8	123	121.5	123.9	124	121.8	127.9	123	120.3	124.6
0.684	0.684	122	121.3	123.4	122	120.7	123.6	122	119.5	123.5	123	121.7	124.5	125	122.5	126.7
0.871	0.225	122	120.7	124.7	124	122.5	125.8	127	124.8	128.3	124	121.4	126.6	124	121.5	126.5
0.9	0	123	121.6	124.5	121	119.0	123.3	124	121.6	125.9	124	122.1	125.7	125	123.4	127.3

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	123	121.9	125.3	125	122.8	127.6	128	126.4	128.9	129	127.1	131.5	131	128.2	133.2
0.225	0.871	125	122.8	126.4	126	123.9	129.4	127	124.4	128.5	132	129.7	133.7	130	128.9	131.8
0.684	0.684	127	124.7	128.3	129	128.0	129.0	130	127.7	132.9	130	128.5	132.3	129	127.6	131.6
0.871	0.225	128	126.1	130.6	128	125.3	129.1	130	127.7	132.2	130	129.4	132.2	129	126.4	131.2
0.9	0	129	128.2	129.6	130	127.7	131.6	129	127.8	129.2	130	128.0	132.5	133	130.5	134.5

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	133	130.3	136.2	136	133.3	138.8	140	138.1	142.4	150	145.8	155.6	151	148.4	154.3
0.225	0.871	134	132.0	136.4	140	137.8	142.1	141	138.8	143.5	146	142.9	149.5	154	150.0	157.8
0.684	0.684	143	140.0	144.5	143	139.7	145.8	146	143.5	148.5	150	147.5	151.9	152	149.1	156.2
0.871	0.225	143	140.1	145.9	145	142.5	147.3	150	146.0	154.5	147	144.4	149.7	151	148.6	153.1
0.9	0	144	141.0	146.7	144	141.5	145.1	148	146.3	150.5	152	147.3	156.1	150	147.9	152.5

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	141	138.7	143.5	147	144.1	150.3	156	152.1	159.7	165	160.9	168.4	178	172.8	183.5
0.225	0.871	147	143.2	151.5	150	147.3	153.4	158	154.8	162.3	167	163.1	170.9	182	177.4	187.1
0.684	0.684	160	157.8	162.3	165	160.4	169.0	164	160.7	167.0	176	172.1	179.4	180	175.5	184.8
0.871	0.225	163	158.7	169.1	166	163.7	168.4	170	165.0	175.2	175	171.5	178.1	181	176.6	185.5
0.9	0	161	159.0	163.3	165	160.7	170.1	166	161.9	169.8	176	171.6	181.4	181	177.6	184.3

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	148	144.7	151.8	159	156.0	162.0	174	169.8	178.7	191	186.6	193.1	195	195.0	195.0
0.225	0.871	154	151.8	156.8	165	161.2	169.0	179	175.3	182.3	193	190.1	194.3	195	194.7	195.0
0.684	0.684	181	177.5	185.4	187	183.9	189.9	193	191.1	194.5	195	194.5	195.0	195	194.7	195.0
0.871	0.225	193	190.8	193.9	194	193.5	194.3	194	193.8	194.6	195	194.5	195.0	195	195.0	195.0
0.9	0	191	188.6	193.4	194	193.6	194.4	195	194.2	194.8	195	194.7	195.0	195	195.0	195.0

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	105	87.3	125.9	102.8	74.4	133	74.4	48.8	103	103.8	75.7	131	103.0	73.6	134.31
0.225	0.871	93	56.2	134.3	100.3	81.0	126	105.3	81.8	130	96.6	67.1	128	107.8	77.2	137.05
0.684	0.684	71	56.0	91.6	77.5	51.6	107	109.9	75.7	148	80.6	61.0	106	88.1	58.8	114.6
0.871	0.225	116	84.8	145.2	110.2	77.8	144	126.3	92.4	156	126.3	100.9	150	95.0	63.8	124.6
0.9	0	107	74.2	135.7	139.9	109.9	166	113.1	82.9	144	117.9	98.7	136	82.2	57.5	109.7

Table S10: Prevalence peak times (means and 95% ensemble bootstrap CIs) produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and no case-targeted NPIs (n = 10 instances per scenario).

General Vaccination with Case-Targeted NPIs, VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.18E-01	1.16E-01	1.20E-01	1.17E-01	1.14E-01	1.21E-01	1.15E-01	1.12E-01	1.18E-01	1.12E-01	1.08E-01	1.15E-01	1.10E-01	1.07E-01	1.13E-01
0.15	0.529	1.15E-01	1.11E-01	1.19E-01	1.14E-01	1.10E-01	1.16E-01	1.15E-01	1.11E-01	1.19E-01	1.13E-01	1.10E-01	1.17E-01	1.11E-01	1.08E-01	1.14E-01
0.368	0.368	1.11E-01	1.07E-01	1.16E-01	1.14E-01	1.12E-01	1.17E-01	1.14E-01	1.11E-01	1.18E-01	1.12E-01	1.10E-01	1.15E-01	1.10E-01	1.07E-01	1.13E-01
0.529	0.15	1.14E-01	1.11E-01	1.18E-01	1.14E-01	1.11E-01	1.18E-01	1.15E-01	1.11E-01	1.19E-01	1.12E-01	1.10E-01	1.14E-01	1.13E-01	1.09E-01	1.16E-01
0.6	0	1.13E-01	1.09E-01	1.17E-01	1.13E-01	1.09E-01	1.15E-01	1.10E-01	1.05E-01	1.13E-01	1.11E-01	1.08E-01	1.13E-01	1.14E-01	1.09E-01	1.18E-01

population vaccinated: 4.6 M(~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.12E-01	1.08E-01	1.15E-01	1.11E-01	1.09E-01	1.13E-01	1.08E-01	1.04E-01	1.10E-01	1.08E-01	1.04E-01	1.12E-01	1.07E-01	1.04E-01	1.11E-01
0.15	0.529	1.12E-01	1.08E-01	1.15E-01	1.13E-01	1.09E-01	1.15E-01	1.08E-01	1.04E-01	1.11E-01	1.06E-01	1.01E-01	1.09E-01	1.04E-01	9.98E-02	1.09E-01
0.368	0.368	1.11E-01	1.07E-01	1.16E-01	1.11E-01	1.08E-01	1.14E-01	1.06E-01	1.02E-01	1.09E-01	1.04E-01	1.01E-01	1.07E-01	1.06E-01	1.03E-01	1.09E-01
0.529	0.15	1.11E-01	1.08E-01	1.16E-01	1.07E-01	1.05E-01	1.10E-01	1.05E-01	1.03E-01	1.08E-01	1.08E-01	1.05E-01	1.11E-01	1.03E-01	9.95E-02	1.06E-01
0.6	0	1.10E-01	1.07E-01	1.14E-01	1.09E-01	1.06E-01	1.11E-01	1.09E-01	1.07E-01	1.11E-01	1.03E-01	1.01E-01	1.06E-01	1.05E-01	1.03E-01	1.07E-01

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.10E-01	1.07E-01	1.12E-01	1.05E-01	1.03E-01	1.06E-01	9.60E-02	9.39E-02	9.81E-02	9.13E-02	8.81E-02	9.45E-02	8.44E-02	8.23E-02	8.70E-02
0.15	0.529	1.09E-01	1.07E-01	1.11E-01	1.01E-01	9.75E-02	1.05E-01	9.90E-02	9.67E-02	1.02E-01	9.12E-02	8.82E-02	9.45E-02	8.37E-02	8.08E-02	8.68E-02
0.368	0.368	1.06E-01	1.04E-01	1.08E-01	9.85E-02	9.54E-02	1.02E-01	9.41E-02	9.26E-02	9.53E-02	9.07E-02	8.82E-02	9.30E-02	8.61E-02	8.38E-02	8.86E-02
0.529	0.15	9.75E-02	9.59E-02	9.94E-02	9.40E-02	9.26E-02	9.56E-02	9.21E-02	8.92E-02	9.57E-02	8.66E-02	8.42E-02	8.92E-02	8.55E-02	8.24E-02	8.78E-02
0.6	0	9.95E-02	9.81E-02	1.01E-01	9.63E-02	9.41E-02	9.89E-02	8.99E-02	8.79E-02	9.20E-02	8.85E-02	8.55E-02	9.22E-02	8.44E-02	8.31E-02	8.58E-02

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.03E-01	1.01E-01	1.05E-01	9.72E-02	9.50E-02	9.90E-02	8.76E-02	8.45E-02	9.10E-02	7.30E-02	7.11E-02	7.55E-02	6.43E-02	6.24E-02	6.63E-02
0.15	0.529	1.02E-01	1.00E-01	1.04E-01	9.31E-02	9.07E-02	9.53E-02	8.30E-02	8.16E-02	8.46E-02	7.54E-02	7.26E-02	7.84E-02	6.40E-02	6.19E-02	6.60E-02
0.368	0.368	9.54E-02	9.36E-02	9.71E-02	8.67E-02	8.38E-02	8.94E-02	8.16E-02	7.91E-02	8.48E-02	7.10E-02	6.77E-02	7.45E-02	6.40E-02	6.22E-02	6.59E-02
0.529	0.15	8.66E-02	8.36E-02	8.87E-02	8.42E-02	8.25E-02	8.61E-02	7.62E-02	7.52E-02	7.70E-02	6.83E-02	6.65E-02	7.00E-02	6.48E-02	6.20E-02	6.71E-02
0.6	0	8.56E-02	8.31E-02	8.83E-02	8.00E-02	7.78E-02	8.22E-02	7.70E-02	7.48E-02	7.98E-02	6.95E-02	6.76E-02	7.10E-02	6.28E-02	6.07E-02	6.51E-02

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.03E-01	1.01E-01	1.06E-01	9.04E-02	8.87E-02	9.15E-02	7.44E-02	7.19E-02	7.74E-02	5.76E-02	5.63E-02	5.93E-02	3.74E-02	3.57E-02	3.97E-02
0.15	0.529	9.92E-02	9.80E-02	1.00E-01	8.54E-02	8.29E-02	8.87E-02	7.09E-02	6.99E-02	7.25E-02	5.55E-02	5.41E-02	5.73E-02	4.14E-02	3.99E-02	4.32E-02
0.368	0.368	8.66E-02	8.42E-02	8.94E-02	7.65E-02	7.47E-02	7.85E-02	6.42E-02	6.16E-02	6.61E-02	5.20E-02	4.96E-02	5.42E-02	4.08E-02	3.82E-02	4.28E-02
0.529	0.15	7.54E-02	7.36E-02	7.72E-02	7.01E-02	6.77E-02	7.28E-02	6.03E-02	5.81E-02	6.31E-02	4.97E-02	4.83E-02	5.18E-02	3.97E-02	3.69E-02	4.17E-02
0.6	0	7.29E-02	7.05E-02	7.54E-02	6.51E-02	6.33E-02	6.75E-02	5.74E-02	5.57E-02	5.93E-02	4.77E-02	4.63E-02	4.92E-02	3.99E-02	3.74E-02	4.22E-02

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.6	1.55E-02	1.50E-02	1.61E-02	1.26E-02	1.16E-02	1.36E-02	1.01E-02	9.23E-03	1.08E-02	6.26E-03	5.45E-03	6.96E-03	1.74E-03	8.11E-04	2.94E-03
0.15	0.529	1.54E-02	1.49E-02	1.60E-02	1.23E-02	1.16E-02	1.30E-02	9.41E-03	8.77E-03	1.01E-02	5.70E-03	5.12E-03	6.26E-03	2.11E-03	1.23E-03	3.09E-03
0.368	0.368	1.49E-02	1.43E-02	1.55E-02	1.32E-02	1.26E-02	1.37E-02	9.75E-03	9.20E-03	1.04E-02	5.87E-03	5.06E-03	6.79E-03	1.57E-03	7.93E-04	2.48E-03
0.529	0.15	1.46E-02	1.37E-02	1.55E-02	1.25E-02	1.22E-02	1.28E-02	9.16E-03	8.55E-03	9.76E-03	5.80E-03	4.90E-03	6.50E-03	1.41E-03	7.15E-04	2.13E-03
0.6	0	1.57E-02	1.51E-02	1.65E-02	1.27E-02	1.20E-02	1.35E-02	9.64E-03	8.86E-03	1.07E-02	6.33E-03	5.71E-03	7.07E-03	1.40E-03	6.65E-04	2.18E-03

Table S11: Mean incidence growth rate values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

General Vaccination with Case-Targeted NPIs, VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	1.11E+06	1.08E+06	1.15E+06	1.08E+06	1.04E+06	1.11E+06	1.08E+06	1.05E+06	1.10E+06	1.02E+06	9.88E+05	1.04E+06	9.85E+05	9.44E+05	1.02E+06
0.15	0.529	1.10E+06	1.07E+06	1.14E+06	1.09E+06	1.07E+06	1.12E+06	1.02E+06	9.80E+05	1.06E+06	1.00E+06	9.54E+05	1.04E+06	9.63E+05	9.25E+05	9.96E+05
0.368	0.368	1.08E+06	1.05E+06	1.11E+06	1.06E+06	1.03E+06	1.08E+06	1.03E+06	1.00E+06	1.06E+06	9.91E+05	9.54E+05	1.03E+06	9.78E+05	9.58E+05	9.94E+05
0.529	0.15	1.08E+06	1.04E+06	1.11E+06	1.06E+06	1.04E+06	1.09E+06	1.00E+06	9.53E+05	1.03E+06	1.01E+06	9.83E+05	1.04E+06	9.55E+05	9.42E+05	9.72E+05
0.6	0	1.07E+06	1.02E+06	1.11E+06	1.06E+06	1.03E+06	1.09E+06	1.00E+06	9.64E+05	1.04E+06	9.61E+05	9.30E+05	9.87E+05	9.65E+05	9.37E+05	9.90E+05

population vaccinated: 4.6 M(~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	1.03E+06	9.94E+05	1.06E+06	9.37E+05	9.01E+05	9.65E+05	8.85E+05	8.73E+05	8.95E+05	8.13E+05	7.85E+05	8.35E+05	7.57E+05	7.32E+05	7.81E+05
0.15	0.529	9.74E+05	9.42E+05	1.01E+06	9.60E+05	9.33E+05	9.80E+05	8.61E+05	8.41E+05	8.80E+05	7.87E+05	7.55E+05	8.16E+05	7.16E+05	6.61E+05	7.58E+05
0.368	0.368	9.37E+05	9.07E+05	9.76E+05	9.20E+05	8.91E+05	9.51E+05	8.36E+05	8.01E+05	8.70E+05	7.90E+05	7.60E+05	8.21E+05	7.45E+05	7.08E+05	7.81E+05
0.529	0.15	9.32E+05	8.88E+05	9.62E+05	8.78E+05	8.46E+05	9.10E+05	8.07E+05	7.69E+05	8.39E+05	7.61E+05	7.38E+05	7.88E+05	7.52E+05	7.25E+05	7.75E+05
0.6	0	9.12E+05	8.89E+05	9.40E+05	8.59E+05	8.30E+05	8.92E+05	8.30E+05	8.10E+05	8.48E+05	7.81E+05	7.62E+05	7.95E+05	7.34E+05	6.99E+05	7.64E+05

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	8.45E+05	8.22E+05	8.70E+05	6.98E+05	6.75E+05	7.22E+05	5.61E+05	5.41E+05	5.84E+05	4.79E+05	4.66E+05	4.94E+05	3.58E+05	3.37E+05	3.80E+05
0.15	0.529	7.81E+05	7.51E+05	8.08E+05	6.70E+05	6.43E+05	6.98E+05	5.29E+05	5.01E+05	5.58E+05	4.49E+05	4.29E+05	4.66E+05	3.52E+05	3.37E+05	3.69E+05
0.368	0.368	7.16E+05	6.97E+05	7.34E+05	6.01E+05	5.82E+05	6.19E+05	4.90E+05	4.64E+05	5.15E+05	4.26E+05	4.14E+05	4.40E+05	3.78E+05	3.66E+05	3.92E+05
0.529	0.15	6.70E+05	6.60E+05	6.83E+05	5.80E+05	5.57E+05	5.96E+05	4.89E+05	4.64E+05	5.05E+05	4.18E+05	3.92E+05	4.38E+05	3.61E+05	3.40E+05	3.79E+05
0.6	0	6.39E+05	6.27E+05	6.55E+05	5.49E+05	5.18E+05	5.69E+05	4.87E+05	4.68E+05	5.03E+05	4.28E+05	4.20E+05	4.39E+05	3.67E+05	3.44E+05	3.87E+05

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	6.49E+05	6.30E+05	6.75E+05	4.81E+05	4.53E+05	5.05E+05	3.58E+05	3.45E+05	3.69E+05	2.54E+05	2.42E+05	2.65E+05	1.40E+05	1.26E+05	1.52E+05
0.15	0.529	5.98E+05	5.85E+05	6.10E+05	4.53E+05	4.39E+05	4.65E+05	3.33E+05	3.22E+05	3.43E+05	2.38E+05	2.27E+05	2.45E+05	1.27E+05	1.10E+05	1.46E+05
0.368	0.368	5.09E+05	4.90E+05	5.24E+05	3.86E+05	3.71E+05	3.98E+05	2.90E+05	2.69E+05	3.05E+05	2.21E+05	2.11E+05	2.32E+05	1.26E+05	1.16E+05	1.37E+05
0.529	0.15	4.20E+05	4.04E+05	4.32E+05	3.40E+05	3.31E+05	3.52E+05	2.58E+05	2.37E+05	2.77E+05	2.02E+05	1.89E+05	2.12E+05	1.31E+05	1.16E+05	1.45E+05
0.6	0	3.95E+05	3.83E+05	4.05E+05	3.12E+05	2.89E+05	3.31E+05	2.52E+05	2.41E+05	2.63E+05	1.94E+05	1.83E+05	2.03E+05	1.35E+05	1.12E+05	1.51E+05

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	5.05E+05	4.88E+05	5.22E+05	3.54E+05	3.45E+05	3.63E+05	2.13E+05	2.05E+05	2.22E+05	6.60E+04	5.41E+04	7.65E+04	6.00E+03	3.93E+03	8.22E+03
0.15	0.529	4.29E+05	3.99E+05	4.55E+05	2.94E+05	2.82E+05	3.05E+05	1.84E+05	1.73E+05	1.91E+05	6.40E+04	5.50E+04	7.55E+04	8.00E+03	5.53E+03	1.03E+04
0.368	0.368	3.32E+05	3.21E+05	3.43E+05	2.28E+05	2.23E+05	2.34E+05	1.30E+05	1.20E+05	1.40E+05	4.60E+04	3.39E+04	5.88E+04	7.00E+03	5.39E+03	8.50E+03
0.529	0.15	2.74E+05	2.63E+05	2.82E+05	1.97E+05	1.90E+05	2.02E+05	1.15E+05	1.10E+05	1.19E+05	3.30E+04	2.66E+04	4.10E+04	9.00E+03	6.06E+03	1.14E+04
0.6	0	2.37E+05	2.27E+05	2.44E+05	1.65E+05	1.54E+05	1.74E+05	9.00E+04	8.06E+04	9.99E+04	3.10E+04	2.45E+04	3.70E+04	8.00E+03	4.75E+03	1.07E+04

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.6	124	113	136	80	68	95	56	48	65	32	28	36	18	16	21
0.15	0.529	131	118	143	72	65	81	49	45	55	31	29	33	19	17	20
0.368	0.368	114	106	126	90	80	99	50	45	56	30	26	33	19	17	21
0.529	0.15	111	94	130	77	74	80	49	44	54	30	26	34	17	15	19
0.6	0	127	115	140	80	70	90	52	45	59	33	30	36	17	15	18

Table S12: Mean peak prevalence values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

General Vaccination with Case-Targeted NPIs, VEc = 0.6

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	134	132.3	135.2	133	131.2	135.7	136	134.0	137.9	136	135.4	137.9	137	135.6	139.0
0.15	0.529	134	131.6	137.1	135	132.9	136.3	135	133.0	136.3	136	133.9	138.4	139	136.4	141.0
0.368	0.368	137	135.3	138.5	135	133.9	136.6	137	134.9	138.8	136	135.4	137.7	137	135.6	139.2
0.529	0.15	135	132.8	137.6	135	132.7	136.0	135	134.1	137.5	136	133.9	137.8	137	135.6	138.6
0.6	0	136	135.1	136.5	136	134.6	137.4	137	135.1	139.1	136	135.3	137.7	136	134.1	139.0

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	135	133.6	135.7	138	136.1	140.4	140	137.7	141.4	142	140.6	143.2	145	143.2	147.6
0.15	0.529	138	135.2	141.5	137	134.7	139.6	141	138.8	143.0	143	140.2	147.0	148	144.7	152.3
0.368	0.368	137	134.1	138.7	138	136.5	140.4	142	139.8	144.0	144	141.4	147.4	142	139.7	144.5
0.529	0.15	138	136.1	140.3	140	137.8	141.3	143	140.5	144.8	143	141.7	143.5	145	142.8	147.1
0.6	0	139	136.7	140.6	140	137.3	141.6	141	138.9	143.3	146	143.4	149.3	145	142.5	147.6

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	138	136.3	139.8	146	142.9	147.6	153	150.7	155.7	158	156.0	159.8	172	165.4	179.3
0.15	0.529	140	138.8	141.9	147	144.6	148.9	154	151.7	158.1	163	159.8	166.8	169	165.7	173.1
0.368	0.368	147	144.6	148.5	151	148.4	154.0	155	152.7	157.5	160	156.6	163.5	166	162.4	170.5
0.529	0.15	148	145.9	150.8	154	151.5	155.5	159	155.6	163.7	164	160.9	168.2	167	161.7	172.4
0.6	0	150	147.1	152.2	156	152.5	158.3	158	155.7	160.8	162	160.0	163.8	168	165.1	170.1

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	144	140.7	146.7	157	153.2	163.1	167	164.7	169.1	182	178.9	185.8	194	191.4	195.0
0.15	0.529	148	145.8	150.2	158	155.8	159.0	169	165.7	173.2	183	178.7	188.4	194	191.7	195.0
0.368	0.368	156	153.9	158.1	161	157.9	163.6	177	172.8	181.4	188	184.8	191.3	195	194.1	195.0
0.529	0.15	165	161.5	169.6	170	168.1	172.9	181	176.8	185.3	192	189.2	194.5	195	194.2	195.0
0.6	0	165	162.2	168.0	173	170.1	175.8	182	178.6	185.7	192	190.0	193.0	195	194.2	195.0

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	145	143.9	147.0	161	157.7	163.6	183	180.6	186.3	195	195.0	195.0	195	195.0	195.0
0.15	0.529	154	151.4	156.9	167	164.6	168.9	192	189.1	193.5	195	195.0	195.0	195	195.0	195.0
0.368	0.368	166	164.4	168.4	180	176.7	184.8	195	194.6	195.0	195	195.0	195.0	195	195.0	195.0
0.529	0.15	179	176.1	181.6	187	184.5	190.0	195	194.1	195.0	195	195.0	195.0	195	195.0	195.0
0.6	0	180	176.2	183.2	194	193.4	194.9	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.6	176	163.9	185.9	168	153.1	178.3	168	139.7	184.2	159	138.7	177.0	143	116.7	167.3
0.15	0.529	161	151.4	173.3	163	135.7	178.6	145	126.9	162.8	144	125.2	160.6	141	116.0	159.0
0.368	0.368	158	144.7	167.6	167	148.1	181.5	173	154.1	187.1	162	139.3	177.4	134	109.9	159.0
0.529	0.15	179	168.1	187.5	175	161.4	184.5	151	122.8	172.5	160	134.9	179.5	130	108.5	152.7
0.6	0	164	147.8	180.2	158	148.3	167.4	165	152.4	176.8	163	144.3	173.0	130	104.8	154.0

Table S13: Prevalence peak times (means and 95% ensemble bootstrap CIs) produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.6 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

Priority Vaccination with Case-Targeted NPIs, VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	1.15E-01	1.13E-01	1.18E-01	1.14E-01	1.11E-01	1.17E-01	1.13E-01	1.10E-01	1.16E-01	1.13E-01	1.10E-01	1.15E-01	1.14E-01	1.11E-01	1.17E-01
0.225	0.871	1.15E-01	1.12E-01	1.18E-01	1.13E-01	1.12E-01	1.15E-01	1.12E-01	1.09E-01	1.15E-01	1.12E-01	1.09E-01	1.14E-01	1.11E-01	1.09E-01	1.12E-01
0.684	0.684	1.12E-01	1.07E-01	1.16E-01	1.12E-01	1.09E-01	1.15E-01	1.14E-01	1.11E-01	1.17E-01	1.11E-01	1.08E-01	1.14E-01	1.11E-01	1.07E-01	1.14E-01
0.871	0.225	1.15E-01	1.11E-01	1.18E-01	1.13E-01	1.10E-01	1.16E-01	1.10E-01	1.07E-01	1.14E-01	1.11E-01	1.09E-01	1.13E-01	1.11E-01	1.08E-01	1.14E-01
0.9	0	1.13E-01	1.09E-01	1.15E-01	1.13E-01	1.09E-01	1.17E-01	1.13E-01	1.10E-01	1.16E-01	1.11E-01	1.08E-01	1.15E-01	1.13E-01	1.11E-01	1.14E-01

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	1.13E-01	1.10E-01	1.16E-01	1.11E-01	1.09E-01	1.13E-01	1.08E-01	1.05E-01	1.11E-01	1.06E-01	1.04E-01	1.09E-01	1.04E-01	1.02E-01	1.07E-01
0.225	0.871	1.11E-01	1.09E-01	1.14E-01	1.09E-01	1.06E-01	1.13E-01	1.08E-01	1.05E-01	1.12E-01	1.07E-01	1.04E-01	1.10E-01	1.08E-01	1.05E-01	1.10E-01
0.684	0.684	1.09E-01	1.06E-01	1.12E-01	1.06E-01	1.03E-01	1.09E-01	1.07E-01	1.04E-01	1.11E-01	1.03E-01	1.01E-01	1.05E-01	1.03E-01	1.01E-01	1.06E-01
0.871	0.225	1.07E-01	1.05E-01	1.10E-01	1.09E-01	1.06E-01	1.11E-01	1.07E-01	1.04E-01	1.10E-01	1.06E-01	1.05E-01	1.08E-01	1.05E-01	1.03E-01	1.07E-01
0.9	0	1.08E-01	1.06E-01	1.10E-01	1.05E-01	1.02E-01	1.08E-01	1.07E-01	1.05E-01	1.08E-01	1.04E-01	1.02E-01	1.06E-01	1.03E-01	1.01E-01	1.05E-01

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	1.06E-01	1.03E-01	1.08E-01	1.03E-01	9.98E-02	1.05E-01	9.52E-02	9.16E-02	9.84E-02	9.21E-02	8.89E-02	9.52E-02	8.53E-02	8.30E-02	8.76E-02
0.225	0.871	1.04E-01	9.96E-02	1.08E-01	9.82E-02	9.63E-02	1.00E-01	9.13E-02	8.85E-02	9.45E-02	8.92E-02	8.77E-02	9.05E-02	8.56E-02	8.41E-02	8.71E-02
0.684	0.684	9.45E-02	9.16E-02	9.78E-02	8.96E-02	8.72E-02	9.21E-02	9.09E-02	8.84E-02	9.38E-02	8.66E-02	8.39E-02	8.92E-02	8.66E-02	8.48E-02	8.86E-02
0.871	0.225	9.08E-02	8.78E-02	9.37E-02	9.02E-02	8.76E-02	9.29E-02	8.71E-02	8.51E-02	8.91E-02	8.62E-02	8.31E-02	8.89E-02	8.25E-02	8.03E-02	8.45E-02
0.9	0	8.81E-02	8.53E-02	9.08E-02	8.78E-02	8.53E-02	9.01E-02	8.79E-02	8.54E-02	9.01E-02	8.59E-02	8.36E-02	8.83E-02	8.43E-02	8.25E-02	8.63E-02

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	1.05E-01	1.03E-01	1.06E-01	9.35E-02	9.15E-02	9.57E-02	8.35E-02	8.03E-02	8.54E-02	7.52E-02	7.36E-02	7.65E-02	6.33E-02	6.17E-02	6.51E-02
0.225	0.871	9.30E-02	9.04E-02	9.61E-02	8.81E-02	8.64E-02	9.01E-02	7.83E-02	7.65E-02	8.06E-02	7.22E-02	6.94E-02	7.45E-02	6.10E-02	5.97E-02	6.26E-02
0.684	0.684	7.91E-02	7.77E-02	8.10E-02	7.53E-02	7.34E-02	7.74E-02	7.19E-02	7.01E-02	7.37E-02	6.69E-02	6.49E-02	6.86E-02	6.14E-02	5.98E-02	6.29E-02
0.871	0.225	7.16E-02	6.91E-02	7.36E-02	6.92E-02	6.64E-02	7.16E-02	6.58E-02	6.31E-02	6.84E-02	6.55E-02	6.35E-02	6.75E-02	6.52E-02	6.29E-02	6.72E-02
0.9	0	7.00E-02	6.84E-02	7.11E-02	6.80E-02	6.60E-02	6.99E-02	6.59E-02	6.39E-02	6.80E-02	6.52E-02	6.32E-02	6.78E-02	6.33E-02	6.17E-02	6.51E-02

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	9.63E-02	9.47E-02	9.75E-02	8.28E-02	8.02E-02	8.56E-02	7.01E-02	6.87E-02	7.16E-02	5.58E-02	5.39E-02	5.73E-02	4.06E-02	3.89E-02	4.22E-02
0.225	0.871	8.80E-02	8.62E-02	8.97E-02	7.64E-02	7.48E-02	7.82E-02	6.53E-02	6.34E-02	6.78E-02	5.21E-02	5.04E-02	5.43E-02	4.10E-02	3.84E-02	4.28E-02
0.684	0.684	6.29E-02	6.17E-02	6.42E-02	5.70E-02	5.54E-02	5.86E-02	5.25E-02	5.01E-02	5.46E-02	4.44E-02	4.23E-02	4.61E-02	3.99E-02	3.92E-02	4.08E-02
0.871	0.225	5.12E-02	4.99E-02	5.25E-02	4.81E-02	4.64E-02	4.94E-02	4.58E-02	4.43E-02	4.79E-02	4.24E-02	4.07E-02	4.39E-02	3.76E-02	3.63E-02	3.91E-02
0.9	0	5.13E-02	4.97E-02	5.35E-02	4.73E-02	4.56E-02	4.87E-02	4.57E-02	4.47E-02	4.67E-02	4.15E-02	3.98E-02	4.29E-02	3.97E-02	3.79E-02	4.17E-02

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI		growth rate	95% CI	
0	0.9	2.75E-03	2.34E-03	3.19E-03	1.15E-03	8.56E-04	1.45E-03	3.31E-05	7.86E-13	1.32E-04	4.96E-11	2.99E-12	1.20E-10	2.05E-11	2.54E-12	6.16E-11
0.225	0.871	2.82E-03	2.39E-03	3.17E-03	1.64E-03	1.23E-03	2.08E-03	1.71E-05	9.75E-13	6.84E-05	1.74E-11	2.14E-12	3.98E-11	1.23E-11	2.11E-12	2.63E-11
0.684	0.684	2.48E-03	2.14E-03	2.77E-03	1.04E-03	7.56E-04	1.33E-03	6.33E-11	1.47E-12	1.93E-10	2.57E-11	7.48E-12	5.27E-11	1.76E-11	2.15E-12	4.50E-11
0.871	0.225	2.84E-03	2.44E-03	3.20E-03	1.67E-03	1.30E-03	2.02E-03	3.91E-05	2.67E-12	1.56E-04	3.27E-11	7.37E-12	6.98E-11	1.91E-11	2.75E-12	4.34E-11
0.9	0	3.00E-03	2.63E-03	3.35E-03	1.53E-03	1.04E-03	1.99E-03	4.79E-05	6.79E-11	1.21E-04	1.52E-12	3.78E-13	3.81E-12	1.61E-11	2.02E-12	3.76E-11

Table S14: Mean incidence growth rate and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

Priority Vaccination with Case-Targeted NPIs, VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	1.05E+06	1.01E+06	1.08E+06	1.06E+06	1.03E+06	1.09E+06	1.01E+06	9.58E+05	1.04E+06	9.78E+05	9.44E+05	1.01E+06	9.26E+05	8.73E+05	9.69E+05
0.225	0.871	1.03E+06	9.91E+05	1.06E+06	1.00E+06	9.70E+05	1.03E+06	9.99E+05	9.72E+05	1.03E+06	9.39E+05	9.05E+05	9.77E+05	9.57E+05	9.31E+05	9.82E+05
0.684	0.684	9.96E+05	9.83E+05	1.01E+06	9.86E+05	9.61E+05	1.02E+06	9.66E+05	9.31E+05	9.98E+05	9.36E+05	9.03E+05	9.68E+05	9.16E+05	8.77E+05	9.59E+05
0.871	0.225	9.90E+05	9.55E+05	1.02E+06	9.34E+05	9.02E+05	9.61E+05	9.14E+05	8.77E+05	9.54E+05	9.16E+05	8.96E+05	9.43E+05	9.55E+05	9.37E+05	9.69E+05
0.9	0	9.51E+05	9.06E+05	9.89E+05	9.61E+05	9.33E+05	9.90E+05	9.22E+05	8.92E+05	9.49E+05	9.22E+05	9.00E+05	9.40E+05	9.24E+05	8.90E+05	9.48E+05

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	9.14E+05	8.83E+05	9.43E+05	8.98E+05	8.76E+05	9.18E+05	7.91E+05	7.66E+05	8.19E+05	7.58E+05	7.31E+05	7.78E+05	7.11E+05	6.92E+05	7.29E+05
0.225	0.871	8.67E+05	8.31E+05	9.02E+05	8.15E+05	7.72E+05	8.42E+05	8.00E+05	7.75E+05	8.16E+05	7.64E+05	7.45E+05	7.79E+05	7.21E+05	7.11E+05	7.32E+05
0.684	0.684	7.74E+05	7.43E+05	8.04E+05	7.61E+05	7.33E+05	7.84E+05	7.47E+05	7.19E+05	7.76E+05	7.29E+05	7.03E+05	7.53E+05	7.11E+05	6.90E+05	7.32E+05
0.871	0.225	7.17E+05	6.84E+05	7.46E+05	7.06E+05	6.77E+05	7.35E+05	7.09E+05	6.89E+05	7.35E+05	6.77E+05	6.53E+05	7.00E+05	6.90E+05	6.71E+05	7.16E+05
0.9	0	7.25E+05	7.05E+05	7.38E+05	7.33E+05	7.13E+05	7.55E+05	7.16E+05	7.03E+05	7.31E+05	6.94E+05	6.68E+05	7.17E+05	6.86E+05	6.70E+05	7.01E+05

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	6.48E+05	6.30E+05	6.65E+05	5.65E+05	5.48E+05	5.79E+05	4.89E+05	4.80E+05	5.02E+05	4.08E+05	3.89E+05	4.28E+05	3.25E+05	3.03E+05	3.44E+05
0.225	0.871	5.99E+05	5.80E+05	6.19E+05	5.03E+05	4.90E+05	5.15E+05	4.43E+05	4.26E+05	4.58E+05	3.85E+05	3.76E+05	3.95E+05	3.22E+05	3.10E+05	3.30E+05
0.684	0.684	4.37E+05	4.20E+05	4.54E+05	3.98E+05	3.85E+05	4.11E+05	3.63E+05	3.49E+05	3.78E+05	3.15E+05	2.98E+05	3.30E+05	3.07E+05	2.96E+05	3.20E+05
0.871	0.225	3.58E+05	3.43E+05	3.71E+05	3.67E+05	3.57E+05	3.77E+05	3.37E+05	3.32E+05	3.43E+05	3.10E+05	2.99E+05	3.22E+05	3.04E+05	2.95E+05	3.14E+05
0.9	0	3.58E+05	3.53E+05	3.62E+05	3.48E+05	3.34E+05	3.58E+05	3.36E+05	3.21E+05	3.49E+05	3.20E+05	3.11E+05	3.30E+05	3.00E+05	2.85E+05	3.12E+05

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	4.39E+05	4.24E+05	4.55E+05	3.35E+05	3.18E+05	3.51E+05	2.63E+05	2.55E+05	2.69E+05	1.86E+05	1.74E+05	1.96E+05	1.16E+05	1.04E+05	1.26E+05
0.225	0.871	3.62E+05	3.47E+05	3.76E+05	2.81E+05	2.64E+05	2.96E+05	2.22E+05	2.06E+05	2.36E+05	1.59E+05	1.43E+05	1.72E+05	1.06E+05	9.53E+04	1.15E+05
0.684	0.684	2.08E+05	2.00E+05	2.15E+05	1.83E+05	1.74E+05	1.89E+05	1.57E+05	1.48E+05	1.66E+05	1.23E+05	1.07E+05	1.33E+05	1.06E+05	9.12E+04	1.18E+05
0.871	0.225	1.53E+05	1.48E+05	1.58E+05	1.43E+05	1.38E+05	1.48E+05	1.32E+05	1.22E+05	1.38E+05	1.05E+05	9.36E+04	1.16E+05	9.50E+04	8.64E+04	1.02E+05
0.9	0	1.46E+05	1.41E+05	1.51E+05	1.40E+05	1.32E+05	1.47E+05	1.29E+05	1.22E+05	1.34E+05	1.15E+05	1.10E+05	1.20E+05	9.20E+04	8.64E+04	9.81E+04

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	2.86E+05	2.75E+05	2.92E+05	2.01E+05	1.94E+05	2.09E+05	1.34E+05	1.28E+05	1.39E+05	4.60E+04	3.80E+04	5.34E+04	6.00E+03	4.54E+03	7.54E+03
0.225	0.871	2.17E+05	2.11E+05	2.24E+05	1.52E+05	1.42E+05	1.62E+05	1.02E+05	9.45E+04	1.10E+05	3.10E+04	2.61E+04	3.70E+04	6.00E+03	4.43E+03	8.71E+03
0.684	0.684	8.10E+04	7.65E+04	8.69E+04	5.80E+04	5.42E+04	6.12E+04	3.20E+04	2.57E+04	3.68E+04	1.30E+04	1.00E+04	1.49E+04	7.00E+03	5.38E+03	8.54E+03
0.871	0.225	3.60E+04	2.98E+04	4.15E+04	2.40E+04	2.11E+04	2.68E+04	1.50E+04	1.17E+04	1.88E+04	9.00E+03	7.65E+03	9.94E+03	5.00E+03	3.52E+03	6.22E+03
0.9	0	2.80E+04	2.28E+04	3.16E+04	2.30E+04	2.07E+04	2.47E+04	1.60E+04	1.38E+04	1.85E+04	9.00E+03	7.39E+03	1.09E+04	5.00E+03	4.34E+03	5.96E+03

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI		prevalence	95% CI	
0	0.9	20	19	22	17	16	18	14	13	15	11	10	12	8	7	9
0.225	0.871	21	19	23	20	18	23	14	13	15	11	10	13	8	7	9
0.684	0.684	21	19	22	18	17	20	14	14	15	11	10	12	7	7	8
0.871	0.225	21	20	22	19	17	21	14	13	16	11	10	12	8	7	9
0.9	0	21	19	22	17	16	19	14	13	15	11	11	12	9	8	10

Table S15: Mean peak prevalence values and 95% ensemble bootstrap CIs produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

Priority Vaccination with Case-Targeted NPIs, VEc = 0.9

population vaccinated: 2.3 M (~10%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	134	132.9	134.8	135	133.2	137.3	135	133.1	137.1	137	135.1	138.5	138	135.3	140.0
0.225	0.871	135	133.2	137.7	137	134.6	138.9	136	134.7	138.4	136	135.3	137.7	137	135.8	139.4
0.684	0.684	135	134.4	136.1	135	133.3	137.7	135	134.2	136.4	138	135.4	141.4	138	136.3	140.5
0.871	0.225	135	134.6	136.3	138	136.1	140.3	138	135.0	140.1	137	135.7	139.0	138	136.2	140.1
0.9	0	137	134.8	139.3	137	135.0	139.9	137	134.7	139.1	139	136.1	141.1	136	134.9	138.1

population vaccinated: 4.6 M (~20%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	137	135.0	138.7	139	135.8	141.9	141	138.7	142.5	144	141.2	147.5	147	144.6	149.2
0.225	0.871	139	137.1	140.9	141	138.3	144.7	142	138.5	146.5	143	140.3	144.8	144	142.3	145.6
0.684	0.684	141	139.5	142.7	141	138.4	143.1	142	139.7	143.5	143	141.4	144.7	145	142.3	147.5
0.871	0.225	144	140.5	146.6	141	138.7	142.6	142	140.1	144.4	144	141.0	147.3	145	142.0	147.0
0.9	0	138	136.7	139.8	144	141.6	147.4	143	141.4	145.7	144	142.3	146.8	145	142.1	148.1

population vaccinated: 9.2 M (~40%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	143	140.1	145.3	149	146.3	150.6	152	148.9	155.1	161	157.2	165.0	168	163.9	172.7
0.225	0.871	145	143.2	148.0	152	149.7	154.9	157	154.9	158.7	162	158.8	164.4	170	166.5	174.3
0.684	0.684	154	151.2	156.6	161	158.0	163.3	163	161.4	165.4	166	163.7	168.4	168	165.8	170.6
0.871	0.225	162	158.3	165.7	163	159.3	166.6	163	160.3	166.5	165	162.1	168.9	167	164.6	170.0
0.9	0	157	154.8	159.7	162	159.0	166.3	160	157.1	163.1	164	161.5	166.1	166	163.3	168.6

population vaccinated: 13.8 M (~60%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	147	144.8	149.0	158	154.2	160.6	169	163.8	175.4	185	181.3	188.7	195	195.0	195.0
0.225	0.871	155	153.2	157.0	165	160.9	167.8	175	171.0	180.6	191	188.5	193.5	195	194.4	195.0
0.684	0.684	175	172.5	178.1	181	178.9	184.3	186	181.9	190.3	193	189.4	194.7	195	194.4	195.0
0.871	0.225	182	179.0	186.0	188	183.0	191.9	190	187.4	192.8	194	193.0	195.0	194	191.4	195.0
0.9	0	185	182.1	187.6	189	186.2	191.2	189	185.1	192.3	192	189.4	193.2	195	195.0	195.0

population vaccinated: 18.4 M (~80%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	153	149.6	155.7	170	166.1	173.0	187	184.1	189.9	195	195.0	195.0	195	195	195
0.225	0.871	164	161.0	167.5	180	176.2	184.6	195	195.0	195.0	195	195.0	195.0	195	195	195
0.684	0.684	195	194.5	195.0	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0	195	195	195
0.871	0.225	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0	195	195	195
0.9	0	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0	195	195.0	195.0	195	195	195

population vaccinated: 23 M (~100%)

		VEi														
VEs	VEd	0			0.25			0.5			0.75			1		
		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI		day of peak	95% CI	
0	0.9	123	99	151	89	63	119	105	67	143	74	60	88	75	44	113
0.225	0.871	88	55	125	121	84	154	87	62	113	89	62	122	94	60	131
0.684	0.684	131	107	155	84	59	117	101	79	127	113	82	142	87	54	126
0.871	0.225	116	87	145	116	84	147	76	50	110	121	90	145	79	53	109
0.9	0	75	55	103	110	80	139	120	89	143	81	59	101	108	71	142

Table S16: Prevalence peak times (means and 95% ensemble bootstrap CIs) produced by the ABM for various combinations of vaccine efficacy parameters and coverage levels, assuming a clinical efficacy of VEc = 0.9 and active case-targeted NPIs consisting of case isolation, home-quarantine of household contacts of detected cases, and international travel restrictions (n = 10 instances per scenario).

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