COVID-19 Pandemic Trade-offs: Launch of web-tool

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Transport Health Urban Design (THUD) Laboratory team at the Melbourne School of Design:

- Dr Jason Thompson built the original agent-based model (ABM)
- Profs Stevenson and McClure, THUD, contributed to early development of the ABM
- Drs Haifeng Zhao and Sachith Seneviratne (THUD) provided high-speed computing support.

Population interventions team, MSPGH:

- Dr Driss Ait Ouakrim, Ms Ameera Katar and Mr Patrick Abraham undertook the literature review to establish which diseases and conditions are associated with lockdowns
- Drs Laxman Bablani and Patrick Andersen contributed coding and expertise to assist the proportional multistate lifetable modelling
- Dr Natalie Carvalho contributed health economic advice.

Structure

1. Live look at tool
2. Some power point slides of figures taken from tool
3. Our interpretation of what matters
4. What next?

Reminder – what our Vaccine Rollout looks like

Phase 1a – up to 1.4m doses

Ongoing

Quarantine and border workers	70,000
Frontline health care worker sub-groups for prioritisation	100,000
Aged care and disability care staff	318,000
Aged care and disability care residents	190,000
Total	**678,000**

Phase 1b – up to 14.8m doses

Elderly adults aged 80 years and over	1,045,000
Elderly adults aged 70-79 years	1,858,000
Other health care workers	953,000
Aboriginal and Torres Strait Islander people > 55	87,000
Younger adults with an underlying medical condition, including those with a disability	2,000,000
Critical and high risk workers including defence, police, fire, emergency services and meat processing	196,000
Total	**6,139,000**

Phase 2a – up to 15.8m doses

Adults aged 60-69 years	2,650,000
Adults aged 50-59 years	3,080,000
Aboriginal and Torres Strait Islander people 18- 54	387,000
Other critical and high risk workers	453,000
Total	**6,570,000**

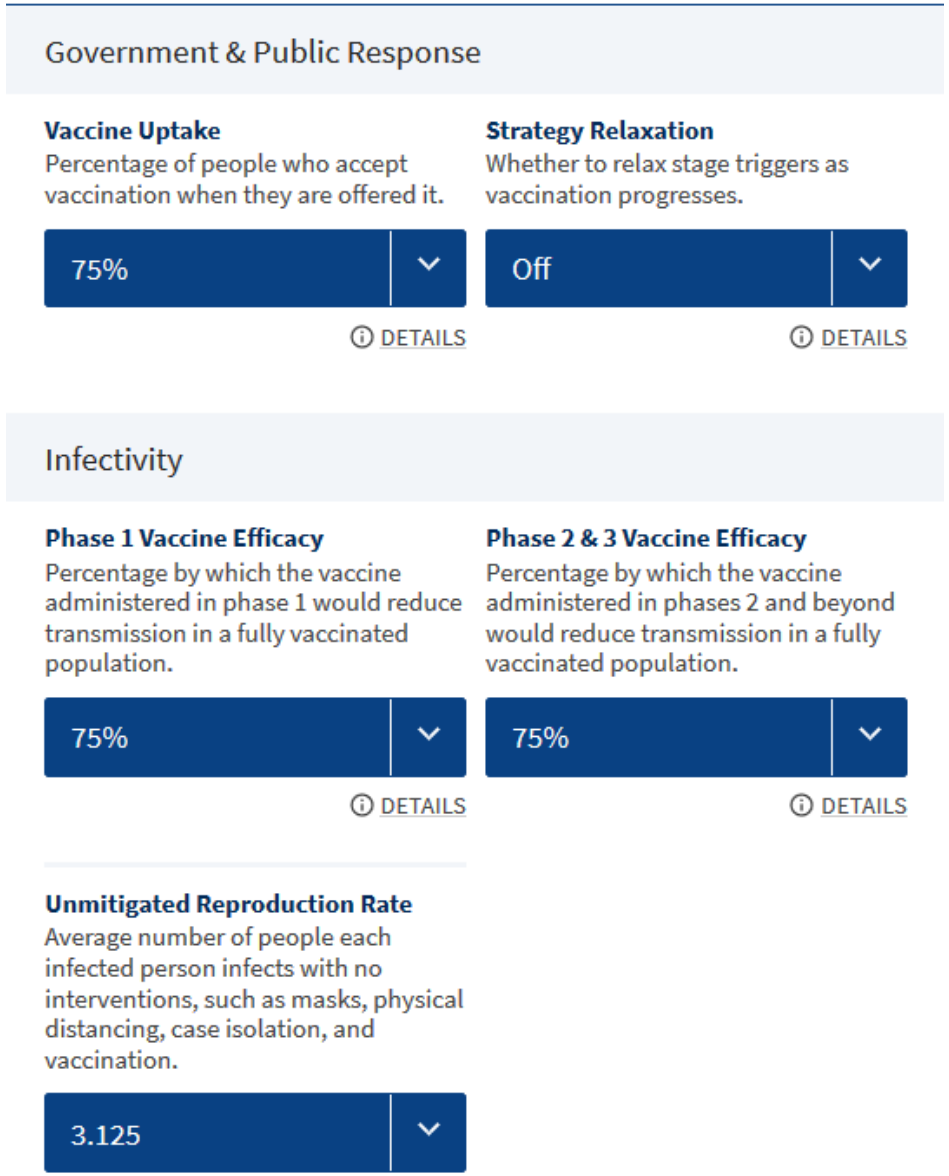
Phase 2b – up to 16m doses

Balance of adult population	**6,643,000**
Catch up any unvaccinated Australians from previous phases	

Phase 3 – up to 13.6m doses

< 18 if recommended	**5,670,000**

COVID-19 Trade Offs (default settings)



Uptake	75%
Relax	off
VE (trans)	75%
R0 =	3.125

For every scenario you select, we give you outputs for four policy response scenarios

- Aggressive elimination:
  - approximating the intensity of response taken in NZ and Victoria in 2020
- Moderate elimination:
  - approximating the responses by NSW to outbreaks (later to lockdown, earlier out, rely more on contact tracing; but still trying to eliminate)
- Tight suppression:
  - approximating the South Korea approach to keeping numbers low, but not going for elimination
- Loose suppression:
  - approximating Europe before Christmas 2020 'living with the virus'

We simulate four policy strategies, with and without relaxation

*Trigger in average daily **cases per million** in the last 7 days **(or total cases in last 7 days for Victorian population)** with trigger thresholds → stage 3*

Strategy	Relaxation 'off'	Relaxation 'on'			
	All phases				
Aggressive elimination	0.23 (>10)				
Moderate elimination	0.9 (>42)				
Tight suppression	10 (>460)				
Loose suppression	50 (>2310)				

We simulate four policy strategies, with and without relaxation

*Trigger in average daily **cases per million** in the last 7 days **(or total cases in last 7 days for Victorian population)** with trigger thresholds → stage 3*

Strategy	Relaxation 'off'	Relaxation 'on'			
	All phases	Phase 1a and 1b (priority, 70+, ATSI 65+)	Phase 2a (50+, ATSI 18+)	Phase 2b (rest adults)	Phase 3 (children)
Aggressive elimination	0.23 (>10)	0.23 (>10)	0.45 (>20)	0.91 (>40)	1.82 (>80)
Moderate elimination	0.9 (>42)	0.9 (>42)	1.82 (>84)	3.64 (>168)	7.27 (>336)
Tight suppression	10 (>460)	10 (>460)	20 (>924)	40 (>1,848)	80 (>3,696)
Loose suppression	50 (>2310)	50 (>2310)	100 (>4,620)	200 (>9,240)	400 (>18,480)

Live demonstration of tool

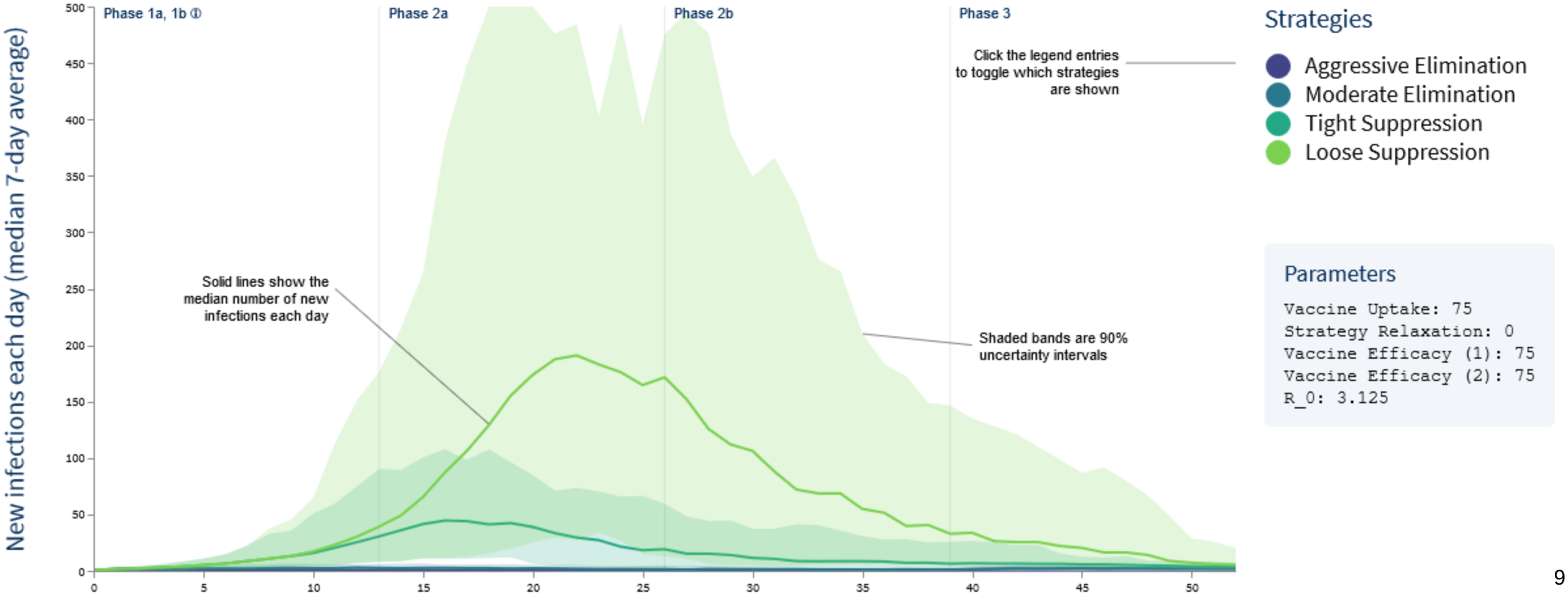
COVID-19 Pandemic Trade-off tool

Default when you open tool

Uptake	75%
Relax	off
VE (trans)	75%
R0 =	3.125

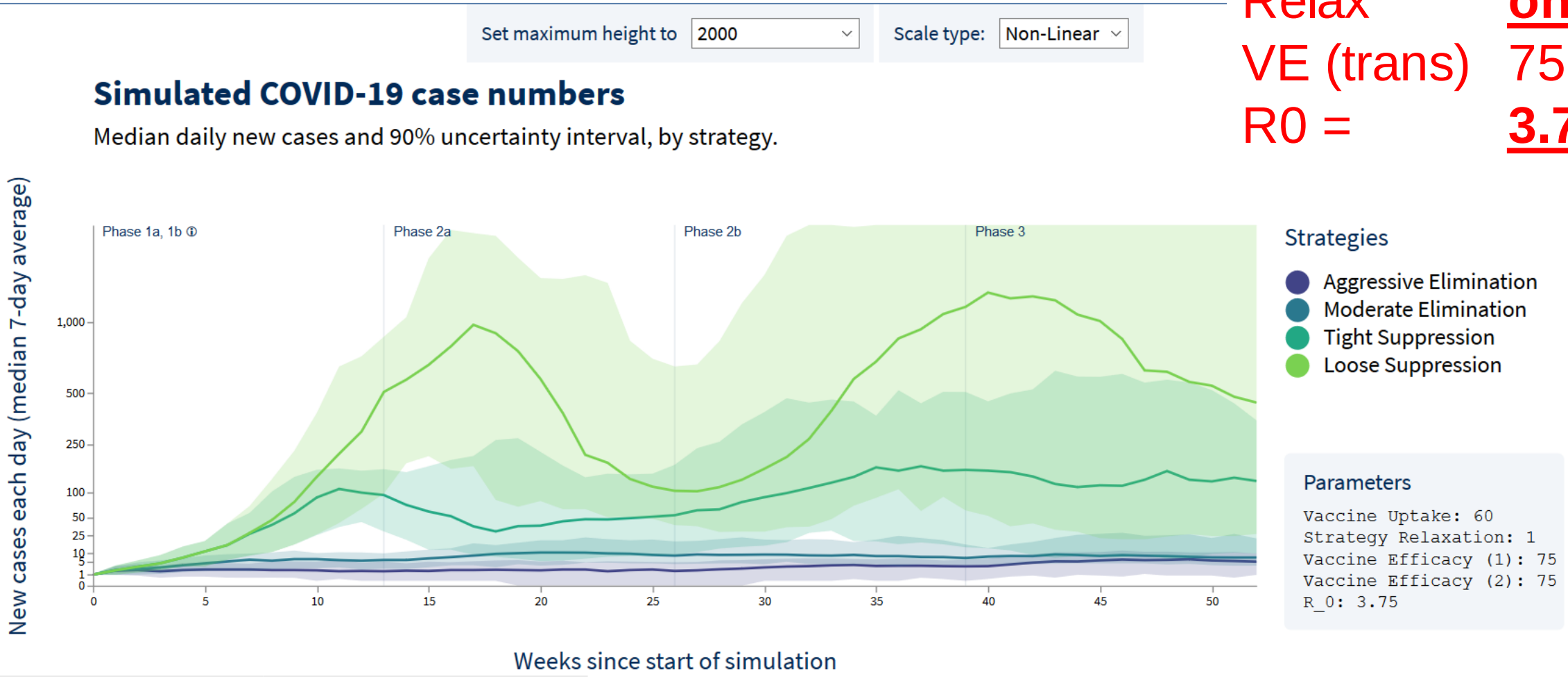
Simulated COVID-19 infection numbers

Median daily new infections and 90% uncertainty interval, by strategy.



Pretty pessimistic scenario

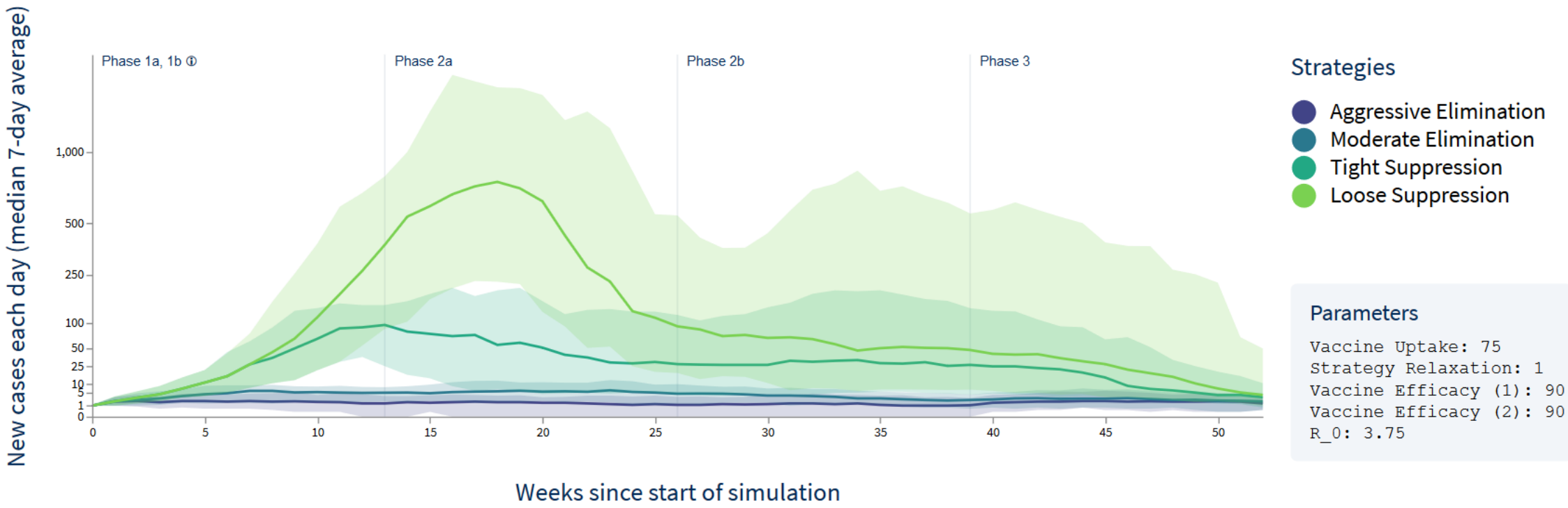
Uptake **60%**
Relax **on**
VE (trans) 75%
R0 = **3.75**



Perhaps my best guess scenario

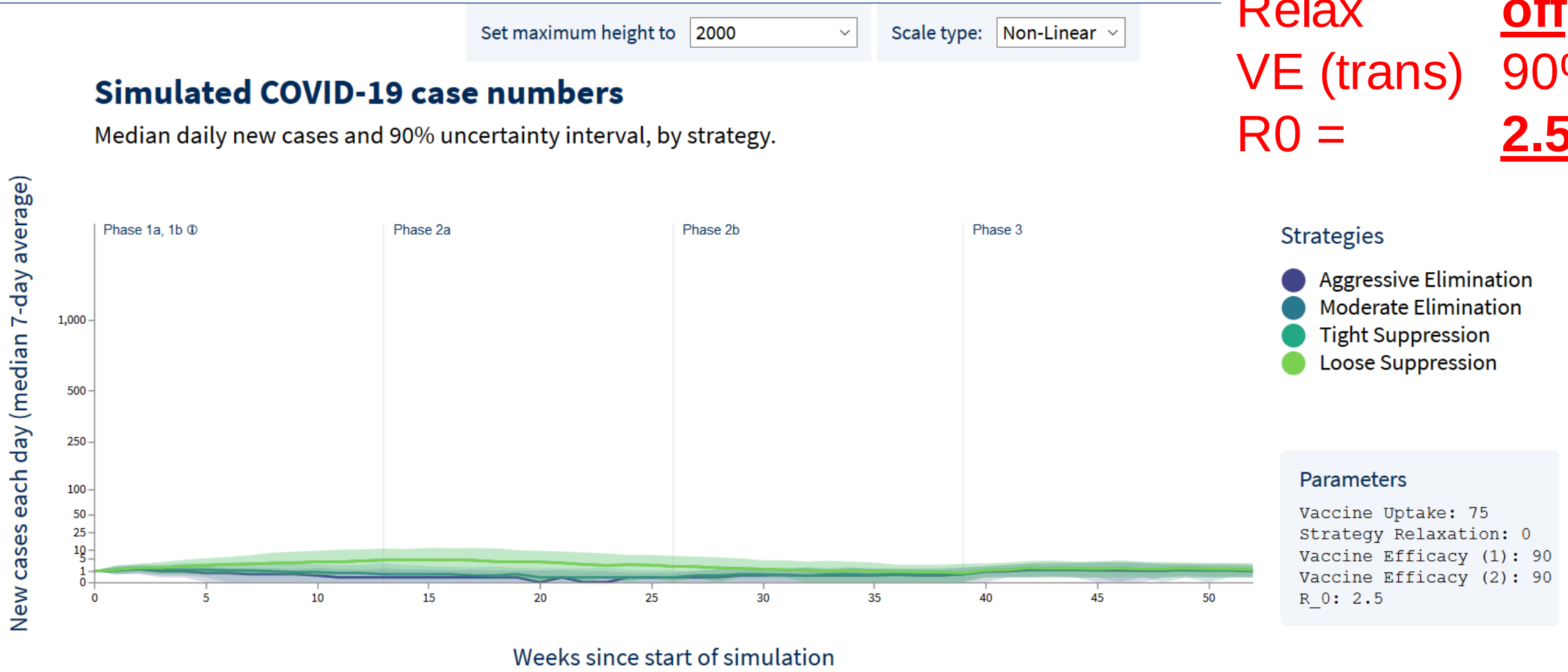
Uptake **75%**
Relax on
VE (trans) **90%**
R0 = 3.75

Set maximum height to 2000 | Scale type: Non-Linear

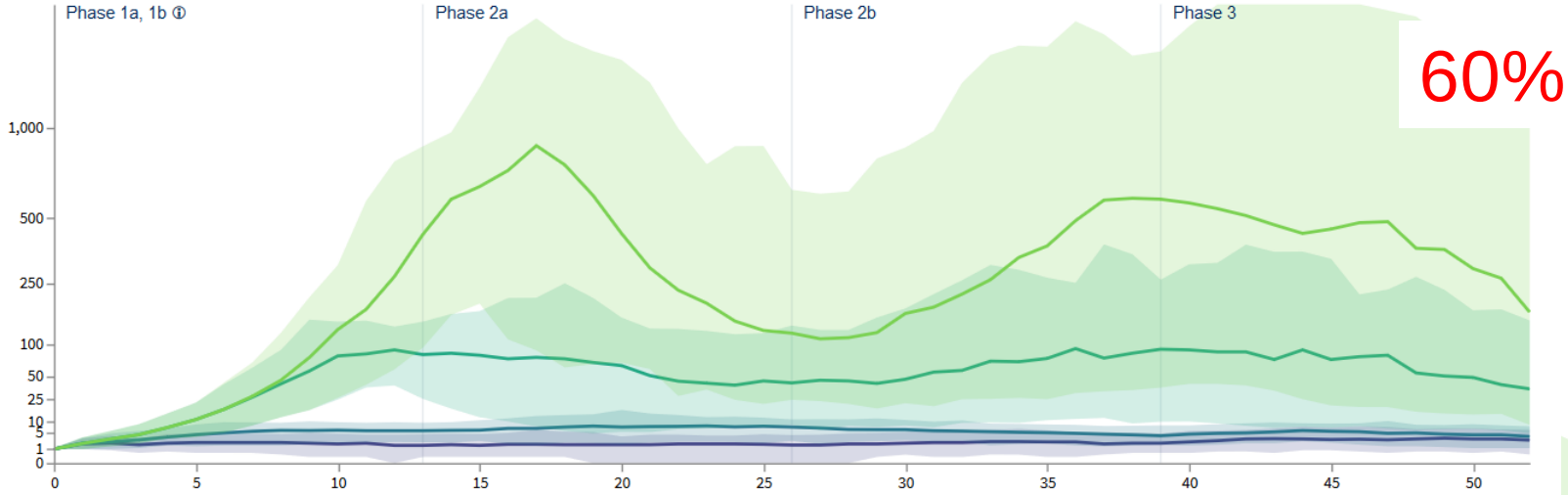


Optimistic scenario (probably unrealistic)

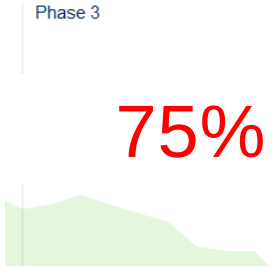
Uptake 75%
Relax **off**
VE (trans) 90%
R0 = **2.5**



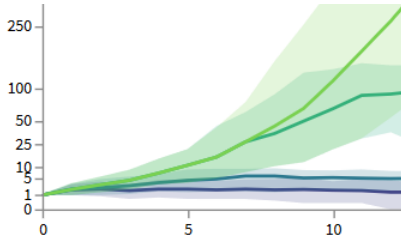
What about sole effect of vaccine uptake on my best guess scenario? (Relax: on; VE (trans) 90%; Ro = 3.75)

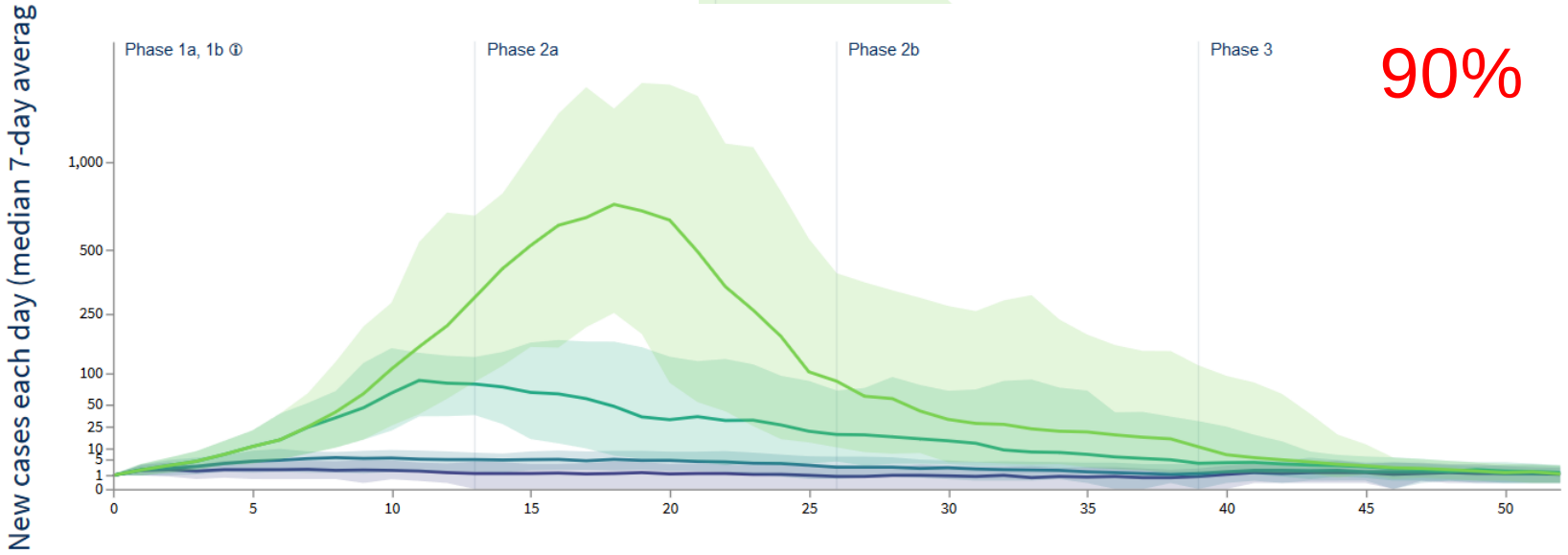


60%



75%





90%

Summarizing 216 scenarios: average weekly number of infections in Phase 2b

				Aggressive elimination			Moderate elimination			Tight suppression			Loose suppression		
	Transmission reduction from vaccine			90%	75%	50%	90%	75%	50%	90%	75%	50%	90%	75%	50%
R0=2.5	No strategy relaxation		90%	3	4	5	3	4	6	5	11	44	5	13	88
		Vaccine coverage	75%	3	4	5	4	5	8	9	20	60	10	26	150
			60%	4	4	5	4	6	8	17	36	85	25	56	158
	Strategy relaxation		90%	3	4	6	3	5	9	5	12	62	5	13	117
		Vaccine coverage	75%	3	5	6	4	6	11	9	25	103	10	26	229
			60%	4	5	7	6	8	11	20	47	150	42	62	270
R0=3.175	No strategy relaxation		90%	3	5	7	5	8	17	32	71	153	182	479	970
		Vaccine coverage	75%	4	5	8	6	10	19	62	98	168	399	732	988
			60%	5	6	8	9	13	22	85	132	171	628	763	1141
	Strategy relaxation		90%	4	6	12	6	11	24	59	212	531	382	1676	3260
		Vaccine coverage	75%	5	8	13	9	15	27	138	289	578	998	2773	3355
			60%	6	10	16	13	21	38	281	475	735	2443	3127	3542
R03.75	No strategy relaxation		90%	5	7	12	10	19	30	43	116	309	166	497	1453
		Vaccine coverage	75%	6	8	12	15	23	35	83	199	364	342	799	1568
			60%	8	10	13	23	30	37	164	276	365	727	1180	1859
	Strategy relaxation		90%	6	11	24	14	32	90	139	474	1169	442	2273	5332
		Vaccine coverage	75%	10	15	27	23	45	110	335	822	1327	1129	3384	6805
			60%	15	20	29	37	64	134	633	1082	1389	3110	4726	7109

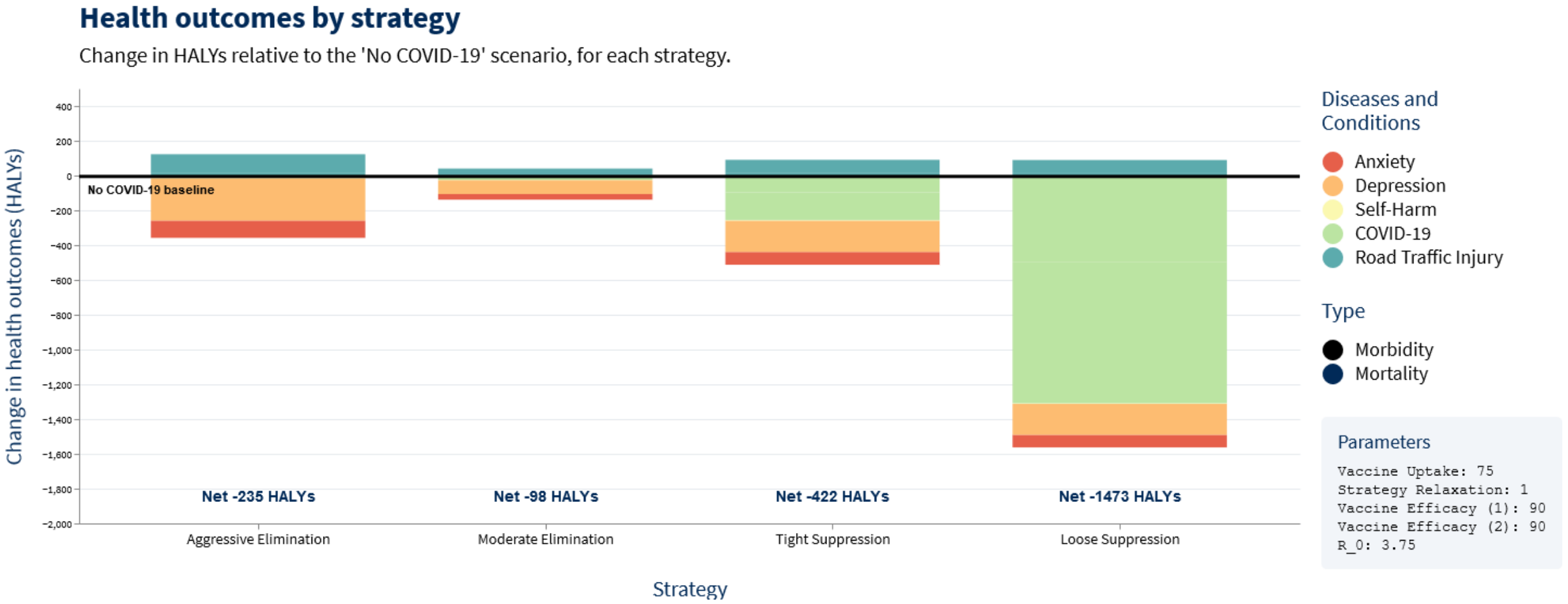
Summarizing 216 scenarios: proportion of time in stage 3 or 4 lockdown in Phase 2b

			Aggressive elimination			Moderate elimination			Tight suppression			Loose suppression		
	Transmission reduction from vaccine		90%	75%	50%	90%	75%	50%	90%	75%	50%	90%	75%	50%
R0=2.5	No strategy relaxation	90%	0.09	0.11	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Vaccine cc	75%	0.08	0.15	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		60%	0.14	0.21	0.33	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
	Strategy relaxation	90%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Vaccine cc	75%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		60%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R0=3.175	No strategy relaxation	90%	0.10	0.27	0.37	0.03	0.09	0.21	0.00	0.00	0.04	0.00	0.01	0.11
	Vaccine cc	75%	0.20	0.32	0.43	0.02	0.17	0.39	0.00	0.02	0.14	0.00	0.01	0.17
		60%	0.21	0.37	0.47	0.11	0.28	0.48	0.01	0.03	0.11	0.04	0.13	0.20
	Strategy relaxation	90%	0.00	0.00	0.02	0.00	0.03	0.23	0.00	0.00	0.00	0.00	0.02	0.11
	Vaccine cc	75%	0.00	0.01	0.00	0.04	0.12	0.32	0.00	0.00	0.00	0.01	0.07	0.15
		60%	0.00	0.02	0.04	0.10	0.24	0.28	0.00	0.00	0.00	0.04	0.06	0.14
R03.75	No strategy relaxation	90%	0.26	0.43	0.68	0.05	0.05	0.28	0.02	0.08	0.33	0.00	0.01	0.30
	Vaccine cc	75%	0.35	0.52	0.67	0.07	0.12	0.28	0.05	0.15	0.42	0.01	0.13	0.36
		60%	0.59	0.62	0.71	0.10	0.25	0.37	0.16	0.26	0.52	0.10	0.34	0.53
	Strategy relaxation	90%	0.04	0.06	0.23	0.01	0.04	0.30	0.00	0.00	0.13	0.00	0.04	0.30
	Vaccine cc	75%	0.09	0.12	0.32	0.06	0.12	0.21	0.00	0.06	0.23	0.02	0.12	0.40
		60%	0.14	0.28	0.35	0.12	0.13	0.36	0.02	0.06	0.41	0.09	0.24	0.50

Net health impacts

- Social restrictions (including lockdowns) are essential to control COVID-19
- But there are likely unintended health consequences
- Moreover, the 'right' balance of strategy and lockdowns (given unintended health consequences) will likely vary as vaccine coverage increases
- We undertook an international literature review to determine which diseases (and risk factors) are associated with lockdowns:
  - Increase: **depression, anxiety, self-harm** (but not suicide), intimate partner violence
  - Decrease: **road traffic injury,** physical activity
- **Blue** ones include in web-tool now, others (and uncertainty analyses) coming soon

Net-health impacts for my scenario at COVID-19 Pandemics Trade-off web-tool



Uptake = 75%; Relax = on; VE (trans) = 90%; R0 = 3.75

We encourage you to make your own interpretations … but here are ours (so far)

- The likelihood of future uncontrolled outbreaks is – unsurprisingly – considerably greater if we adopt a loose suppression approach.
- The risk varies **markedly** with the R0 of the circulating variant. Therefore, the greater infectivity of new variants is of grave concern until vaccine coverage is high for a vaccine that reduces transmission.
    - *Gives one pause to think given Brisbane situation right now with UK variant that probably has R0 somewhere around our 3.75 scenario*
- An ongoing aggressive elimination strategy (as per NZ and Vic in 2020) will not be optimal as vaccine coverage increases
- **But** we need to minimize viral incursions from overseas until vaccine coverage is high:
    - *Again, thinking of Brisbane now*
    - *we will explore border options more explicitly in the next month (and update the web-tool).*
- If children are not vaccinated, an Australian population strongly resilient to incursions of the virus is unlikely. As shown by others (e.g. Zachreson, Change, Cliff and Prokopenko (2021)) herd immunity will be hard – if not impossible – to achieve without vaccinating children.

What next?

We will be evolving this web-tool to:

- Include specific options for border opening (it is currently part of 'model uncertainty')
- Build in uncertainty about the health impacts
- Add in net health expenditure and GDP costs for each scenario
- Include a cost-effectiveness tool to work out what is an 'optimal' scenario to pursue
- Updating inputs to the model as out evidence-base globally and in Australasia improves

COVID-19 Pandemic Trade-offs: Launch of web-tool

Web-tool: https://populationinterventions.science.unimelb.edu.au/pandemic-trade-offs/

- this power point there too
- here you will find user guide too

Summary up at The Pursuit about now: https://pursuit.unimelb.edu.au/

And you can go to the Population Interventions Unit website:

- https://mspgh.unimelb.edu.au/research-groups/centre-for-epidemiology-and-biostatistics-research/population-interventions