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Post-vaccine New Zealand:
Northern Region DHB planning scenarios for covid-19 in 2022

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Summary

Te Pūnaha Matatini has recently released a modelling paper[1] which includes likely covid-19 rates once the vaccination programme has finished and borders re-opened. Based on a large number of assumptions drawn from the world literature and their own modelling the researchers derived likely case numbers over many scenarios. This paper draws on the scenarios considered most likely to occur, matched with projected vaccination rates by age and ethnicity in the Northern Region DHBs to suggest plausible scenarios for DHB planning purposes for 2022. Broadly:

1 NZ is considered 'fully vaccinated' by Dec 2021
2 Borders are opened 1 Jan 2022 to most countries, but restrictions remain on some, including vaccine passports, and isolation and testing of higher risk travellers.
3 Lockdowns and border closures no longer used, but case tracking and isolation used as per other notifiable diseases
4 Delta variant or similar is main circulating virus
5 Vaccination rates in adults might achieve 80%-90% coverage for those aged 16+
6 12- 15 year olds are vaccinated, but 0-11 year olds are not
7 risks equivalent to seasonal influenza will be accepted by the health system and general public

[1] Steyn N, Plank MI, Binny RN, Hendy SC et al. A COVID-19 Vaccination Model for Aotearoa New Zealand. Pre-print, 30 June 2021. [and Supplement Paper]

8 Vaccine efficacy remains high, or is maintained high with booster vaccinations.

Table 1. Example figures from model, for vaccination rates of 80-90% in those aged 12+, strong border and public health measures remain in place

	Over 2022 year			Average per week in 2022			Over 2022 year		
DHB	Cases	Hospitali-sations	Deaths	Cases	Hospitali-sations	Deaths	Maaori deaths	Pacific deaths	% deaths M or P
Northland	3,100	120	20	60	2	0.5	10	-	42%
Waitemata	10,100	300	50	190	5	1	5	5	25%
Auckland	7,800	250	40	150	4	0.7	5	10	34%
Counties M	9,800	300	50	190	6	1	10	20	53%
Total NR	30,800	950	160	590	18	3	30	35	38%

By way of comparison seasonal influenza has about 500 deaths a year in New Zealand, or ~200 in the Northern Region. If the public, and thence politicians are able to accept the risks around seasonal influenza then this might be a system setting able to be considered. This appears to be around the level that has been accepted in the UK.

Based on the parameters used, and being optimistic in the level of control able to be achieved, hospitals in the Northern Region might each expect between **1 covid admission a day to 1 a week,** once 'steady-state' is achieved. This is well de-coupled from expected case numbers (10-30 per day per DHB) due to the effectiveness of the vaccine at preventing serious disease. If one used as a base scenario 5 hospitalisations per week per large metro hospital, with an ALOS of 4-6 days, allowing for overlaps, would suggest around 7 'covid beds' will be required over and above the usual bed needs. Week on week fluctuations will occur, with likely surge runs, and rates are likely to be higher over the winter months, concomitant with other respiratory infections.

There will be a particular risk in 2022 of a worse than normal influenza year, given two years now of low to no exposure. One might plan for a 30 bed ward dedicated to acute respiratory infections for winter 2022, with allowance of another 30 bed ward for overflow/surge.

An anticipated 150-200 deaths due to covid-19 per year might be expected in the Northern Region, similar to seasonal influenza impacts in past years. Based on patterns of hospitalisation seen in the past outbreaks, coupled with potentially lower vaccination rates, this is expected to impact on Maaori and Pacific populations more severely.

Introduction

There is an expectation that once the vaccination programme is completed life will return to 'normal' and oversea travel will be reinstated - for example, the much heralded 'freedom day' in England. The modellers at Te Pūnaha Matatini have considered a variety of parameters associated with 'unmitigated travel'[2] following a 90% vaccination achievement for the 16+ population[3]. For most scenarios considered New Zealand will not be at 'herd immunity'(ie an effective R for the disease being under one) and the delta variant covid-19 virus will easily be able to establish and spread. The case numbers shown in their modelling would suggest an ongoing need for some border controls, so in this report the lower estimates from their papers are used – that is stepping back from the 'unmitigated' assumption of around five travellers arriving per day infectious to one or less. This matches the work done by Blakely et al for the state of Victoria[4]. The exact settings will be determined by the government of the day, but the current indications are of a very conservative approach.

Method

As noted above, the results of the Te Pūnaha Matatini modelling have been used to construct these post-vaccine scenarios for the Northern Region DHBs. Key assumptions from the modelling are listed in Appendix 1. The modelling gave a wide range of plausible results – here it is assumed that the higher case number scenarios would not be accepted by the government of the day or the public. We thus assume controls remain in place such that the risks approximate the equivalent of seasonal influenza – these were accepted by the health system and general public in the past, and perhaps provide a median space between economic and health considerations going forward.

Appendix 1 also notes where the base assumptions have been varied for this report. The main points are: [references to parts of the original report in square brackets]

1. Tighter border and outbreak controls are assumed for the 'tight' scenario. This is effected empirically by using the 'R0=3' scenario in the original paper [Table 5 and S5]
2. The 90% vaccine coverage in ages 16+ is assumed equivalent to 80% coverage in ages 12+ (allowing the sizing of the effect of reducing vaccine levels), with similar-sized steps for the lower coverage scenarios considered, tested against vaccine effectiveness modelling figures [Table 6]
3. Some heterogeneity is assumed in coverage across the Northern Region. Based on responses seen in the UK and other Western countries higher coverage in older/more vulnerable people is expected. Based on past vaccination campaigns slighter lower rates in Maaori and Pacific people are likely. Appendix 2 shows the modelled vaccination coverage figures used. No added transmission effect for the heterogeneity due to uneven vaccine coverage across the different communities is included – 'pockets of susceptibility' might be expected to lead to easier infection spread
4. The addition of ages 12-15 in the vaccinated cohort is modelled using Table S5 in the supplement to the original paper
5. An 'unmitigated' scenario is included [based on the 'R0=6' section in Table S5]
6. Population denominators used are based on the 2020 Health Service User population – see Appendix 2. This allows more detailed ethnicities to be used.

[2] Page 20: "These are counterfactual scenarios in which no interventions are made to control the epidemic. beyond vaccination. This does not mean that the number of hospitalisations and fatalities reported in Table 5 and 6 would be expected to occur, but it demonstrates that, under these scenarios, a significant public health response would still be needed to prevent a major epidemic and the outlined health impacts."

[3] Steyn N, Plank MI, Binny RN, Hendy SC et al. A COVID-19 Vaccination Model for Aotearoa New Zealand. Pre-print, 30 June 2021. [and Supplement Paper]

[4] blogs.otago.ac.nz/pubhealthexpert/whats-the-right-covid-19-risk-to-live-with-an-australian-perspective/

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Results

The main results are shown in the tables below.

Table 2. Scenario A. Best case: 90% of adults vaccinated, strong border and public health controls

			Over 2022 year			Average per week in 2022			Over 2022 year				
DHB	Travel/ outbreak control	Adult vaccination rate	Cases	Hospitali-sations	Deaths	Cases	Hospital isations	Deaths	Maaori deaths	Pacific deaths	% deaths M or P	Deaths in those vacc	% of deaths in vacc
Northland	Tight	90%	620	20	3	10	0	0.1	2	0	52%	1	22%
Waitemata	Tight	90%	2,000	40	6	40	1	0.1	1	1	32%	2	24%
Auckland	Tight	90%	1,540	35	5	30	1	0.1	1	1	42%	1	23%
Counties M	Tight	90%	1,990	50	7	40	1	0.1	2	3	63%	2	20%
Total NR			6,150	150	20	120	3	0.4	5	6	47%	5	22%

Table 3. Scenario B. If vaccination rates not so high - 80%, but still strong public health controls

			Over 2022 year			Average per week in 2022			Over 2022 year				
DHB	Travel/ outbreak control	Adult vaccination rate	Cases	Hospitali-sations	Deaths	Cases	Hospitali-sations	Deaths	Maaori deaths	Pacific deaths	% deaths M or P	Deaths in those vacc	% of deaths in vacc
Northland	Tight	80%	3,100	120	20	60	2	0.5	10	-	41%	3	11%
Waitemata	Tight	80%	10,100	280	50	190	5	1	5	5	24%	5	11%
Auckland	Tight	80%	7,800	230	40	150	4	0.7	5	10	34%	5	11%
Counties M	Tight	80%	9,800	310	50	190	6	1	10	20	53%	5	11%
Total NR			30,800	950	160	590	18	3.1	30	35	38%	20	11%

Comparing A and B, around 5 times more cases in scenario B, and proportionately more hospitalisations and deaths than the 90% scenario. By way of comparison seasonal influenza has about 500 deaths a year in New Zealand, or ~200 in the Northern Region, so somewhere between 80-90% 12+ vaccination rates can give scenarios comparable to seasonal influenza.

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Table 4. Scenario C. High vaccination rate, more relaxed border and public health controls

			Over 2022 year			Average per week in 2022			Over 2022 year				
DHB	Travel/ outbreak control	Adult vaccination rate	Cases	Hospitali-sations	Deaths	Cases	Hospitali-sations	Deaths	Maaori deaths	Pacific deaths	% deaths M or P	Deaths in those vacc	% of deaths in vacc
Northland	Looser	90%	16,500	500	80	300	10	2	40	5	52%	20	22%
Waitemata	Looser	90%	53,200	1,100	170	1,000	22	3	25	30	32%	40	24%
Auckland	Looser	90%	40,900	900	140	800	18	3	20	40	42%	30	23%
Counties M	Looser	90%	53,000	1,400	200	1,000	26	4	40	80	61%	40	20%
Total NR			163,600	3,900	600	3,100	76	11	145	175	47%	130	22%

Table 5. Scenario D. High vaccination rate, little border or public health controls

			Over 2022 year			Average per week in 2022			Over 2022 year				
DHB	Travel/ outbreak control	Adult vaccination rate	Cases	Hospitali-sations	Deaths	Cases	Hospitali-sations	Deaths	Maaori deaths	Pacific deaths	% deaths M or P	Deaths in those vacc	% of deaths in vacc
Northland	Unmitigated	90%	28,400	900	150	500	17	3	70	5	52%	30	22%
Waitemata	Unmitigated	90%	91,400	1,900	300	1,800	37	6	45	50	32%	70	24%
Auckland	Unmitigated	90%	70,300	1,600	240	1,400	31	5	35	65	42%	50	23%
Counties M	Unmitigated	90%	91,100	2,300	340	1,800	45	7	65	140	61%	70	20%
Total NR			281,200	6,700	1,000	5,400	130	20	215	260	47%	220	22%

The looser controls postulated for Scenarios C and D speak directly to the effective R of the virus. Even at 90% vaccination coverage in adults, the large number of unvaccinated 0-11 year olds provides a large pool for the virus to circulate. Decisions for 2022 will need to balance the controls versus the freedom of movement and activity desired. Unmitigated opening of borders and thence free circulation of the virus is not expected, given the hospital impact and death toll that would result. For example, for hospital impact, under Scenario C the Northern Region would average 65 hospital beds and 30 ICU beds occupied by covid-19 patients. For Scenario D it would be 110 hospital beds and 50 ICU beds.

While the chance of severe disease and death is very much reduced for those vaccinated, it is not zero, so large numbers of cases will still see some deaths in those who are vaccinated.

Current planning is to exceed an 80% vaccination coverage in ages 12+. so the best case point for planning for 2022 would be Scenario A. This has covid-19 in the community - around 120 new cases per week in the Region, with around 900-1000 hospitalisations and 25-30 deaths over the year. This is well less than the seasonal influenza load and would likely be considered manageable.

If vaccine rates are lower, or the controls are slightly looser, the impact of covid-19 spreading in the community is naturally higher. A setting with 10 percentage points lower coverage for the 12+ age group is estimated to have about 600 cases per week, ~20 hospitalisations and 3-4 deaths per week. This is more comparable to the seasonal influenza 'benchmark'. Lower vaccination rates/looser controls are proportionately worse.

Overshadowing the exact vaccination levels, the world situation and border controls have the largest impact on the modelling. Compare the tight versus loose scenarios in the tables above, with a 5 to 10-fold increase in numbers.

Discussion

If the CM population were at 80% of the 16+ population vaccinated the overall population coverage would only be 60%, due to the large number of children in CM. At 90%, even with 12-15 year olds included, one gets to 72%. Other DHBs are slightly higher, but still well insufficient to create 'herd immunity' even against the standard covid-19 variety, and certainly not for the later variants. It appears unlikely that the Government (or public) would countenance the looser travel scenario, despite pressures to do so from the business community. This suggests that, to the extent that it is possibly to control the virus, the tighter scenario is in play, with border controls such as MIQ/home isolation remaining for countries with larger numbers of cases.

The 'tight' scenarios assume that there averages less than one case per day entering the community. An 80% average coverage of 12+ year olds does appear attainable for CM Health, suggesting Scenario A or B is possible. There appears to be sufficient vaccine and vaccination capacity to achieve this by December, though the last 10% is likely to take the same time as the first 80%. Other modellers suggest that only if all children are vaccinated will control be possible, targeting 80% of the total population or higher.[5]

The hospitalisation rates shown are well less than what might have been expected from earlier outbreaks given the expected case numbers, due to the effectiveness of the vaccine at preventing serious disease. It would also be anticipated that many of the community cases would be asymptomatic or have milder impacts. At Scenario 1 with 5 hospitalisations a week, taking an average length of stay of 6 days, allowing for overlaps, would suggest around 7 'covid beds' will be required. Rates are likely to be higher over the winter months, concomitant with other respiratory infections – see discussion on fluctuations below.

In England 92% of ages 50+ are fully vaccinated (as at 20 July 2021), giving an indication of what is possible in the general population given sufficient motivation and access to vaccines. A lower rate of coverage has been assumed here – any upside would reduce risk.

Looking at the difference between scenarios A or B and C or D it is clear that the border management and community control policies will be fundamental to the expected caseloads in the

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[5] https://grattan.edu.au/wp-content/uploads/2021/07/Race-to-80-our-best-shot-at-living-with-COVID-Grattan-Report.pdf

community. If the intent is to minimise hospitalisations and deaths then removal of all travel restrictions would not be possible until:

1. World caseloads decrease, decreasing the border impact

2. All children are able to be vaccinated - ie 0-11 year olds as well

3. Adult vaccination rates get to 95% or more.

Comparing the alternate scenarios, vaccinating 12-15 year olds has a surprisingly strong effect on case numbers. Teenagers are high socialisers, and key spreaders of viruses. The higher hospitalisations and deaths are in older groups being exposed to more infections. It is also worth noting that when the R0 is approaching 1 small changes in parameters can have seemingly large changes in case numbers – being just below 1 limits outbreak spread cf just above 1 where it will propagate.

With each drop in vaccination rates tested there is an increase in the numbers of cases, hospitalisations and deaths as expected. The effect is moderated somewhat in that:

1. The vaccine reduces but does not stop onwards transmission – higher coverage slows but does not stop spread

2. Breakthrough cases occur, and while hospitalisation and death rates are markedly reduced with the vaccine, they are not eliminated

3. Children 0-11 are not covered, creating a reservoir for cases to spread in all scenarios

4. The Delta variant is very infectious - R0 ~6, so more than 90% coverage of the whole population will be needed for control

5. The predicted uptake is patterned such that the elderly/most vulnerable are expected to have the higher coverage, blunting the effect of the reductions in overall coverage (see Appendix 2).

Population health and border measures

It is beyond the scope of this paper to look into the detail of what settings might be appropriate to achieve the 'tight' scenario desired. By the end of the year it would be hoped that further lessons from other countries in somewhat similar circumstances – Taiwan, Singapore, Australia - might be gained. Some examples of what may be contemplated:

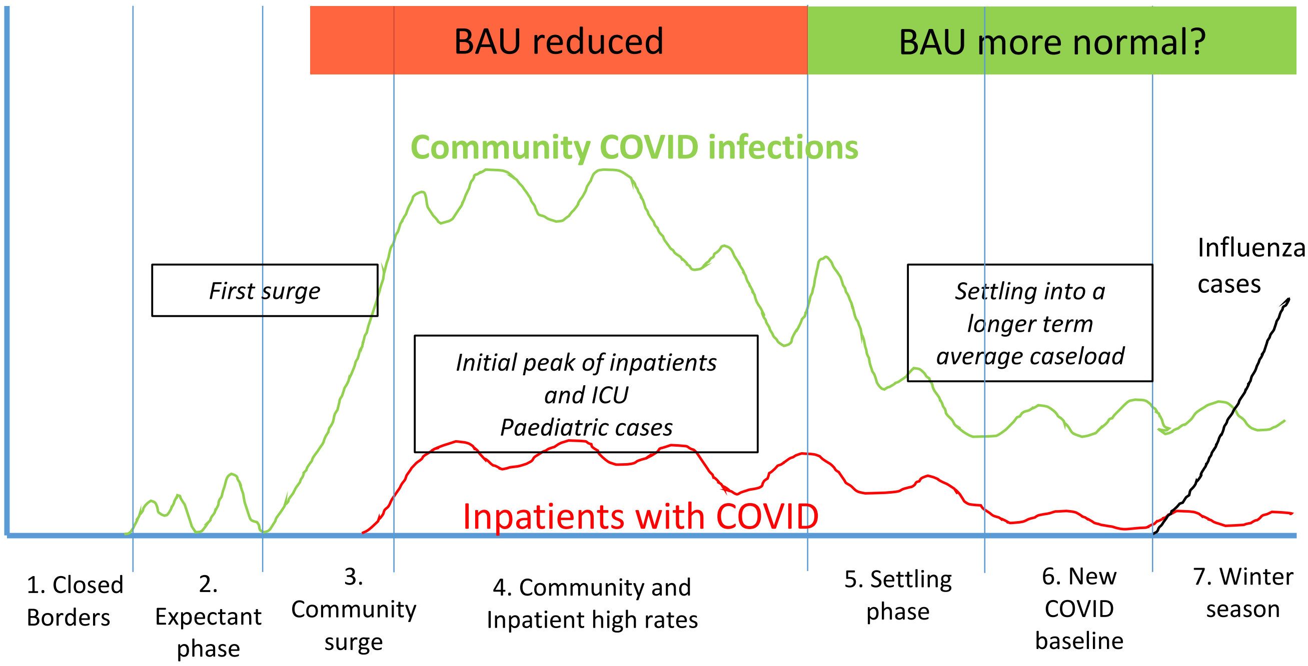
Measure	Example
Border	
Risk-ranked countries	Red/amber/green zone countries determine the travelling restrictions/isolation times
Lateral flow test	Test on entry to country
Vaccination passports	Isolation times vary based on status
Day 3 PCR testing	Able to move freely once day 3 test is clear
Home isolation used	Potentially a residual MIQ for positive cases newly arrived, or with no suitable abode
Community	
Masking on public transport	
Masks in indoor spaces	
Continued scanning app use	'pings' when have been at places of interest, required to do 'day 5' swab

App includes information on vaccination status	Risk-moderated alerts
Mandated stay at home if symptomatic	
Institution outbreaks managed	PHUs 'Manage It' includes controlling school and workplace outbreaks – eg like norovirus
Known covid cases required to isolate for 10 days	PHUs might be needed to monitor this – apps?
Household and close contacts of cases required to isolate	Possibly automatic notifications and monitoring of isolation via app?
Contactless payment systems	
Entry tests to major events, sensitive areas	Lateral flow tests for arenas, sports events, health facilities, ARRC
Workplace testing	Lateral flow tests for health workers, ARRC – where staff infection puts the vulnerable in danger
Booster campaigns	As part of the 'flu campaigns each year?
Improved ventilation in public spaces	Including schools, shops, restaurants, health centres – airflow, air exchange, filtering

Surges and fluctuations

The data in the results presents an average across the year. It will take some time to settle into a stable configuration – indeed the next couple of years may be a series of surges and drops. One picture of what might occur is given in Figure 1.

Figure 1. Hypothetical course of post-vaccine covid-19 in New Zealand



After Chris Luey

This describes a series of small introductions before it takes hold in a larger unvaccinated cohort – eg a series of schools. This might happen several times (not shown) before a somewhat steady-state status quo returns. Like other respiratory viruses covid-19 is likely to spread more easily in winter, as people head indoors. This will be compounded in 2022 by resurgences of other viruses able to return once the borders open up. RSV provides a good example here, with over 80 cases a day attending Middlemore Hospital in July 2021 following the free-travel border arrangement with Australia. Of particular concern will be influenza, with New Zealand having had effectively no cases since March 2020.

It is difficult to size these fluctuations and surges. For the weekly/monthly changes this is potentially like other conditions coming in to health services and might fluctuate 2-3-fold around a median. So for example if we are settling on around 5 hospitalisations a week per hospital, it might fluctuate from 0 to 15 a week regularly. For the surges, we might turn to the 'looser' scenario and suggest peaks of maybe 3000-5000 cases a week across the region for a few weeks (eg Sydney in August 2021), maybe 40-50 admissions for each metro DHB, 20-30 Northland, per week for a month or two? Maybe peaking at twice that? If this generated 5-10 ICU admissions a week each (~2 for Northland) this would fill ICU capacity across the region for several weeks. In a worst case this surge would coincide with the winter surge of other viruses.

Other considerations

As noted in the prior section, other viral illnesses kept at bay with border quarantine are also expected to increase (for example the recent RSV surge) and will need to be managed as if they are covid until viral panel diagnoses are confirmed – eg RSV, parainfluenza, influenza. Further spikes in viral illnesses mimicking potential covid-19 infection seem likely especially if the influenza vaccination drive is less successful with covid-19 vaccinations taking precedence.

There will be a particular risk in 2022 of a worse-than-normal influenza year, given two years now of low to no exposure. As well as a respiratory infections' ward for winter 2022, at least one spill over ward is likely to be required. Particular attention and planning will be need around the 'red' pathway into health facilities – general practice, ED, with appropriate airborne disease protections as standard. Hospitals will need to reassess their single room numbers, and negative pressure capacity. Meanwhile patient flow for 'business as usual' medical and surgical emergencies must be hindered as little as possible. Lateral flow tests may be a useful first step for those patients not assigned to a 'red' pathway (where a PCR is likely still to be needed).

Given the lack of vaccination in children, there will be hospitalisations in children, and some deaths, despite the much lower risk of severe disease in this age group. Paediatrics will need to be manage all infections as potentially covid-related until swab results are available.

ICU beds have not been explicitly modelled. The vaccine appears very protective from serious disease; if we assumed 1 in 10 admissions needed ICU care (compared with 1 in 5 in past outbreaks), then the metro hospitals might be expected to have an admission to ICU every 2 weeks in the tight scenario. With an ALOS of ~14 days (again patterned on past experience) this would equate to an average of one ICU bed occupied by a covid-19 patient throughout the year at each hospital (maybe for 4-5 months of the year in Northland).

Conclusion

The results here are entirely dependent on the risk appetite for the government and public to allow covid-19 into the country as other countries are planning in the post-vaccine world. The Te Pūnaha

Matatini modelling has provided plausible scenarios as to how that might play out. This involves taking a conservative but not draconian approach – ie some opening of the borders is allowed, and the country moves to a 'Manage it' rather than the current 'Keep it Out' strategy, avoiding Alert Level 3 and 4 approaches. In the best case this sees a manageable volumes of cases, hospitalisations and deaths for the Northern Region, but a range of control measures will be needed for some time to ensure this. In the worst case our controls may be somewhat illusory and the virus could sweep through the population giving results more in line with the looser scenarios.

Appendix 1 Key assumptions

Main assumptions are based on the Te Pūnaha Matatini modelling paper, especially Table 3 in the main paper[6]. Key assumptions are noted here, along with any modifications made.

	Assumption in original paper	Modifications for this report
1	NZ is considered 'fully vaccinated' by Dec 2021	
2	Borders are opened 1 Jan 2022	
3	Restrictions remain on travel to some countries, but otherwise 'unmitigated' quarantine-free travel is occurring	The main model uses 5/day imports but this gives major case numbers. Assume tighter border controls to less than 1/day case imports
4	Assume Delta variant is main issue, medium R0 = 4.5	Potential for higher R0 assumed to be factored in to tightness of border control
5	Assume variation in coverage by community around the average vaccination coverages of 90%. Model does not account for heterogeneity of vaccine coverage	Vaccination coverage set by age and ethnicity in 3 scenarios Low 60%, Moderate 70% and High 80% of 16+ population. Assumed higher in older/more vulnerable, and slighter lower rates in Maaori and Pacific. No added transmission for the heterogeneity
6	Vaccine efficiency (Pfizer) against Delta variant is 88%, against severe disease 94% -	
7	Transmissibility by age, and severity proportions as noted [Table 3]	
8	Vaccine reduction in transmission - 85%	
9	No further community lockdowns, but case isolation and contact tracing eg as measles is currently managed now, drops R0 44% [p11]	
10	Children ages 12-15 are vaccinated	To the same % as adults
11	0-11 year olds not vaccinated	
12	Three scenarios for R0 are used, 3, 4.5 and 6.	Assume the R0 = 3 assumption is equivalent to a tighter border regime (recent political reporting suggests that fully open borders will not be occurring next year – possibly in response to this modelling paper). R0=4.5 used as the main estimate – if actual R0 proves to be higher it is likely tighter controls will be placed on border movements
13	Inequities in health outcomes for Māori and Pacific included. No variation for other groups – eg deprivation, sex	Maaori and Pacific have 2.5 and 3 times the rate of hospitalisation as European/Other[7]. Death rates are assumed to be in proportion to that
14	With a 90% coverage of 12+, @ R(eff) = 3.0 [Supplementary table 5] noted 34k infections over 2 years	Assumed equivalent to 2,000 for CM for 1 year, proportionalise for other DHBs. Provides the tight control scenario
15	With a 90% coverage of 12+, @ R(eff) = 4.5 [Supplementary table 5] noted 960k infections over 2 years	Assumed equivalent to 53,000 for CM for 1 year, proportionalise for other DHBs. Provides the 'looser' scenario
16	With a 90% coverage of 12+, @ R(eff) = 6 [Supplementary table 5] noted 1.3m infections over 2 years	Assumed equivalent to 53,000 for CM for 1 year, proportionalise for other DHBs. Provides the 'unmitigated' scenario

[6] Steyn N, Plank MI, Binny RN, Hendy SC et al. A COVID-19 Vaccination Model for Aotearoa New Zealand. Pre-print, 30 June 2021. [and Supplement Paper]

[7] Steyn N, Binny RN, Hannah K, Hendy SC, et al. Māori and Pacific people in New Zealand have a higher risk of hospitalisation for COVID. *NZ Med J* 9 July 2021, 19: 134.

16	With a 90% coverage of 16+, @ R0 = 4.5, [Table 5] noted 1.3m infections over 2 years	Assumed equivalent to an 80% level of vaccination for ages 12+ = 65,000 for CM Health for 1 year. Proportionalise for other DHBs. Provides the sizing for step from 90% to 80%.
17		Assume that the public and Government appetite for risk in circulating virus is measurable using average rates of seasonable influenza. Where choice on risk to accept is available this will be the balance between economic and health factors accepted.
18		Average length of stay for a non-ICU hospital admission = 6 days – based on first and second wave results at Middlemore
19		Chance of entering ICU assumed reduced compared to previous outbreaks due to vaccine effectiveness in reducing severe disease – 1 in 10 hospitalisations expected, rather than 1 in 5 currently. ICU adds 14 days to the ALOS

Appendix 2. Example using CM modelled vaccination coverage and population

High coverage - assumed vaccination rates to get to an 80% coverage for ages 16+

Age	Maaori	Pacific	Indian	Chinese	Other Asian	European/ Other	Overall
00	0	0	0	0	0	0	0
01-04	0	0	0	0	0	0	0
05-09	0	0	0	0	0	0	0
10-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-19	0.52	0.52	0.60	0.60	0.60	0.60	0.56
20-24	0.70	0.70	0.75	0.75	0.70	0.75	0.72
25-29	0.70	0.70	0.80	0.80	0.75	0.75	0.74
30-34	0.70	0.75	0.80	0.80	0.75	0.80	0.77
35-39	0.75	0.75	0.80	0.85	0.80	0.80	0.79
40-44	0.75	0.75	0.85	0.85	0.80	0.80	0.80
45-49	0.75	0.80	0.90	0.90	0.80	0.80	0.81
50-54	0.80	0.80	0.90	0.90	0.80	0.80	0.82
55-59	0.80	0.80	0.90	0.90	0.85	0.80	0.82
60-64	0.80	0.80	0.90	0.90	0.85	0.80	0.82
65-69	0.80	0.80	0.90	0.90	0.85	0.85	0.85
70-74	0.85	0.85	0.90	0.90	0.85	0.85	0.86
75-79	0.85	0.85	0.90	0.90	0.85	0.85	0.86
80-84	0.85	0.85	0.90	0.90	0.85	0.85	0.86
85+	0.85	0.85	0.90	0.90	0.85	0.85	0.86
All ages	0.49	0.52	0.65	0.67	0.61	0.67	0.60
Ages 16+	0.74	0.75	0.83	0.86	0.79	0.80	**0.80**

Moderate coverage - assumed vaccination rates to get to a 70% coverage for ages 16+

Age	Maaori	Pacific	Indian	Chinese	Other Asian	European/ Other	Overall
00	0	0	0	0	0	0	0
01-04	0	0	0	0	0	0	0
05-09	0	0	0	0	0	0	0
10-14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15-19	0.45	0.45	0.52	0.52	0.52	0.52	0.48
20-24	0.60	0.60	0.65	0.65	0.60	0.60	0.61
25-29	0.60	0.65	0.70	0.70	0.65	0.65	0.66
30-34	0.60	0.65	0.70	0.70	0.65	0.65	0.66
35-39	0.65	0.65	0.70	0.75	0.65	0.65	0.67
40-44	0.65	0.65	0.75	0.75	0.70	0.65	0.68
45-49	0.65	0.65	0.75	0.75	0.70	0.70	0.69
50-54	0.65	0.65	0.75	0.75	0.75	0.70	0.70
55-59	0.70	0.70	0.80	0.80	0.75	0.70	0.72
60-64	0.70	0.70	0.80	0.80	0.75	0.70	0.72
65-69	0.70	0.70	0.80	0.80	0.75	0.70	0.73
70-74	0.75	0.75	0.80	0.80	0.75	0.75	0.76

75-79	0.80	0.80	0.85	0.85	0.75	0.75	0.78
80-84	0.80	0.80	0.85	0.85	0.80	0.80	0.81
85+	0.80	0.80	0.85	0.85	0.80	0.80	0.81
All ages	0.42	0.45	0.57	0.58	0.53	0.57	0.52
Ages 16+	0.64	0.65	0.73	0.75	0.69	0.69	**0.70**

Counties Manukau Health Service User (HSU) population 2020

Age	**Maaori**	**Pacific**	**Indian**	**Chinese**	**Other Asian**	**European/ Other**	**Overall**
00	1,745	2,633	1,394	490	563	1,687	8,512
01-04	7,401	10,324	5,231	2,785	2,365	7,209	35,315
05-09	9,829	13,850	5,330	4,036	2,904	10,208	46,157
10-14	9,348	13,950	4,307	2,990	2,569	11,256	44,420
15-19	7,669	12,703	3,487	2,381	2,319	10,927	39,486
20-24	7,559	13,053	4,462	1,982	2,266	10,260	39,582
25-29	7,281	12,023	9,813	2,498	2,740	10,960	45,315
30-34	6,374	10,141	10,534	3,761	3,469	11,469	45,748
35-39	4,669	8,419	7,855	4,980	3,825	11,356	41,104
40-44	4,346	7,717	5,599	3,484	3,279	11,664	36,089
45-49	4,704	7,471	4,237	2,754	2,797	14,018	35,981
50-54	4,616	7,427	3,636	2,804	2,364	14,952	35,799
55-59	4,069	6,398	3,422	2,977	2,233	14,936	34,035
60-64	3,016	4,862	3,104	2,922	1,712	13,364	28,980
65-69	2,049	3,598	2,543	3,195	1,175	11,011	23,571
70-74	1,317	2,680	1,766	1,972	753	10,237	18,725
75-79	733	1,671	1,089	1,132	362	7,637	12,624
80-84	428	937	584	772	233	5,339	8,293
85+	183	561	329	477	156	4,841	6,547
Total	87,336	140,418	78,722	48,392	38,084	193,331	586,283
Total 16+	57,479	97,120	61,763	37,615	29,219	160,786	443,982
As % 16+	*13%*	*22%*	*14%*	*8%*	*7%*	*36%*	*100%*

HSU = All people who received at least one of the following services: inpatient, outpatient, community labs, pharmaceutical dispensing, mental health services, had a new cancer registration, or recorded in the PHO register in the Jan 2021 or had contact with PHO/ made GMS claim in 2020. Deaths up to end of 2020 were excluded.

Ethnicity is prioritised in the order given, as recorded in the health datasets. This differs from the Stats NZ estimated resident population ethnicity distribution, and is thought to better match the ethnicity used in the vaccination data.

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Those not immunised in the 'High' vaccination (80%) scenario in CM

Age	Maaori	Pacific	Indian	Chinese	Other Asian	European/ Other	Overall
00	1,745	2,633	1,394	490	563	1,687	8,512
01-04	7,401	10,324	5,231	2,785	2,365	7,209	35,315
05-09	9,829	13,850	5,330	4,036	2,904	10,208	46,157
10-14	9,348	13,950	4,307	2,990	2,569	11,256	44,420
15-19	3,681	6,097	1,395	952	928	4,371	17,424
20-24	2,268	3,916	1,116	496	680	2,565	11,039
25-29	2,184	3,607	1,963	500	685	2,740	11,678
30-34	1,912	2,535	2,107	752	867	2,294	10,468
35-39	1,167	2,105	1,571	747	765	2,271	8,626
40-44	1,087	1,929	840	523	656	2,333	7,367
45-49	1,176	1,494	424	275	559	2,804	6,732
50-54	923	1,485	364	280	473	2,990	6,516
55-59	814	1,280	342	298	335	2,987	6,055
60-64	603	972	310	292	257	2,673	5,108
65-69	410	720	254	320	176	1,652	3,531
70-74	198	402	177	197	113	1,536	2,622
75-79	110	251	109	113	54	1,146	1,783
80-84	64	141	58	77	35	801	1,176
85+	27	84	33	48	23	726	942
All ages	44,947	67,775	27,324	16,171	15,007	64,247	235,471
Total 16+	15,888	25,799	10,783	5,679	6,421	33,013	97,582
As % 16+	*16%*	*26%*	*11%*	*6%*	*7%*	*34%*	*100%*

Note the high number of children aged 0-11, ~ 138k