



# WA Safe Transition Plan

## Modelling report by WA Department of Health

### Model overview

WA Health built a compartmental Susceptible-Exposed-Infectious-Recovered (SEIR) model. SEIR models are used by epidemiological modellers to simulate viral transmission and are suited to simulating a COVID-19 epidemic in Western Australia. In essence, the model seeks to simulate the spread of COVID-19 based on how likely individuals are to transmit the disease and the control measures in place.

The model includes the following risk mitigations in addition to vaccination:

- public health and social measures (PHSMs);
- testing, tracing, isolation and quarantine (TTIQ); and
- border restrictions.

**PHSMs** are non-pharmaceutical interventions that suppress the spread of COVID-19, such as wearing masks in public places and social distancing.

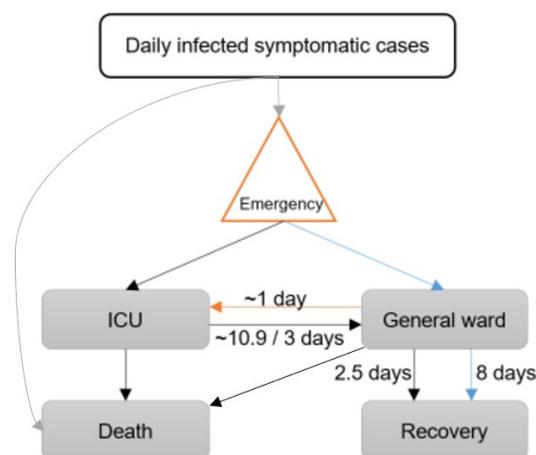
**TTIQ** describes the ability to identify and isolate symptomatic and asymptomatic COVID-19 cases and their close contacts via testing and tracing.

Border restrictions include the triage of arrivals to quarantine based on vaccination status, and pre-departure and/or post-arrival testing.

The average hospital admission length of stay, and length of stay in ICU, were estimated using parameters based on SPRINT-SARI hospital surveillance data held by Monash University. The parameters are described in the table below. The figure below presents the hospitalisation pathways used in the model.

**Table: Hospitalisation parameters and length of stay**

Parameter	Days (sd)
Symptom onset to hospital admission	6 (+/-1 day)
General ward bed stay	8 (+/-3.42)
ICU bed stay (ventilated)	~10.9
ICU bed stay (non-ventilated)	~2.8
Average general ward bed stay prior to ICU admission	1
Average general ward bed stay after step-down from ICU	2.5



**Figure: Clinical care pathway and length of stay**

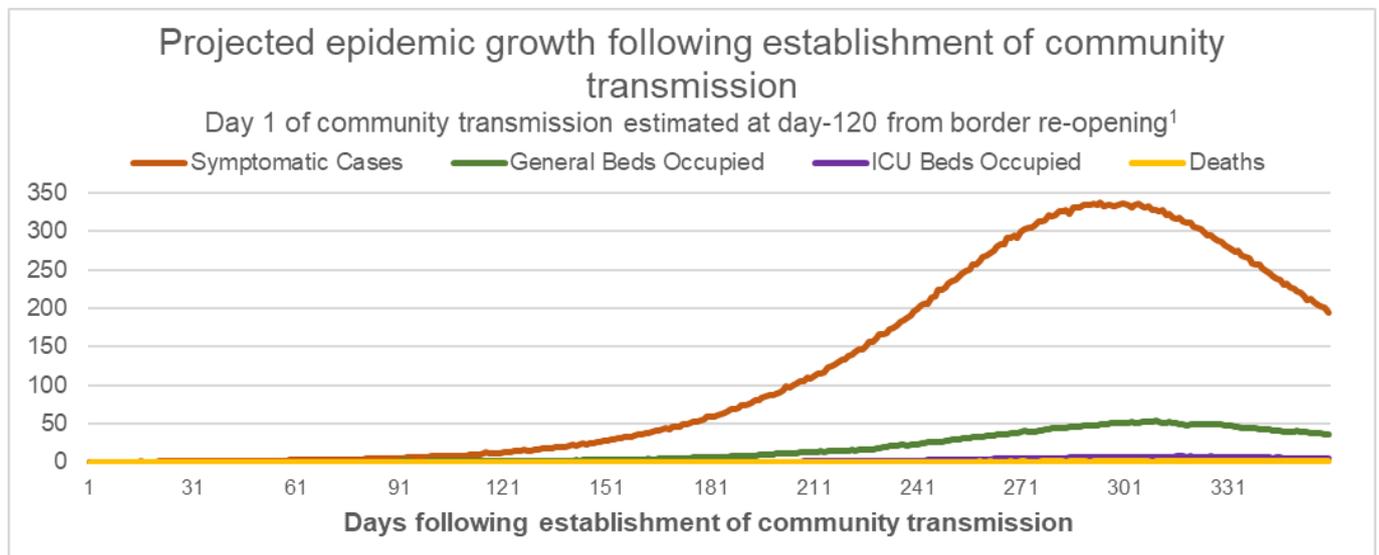
As is the case for all models, actual outcomes are influenced by multiple factors that cannot be predicted or accurately modelled.

## 1. Baseline scenario

WA Health developed a baseline scenario which projects epidemic growth, severe disease and mortality under the following assumptions:

- 90% vaccination coverage in the population aged 12 years and above;
- PHSMs with mask mandates in certain circumstances;
- medium levels of TTIQ;
- mandatory PCR testing pre-departure and testing upon arrival in WA for all international and domestic arrivals;
- double-dose vaccination requirement for all incoming arrivals, except children under 12 years of age and some international arrivals of returning Australians;
- no quarantine requirements for vaccinated arrivals from selected countries;
- 14 days quarantine for unvaccinated returning Australians (and some vaccinated international arrivals deemed high risk); and
- a volume of domestic and international arrivals from selected countries similar to pre-pandemic levels.

**Figure 1: Baseline scenario – 90% coverage**



**Table 1: Baseline scenario with 90% vaccination coverage**

	Symptomatic cases	General ward beds	ICU beds	Mortality
At peak	338	54	8	1
Cumulative 180 days	2,260	37 admissions	2 admissions	4
Cumulative 360 days	43,108	937 admissions	106 admissions	117

<sup>1</sup>The scenarios presented in this document provide a simulation, not forecast, of epidemic growth to 360 days following the onset of the outbreak. We estimate that under the above scenario, community transmission will become prevalent around 120 days from the easing of the border however it is important to stress that the timing of the outbreak is subject to multiple factors including border controls, the efficacy of quarantine and isolation measures as well as public health policies. Within the first 120 days following the easing of the border some cases are expected to occur however the public health measures in place are anticipated to effectively suppress community transmission. This is, however, highly unpredictable and community transmission may actually occur at any point in time.

## 2. Effects of vaccination coverage

Local vaccination coverage was modelled by age group and against the expected uptake of vaccination in WA. Vaccination dosage periods, efficacy of each vaccine and administration of a booster shot were included in each scenario.

Numerous scenarios were modelled to explore the impact of vaccination coverage at 80% and 90% of the WA population aged 12 years and above. To explore the risks of vaccination peaking at lower thresholds, the model was configured to cease further vaccinations once the thresholds of 80% and 90% coverage are met.

The figures below present epidemic growth scenarios at the vaccination coverage thresholds of 80%, and 90% (12+ age groups). The scenarios are overlaid for comparative analysis. Each scenario assumes a baseline level of PHSMs, medium TTIQ and testing of arrivals at the domestic and international border.

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<sup>1</sup> Countries were selected based on pre-pandemic historic arrivals from countries with therapeutic goods regulators that are comparable to the TGA and include the US, UK, Canada, Singapore, Japan and Switzerland. New Zealand was also included due to previous travel bubble arrangements.

Figure 2.1: Symptomatic cases

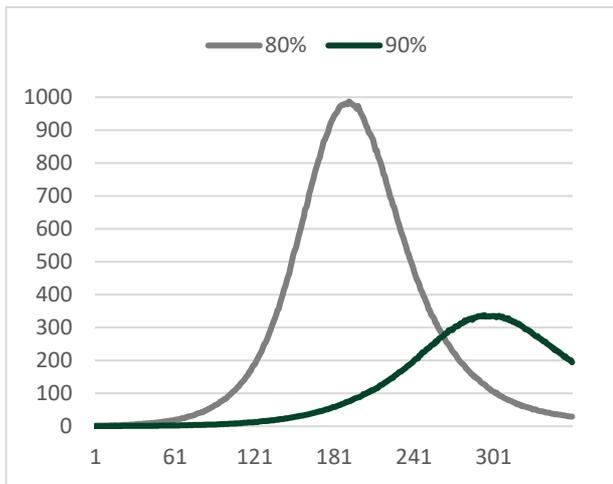


Figure 2.2: General ward beds occupied

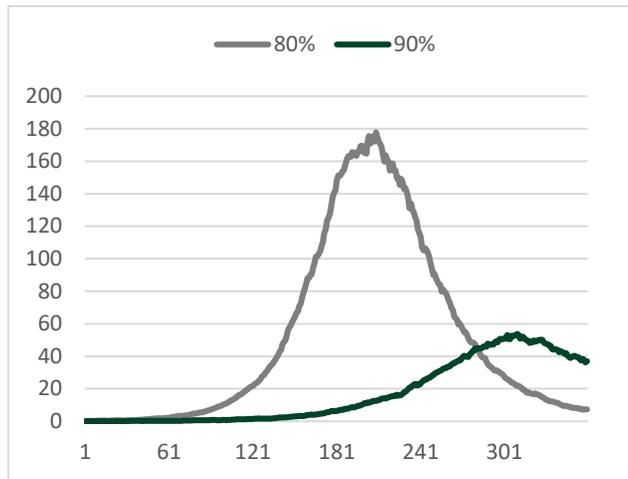


Figure 2.3: ICU beds occupied

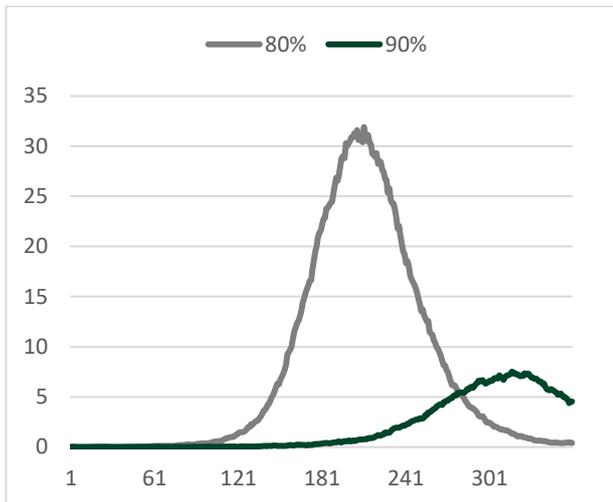


Figure 2.4: Mortality

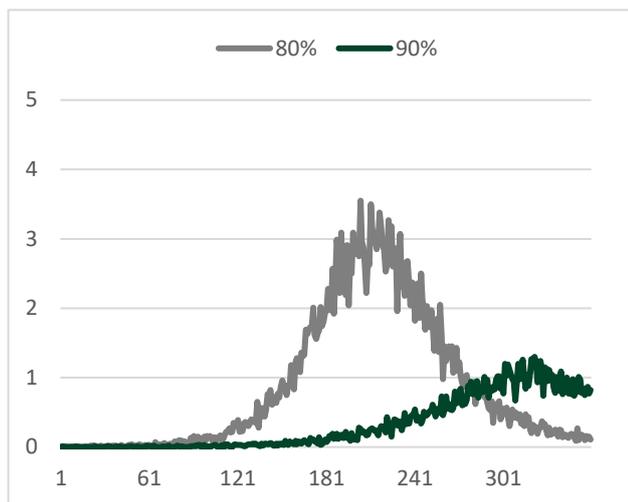


Table 2: 80% versus 90% vaccination coverage

	Symptomatic cases		General ward bed		ICU bed		Mortality	
	80%	90%	80%	90%	80%	90%	80%	90%
At peak	987	338	178*	54*	32*	8*	4	1
Cumulative 180 days	37,330	2,260	795**	37**	92**	2**	64	4
Cumulative 360 days	104,251	43,108	2,921**	937**	391**	106**	313	117

\* refers to number of beds occupied on the peak day (general and ICU beds).

\*\* refers to cumulative number of hospital admissions (general and ICU beds).

## Observations

- Vaccination coverage at 80% results in substantially worse outcomes with 148 additional hospital beds at peak compared to 90% coverage.
- Vaccination coverage at 90% delays the onset and peak of the epidemic, and substantially reduces the number of cases at the peak, from 987 to 338.
- Over the modelled period, there is a 63% reduction in the number of deaths at 90% compared to 80% vaccination coverage.

## 3. Effects of public health and social measures

The effects of PHSMs were simulated at various vaccination coverage thresholds, and at low, medium and high TTIQ efficacy. After considering a range of scenarios, mask-wearing alone was modelled, and PHSMs with mask-wearing was modelled. A proxy for PHSMs was used based on the suite of measures imposed during a step-down as part of a previous outbreak response in WA (e.g. 2 sqm density limits, 150 person capacity in some venues etc).

Similar to the Doherty Institute's model, it is not possible to simulate the effect of individual measures. Rather, the observed effect of measures previously imposed provides the closest proxy. Compliance with PHSMs is assumed to be static throughout the modelled scenarios. Real-world compliance with PHSMs is likely to vary based on numerous contextual variables.

In the scenarios presented below, the model projects case growth over 360 days from establishment of community transmission. There is greater uncertainty at this horizon, however the fulsome results provide greater understanding of the predicted epidemic at 80% and 90% vaccination coverage.

The figures below present the effectiveness of PHSMs (including mask wearing) versus no PHSMs at 80% and 90% vaccination coverage. Medium TTIQ is held constant.

Figure 3.1: Symptomatic cases

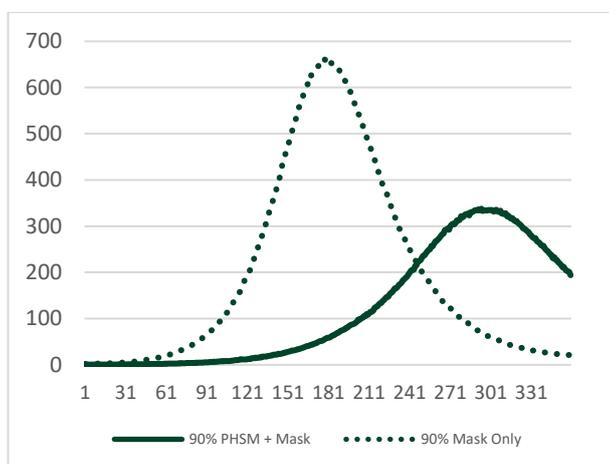


Figure 3.2: General ward beds occupied

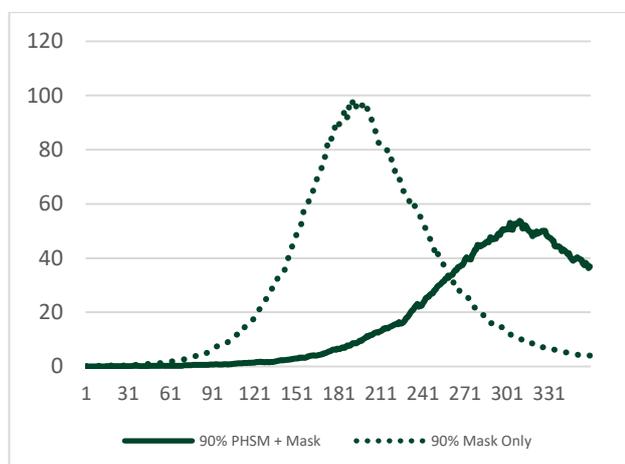


Figure 3.3: ICU beds occupied

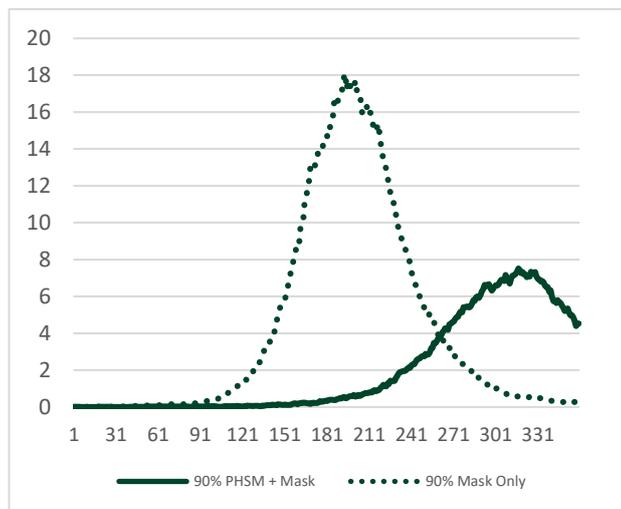


Figure 3.4: Mortality

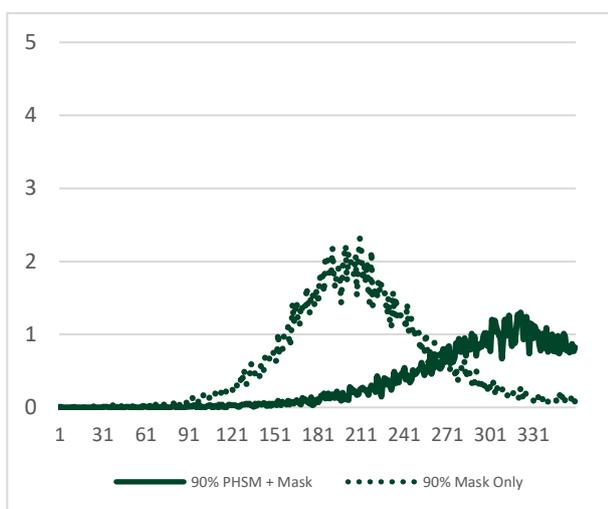


Table 3: Masks only versus PHSMs + masks at 90% vaccination coverage

	Symptomatic cases		General ward bed		ICU bed		Mortality	
	Masks only	PHSMs + masks	Masks only	PHSMs + masks	Masks only	PHSMs + masks	Masks only	PHSMs + masks
At peak	661	338	98*	54*	18*	8*	2	1
Cumulative 180 days	34,420	2,260	583**	37**	73**	2**	56	4
Cumulative 360 days	71,064	43,108	1,628**	937**	217**	106**	207	117

\* refers to number of beds occupied on the peak day (general and ICU beds).

\*\* refers to cumulative number of hospital admissions (general and ICU beds).

## Observations

- PHSMs are effective in flattening the curve and reducing community transmission of COVID-19.
- Imposition of PHSMs slows the onset of epidemic growth, by approximately two to three months.
- Face masks reduce transmission potential, and the effectiveness of mask-wearing is significantly enhanced when combined with some PHSMs.

## 4. Effects of test, trace, isolation and quarantine

TTIQ describes the ability to identify and isolate COVID-19 cases and their close contacts.

Modelling included consideration of:

- Rapid antigen and polymerase chain reaction tests in different circumstances (e.g. screening versus diagnosis);
- Screening testing to identify vaccinated and unvaccinated asymptomatic cases;
- Isolation of vaccinated and unvaccinated close contacts; and
- Differing quarantine arrangements at the domestic and international border.

Factors influencing TTIQ include:

- Levels and effectiveness of asymptomatic testing (i.e. testing for screening);
- Effectiveness of contact tracing systems and processes;
- Volume of COVID-19 cases, and the capacity and capability of contact tracing;
- Definitions of close contacts;<sup>2</sup> and
- Compliance with isolation requirements.

The model assumes 85% sensitivity and 95% specificity for PCR tests, and 63% sensitivity and 95% specificity for rapid antigen tests.

Figures 4.1 to 4.4 present the impact of different levels of testing, tracing and isolation and projected epidemic growth to 360 days from the start of the outbreak. Uncapped, vaccinated domestic arrivals and capped, vaccinated international arrivals from selected countries are included to simulate higher volumes of arrivals. Scenarios assume vaccination coverage thresholds of 80% and 90%, PHSMs with mask wearing, and:

a) *High TTIQ:*

- **90%** compliance rate for close contacts who can be identified are asked to isolate;
- Widespread community testing capable of identifying 10% of asymptomatic children and 5% of asymptomatic adults through rapid antigen testing of **both vaccinated and unvaccinated** people in schools, workplaces and events.

b) *Medium TTIQ:*

- **80%** compliance rate for close contacts who can be identified are asked to isolate;
- Widespread community testing capable of identifying 10% of asymptomatic children and 5% of asymptomatic adults through rapid antigen testing of **unvaccinated people only** in schools, workplaces and events.

c) *Low TTIQ:*

- **80%** compliance rate for close contacts who can be identified are asked to isolate;
- Limited community testing capable of identifying 5% of asymptomatic adults through rapid antigen testing of **unvaccinated adults only** in workplaces and events.

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<sup>2</sup> Prem, K., Cook, A. & Jit, M. (2017). Project social contact matrices in 152 countries using contact surveys and demographic data. *PLoS Computational Biology*, 13.9, e1005697.

Figure 4.1: Symptomatic cases

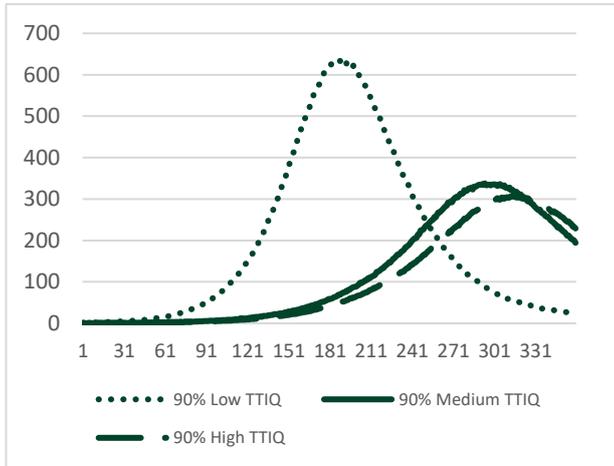


Figure 4.2: General ward beds occupied

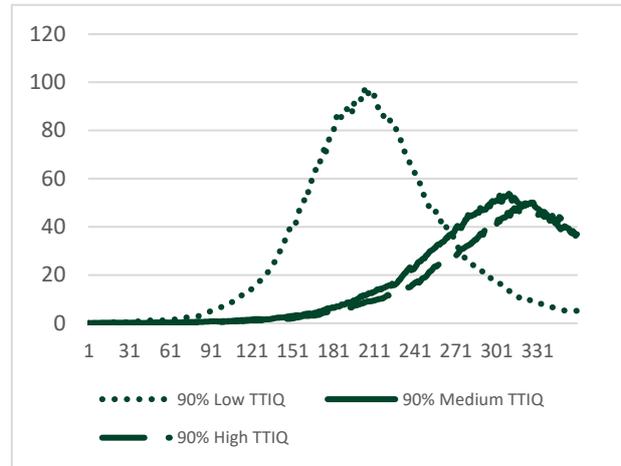


Figure 4.3: ICU beds occupied

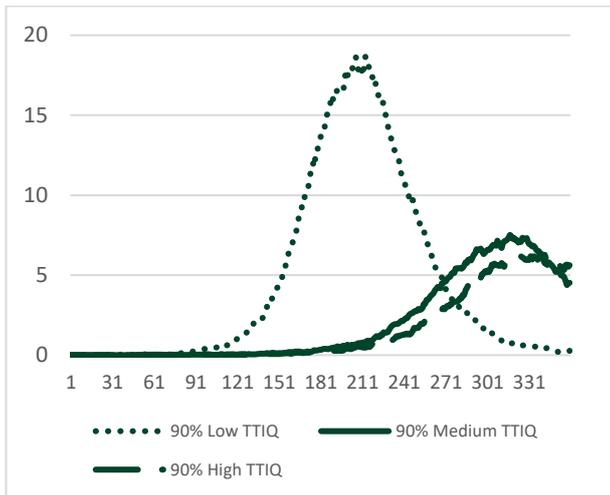
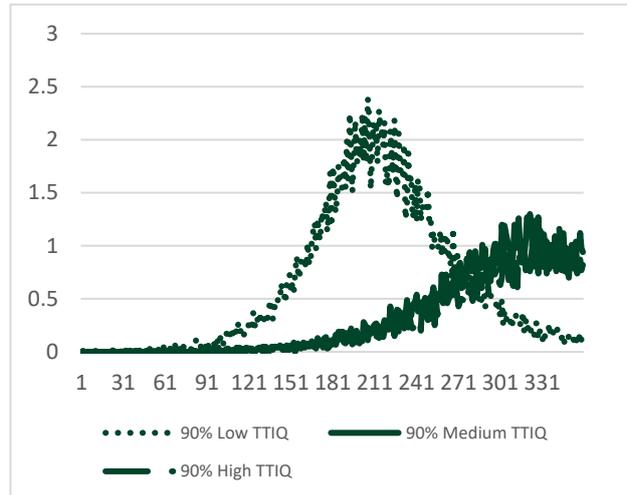


Figure 4.4: Mortality



## Observations

- The benefits of widespread community testing are largely maintained where testing is focused toward unvaccinated cohorts.
- As children under the age of 12 make up a large portion of the unvaccinated population, removing school testing programs and concentrating community testing to adults significantly reduces TTIQ efficacy, which translates to an increase in projected caseload and hospitalisations.
- A 10% reduction in the expected compliance rate of close contacts required to isolate does not have a material impact on the projected epidemic growth.
- Testing to identify and isolate cases and their close contacts effectively reduces case numbers and adverse outcomes.
- Medium TTIQ reduces peak case numbers by 47% at 90% vaccination coverage, compared to low TTIQ.

**Last updated 4 November 2021**

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