Covid-19 Modelling Aotearoa

Modelling the effect of changes to the COVID-19 case isolation policy

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Executive Summary

- We used a mathematical model to investigate the potential impact of ending mandatory COVID-19 case isolation requirements on the number of infections, hospital admissions, and deaths over the next 6 months.
- In the model, ending mandatory case isolation caused a wave of infections in the subsequent 1-2 months, although after 4-6 months infections settled to a level that was only slightly higher than if mandatory isolation was maintained.
- Under our best estimate, ending mandatory case isolation led to a 13-25% increase in the total number of COVID-19 admissions and deaths in the subsequent 6 months.
- However, there is a lot of uncertainty about the exact impact of ending mandatory isolation, because firstly the current behaviour of people with COVID-19 is not well known and secondly the change in behaviour in response to the policy change is difficult to predict. Not everyone follows the current requirements, while others will continue to follow isolation guidelines even if they are no longer mandatory.
- To account for some of this uncertainty, we ran alternative model scenarios. In a scenario with a smaller transmission increase, which could occur if many people continue to test and isolate voluntarily, the increase in hospital admissions and deaths could be as small as 6%. In a scenario with a larger transmission increase where more people leave their dwelling while infectious, the increase in admissions and deaths could be over 35%.
- The model results only relate to total national numbers. It is likely that groups at higher risk of severe COVID-19, including Māori and Pacific people, and shielding individuals will be disproportionately affected by an increase in transmission.
- The model results suggest that, beyond the 4-6 months following a policy change, long-term outcomes are relatively insensitive to the timing of any decision to end mandatory isolation.
- Irrespective of legal requirements, staying at home when sick is an important public health message for reducing disease transmission.

Background

We have previously modelled the dynamics of SARS-CoV-2 in New Zealand using a compartment-based ordinary differential equation (ODE) model (Lustig et al., 2023; Vattiato et al., 2023). This age-structured model includes waning of vaccine-derived and infection-derived immunity, immune evasion of new Omicron sub-variants, age-dependent hospitalisation and death rates, and changes in transmission resulting from behavioural and policy changes. The model is calibrated to data on COVID-19 cases, hospitalisations and deaths using an approximate Bayesian computation (ABC) method.

Anyone testing positive for COVID-19 in New Zealand is currently legally required to self-isolate until 7 days after their positive test result or onset of COVID-19 symptoms, whichever is earlier (Parliamentary Counsel Office, 2022). Previous work from COVID-19 Modelling Aotearoa has estimated the effect of different isolation periods on transmission risk (Harvey et al. 2022a). This report presents results from the ODE model (Lustig et al., 2023) to support the 16 March 2023 Public Health Risk Assessment (PHRA) to assess whether the current public health risk of COVID-19 justifies retaining mandatory isolation. The Ministry of Health is providing information to the PHRA related to risk of reinfections, long covid, and key surveillance trends showing the current impact/risk profile of COVID-19.

Model scenarios

We ran a baseline version of the model fitted to data up to 25 February 2023. We then compared this baseline model against three scenarios in which there is an instantaneous increase in the effective reproduction number on 21 March 2023 of 5%, 10% and 15%. This can equivalently be thought of as a 5%, 10% or 15% increase in the average number of contacts during an individual's infectious period. The 10% increase in transmission is our central estimate of the impact of ending mandatory COVID-19 isolation requirements and shifting to guidance only, with the 5% and 15% scenarios capturing some of the uncertainty about the effect size. We present results showing the change in the number of SARS-CoV-2 infections, COVID-19 hospitalisations and COVID-19 deaths in each of these scenarios. We do not explicitly show results for cases because the effect of a policy change on testing and reporting rates is unknown.

The estimates of increase in transmission are based on results of a behavioural survey (see below) and previous results from COVID-19 Modelling Aotearoa's network contagion model and ODE model. A behavioural survey undertaken on behalf of the NZ Ministry of Health in late 2022 (Horizon Research Limited, 2022) suggests that a large proportion of survey respondents were still testing if symptomatic and self-isolating if they test positive and that they intended to continue with such behaviour in the future (see Supplementary Material). This suggests that self-isolation continues to play a role as part of transmission-reducing behaviour for a significant fraction of the population and as such there remains potential for increased transmission if such behaviours were to end, or significantly reduce, with the end of mandatory self-isolation.

The network contagion model results estimated that the complete removal of case isolation behaviours could lead to a 15% increase in transmission, relative to a baseline with no household quarantine and only symptomatic testing but high compliance with case isolation (Harvey et al., 2022b). There is significant uncertainty in this estimate, in particular due to the difficulty of estimating the proportion of people currently testing and following case isolation requirements, the number of people who would follow “guidance to isolate”, and other unmodelled changes in behaviour that might accompany such a policy change. If case isolation behaviour has already decreased, or if people follow the isolation guidance after mandatory isolation has ended, the modelled increase would be less than 15%. However, model results following the end of the Covid-19 Protection Framework in September 2022 showed that subsequent epidemiological data were consistent with a larger than expected increase in transmission (Vattiato et al., 2023). This was potentially the result of unmodelled behaviour changes, which could also occur following an end to mandatory Covid-19 isolation.

The impact of shifting to guidance will also depend on what the recommended isolation guidance is. For example, voluntary test-to-release for when to end isolation would reduce transmission, but advice to only isolate while symptomatic would increase risk. In previous work, COVID-19 Modelling Aotearoa (Harvey et al. 2022a) calculated that the impact of the current 7 day policy of mandatory isolation of confirmed COVID-19 cases results in an average of 9 hours infectious in the community after release[1] and 83 hours of excess isolation[2] per confirmed case. The same report calculated that a “test-to-release” policy with a 7 day maximum, but with possible early release after day 5 upon returning 1 (respectively 2) negative results on an antigen test would result in only a small increase in hours infectious in the community after release (12 (resp. 10) hours) but a large reduction in hours of excess isolation (51 (resp. 57) hours).

Factors that may shift outcomes towards the lower transmission increase scenario include strong, clear public health messages on the importance of following the

[1] An estimated 15% of individuals are still infectious at the end of their mandatory 7 day isolation period. The average hours infectious in the community is the mean number of hours that individuals remain infectious for, *after* the end of mandatory isolation, averaged across the whole population of confirmed cases including those cases whose infectivity resolves before the end of mandatory isolation and who contribute zero hours to the mean.
[2] The estimated 85% of individuals whose infectious period ends *before* the end of their mandatory isolation period will be required to spend some time in isolation in excess of the end of their infectious period. Average hours of excess isolation is the mean number of hours that individuals spend in isolation when no longer infectious, averaged across the whole population, including those cases whose infectivity resolves after the end of their isolation period and who contribute zero hours to the mean.

recommended isolation guidelines and what the guidelines are, availability of and access to rapid antigen tests, and providing financial support for people to isolate.

Results

Table 1 shows the change in infections, hospitalisations and deaths under each scenario, relative to the baseline model in which there is no policy or behavioural change. The Table shows results for a 7 week period and for a 26 week period following the policy change. ***Figure 1*** shows the relative change in cumulative infections, hospitalisations and deaths over time compared to the baseline model. See ***Supplementary Material*** for additional results broken down by age group.

An increase in transmission typically leads to a wave of infections in the subsequent 2-3 months, with larger transmission increases associated with higher peaks. After a longer period of time, the differences between scenarios are smaller as infection rates settle down to similar levels following the initial wave. The model assumes that behavioural change in response to a policy update occurs immediately. If instead the behavioural change occurs more gradually, this would tend to reduce the size of the initial peak and lead to a more gradual transition onto the same long-term trends. Retrospective analysis of the impact of the September policy change found that epidemiological data was consistent with the transmission increases being spread over several weeks (Vattiato et al., 2023). Relative increases in severe health outcomes in the longer-term tend to be slightly larger than the associated increase in infections (see ***Table 1***). This is because the additional infections caused by the transmission increase tend to occur disproportionately in older age groups due to their lower rates of prior infection.

Table 1. Model results for the short-term and long-term impact of ending mandatory COVID-19 isolation requirements. Differences in cumulative infections, COVID-19 hospital admissions, and COVID-19 deaths, in the 7 weeks and 26 weeks following the policy change, and peak hospital occupancy during the 26 weeks following the policy change, under three model scenarios (+5%, +10% and +15% change in transmission on 21 March 202). All results are relative to the baseline model with no policy change. In each table cell, the first line shows change in absolute numbers and the second line shows relative (percentage) change compared to baseline. Values in brackets represent the 95% confidence intervals on these differences.

Scenario	**Short term impact** Difference in cumulative numbers from 0 to 7 weeks post policy change			**Long term impact** Difference in cumulative numbers from 0 to 26 weeks post policy change			**Difference in peak hospital occupancy** in the 26 weeks post policy change
	Infections	**Hospital admissions**	**Deaths**	**Infections**	**Hospital admissions**	**Deaths**	
Lower (+5% on 21Mar23)	+83,000 [+32,000, +95,000] +27% [+25%, +29%]	+500 [+200, +600] +25% [+21%, +26%]	+23 [+12, +40] +15% [+12%, +16%]	+81,000 [+59,000, +88,000] +6% [+5%, +9%]	+700 [+400, +800] +7% [+6%, +11%]	+73 [+63, +135] +8% [+7%, +13%]	+103 [+30, +130] +24% [+12%, +26%]
Central (+10% on 21Mar23)	+179,000 [+73,000, +200,000] +57% [+52%, +65%]	+1,000 [+400, +1,300] +55% [+48%, +57%]	+51 [+27, +88] +34% [+26%, +36%]	+164,000 [+117,000, +176,000] +12% [+11%, +17%]	+1,400 [+700, +1,500] +15% [+13%, +21%]	+148 [+124, +269] +17% [+15%, +25%]	+233 [+95, +287] +54% [+37%, +57%]
Higher (+15% on 21Mar23)	+282,000 [+123,000, +308,000] +91% [+80%, +108%]	+1,700 [+700, +2,100] +90% [+82%, +96%]	+85 [+45, +145] +56% [+43%, +59%]	+247,000 [+174,000, +264,000] +18% [+16%, +24%]	+2,100 [+1,100, +2,300] +23% [+20%, +31%]	+225 [+185, +406] +25% [+23%, +37%]	+382 [+179, +463] +88% [+70%, +92%]

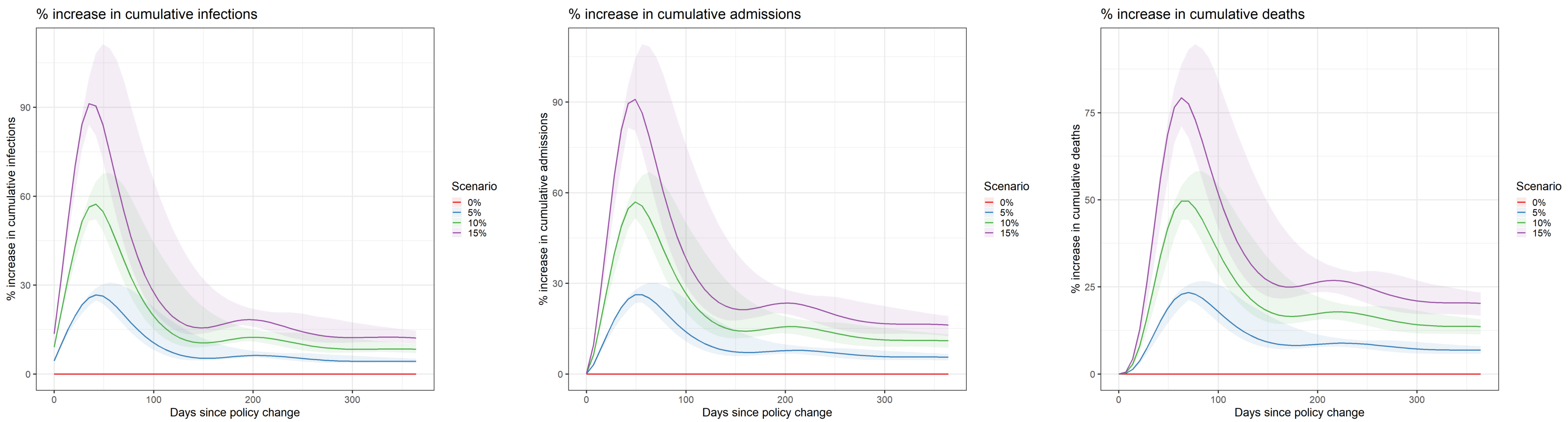

Figure 1. Model results for the ***relative (percentage) increase*** in *cumulative* infections (left), *cumulative* COVID-19 hospital admissions (middle) and *cumulative* COVID-19 deaths (right), over one year following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model (0% change in red). Results are aggregated across all ages. Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference for paired trajectories (same set of parameters) with and without the transmission increase for 95% of accepted model realisations.

Key model assumptions, limitations and sources of uncertainty

- There is significant uncertainty as to the impact of a change in the COVID-19 isolation policy on transmission. This is because the effect of ending legal isolation requirements depends not only on the effect of isolation on individual-level transmission risk, but also on the number of people complying with isolation requirements before the policy change, the number voluntarily following isolation guidance after the change, what the guidance is, and what other behavioural changes there are. The scenarios shown represent a central estimate and a lower and higher estimate of the effect of ending mandatory case isolation. However, outcomes outside this range (either above or below) cannot be completely ruled out.
- The model assumes that the increase in transmission following an end to mandatory isolation occurs uniformly across all age groups. This may not be the reality, although it is a necessary modelling assumption in the absence of detailed age-specific data on compliance with isolation requirements.
- The greatest level of uncertainty applies to the magnitude of the short-term increase in infections following a policy or behavioural change (see Supplementary Figure S1). Long-term differences between different policy settings are likely to be smaller due to the role of infection-acquired immunity in controlling transmission.
- The model assumes that there is no major new variant of SARS-CoV-2, no change in the intrinsic virulence of the virus, no seasonal variation (e.g. transmission rates do not increase in winter), and no other behavioural changes affecting transmission rates over the relevant time period. This means that the baseline model should not be used as a long-term prediction for the absolute numbers of infections, admissions or deaths, but rather a scenario of what would be likely to occur under these specific modelling assumptions. The results for the relative percentage change in these numbers compared to the baseline model are expected to be more robust to these unmodelled effects, and are the focus of this report.
- The model ignores regional and socioeconomic heterogeneities in prevalence, transmission and isolation behaviour and can only be used to give a national population-level picture. Isolation procedures are also an important way to shield vulnerable individuals but this is not included in the model. In particular, the model does not capture the fact that more vulnerable individuals who may be less able to follow non-mandated guidance around isolation will tend to be in contact with others who are also more vulnerable.
- The model does not give any information about how the impact of a policy change will be distributed across particular communities or demographic groups. Any groups that become unable to isolate, for example due to financial pressures,

may be exposed to higher risk. The behavioural survey undertaken for NZ Ministry of Health in late 2022 (Horizon Research Limited, 2022) identified a significant fraction of New Zealanders who felt that they were unable to isolate or quarantine because of economic factors. People who reported that they would be unable to self-isolate if sick with COVID-19 were more likely to be Māori, Pasifika, or Asian. Māori and Pasifika also have higher risk of severe COVID-19 (Steyn et al., 2021; MOH, 2022) so are likely to be disproportionately affected by increased transmission rates.

- We have not modelled any drop in case reporting rates that may follow a policy change, such as is thought to have occurred in Australia for example. This does not affect the number of infections, hospitalisations or deaths in the model. However, in practice it could affect COVID-19 surveillance systems and situational awareness, as well as access to antiviral medications, which rely on prompt diagnosis.
- The model currently overestimates the number of daily deaths following a reduction in the observed case fatality ratio since around September 2022. If this discrepancy continues, model results for the effect of the policy change may overestimate its effect on the number of deaths (although results for the relative percentage change will be more robust).
- The immune landscape in New Zealand has become more complex, with various combinations of immunity derived from vaccination and prior infection at different time points. The model necessarily makes simplifying assumptions about the nature of the immunity landscape and it is possible that results are sensitive to these assumptions.
- The model does not include the effect of any vaccine doses given after 13 February 2023. This is to avoid the need to make assumptions about future vaccine uptake. Future updates to the model will continue to account for vaccine doses given, particularly following the rollout of the bivalent booster vaccine from April 2023.
- The model does not consider the economic, legal or broader public health (e.g. mental health) implications of the COVID-19 isolation policy.

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Author contributions

- SD: prepared document, including model output manipulation and visualisations; contributed to ODE model.
- JG: contributed to the design and building of the interaction network that the Network Contagion Model runs on.
- EH: design, building, and running the Network Contagion Model which feeds parameters into the ODE model, contributed to ODE model design, assisted in writing the document.
- DO: led design and building of the Network Contagion Model which feeds parameters into the ODE model, contributed to ODE model design, assisted in writing the document.
- FPE: involved in running the Network Contagion Model which feeds parameters into the ODE model, and interpreting results.
- EPF: involved in running the Network Contagion Model which feeds parameters into the ODE model, and interpreting results, assisted in writing the document.
- MP: prepared document, involved in building the ODE model.
- OM: contributed to the design of the contagion code for the Network Contagion Model, involved in building the ODE model, developed/implemented the fitting/credible band construction methods, assisted in writing the document.
- ST: contributed to the design and building of the interaction network that the Network Contagion Model runs on.
- GV: prepared document, involved in building the ODE model, ran model simulations presented.
- DW: developed the contagion code codebase for the Network Contagion Model.

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Supplementary Material

Summary of behavioural survey results relevant to self-isolation

Results from a behavioural survey undertaken for the Ministry of Health in late 2022 (Horizon Research Limited, 2022) show that, in the two weeks prior to the survey:

- 63% of respondents with COVID-19 symptoms took at least one RAT.
- 78% of respondents who tested positive self-isolated.
- 90% of those who tested positive reported symptoms.
- Only 8% of respondents who tested positive did not report any of their test results from the prior two weeks on My COVID Record.

When asked about future intentions:

- over 75% of respondents said they were "likely" or "very likely" to "have a RAT if [they have] COVID-19 symptoms in the future".
- over 80% said that they were "likely" or "very likely" to "self-isolate for the required 7-day period if [they have] a positive RAT result in the future"[3].

In terms of results relating to the level of adherence to the guidelines for household contacts of confirmed cases once mandatory quarantine was removed, the behavioural survey found that, in the two weeks prior to the survey

- 71% of household contacts of a confirmed case took at least one RAT.
- 33% of household contacts of a confirmed case quarantined (self-isolated).

These results suggest that there are reasonably high levels of compliance with current case isolation requirements. This also shows that although household contact quarantine requirements were replaced with guidance in September, in November there were a reasonable number of household contacts following the guidance. This is evidence that there is still a significant proportion of the public who are currently taking actions including symptomatic testing, case isolation and household contact quarantine to reduce transmission. And therefore there is potential for an increase in transmission if case isolation requirements are removed, and if behaviours changed around testing and staying home if sick, or if a household contact.

ODE model summary

The ODE model is based on numerous parameter assumptions: some of these values are fixed, others are fitted using a naive ABC (approximate Bayesian computation) method (see Lustig et al., 2023 for details). Using this method, the model picks random combinations of parameter values from their 'prior' distributions (results presented here

[3] In the survey, of the people who indicated that they would have difficulty self-isolating, 18% said it was because they "don't have space to self-isolate away from others at home". This indicates a potential misinterpretation of "self-isolation", and suggests that some of those who hadn't (or wouldn't) self-isolate, may still stay home, they just may not be able to stay away from their household contacts.

are from 15,000 independent draws from the prior distribution), then outputs a sample from an approximate posterior distribution of accepted values. The accepted values are those resulting in the 1% best fitting trajectories (i.e. those that give the smallest value for a distance function that measures the difference between a simulated trajectory and observed data). The distance function is based on the number of new daily infections in a routinely tested cohort of border workers (up to July 2022), total and age-stratified daily reported cases of COVID-19, total and age-stratified daily hospital admissions for COVID-19, and total daily COVID-19 deaths (excluding deaths that are classified as “Not COVID-related”. The age-stratified daily cases and hospital admissions are included for each age group as a proportion of the total. The accepted model runs are then used to plot a 'best fit' line and a 95% confidence interval.

It is worth noting that multiple different combinations of parameter choices can result in simulations that give an equally good fit to empirical data, including combinations of parameters that may conflict with other parameter combinations. It is therefore important to consider modelling results as an ensemble of plausible trajectories, subject to the constraints and assumptions of the model.

Supplementary results

The results shown here are for scenarios with a specified increase in transmission on 21 March 2023, representing the potential impact of a reduction in the number of infected individuals effectively isolating during their infectious period, as described in the Main Text. The model was run with an increase in transmission of: 0% (henceforth referred to as the 'baseline' model), 5%, 10% and 15%.

Figure S1 shows model results in the four scenarios for the number of daily infections, reported cases, new daily Covid-19 hospital admissions, hospital occupancy, and daily Covid-19 deaths. Note that for the results on cases, the model assumes that the case ascertainment rate (i.e. proportion of infections that are reported as cases) is not affected by any policy change. In reality, it is likely that ending mandatory reporting/isolation will lead to a drop in the case ascertainment rate, as is thought to have occurred in Australia for example. This means that the model may significantly overestimate the number of reported cases following a policy change, but we note that this does not affect the number of infections, hospitalisations or deaths in the model.

Figures S2-S7 show the increase in infections, hospital admissions and deaths in the scenarios with an increase in transmission, compared to the baselines model. In each graph, solid curves show the difference in the cumulative number of outcomes over time in the best-fit model between the baseline (no change) model and the scenario with the specified increase in transmission (5%, 10% or 15%). Shaded bands represent a 95% confidence interval (under model assumptions) for the difference in the cumulative number of outcomes as a result of the transmission increase.

Graphs are shown both for absolute increase and for relative increase compared to baseline. We do not plot cases here as the effect of any policy change on testing and reporting behaviour is unknown and not included in the model (see also Main Text). Each set of graphs shows results split into 10-year age groups and for the aggregated totals (bottom-right plot in yellow box).

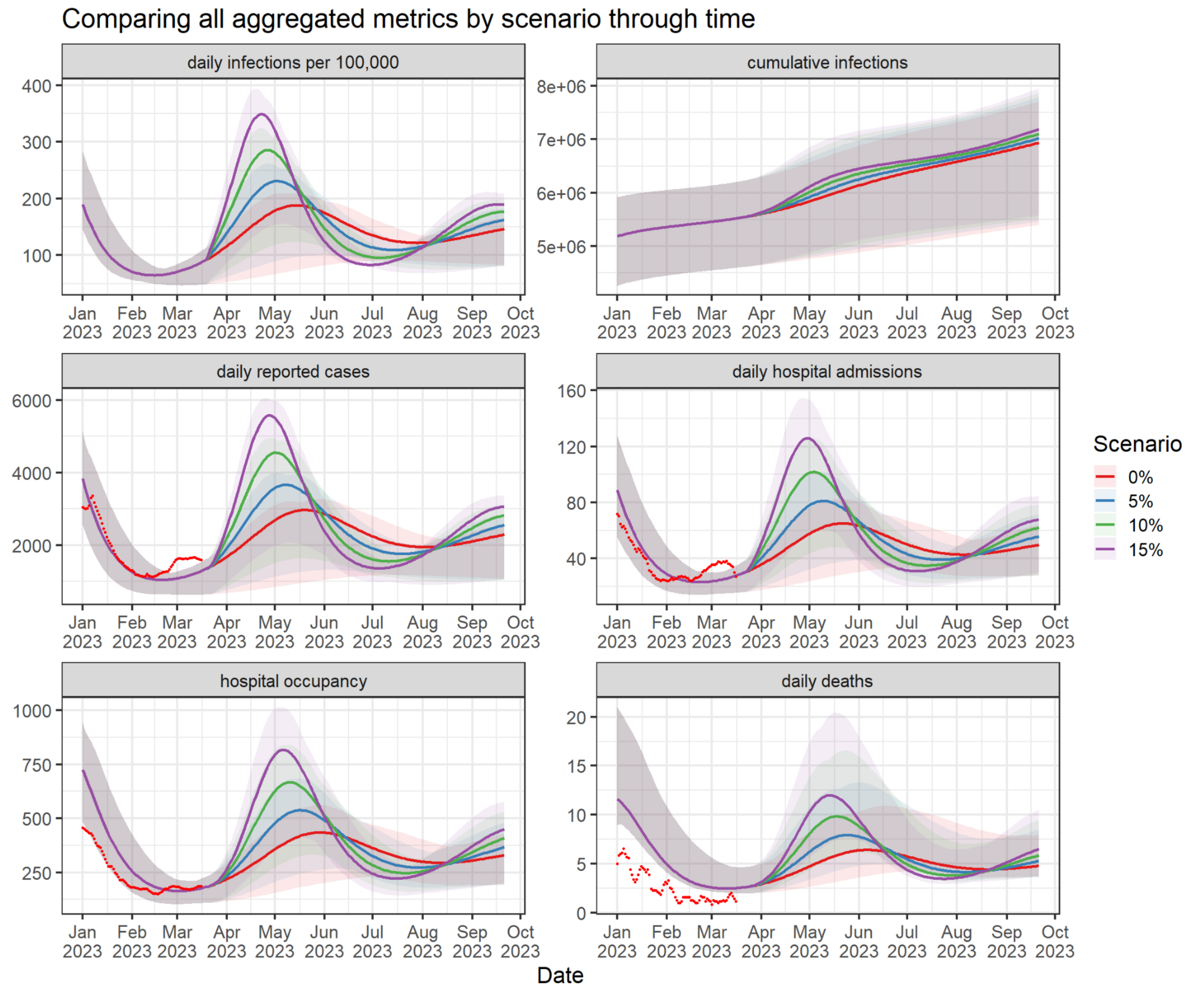

Figure S1. Model results for new daily infections (per 100,000 people), cumulative infections since 1 January 2023, daily reported cases, new daily Covid-19 hospital admissions, hospital occupancy and daily Covid-19 deaths for the four model scenarios (red = baseline, blue = 5% increase, green = 10% increase, purple = 15% increase in transmission on 21 March 2023). Solid curves show the best-fit model trajectory, shaded bands contain 95% of accepted model realisations, red points show observed data. Note the model assumes that there is no major new variant of SARS-CoV-2, no change in the intrinsic virulence of the virus, no seasonality or other changes affecting transmission rates over the relevant time period. This means that the baseline model should not be used as a long-term prediction for the absolute numbers of infections, admissions or deaths, but rather a scenario of what would be likely to occur under these specific modelling assumptions.

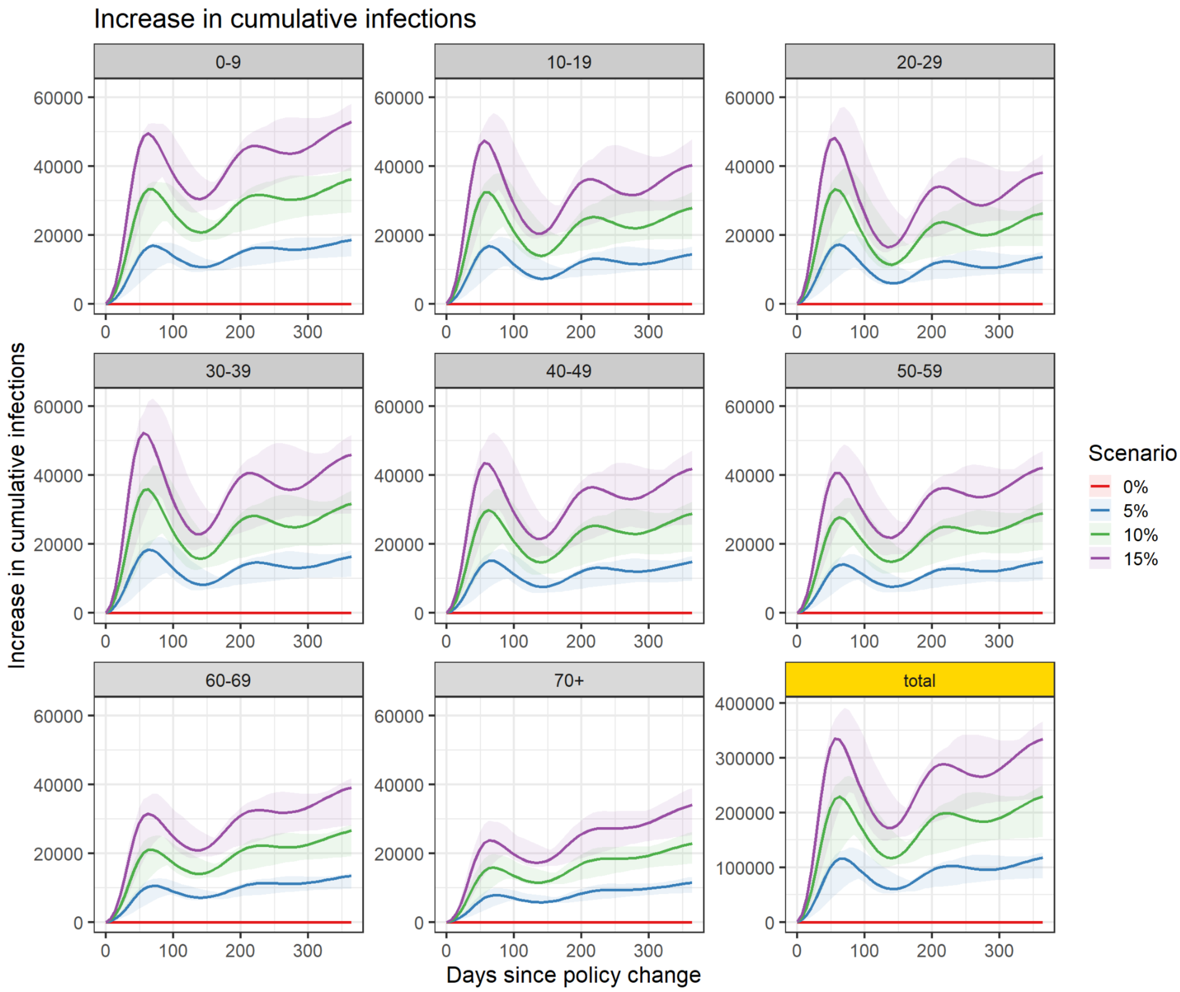

Figure S2. Model results for the change in cumulative infections following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

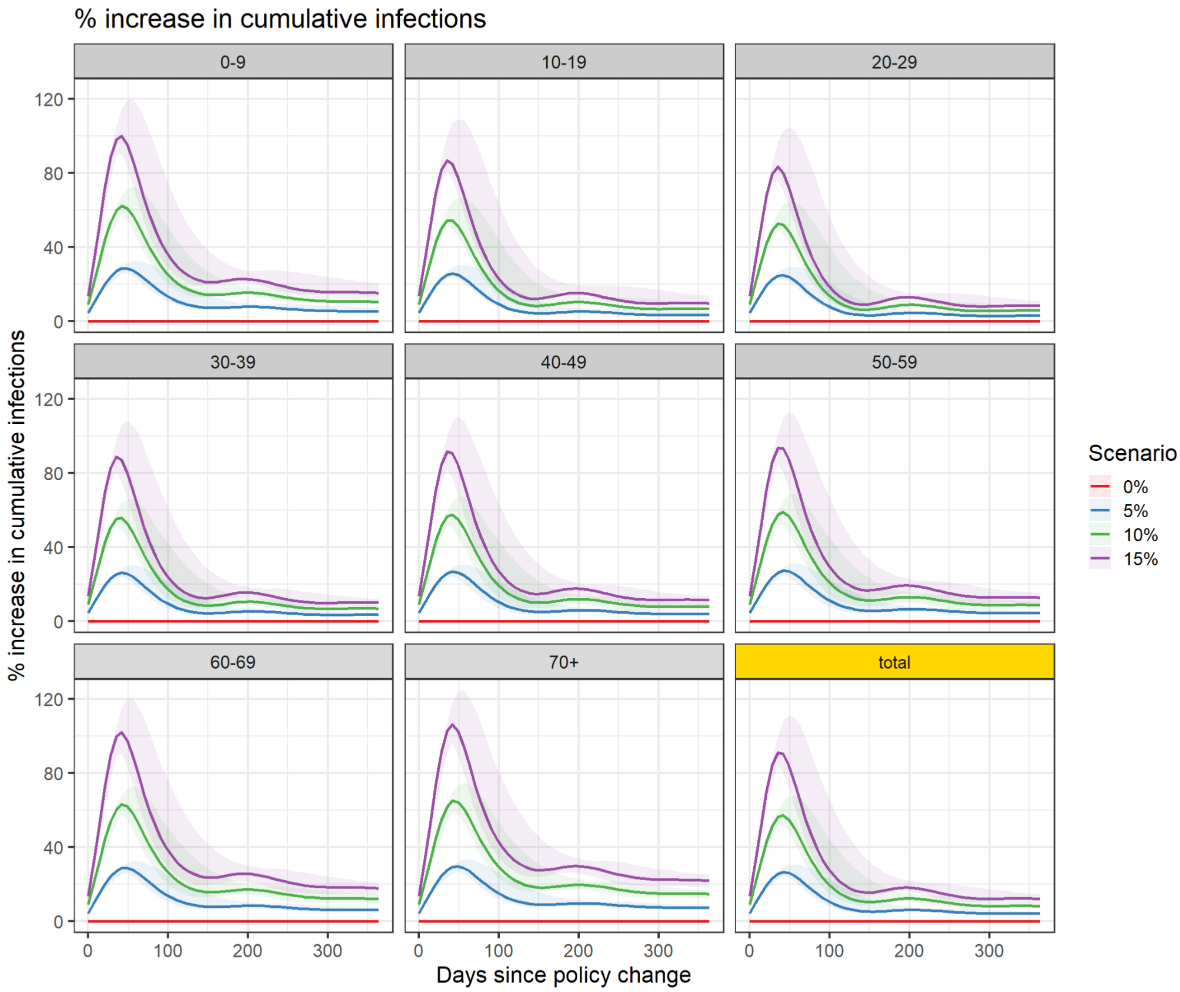

Figure S3. Model results for the percentage increase in cumulative infections following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

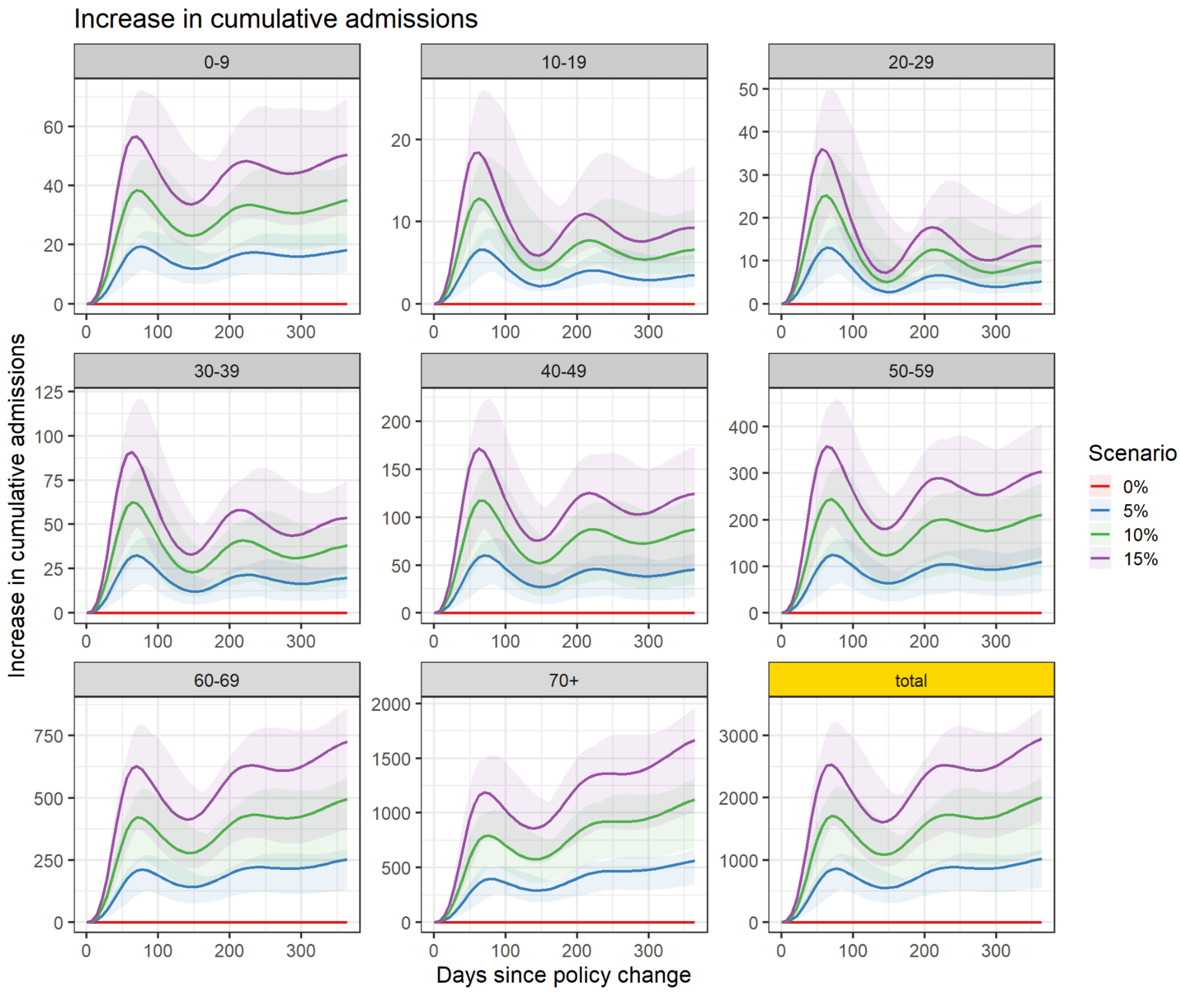

Figure S4. Model results for the change in cumulative Covid-19 hospital admissions following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

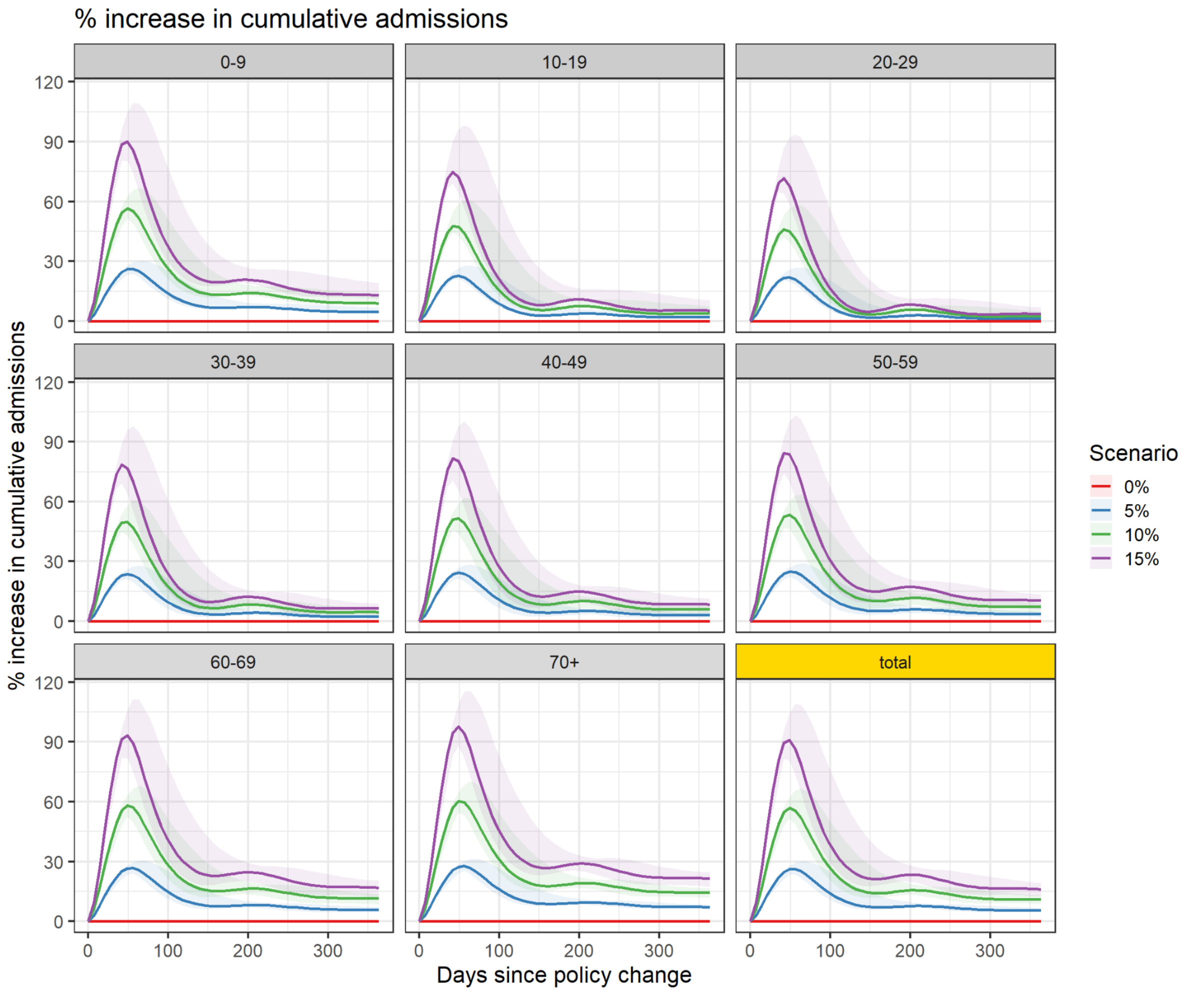

Figure S5. Model results for the percentage increase in cumulative Covid-19 hospital admissions following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

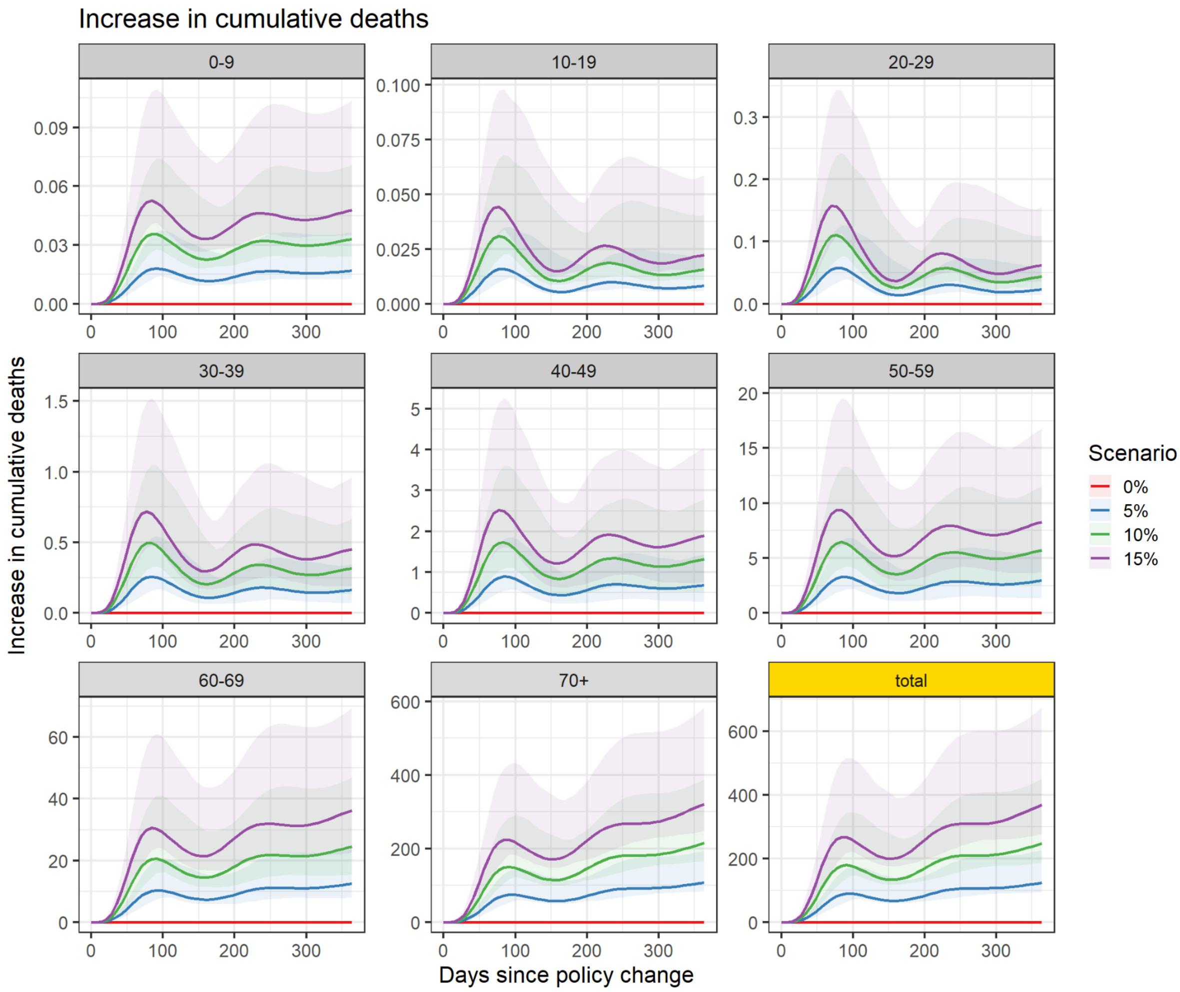

Figure S6. Model results for the change in cumulative Covid-19 deaths following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

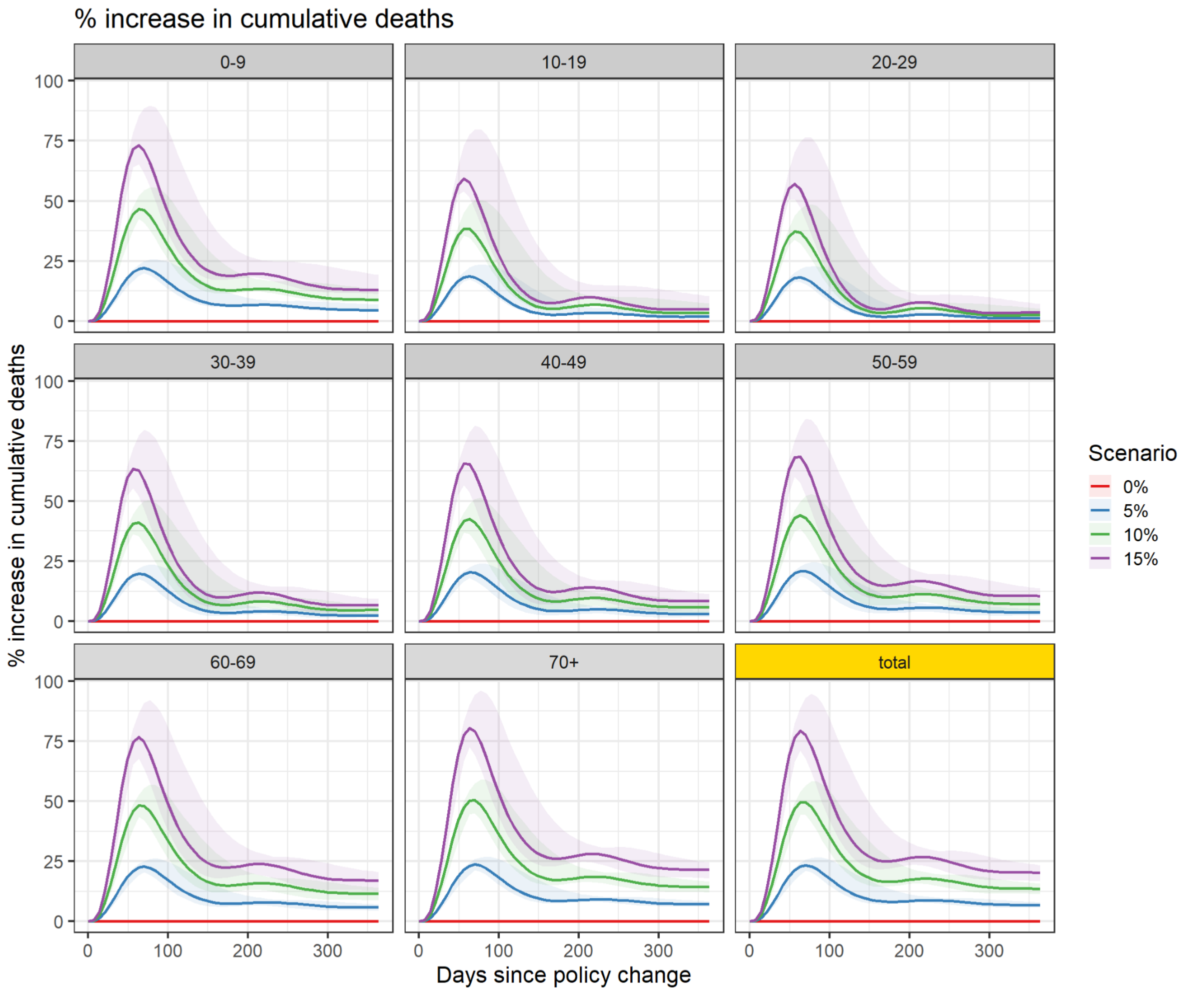

Figure S7. Model results for the percentage increase in cumulative Covid-19 deaths following an increase in transmission of 5% (blue), 10% (green), 15% (purple) compared to the baseline model. Results are shown split into 10-year age bands, and aggregated across all ages (bottom right graph). Solid curves show the difference in best-fit model trajectory with and without the transmission increase, shaded bands contain the difference in trajectories with and without the transmission increase for 95% of accepted model realisations.

After 7 weeks (2 May 2023)

Infections

Scenario	Cumulative infections	Range	Increase	Increase range	% increase	% increase range
0%	312,000	129,000 - 379,000	-	-	-	-
5%	395,000	161,000 - 474,000	83,000	32,000 - 95,000	26.7	24.9 - 29
10%	490,000	202,000 - 579,000	179,000	73,000 - 200,000	57.3	52.1 - 65
15%	594,000	252,000 - 687,000	282,000	123,000 - 308,000	90.5	80.4 - 108.3

Covid-19 hospital admissions

Scenario	Cumulative admissions	Range	Increase	Increase range	% increase	% increase range
0%	1,900	800 - 2,500	-	-	-	-
5%	2,300	1,000 - 3,100	500	200 - 600	24.8	21.2 - 25.7
10%	2,900	1,300 - 3,800	1,000	400 - 1,300	54.8	48 - 57.1
15%	3,500	1,600 - 4,500	1,700	700 - 2,100	89.5	81.5 - 95.6

Covid-19 deaths

Scenario	Cumulative deaths	Range	Increase	Increase range	% increase	% increase range
0%	151	96 - 257	-	-	-	-
5%	174	108 - 297	23	12 - 40	15.2	11.6 - 15.9
10%	202	123 - 345	51	27 - 88	33.8	25.8 - 35.5
15%	236	141 - 402	85	45 - 145	56.1	43.1 - 58.9

After 26 weeks (19 September 2023)

Infections

Scenario	Cumulative infections	Range	Increase	Increase range	% increase	% increase range
0%	1,384,000	750,000 - 1,515,000	-	-	-	-
5%	1,465,000	816,000 - 1,602,000	81,000	59,000 - 88,000	5.9	5.3 - 8.8
10%	1,548,000	875,000 - 1,690,000	164,000	117,000 - 176,000	11.9	10.6 - 16.7
15%	1,631,000	930,000 - 1,777,000	247,000	174,000 - 264,000	17.9	16.1 - 24

Covid-19 hospital admissions

Scenario	Cumulative admissions	Range	Increase	Increase range	% increase	% increase range
0%	9,100	5,100 - 11,200	-	-	-	-
5%	9,800	5,500 - 12,000	700	400 - 800	7.4	6.4 - 10.9
10%	10,500	5,900 - 12,700	1,400	700 - 1,500	14.9	12.9 - 21
15%	11,200	6,300 - 13,500	2,100	1,100 - 2,300	22.7	19.6 - 30.7

Covid-19 deaths

Scenario	Cumulative deaths	Range	Increase	Increase range	% increase	% increase range
0%	891	630 - 1,534	-	-	-	-
5%	965	697 - 1,666	73	63 - 135	8.2	7.3 - 12.8
10%	1,039	760 - 1,797	148	124 - 269	16.6	14.8 - 24.9
15%	1,116	822 - 1,932	225	185 - 406	25.2	22.5 - 36.6

Peak hospital occupancy

Scenario	Maximum occupancy	Range	Increase	Increase range	% increase	% increase range

0%	435	234 - 562	-	-	-	-
5%	538	268 - 684	103	30 - 130	23.6	11.7 - 25.9
10%	668	331 - 839	233	95 - 287	53.5	36.7 - 56.9
15%	817	413 - 1015	382	179 - 463	87.7	69.8 - 92.1