

COVID-19 Results Briefing

China

December 15, 2022

This document contains summary information on the latest projections from the IHME model on COVID-19 in China. The model was run on December 15, 2022, with data through December 12, 2022.

Although reported cases in the last few days have declined in China, we expect a major Omicron epidemic to unfold in the coming months. Although there is a high rate of vaccination, comparatively low effectiveness of the vaccines used in China against Omicron and the long duration since vaccination for many individuals mean that 80% of the population is susceptible to Omicron infection. In our reference scenario, we expect 323,000 total deaths from COVID-19 by April 1. Even though infection would peak around April 1, we expect the number of susceptible individuals at that point to sustain ongoing transmission many months after April 1.

There is the perception in some circles in China that Omicron is mild and that the epidemic that will unfold as the zero-COVID strategy has been relaxed will not have a high death toll. The experience in Hong Kong, however, where 10,000 died in the first months of the Omicron wave, would suggest otherwise. Hong Kong is a good indicator of what is likely to unfold in China, with similar levels of vaccination with a comparatively poor vaccine and low levels of vaccination in the over-80 population, who are at the highest risk of death. Over 2022, the infection-fatality rate in Hong Kong was over 0.1% overall. With 80% of China susceptible, the death toll could arguably reach well over 1 million during 2023. Our reference scenario lowers the death toll by April 1 by the implementation of some social distancing mandates as the death rate in each province gets above a critical threshold. We have included a no-mandate scenario which suggests that without social distancing mandates the death toll could exceed 500,000 by April 1.

The large number of susceptible individuals in China implies that as the zero-COVID strategy is relaxed, there will inevitably be a massive wave of infection and huge numbers with severe disease in the elderly population. Hospitals will likely be overwhelmed, and the death toll, as noted, will be considerable. Strategies to greatly reduce the death toll have been available but not used: switching to the more effective mRNA vaccines and producing or acquiring Paxlovid to manage disease in the vulnerable populations. No major effort has been made to switch to these more effective interventions.

As the epidemic begins to take off in mid-January, according to our models, local governments will have to take measures to support hospitals as the number of individuals affected will be extraordinary. Use of social distancing mandates including mask mandates, gathering restrictions, and business restrictions can slow transmission and spread the burden on hospitals over the rest of the year. These restrictions, however, may not substantially change the outcome by the end of 2023 without improvements in vaccination or the use of effective antivirals.

By any account, the Chinese government faces extremely hard choices in the coming months balancing economic and schooling outcomes against the real prospect of substantial death, particularly in the over-80 population. Using vaccines and drugs developed outside of China could save many lives. It is unclear if China will take this course of action at this point.

Current situation

- Estimated daily infections in the last week decreased to 743,000 per day on average compared to 960,000 the week before (Figure 1.1).
- Daily reported cases in the last week decreased to 32,000 per day on average compared to 43,000 the week before (Figure 2.1).
- Estimated daily hospital census in the last week (through December 12) decreased to 39,000 per day on average compared to 44,000 the week before.
- Reported deaths due to COVID-19 in the last week increased to 93 per day on average compared to 18 the week before (Figure 3.1).
- Total deaths due to COVID-19 in the last week increased to 99 per day on average compared to 18 the week before (Figure 3.1). This makes COVID-19 the number 35 cause of death in China this week (Table 1). Estimated total daily deaths due to COVID-19 in the past week were 1.1 times larger than the reported number of deaths.
- The daily rate of reported deaths due to COVID-19 is greater than 4 per million in no locations (Figure 4.1).
- The daily rate of total deaths due to COVID-19 is greater than 4 per million in no locations (Figure 4.2).
- We estimate that 11% of people in China have been infected at least once as of December 12 (Figure 6.1). Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in five locations (Figure 7.1).
- The infection-detection rate in China was close to 6% on December 12 (Figure 8.1).
- Based on the GISAID and various national databases, combined with our variant spread model, we estimate the current prevalence of variants of concern (Figures 9.1-9.6). The dominant variant is either BA.1/2 or the BA.5 Omicron subvariant.

Trends in drivers of transmission

- Based on self-reported mask use data collected in the COVID-19 Trends and Impact Survey, an estimated 59% of people are projected to always wear a mask when leaving their home. Mask use after September 28, 2020, is a statistical forecast.
- As of December 12, 33 locations have reached 70% or more of the population who have received at least one vaccine dose, and 32 locations have reached 70% or more of the population who are fully vaccinated (Figures 12.1 and 12.2). 93% of people in China have received at least one vaccine dose, and 87% are fully vaccinated.

- In our current reference scenario, we expect that 1.3 billion people will be vaccinated with at least one dose by April 1 (Figure 14.1). We expect that 87% of the population will be fully vaccinated by April 1.

Projections and scenarios

We produce four scenarios when projecting COVID-19. The **reference scenario** is our forecast of what we think is most likely to happen:

- Vaccines are distributed at the expected pace. Brand- and variant-specific vaccine efficacy is updated using the latest available information from peer-reviewed publications and other reports.
- Future mask use will decline to 50% of the minimum level it reached between January 1, 2021, and May 1, 2022. This decline begins after the last observed data point in each location and transitions linearly to the minimum over a period of six weeks.
- Mobility increases as vaccine coverage increases.
- Mandates will be reimposed at the maximum level of mandates in the post-ancestral period once the death rate has reached an algorithmic minimum threshold of daily reported deaths for a given location.
- 80% of those who are fully vaccinated (two doses for most vaccines, or one dose for Johnson & Johnson) receive an additional dose six months after becoming fully vaccinated, and 80% of those who receive an additional dose receive a second additional dose six months later.
- Antiviral utilization for COVID-19 risk prevention has reached 80% in high-risk populations and 50% in low-risk populations between March 1, 2022, and June 1, 2022. This applies in high-income countries, but not low- and middle-income countries, and this rollout assumption follows a similar pattern to global vaccine rollouts.

The **80% mask use scenario** makes all the same assumptions as the reference scenario but assumes all locations reach 80% mask use within seven days. If a location currently has higher than 80% use, mask use remains at the current level.

The **antiviral access scenario** makes all the same assumptions as the reference scenario but assumes globally distributed antivirals and extends coverage to all low- and middle-income countries between August 15, 2022, and September 15, 2022.

The **no mandate reimposition** scenario makes all the same assumptions as the reference scenario but assumes mandates are never reimposed regardless of the reported death rate.

Infections

- Daily estimated infections in the **reference scenario** will rise to 2.9 million by mid-March 2023 (Figure 16.1).
- Daily estimated infections in the **80% mask use scenario** will rise to 2.2 million by mid-March 2023 (Figure 16.1).

- Daily estimated infections in the **antiviral access scenario** will rise to 2.9 million by mid-March 2023 (Figure 16.1).
- Daily estimated infections in the **no mandate reimposition scenario** will rise to 4.6 million by March 1, 2023 (Figure 16.1).

Cases

- Daily estimated cases in the **reference scenario** will rise to 362,000 by April 1, 2023 (Figure 16.2).
- Daily estimated cases in the **80% mask use scenario** will rise to 243,000 by April 1, 2023 (Figure 16.2).
- Daily estimated cases in the **antiviral access scenario** will rise to 374,000 by April 1, 2023 (Figure 16.2).
- Daily estimated cases in the **no mandate reimposition scenario** will rise to 859,000 by April 1, 2023 (Figure 16.2).

Hospitalizations

- Daily hospital census in the **reference scenario** will rise to 96,740 by April 1, 2023 (Figure 16.3).
- Daily hospital census in the **80% mask use scenario** will rise to 71,450 by April 1, 2023 (Figure 16.3).
- Daily hospital census in the **antiviral access scenario** will rise to 81,890 by April 1, 2023 (Figure 16.3).
- Daily hospital census in the **no mandate reimposition scenario** will rise to 157,900 by March 20, 2023 (Figure 16.3).

Deaths

- In our **reference scenario**, our model projects 293,000 cumulative reported deaths due to COVID-19 on April 1. This represents 275,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **reference scenario** will rise to 5,060 by April 1, 2023 (Figure 16.4).
- Under our **reference scenario**, our model projects 323,000 cumulative total deaths due to COVID-19 on April 1. This represents 300,000 additional deaths from December 12 to April 1 (Figure 16.5).
- In our **80% mask use scenario**, our model projects 225,000 cumulative reported deaths due to COVID-19 on April 1. This represents 208,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **80% mask use scenario** will rise to 3,620 by April 1, 2023 (Figure 16.4).

- In our **antiviral access scenario**, our model projects 250,000 cumulative reported deaths due to COVID-19 on April 1. This represents 232,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **antiviral access scenario** will rise to 4,120 by April 1, 2023 (Figure 16.4).
- In our **no mandate reimposition scenario**, our model projects 502,000 cumulative reported deaths due to COVID-19 on April 1. This represents 485,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **no mandate reimposition scenario** will rise to 8,860 by March 29, 2023 (Figure 16.4).
- Figure 17.1 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.

Model updates

We have updated our reference scenario to assume that mandates will be re-imposed at the maximum level of mandates in the post-ancestral period once the death rate has reached an algorithmic minimum threshold of daily reported deaths for a given location. We have added a “no mandates scenario” to the China model only that makes all the same assumptions as the reference scenario but assumes mandates are never re-imposed regardless of the reported death rate.

For the foreseeable future, we will not be updating our model or producing COVID-19 estimates. These will be the final briefing documents we produce until further notice.

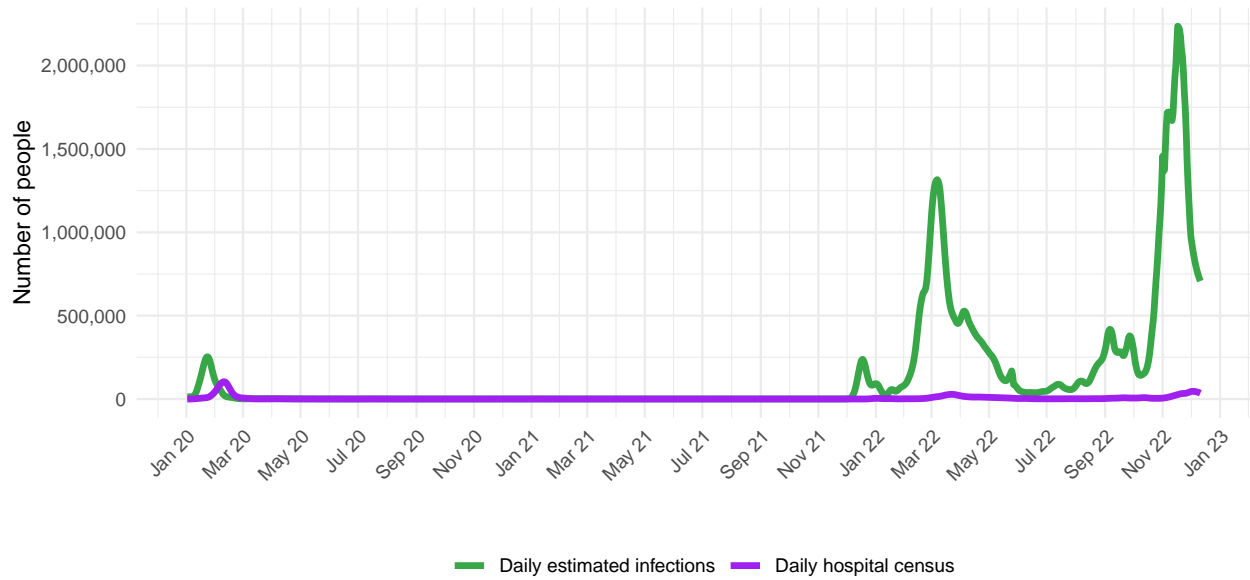
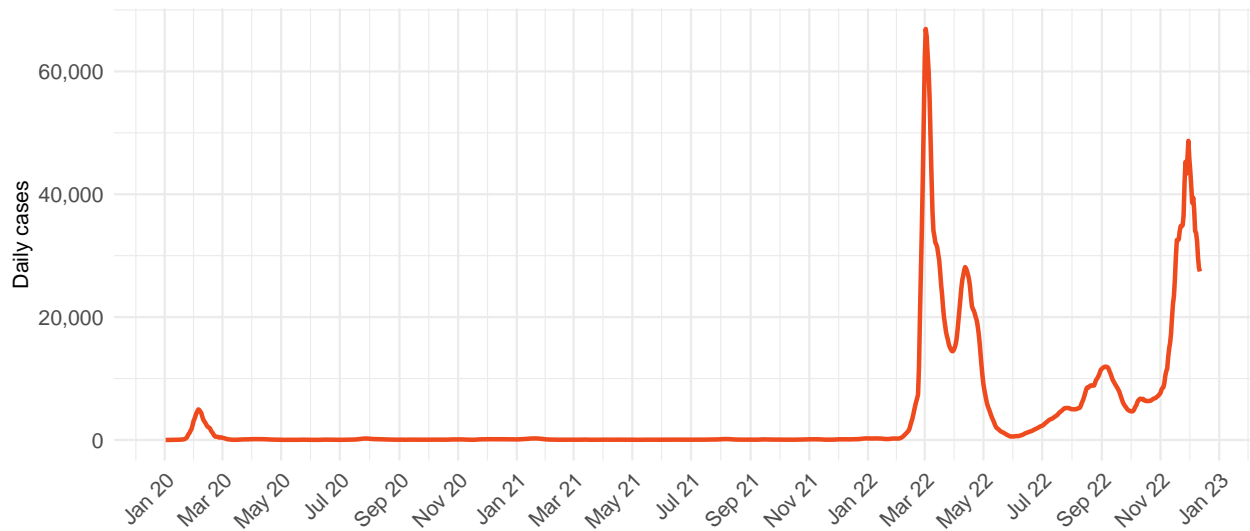
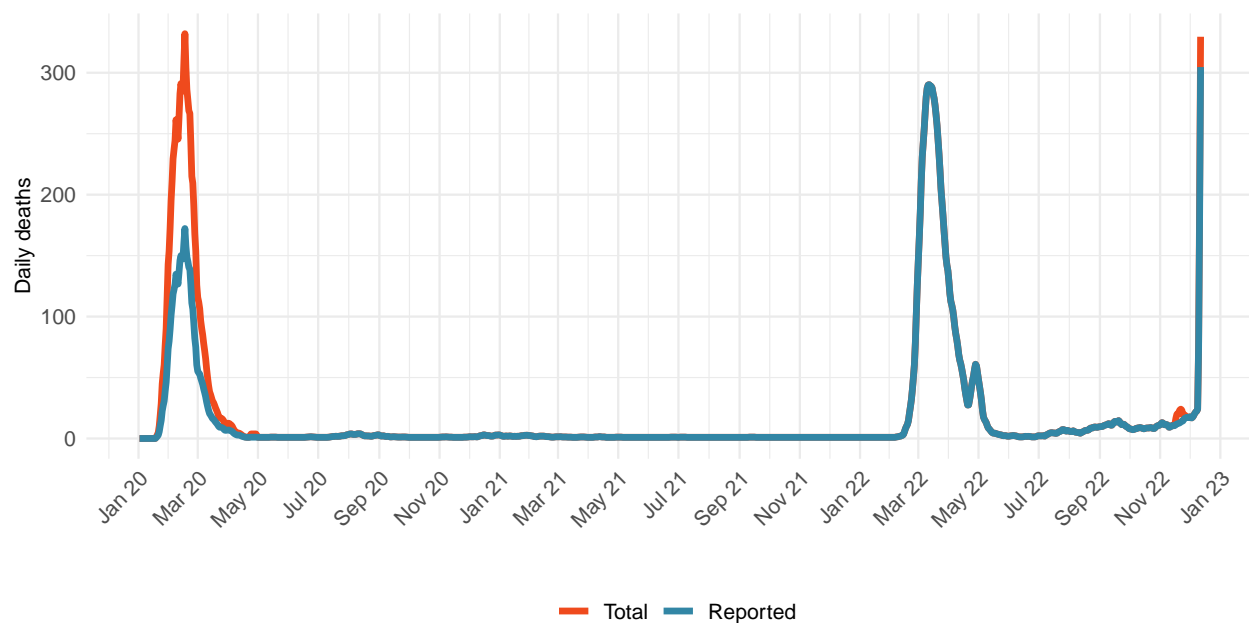
Figure 1.1: Daily COVID-19 hospital census and estimated infections**Figure 2.1: Reported daily COVID-19 cases, moving average**

Table 1: Ranking of total deaths due to COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Stroke	42,100	1
Ischemic heart disease	36,039	2
Chronic obstructive pulmonary disease	19,951	3
Tracheal, bronchus, and lung cancer	14,561	4
Stomach cancer	8,107	5
Alzheimer’s disease and other dementias	6,168	6
Hypertensive heart disease	6,156	7
Colon and rectum cancer	5,034	8
Esophageal cancer	4,948	9
Road injuries	4,808	10
COVID-19	692	35

Figure 3.1: Smoothed trend estimate of daily COVID-19 deaths



Daily COVID-19 death rate per 1 million on December 12, 2022

Figure 4.1: Daily reported COVID-19 death rate per 1 million

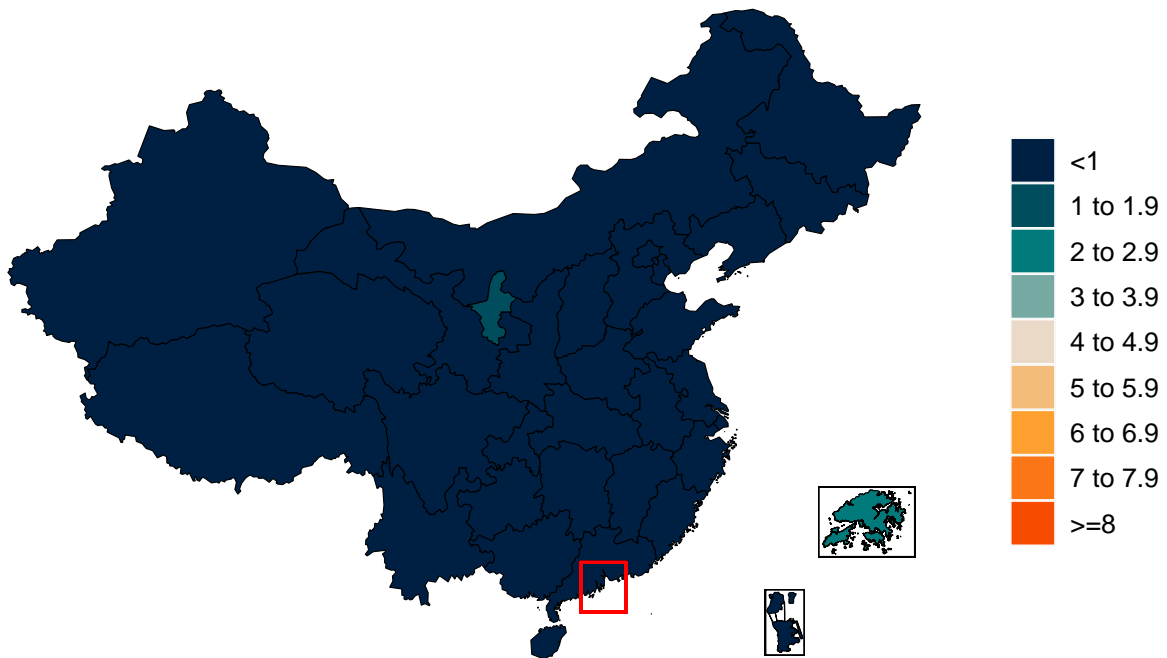
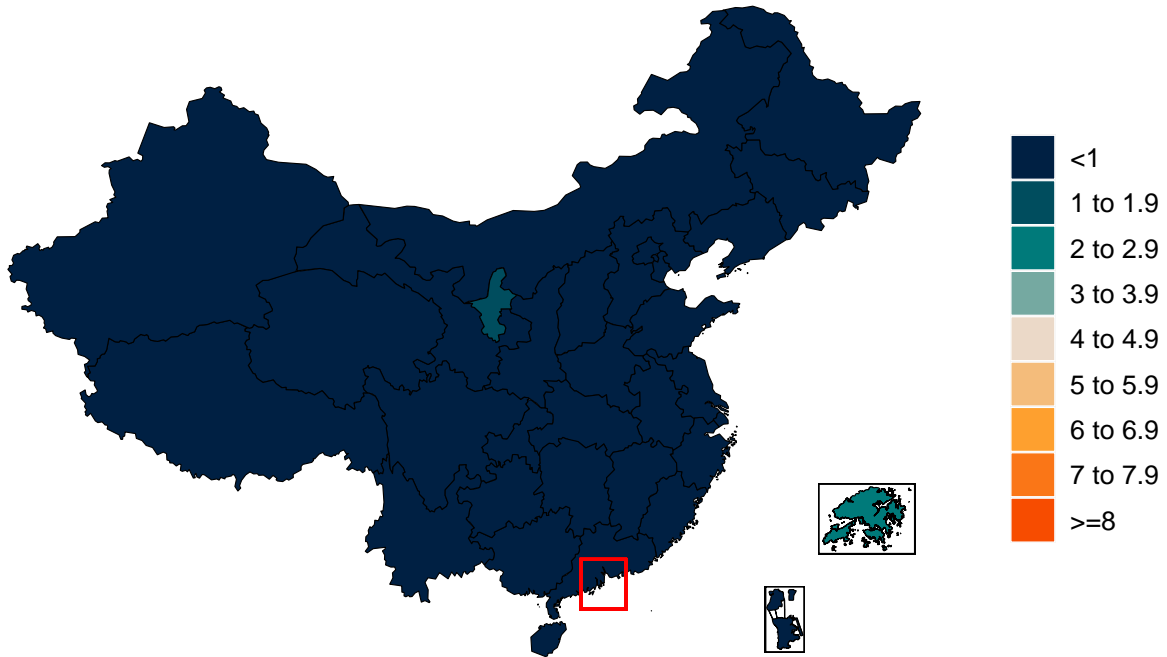


Figure 4.2: Daily total COVID-19 death rate per 1 million



Cumulative COVID-19 deaths per 100,000 on December 12, 2022

Figure 5.1: Reported cumulative COVID-19 deaths per 100,000

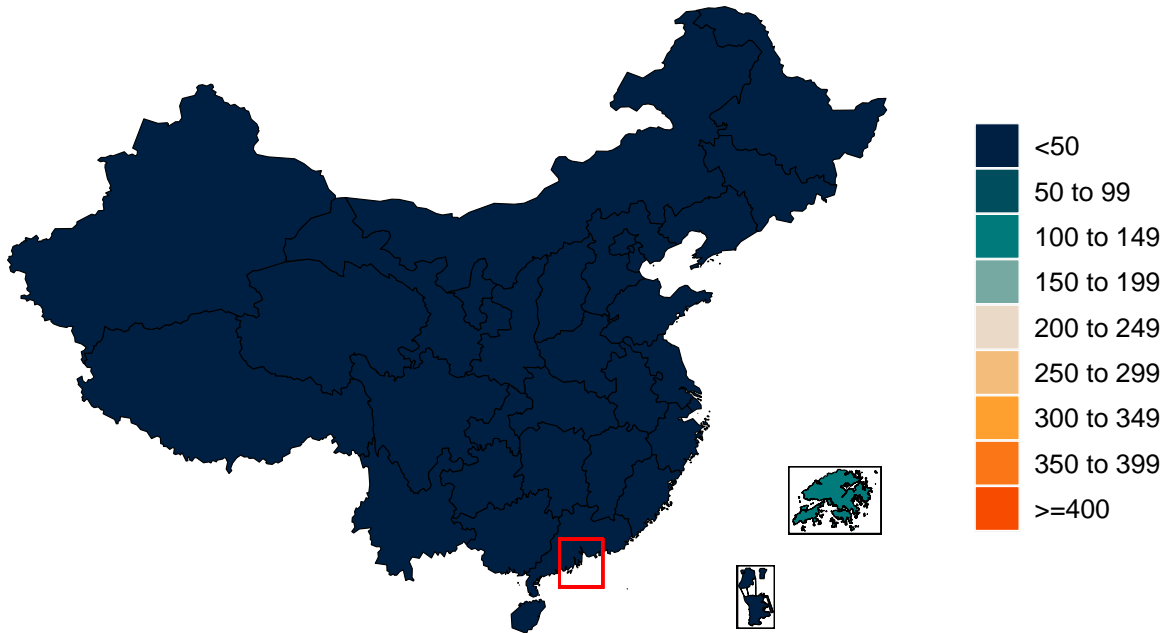


Figure 5.2: Total cumulative COVID-19 deaths per 100,000

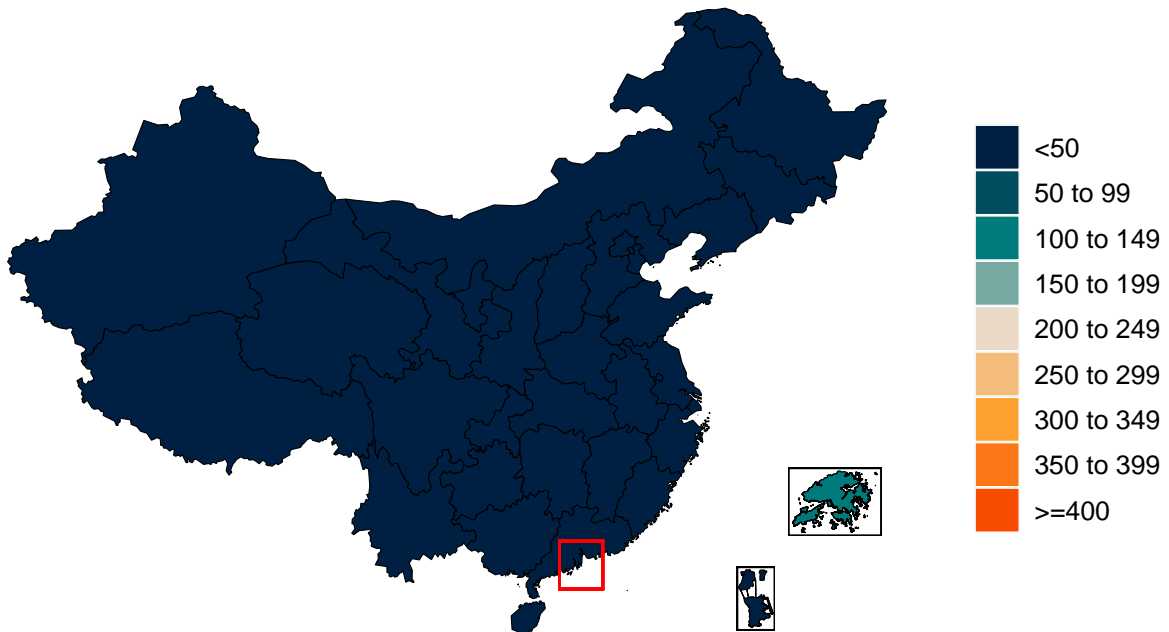


Figure 6.1: Estimated percent of the population infected with COVID-19 on December 12, 2022

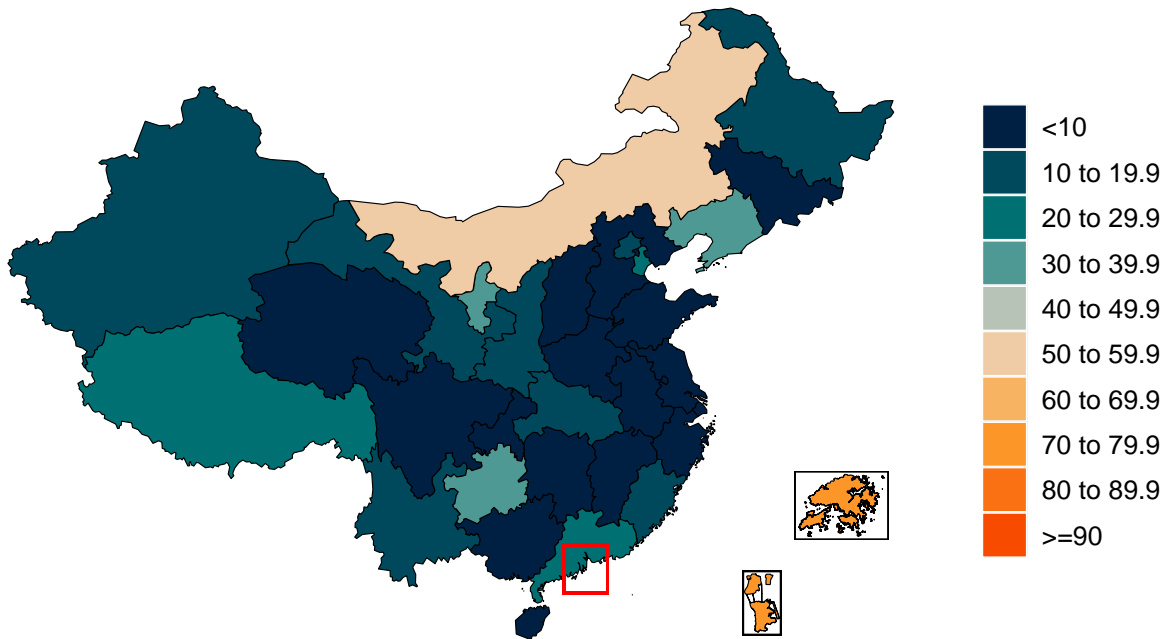


Figure 7.1: Mean effective R on December 1, 2022. Effective R less than 1 means that transmission should decline, all other things being held the same. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past.

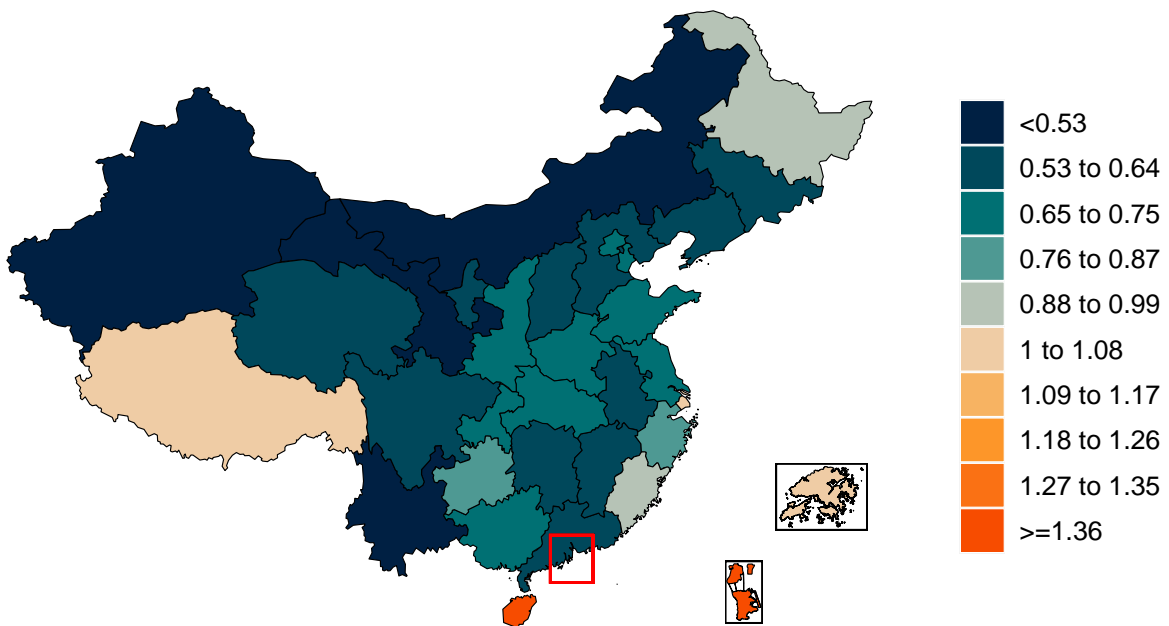
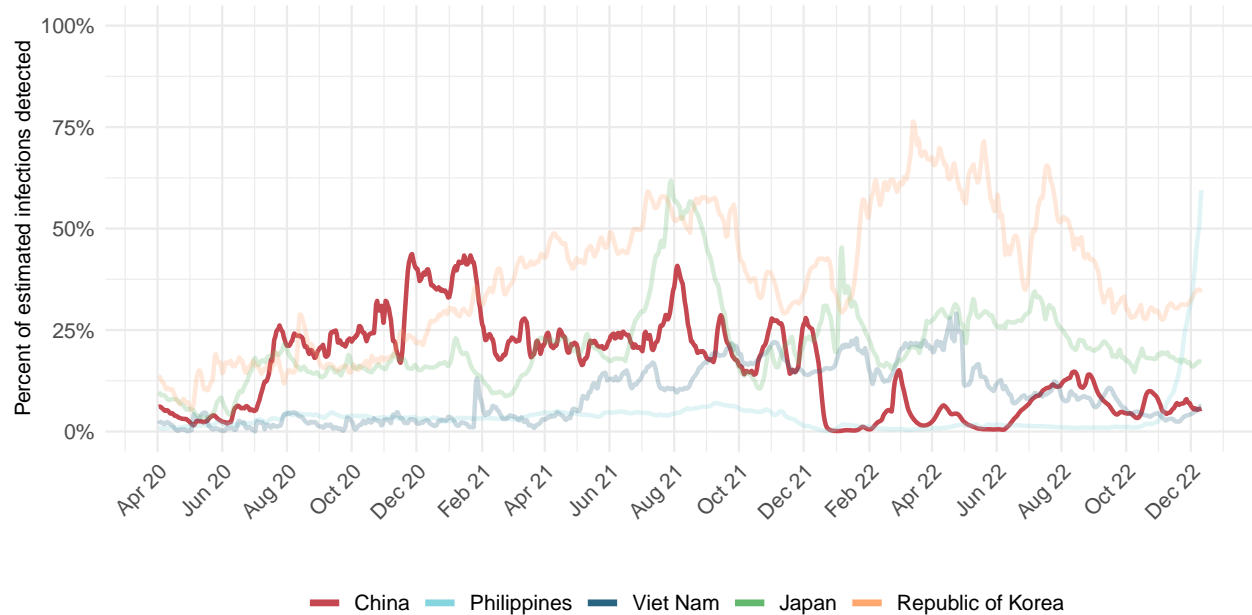


Figure 8.1: Percent of estimated COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model. Due to measurement errors in cases and testing rates, the infection-detection rate can exceed 100% at particular points in time.



Estimated percent of circulating SARS-CoV-2 for primary variant families on December 12, 2022

Figure 9.1: Estimated percent of new infections that are Alpha variant



Figure 9.2: Estimated percent of new infections that are Beta variant

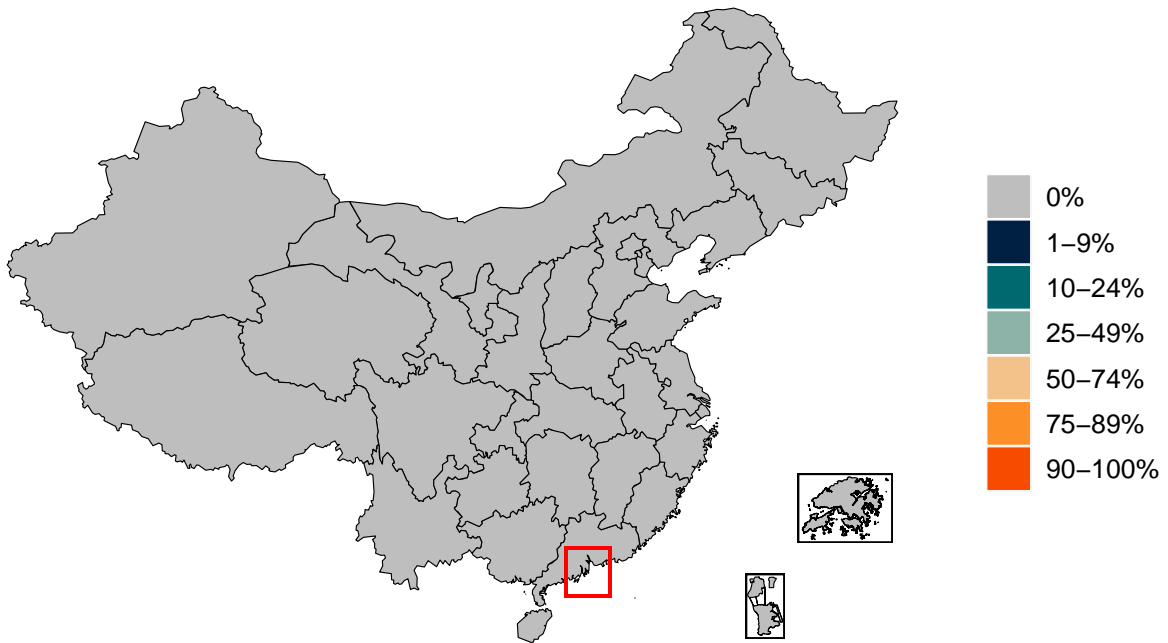


Figure 9.3: Estimated percent of new infections that are Delta variant

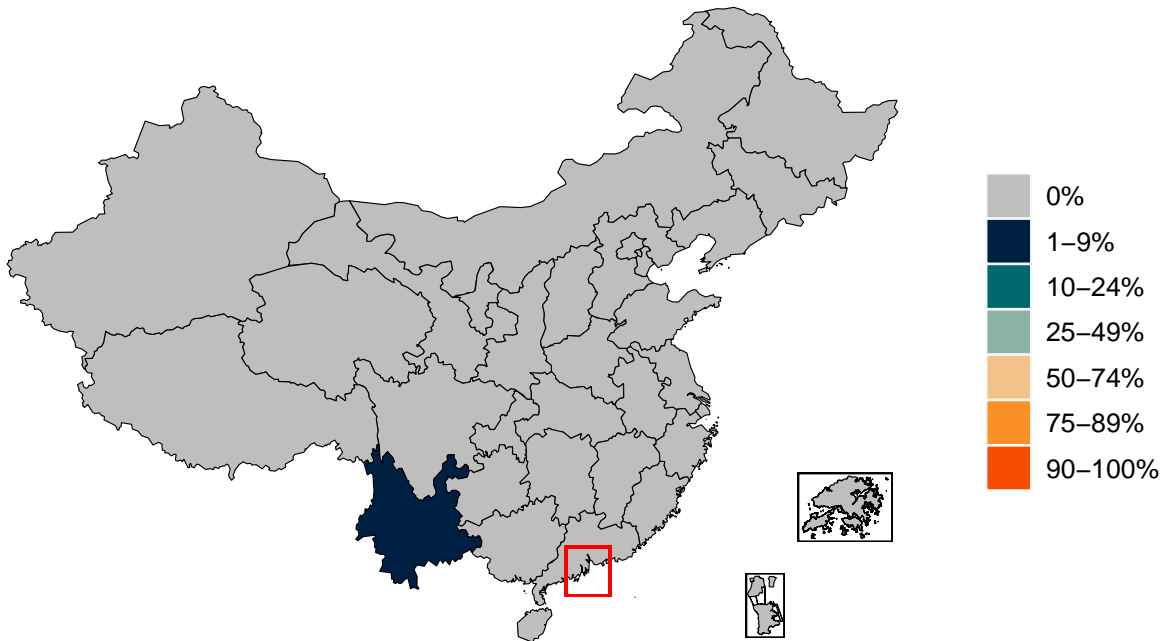


Figure 9.4: Estimated percent of new infections that are Gamma variant

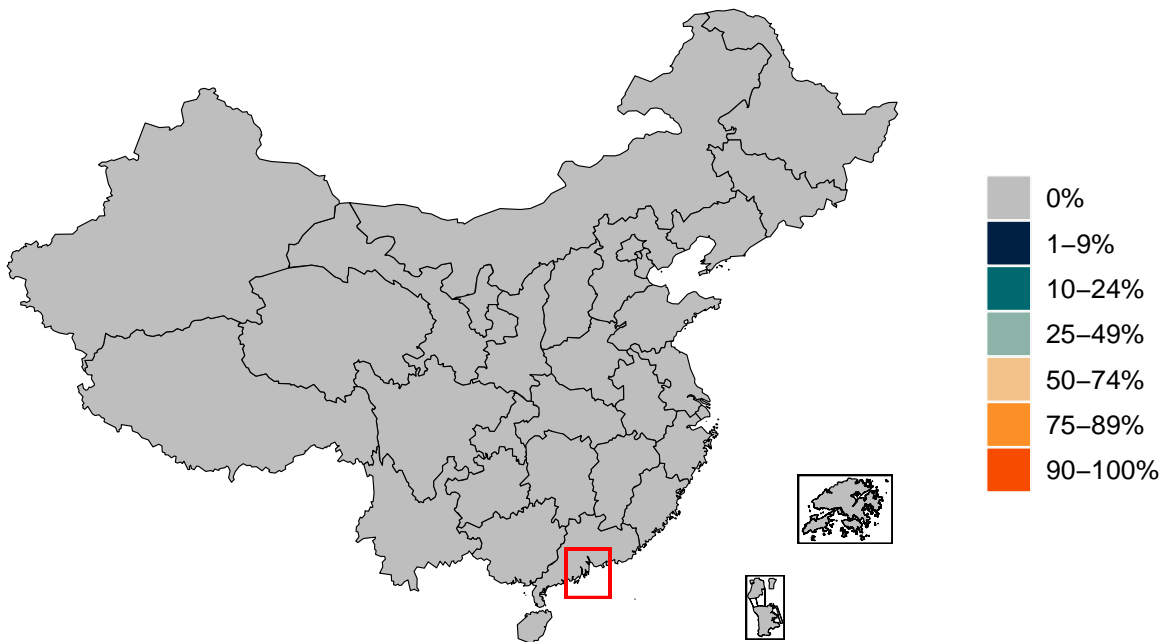


Figure 9.5: Estimated percent of new infections that are BA.1/BA.2 variant

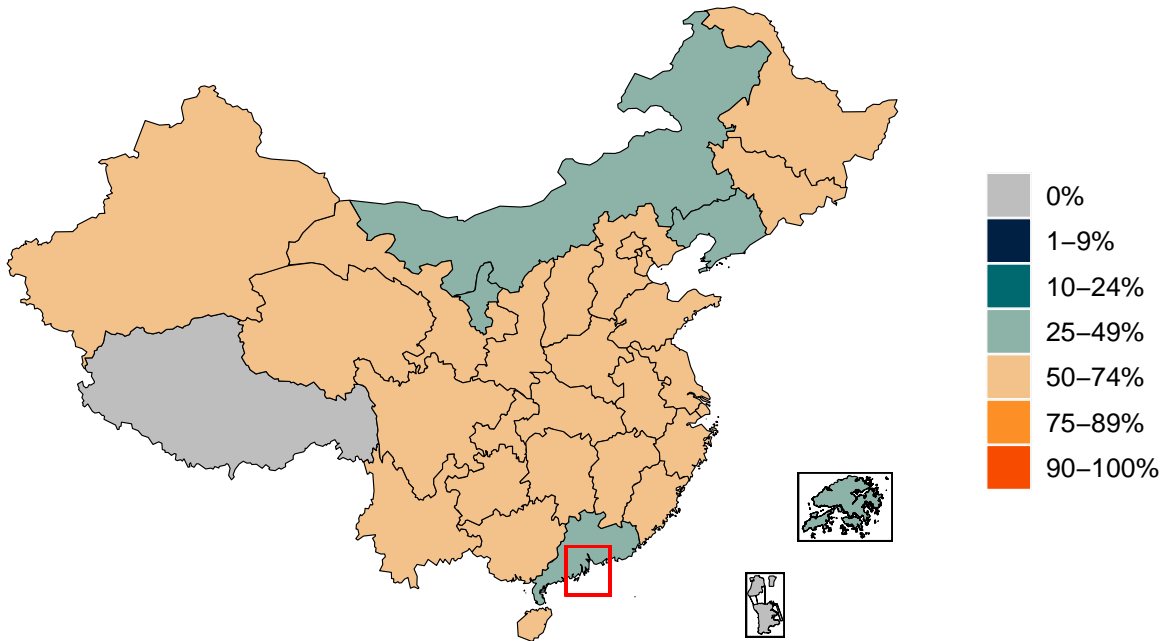


Figure 9.6: Estimated percent of new infections that are BA.5 variant

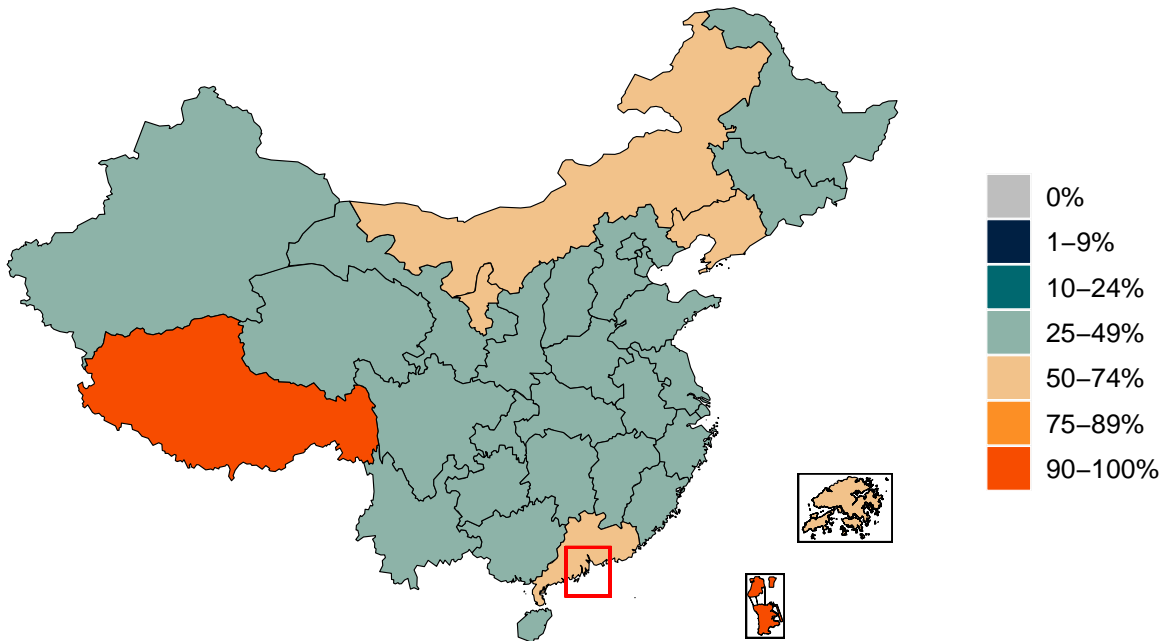


Figure 10.1: Infection-fatality rate on December 12, 2022. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.



Critical drivers

Table 2: Current mandate implementation

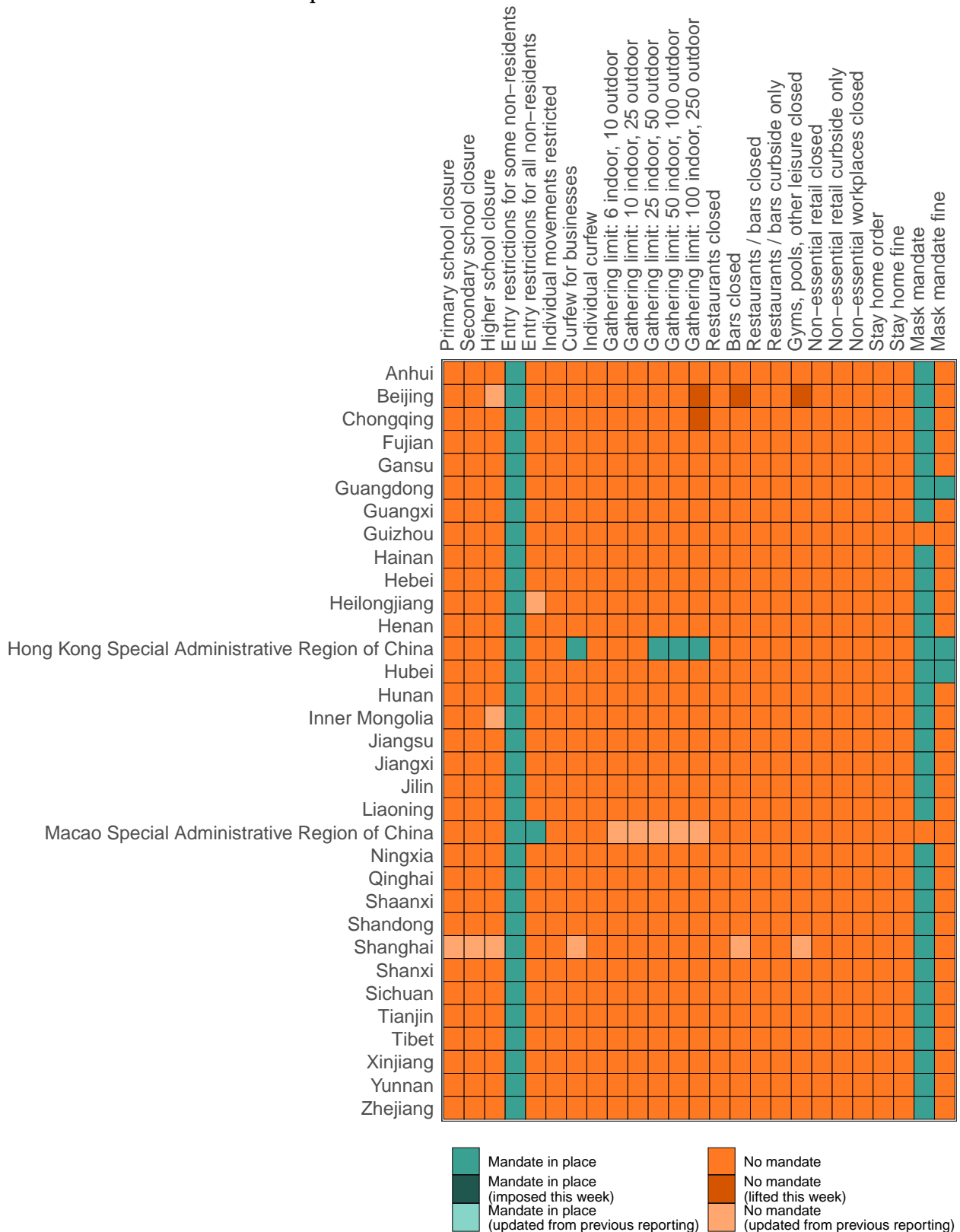


Figure 11.1: Trend in the proportion of the population reporting always wearing a mask when leaving home

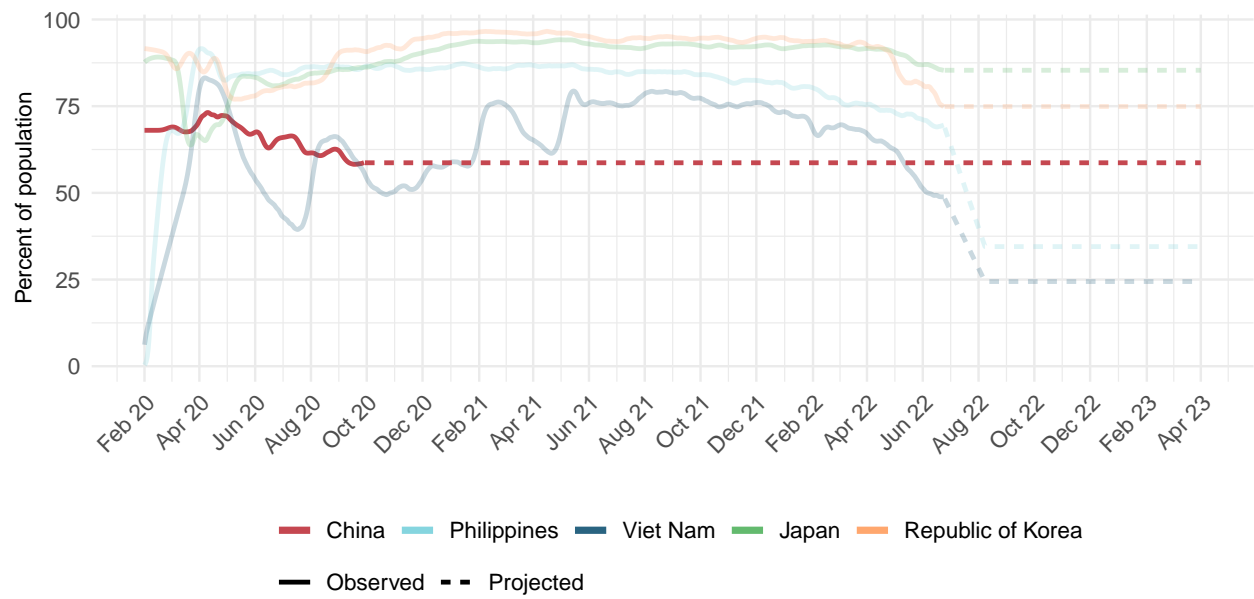


Table 3: Estimates of vaccine effectiveness for specific vaccines used in the model at preventing severe disease and infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our [website](#).

Vaccine	Effectiveness at preventing													
	Ancestral		Alpha		Beta		Gamma		Delta		BA.1/BA.2		BA.5	
	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection
AstraZeneca	94%	63%	94%	63%	94%	69%	94%	69%	94%	69%	71%	36%	71%	36%
CanSino	66%	62%	66%	62%	64%	61%	64%	61%	64%	61%	48%	32%	48%	32%
CoronaVac	50%	47%	50%	47%	49%	46%	49%	46%	49%	46%	37%	24%	37%	24%
Covaxin	78%	73%	78%	73%	76%	72%	76%	72%	76%	72%	57%	38%	57%	38%
Johnson & Johnson	86%	72%	86%	72%	76%	64%	76%	64%	76%	64%	57%	33%	57%	33%
Moderna	97%	92%	97%	92%	97%	91%	97%	91%	97%	91%	73%	48%	73%	48%
Novavax	89%	83%	89%	83%	86%	82%	86%	82%	86%	82%	65%	43%	65%	43%
Pfizer/BioNTech	95%	86%	95%	86%	95%	84%	95%	84%	95%	84%	72%	44%	72%	44%
Sinopharm	73%	68%	73%	68%	71%	67%	71%	67%	71%	67%	53%	35%	53%	35%
Sputnik-V	92%	86%	92%	86%	89%	85%	89%	85%	89%	85%	67%	44%	67%	44%
Other vaccines	75%	70%	75%	70%	73%	69%	73%	69%	73%	69%	55%	36%	55%	36%
Other vaccines (mRNA)	91%	86%	91%	86%	88%	85%	88%	85%	88%	85%	67%	45%	67%	45%

Percent of the population having received at least one dose (12.1) and fully vaccinated against SARS-CoV-2 (12.2) by December 12, 2022

Figure 12.1: Percent of the population having received one dose of a COVID-19 vaccine

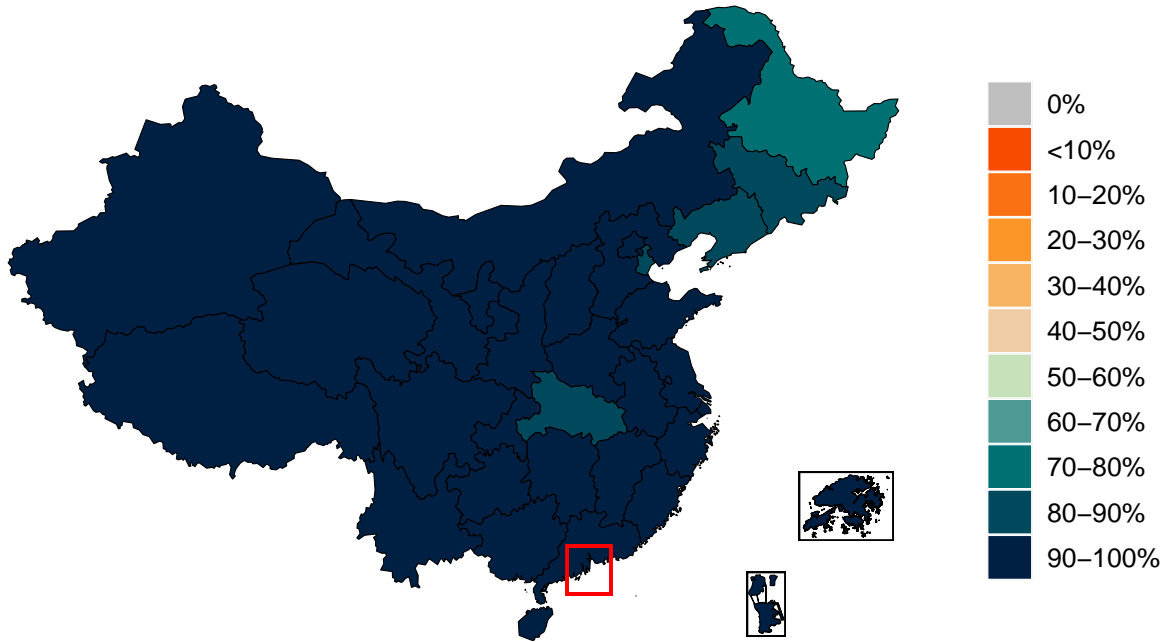


Figure 12.2: Percent of the population fully vaccinated against SARS-CoV-2

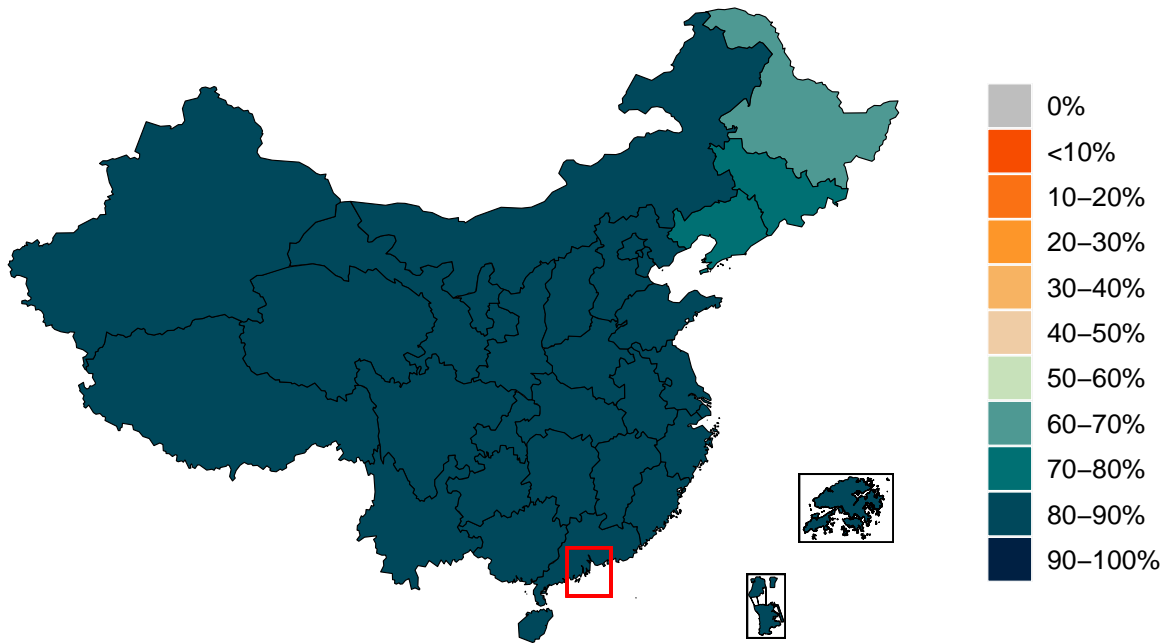


Figure 13.1: Estimated proportion of the total population that is not vaccinated but willing to be vaccinated as of June 24, 2022

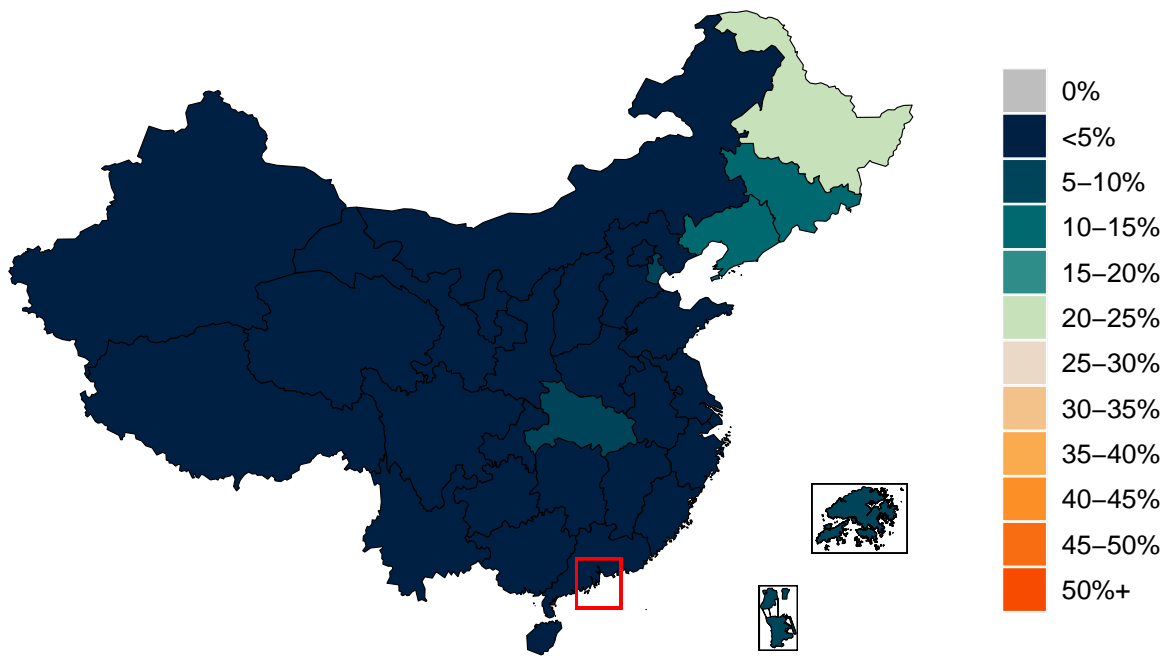


Figure 14.1: Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated

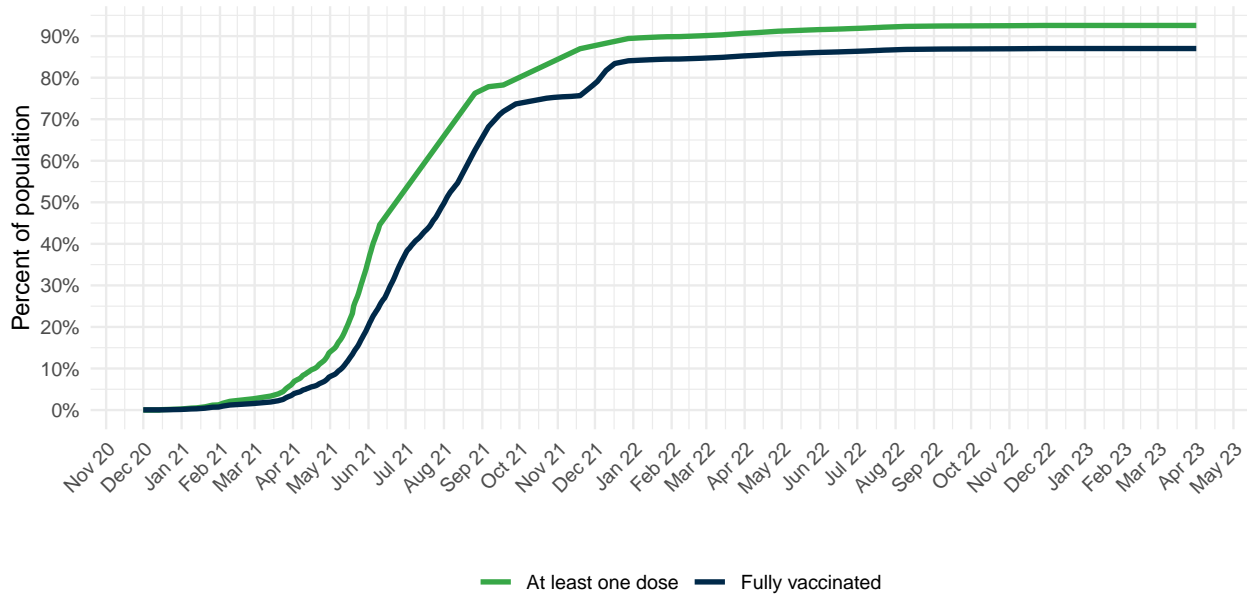
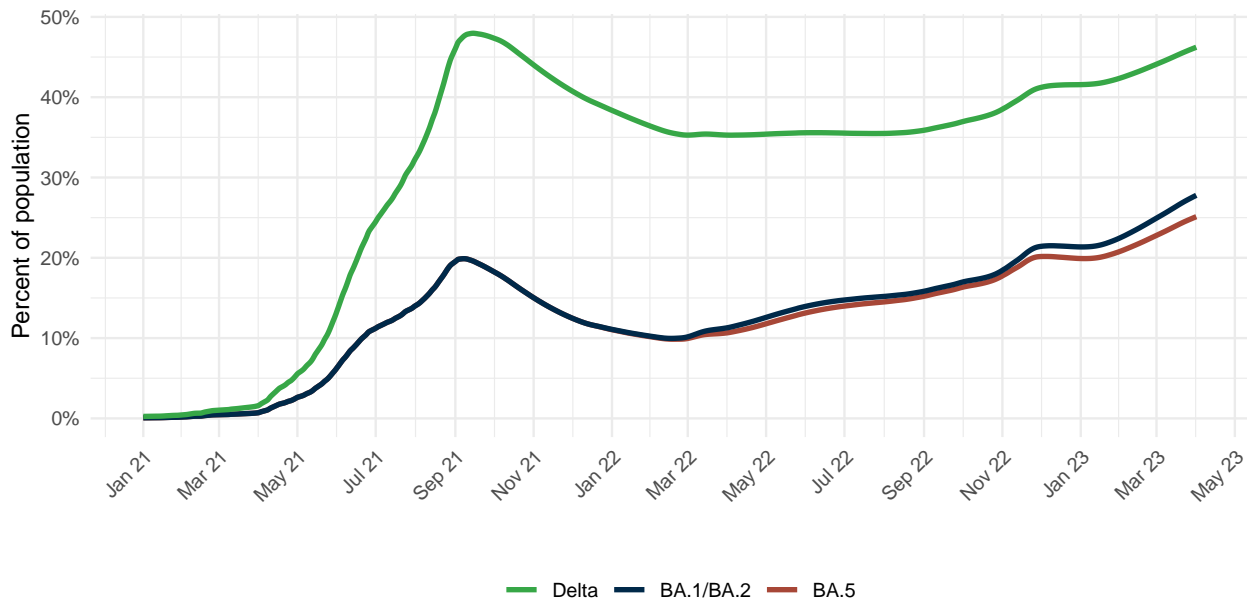


Figure 15.1: Percent of people who are immune to Delta, BA.1/BA.2 or BA.5. Immunity is based on protection due to prior vaccination and infection(s). Moreover, variant-specific immunity is also based on variant-variant specific protection.



Projections and scenarios

Figure 16.1: Daily COVID-19 infections until April 01, 2023 for four scenarios

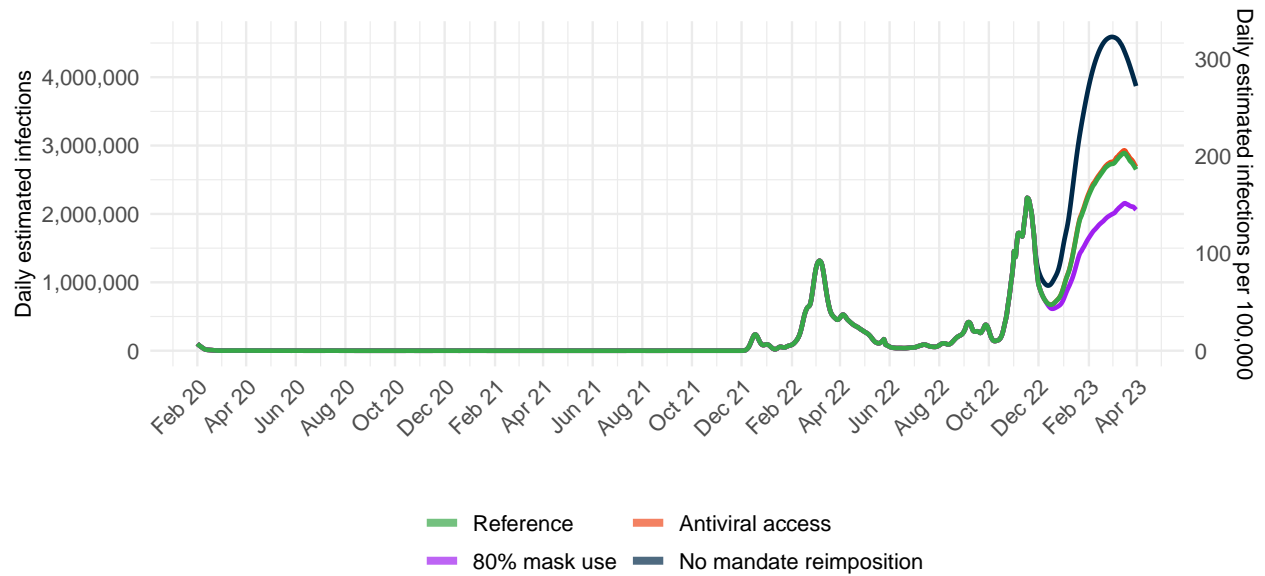


Figure 16.2: Daily COVID-19 reported cases until April 01, 2023 for four scenarios

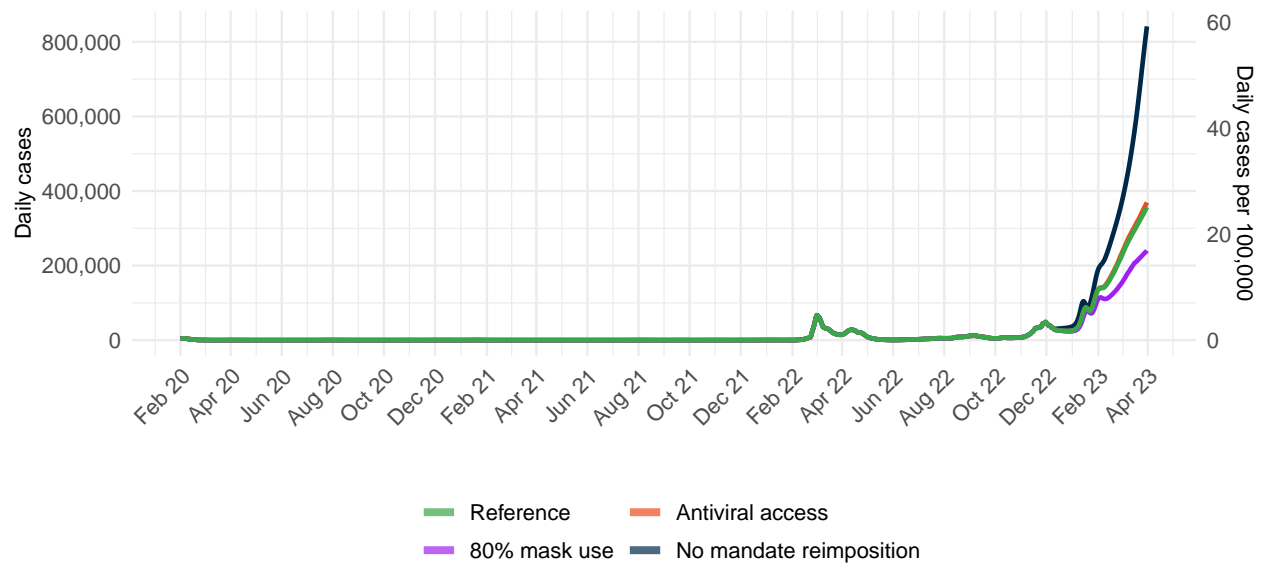


Figure 16.3: Daily COVID-19 hospital census until April 01, 2023 for four scenarios

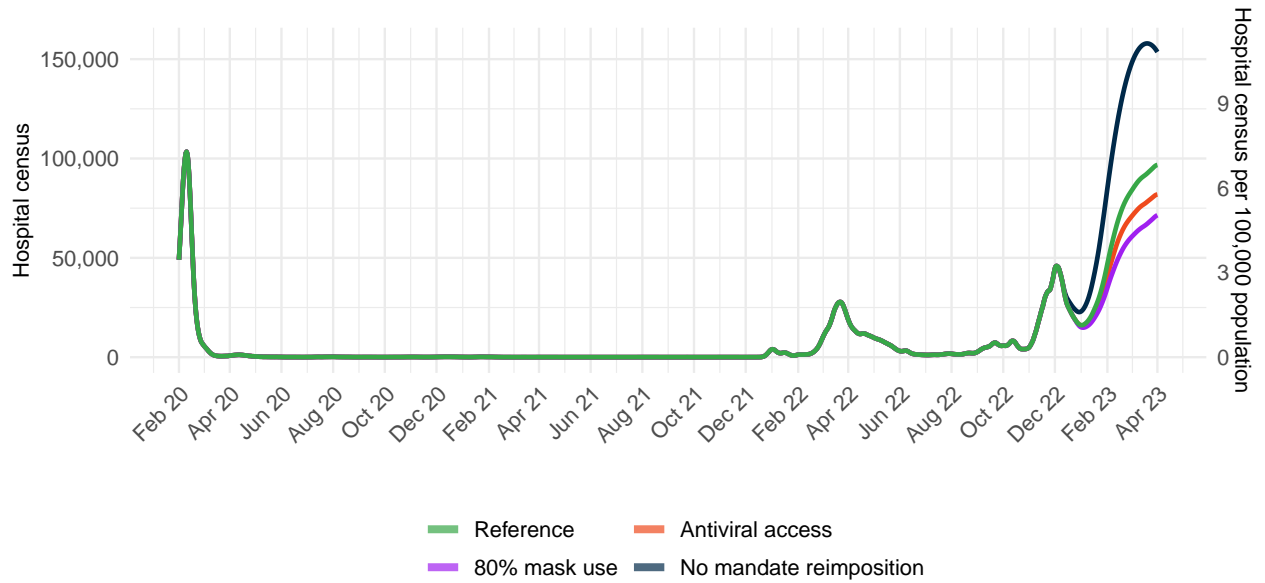


Figure 16.4: Reported daily COVID-19 deaths per 100,000

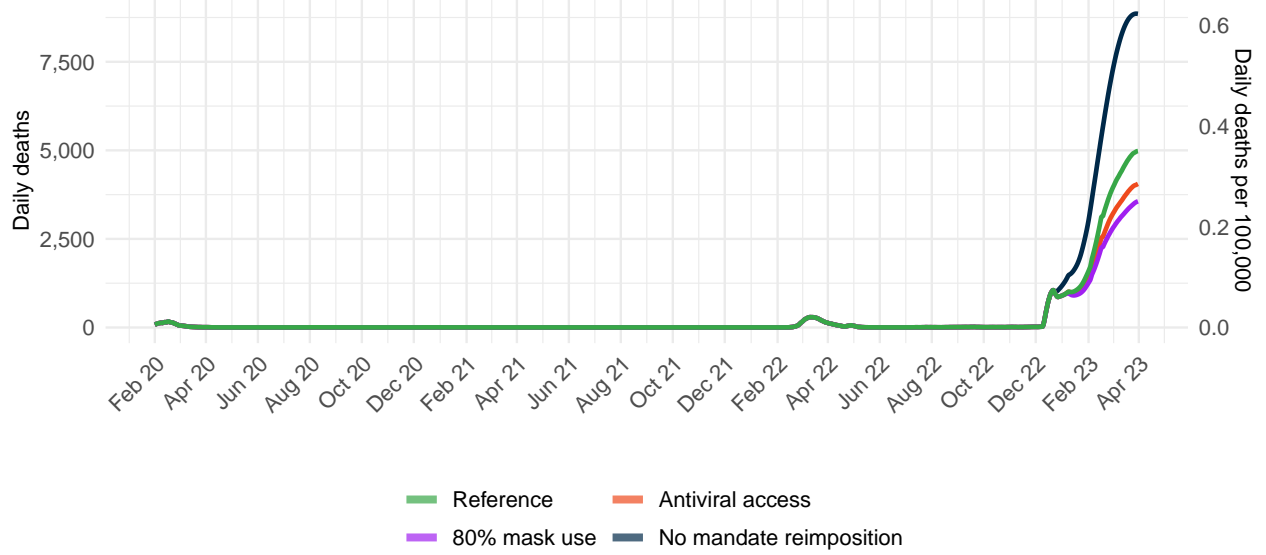


Figure 16.5: Total daily COVID-19 deaths per 100,000

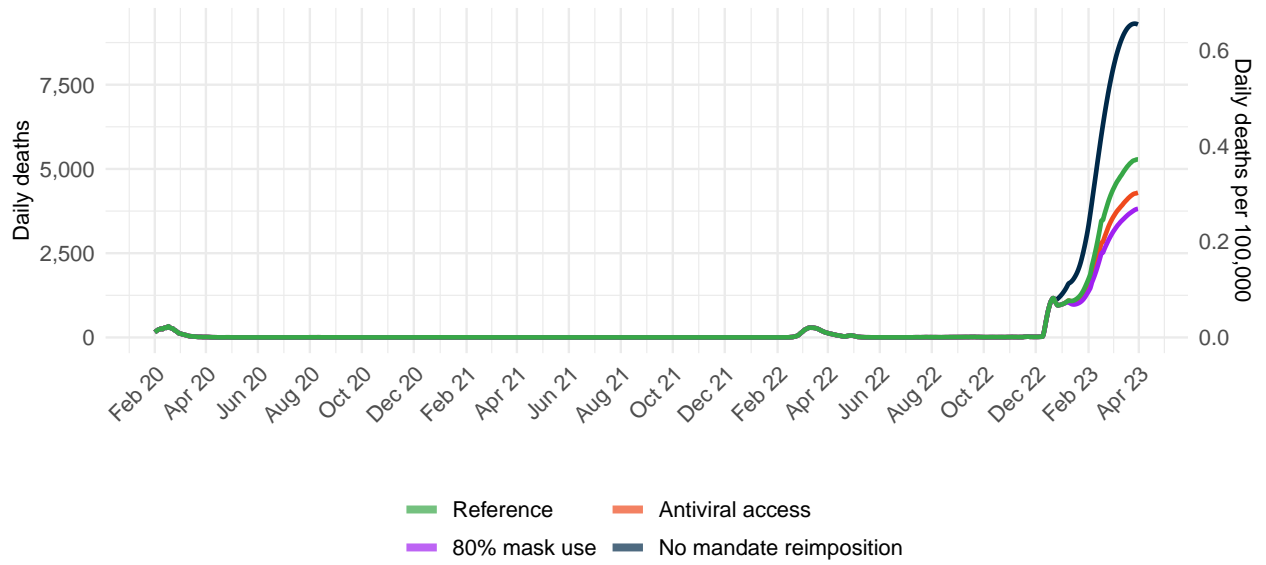
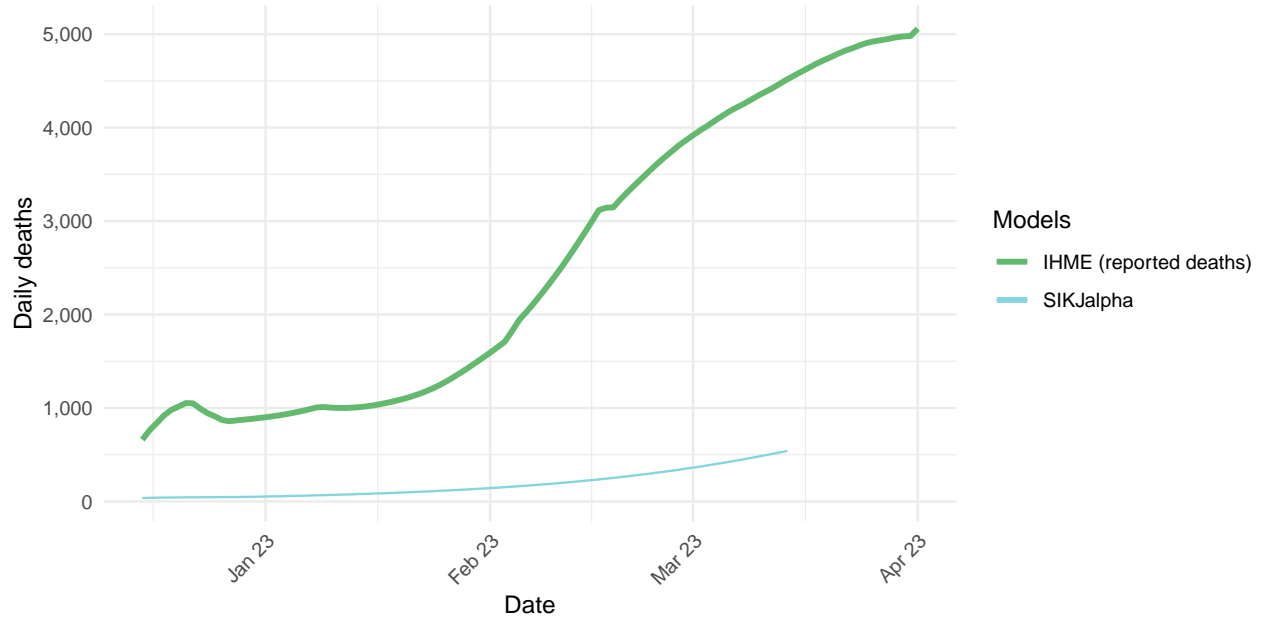


Figure 17.1: Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available, last model update in brackets: the SI-KJalpha model from the University of Southern California ([SIKJalpha](#)) [December 5, 2022]. Regional values are aggregates from available locations in that region.



More information

Data sources:

Mask use and vaccine confidence data are from the [The Delphi Group at Carnegie Mellon University and University of Maryland COVID-19 Trends and Impact Surveys](#), in partnership with Facebook. Mask use data are also from [Premise](#), the Kaiser Family Foundation, and the [YouGov COVID-19 Behaviour Tracker](#) survey.

Genetic sequence and metadata are primarily from the GISAID Initiative. Further details available on the COVID-19 model [FAQ page](#).

A note of thanks:

We wish to warmly acknowledge the support of [these](#) and others who have made our COVID-19 estimation efforts possible.

More information:

For all COVID-19 resources at IHME, visit <http://www.healthdata.org/covid>.

To download our most recent results, visit our [Data downloads page](#).

Questions? Requests? Feedback? Please contact us at <https://www.healthdata.org/covid/contact-us>.