

COVID-19 Results Briefing

Puerto Rico

December 15, 2022

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

Current situation

- Daily infections in the last week increased to 29,000 per day on average compared to 24,000 the week before (Figure 1.1).
- Daily reported cases in the last week increased to 1,500 per day on average compared to 1,400 the week before (Figure 2.1).
- Daily hospital census in the last week (through December 12) increased to 330 per day on average compared to 260 the week before.
- Reported deaths due to COVID-19 in the last week increased to seven per day on average compared to six the week before (Figure 3.1).
- Total deaths due to COVID-19 in the last week increased to 12 per day on average compared to 10 the week before (Figure 3.1). This makes COVID-19 the number two cause of death in Puerto Rico this week (Table 1). Estimated total daily deaths due to COVID-19 in the past week were 1.7 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 two countries (Figure 4.1).
- The daily rate of total deaths due to COVID-19 is greater than 4 per million in two countries (Figure 4.2).
- We estimate that 96% of people in Puerto Rico 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 28 countries and 40 subnational locations. Effective R in Puerto Rico was 1.3 on December 1 (Figure 7.1).
- The infection-detection rate in Puerto Rico was close to 11% 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). We estimate that the Alpha variant is circulating in five countries and no subnational locations, that the Beta variant is circulating in no countries and no subnational locations, that the Delta variant is circulating in 23 countries and 28 subnational locations, that the Gamma variant is circulating in 14 countries and 26 subnational locations, that the BA.1/BA.2 variants are circulating in 34 countries and 59 subnational locations, and that the BA.5 variant is circulating in 34 countries and 59 subnational locations.

Trends in drivers of transmission

- Based on self-reported mask use data collected in the COVID-19 Trends and Impact Survey, an estimated 35% of people are projected to always wear a mask when leaving their home. Mask use after April 13, 2022 is a statistical forecast.
- As of December 12, 17 countries and 54 subnational locations have reached 70% or more of the population who have received at least one vaccine dose, and 14 countries and 37 subnational locations have reached 70% or more of the population who are fully vaccinated (Figures 12.1 and 12.2). 89% of people in Puerto Rico have received at least one vaccine dose, and 83% are fully vaccinated.
- In our current reference scenario, we expect that 3.1 million people will be vaccinated with at least one dose by April 1 (Figure 14.1). We expect that 83% of the population will be fully vaccinated by April 1.

Projections and scenarios

We produce three 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.

Infections

- Daily estimated infections in the **reference scenario** will rise to 31,930 by December 18, 2022 (Figure 16.1).
- Daily estimated infections in the **80% mask use scenario** will rise to 21,750 by December 13, 2022 (Figure 16.1).
- Daily estimated infections in the **antiviral access scenario** will rise to 31,930 by December 18, 2022 (Figure 16.1).

Cases

- Daily estimated cases in the **reference scenario** will rise to 4,600 by January 8, 2023 (Figure 16.2).
- Daily estimated cases in the **80% mask use scenario** will rise to 3,110 by January 8, 2023 (Figure 16.2).
- Daily estimated cases in the **antiviral access scenario** will rise to 4,600 by January 8, 2023 (Figure 16.2).

Hospitalizations

- Daily hospital census in the **reference scenario** will rise to 1,060 by January 4, 2023 (Figure 16.3). At some point from December through April 1, four countries will have high or extreme stress on hospital beds (Figure 18.1). At some point from December through April 1, 10 countries will have high or extreme stress on intensive care unit (ICU) capacity (Figure 19.1).
- Daily hospital census in the **80% mask use scenario** will rise to 710 by January 2, 2023 (Figure 16.3).
- Daily hospital census in the **antiviral access scenario** will rise to 1,050 by January 3, 2023 (Figure 16.3).

Deaths

- In our **reference scenario**, our model projects 6,700 cumulative reported deaths due to COVID-19 on April 1. This represents 1,200 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **reference scenario** will rise to 20 by January 13, 2023 (Figure 16.4).

- Under our **reference scenario**, our model projects 11,000 cumulative total deaths due to COVID-19 on April 1. This represents 2,000 additional deaths from December 12 to April 1 (Figure 16.5).
- In our **80% mask use scenario**, our model projects 6,500 cumulative reported deaths due to COVID-19 on April 1. This represents 1,000 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **80% mask use scenario** will rise to 10 by December 28, 2022 (Figure 16.4).
- In our **antiviral access scenario**, our model projects 6,600 cumulative reported deaths due to COVID-19 on April 1. This represents 1,100 additional deaths from December 12 to April 1. Daily reported COVID-19 deaths in the **antiviral access scenario** will rise to 20 by January 11, 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.

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.

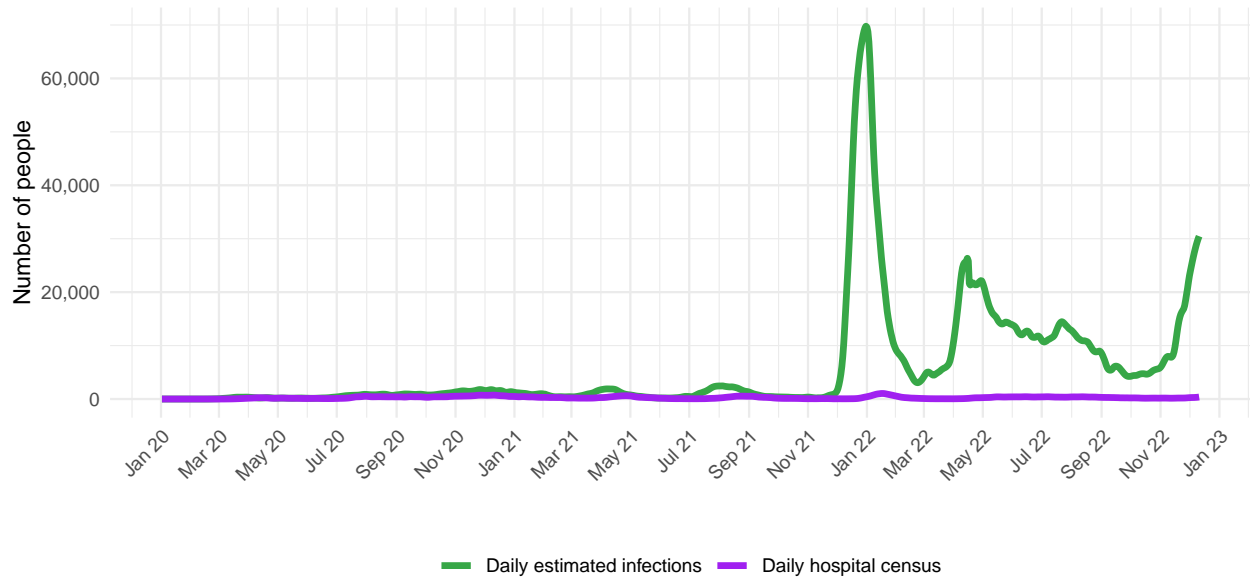
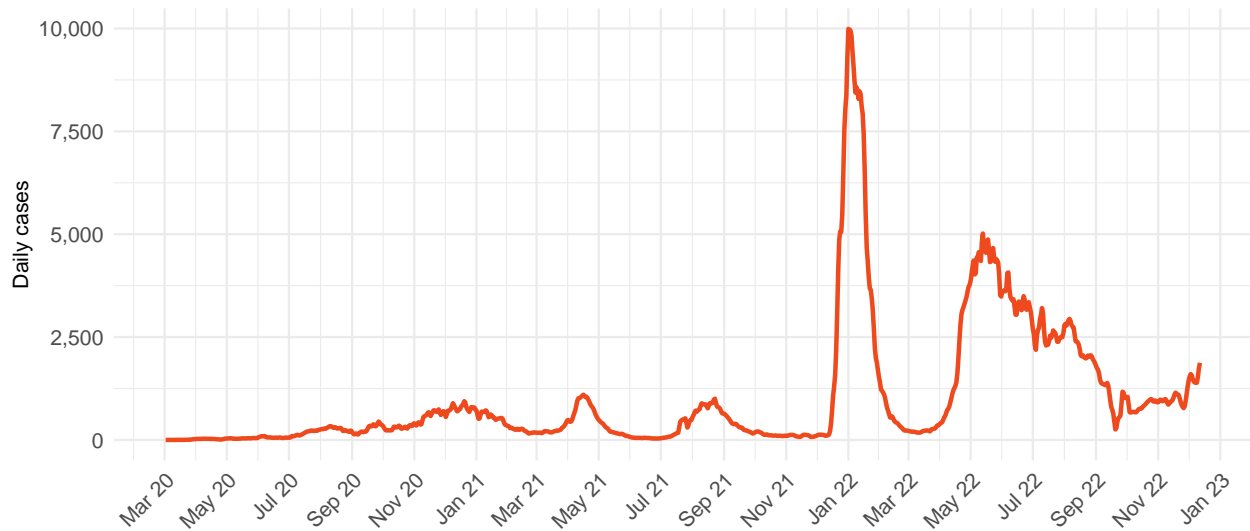
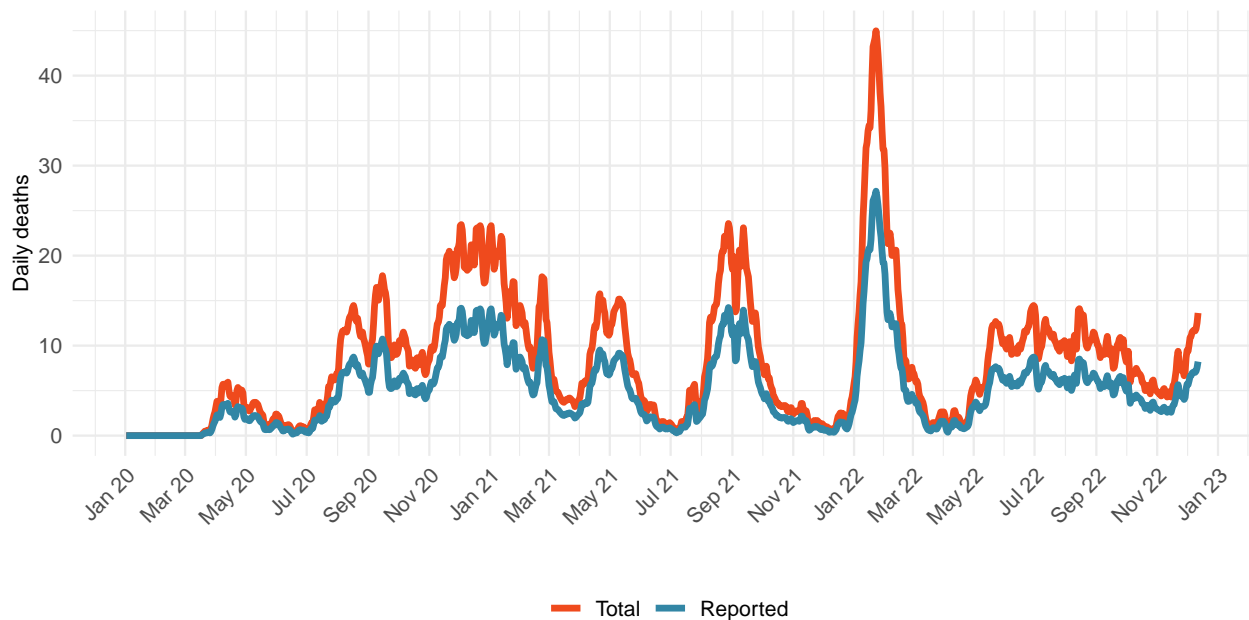
Figure 1.1: Daily COVID-19 hospital census and estimated infections**Figure 2.1: Reported daily COVID-19 cases, moving average**

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
Ischemic heart disease	93	1
COVID-19	85	2
Diabetes mellitus	65	3
Chronic kidney disease	40	4
Alzheimer’s disease and other dementias	39	5
Stroke	37	6
Chronic obstructive pulmonary disease	30	7
Lower respiratory infections	24	8
Colon and rectum cancer	22	9
Cirrhosis and other chronic liver diseases	20	10

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

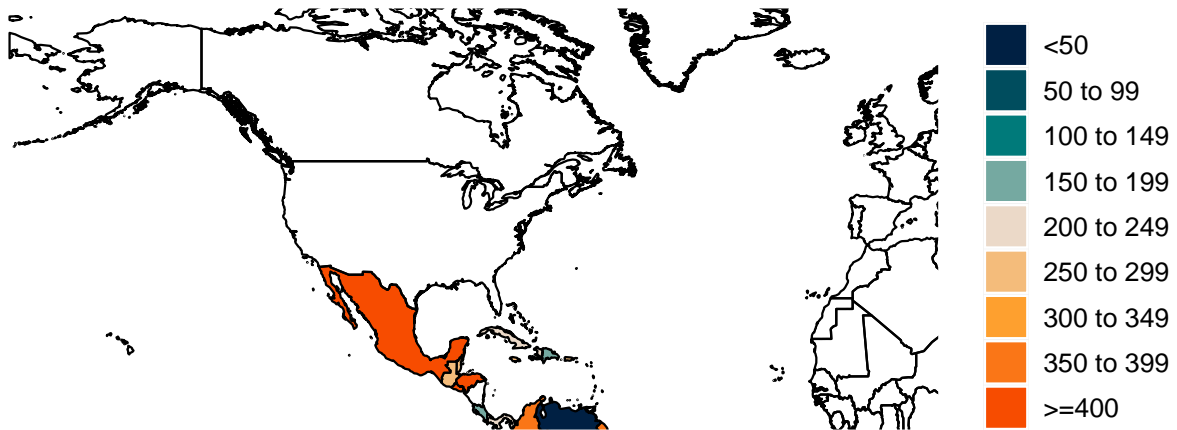


Figure 6.1: Estimated percent of the population infected with COVID-19 on December 12, 2022



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.

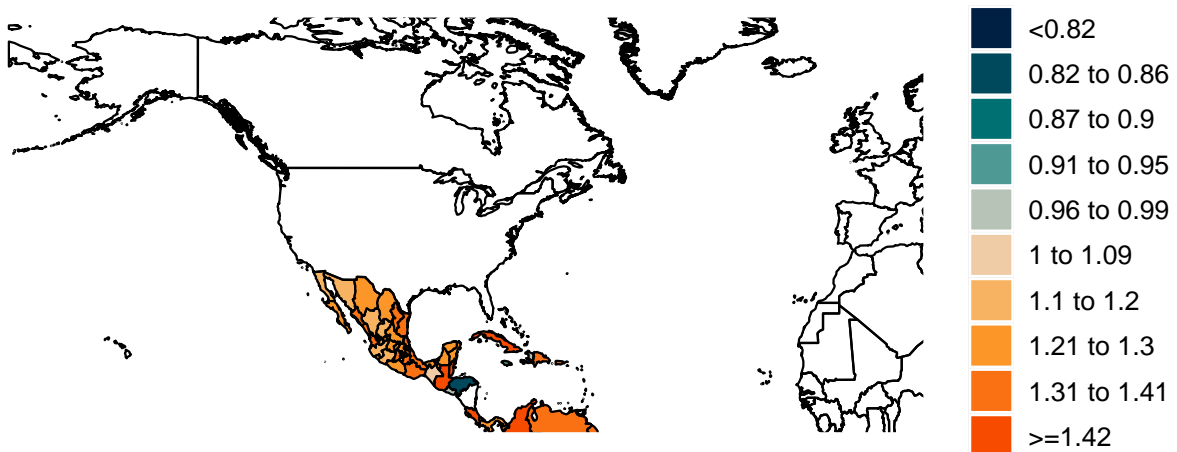
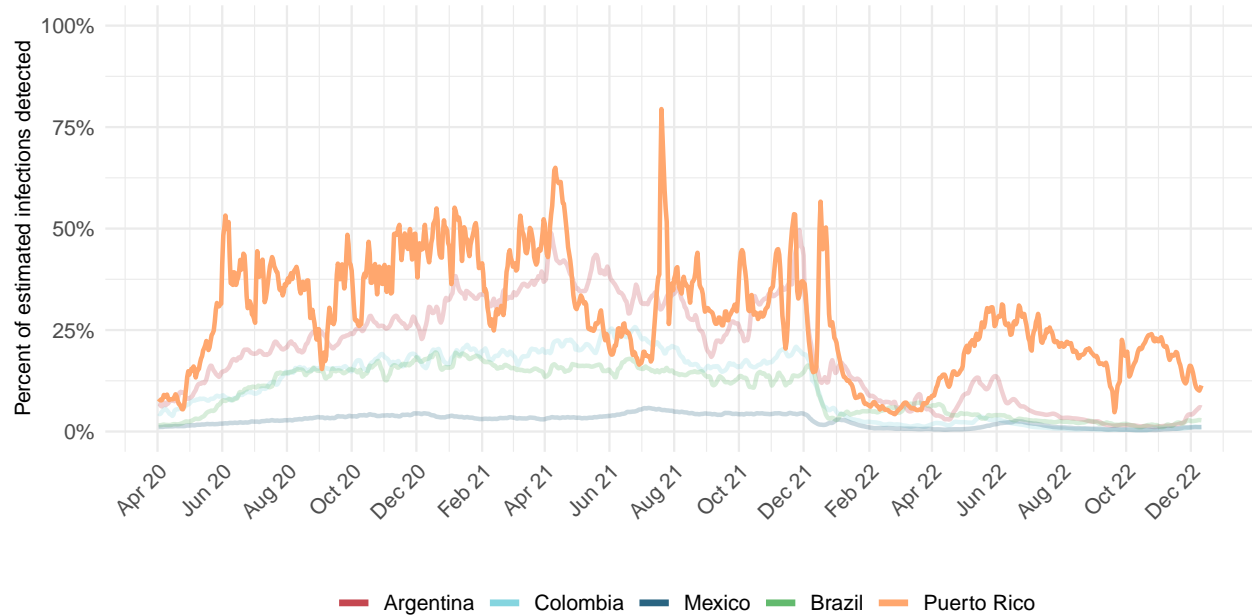


Figure 8.1: Percent of estimated COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model. Due to measurement errors in cases and testing rates, the infection-detection rate can exceed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

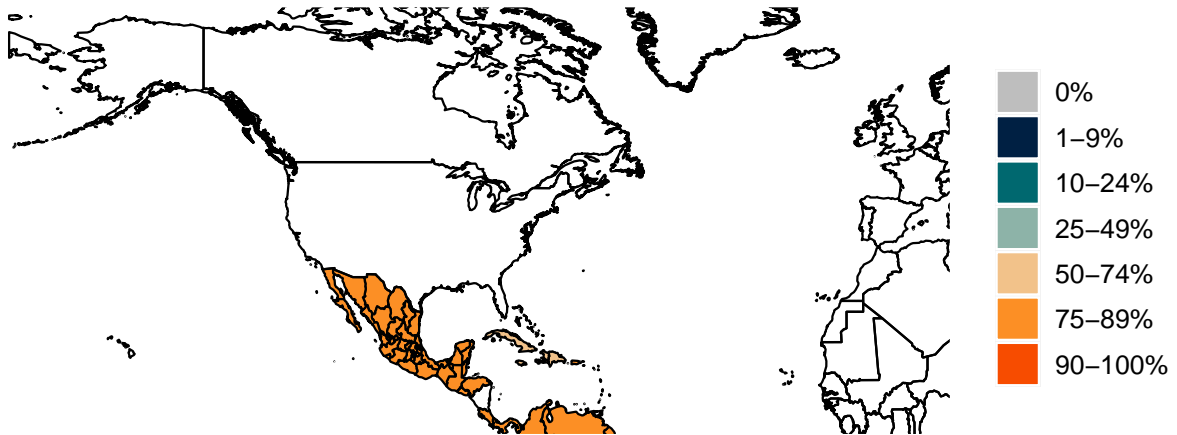


Figure 10.1: Infection-fatality rate on December 12, 2022. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.



Critical drivers

Table 2: Current mandate implementation

	Primary school closure	Secondary school closure	Higher school closure	Entry restrictions for some non-residents	Entry restrictions for all non-residents	Individual movements restricted	Curfew for businesses	Individual curfew	Gathering limit: 6 indoor, 10 outdoor	Gathering limit: 10 indoor, 25 outdoor	Gathering limit: 25 indoor, 50 outdoor	Gathering limit: 50 indoor, 100 outdoor	Gathering limit: 100 indoor, 250 outdoor	Restaurants closed	Bars closed	Restaurants / bars closed	Restaurants / bars curbside only	Gyms, pools, other leisure closed	Non-essential retail closed	Non-essential retail curbside only	Non-essential workplaces closed	Stay home order	Stay home fine	Mask mandate	Mask mandate fine
Antigua and Barbuda																									
Argentina																									
Bahamas																									
Barbados																									
Belize																									
Bolivia (Plurinational State of)																									
Brazil																									
Chile																									
Colombia																									
Costa Rica																									
Cuba																									
Dominica																									
Dominican Republic																									
Ecuador																									
El Salvador																									
Grenada																									
Guatemala																									
Guyana																									
Haiti																									
Honduras																									
Jamaica																									
Mexico																									
Nicaragua																									
Panama																									
Paraguay																									
Peru																									
Puerto Rico																									
Saint Kitts and Nevis																									
Saint Lucia																									
Saint Vincent and the Grenadines																									
Suriname																									
Trinidad and Tobago																									
United States Virgin Islands																									
Uruguay																									
Venezuela (Bolivarian Republic of)																									

*Not all locations are measured at the subnational level.

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

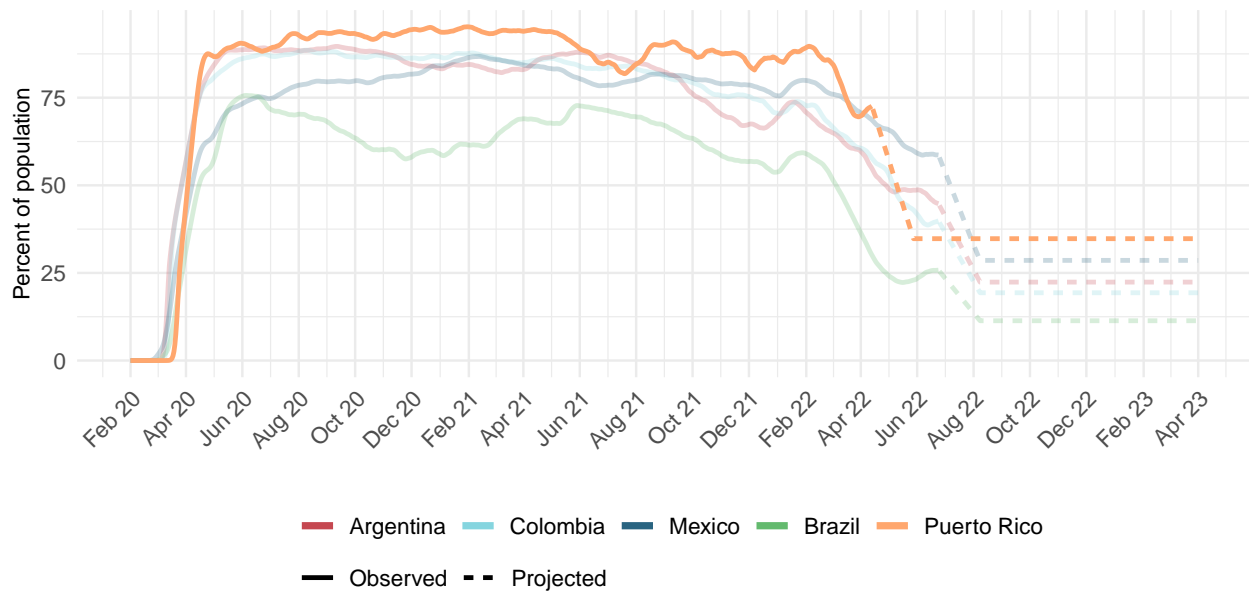


Table 3: Estimates of vaccine effectiveness for specific vaccines used in the model at preventing severe disease and infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our [website](#).

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

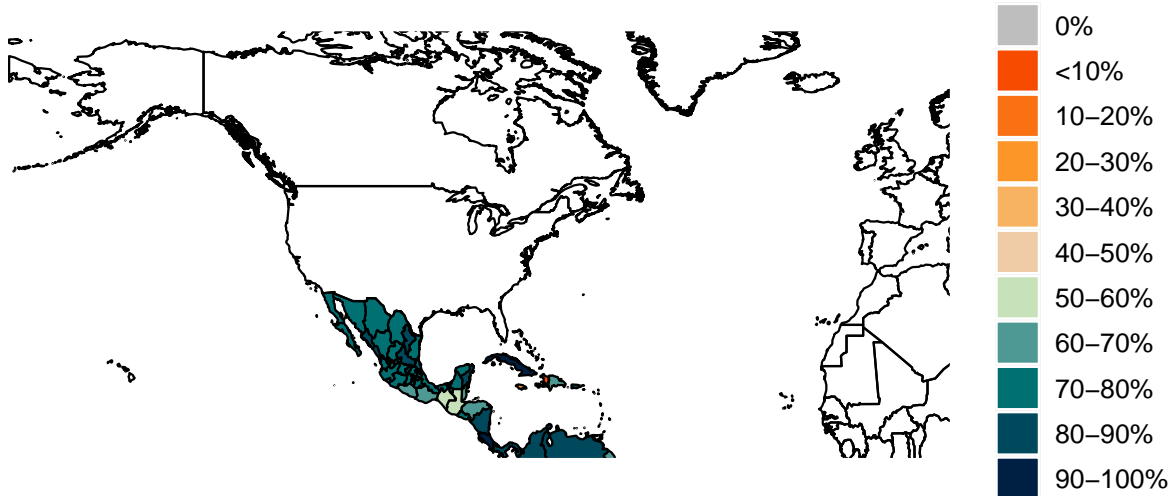


Figure 12.2: Percent of the population fully vaccinated against SARS-CoV-2

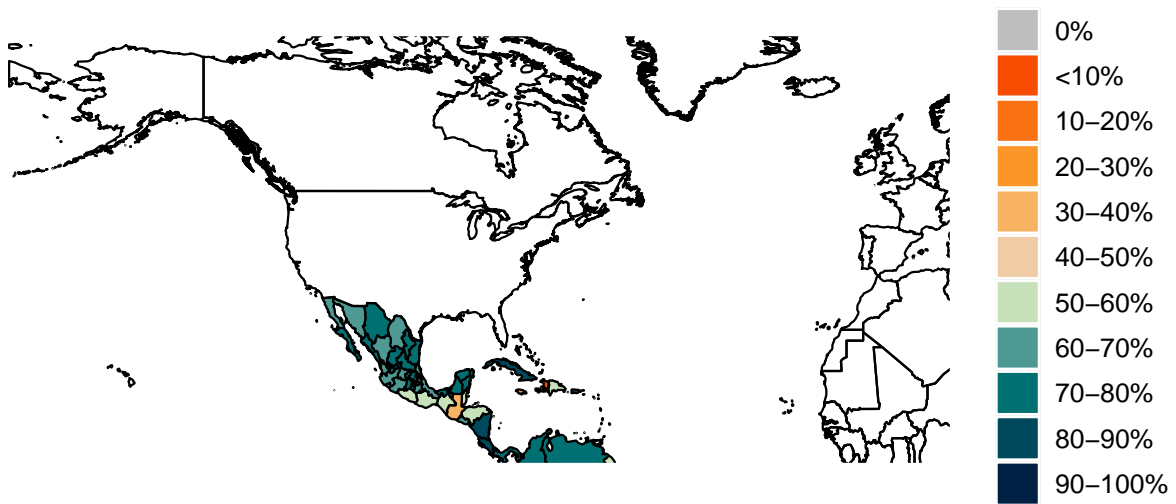


Figure 13.1: Estimated proportion of the total population that is not vaccinated but willing to be vaccinated as of June 24, 2022

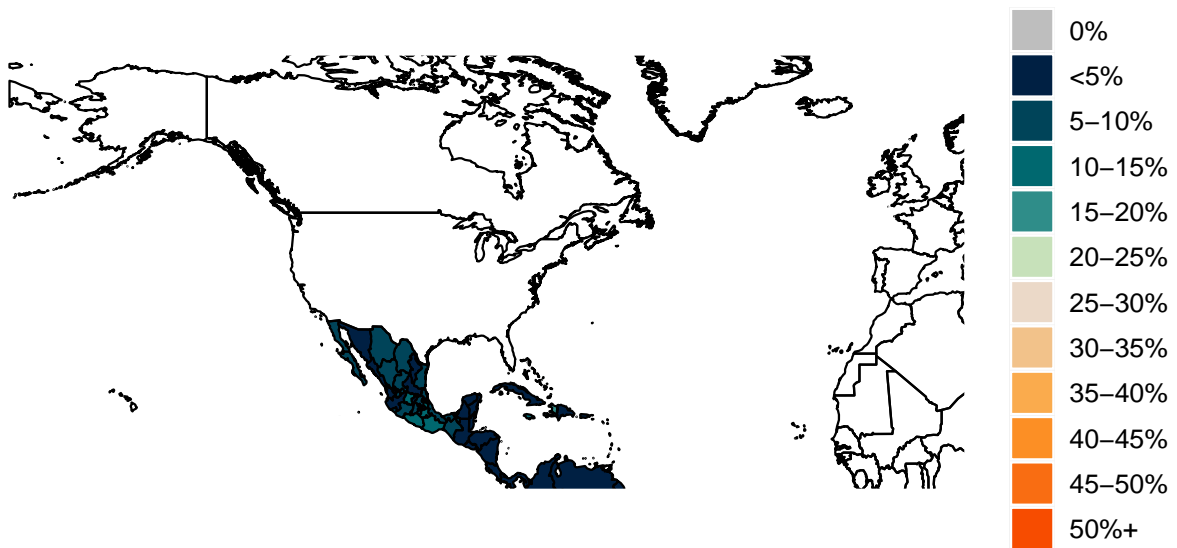


Figure 14.1: Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated

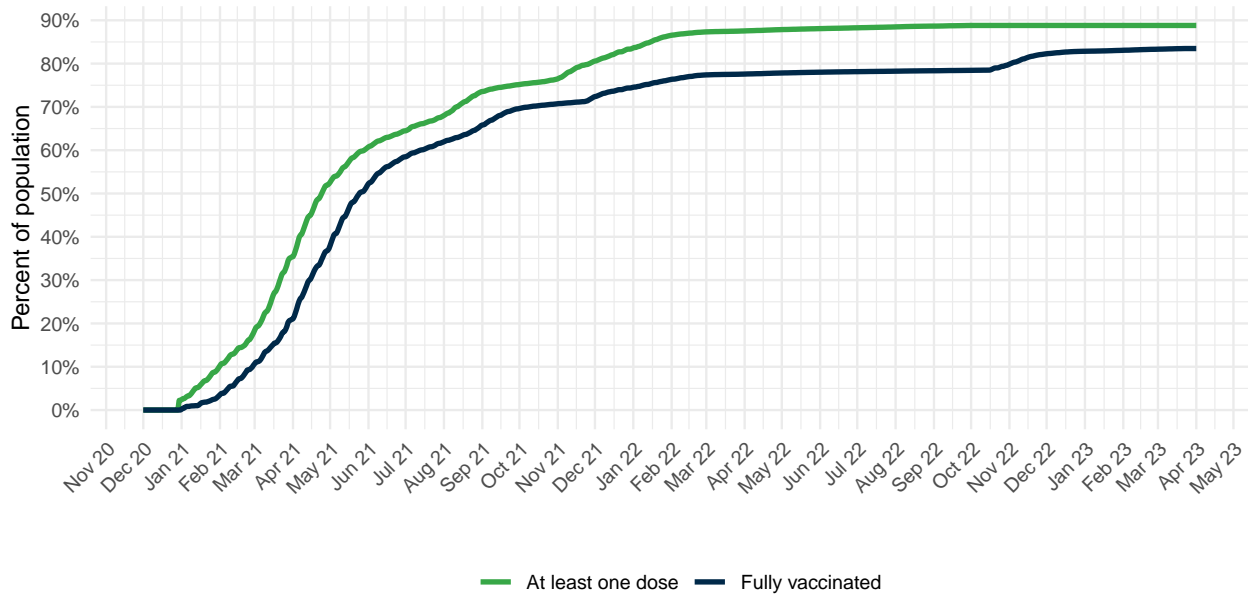
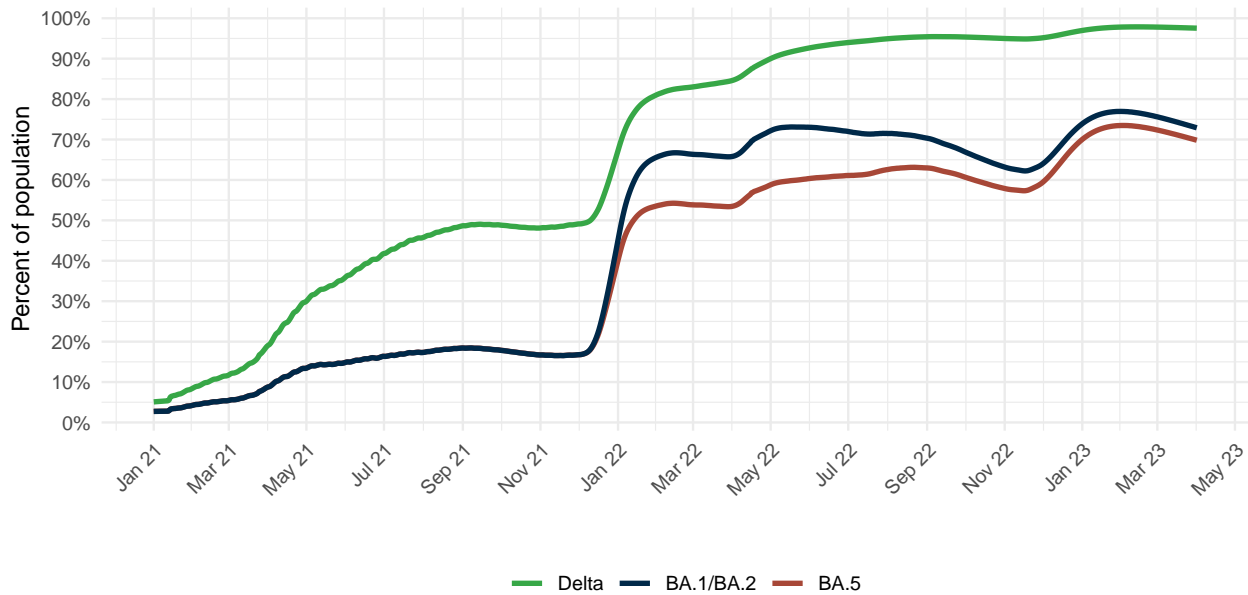


Figure 15.1: Percent of people who are immune to Delta, BA.1/BA.2 or BA.5. Immunity is based on protection due to prior vaccination and infection(s). Moreover, variant-specific immunity is also based on variant-variant specific protection.



Projections and scenarios

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

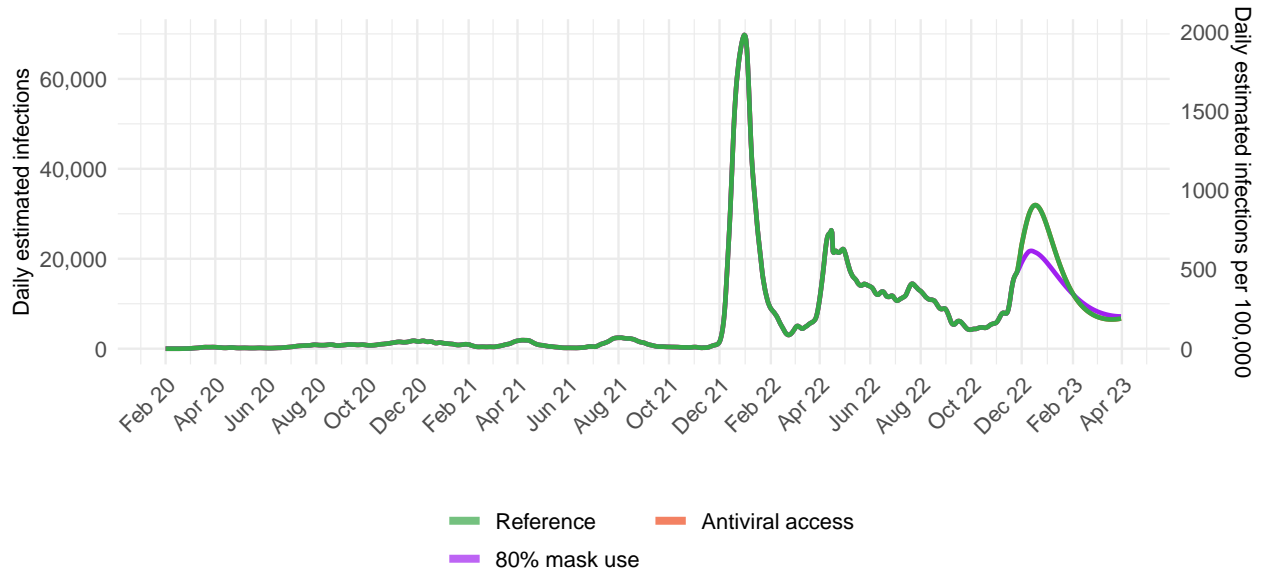


Figure 16.2: Daily COVID-19 reported cases until April 01, 2023 for three scenarios

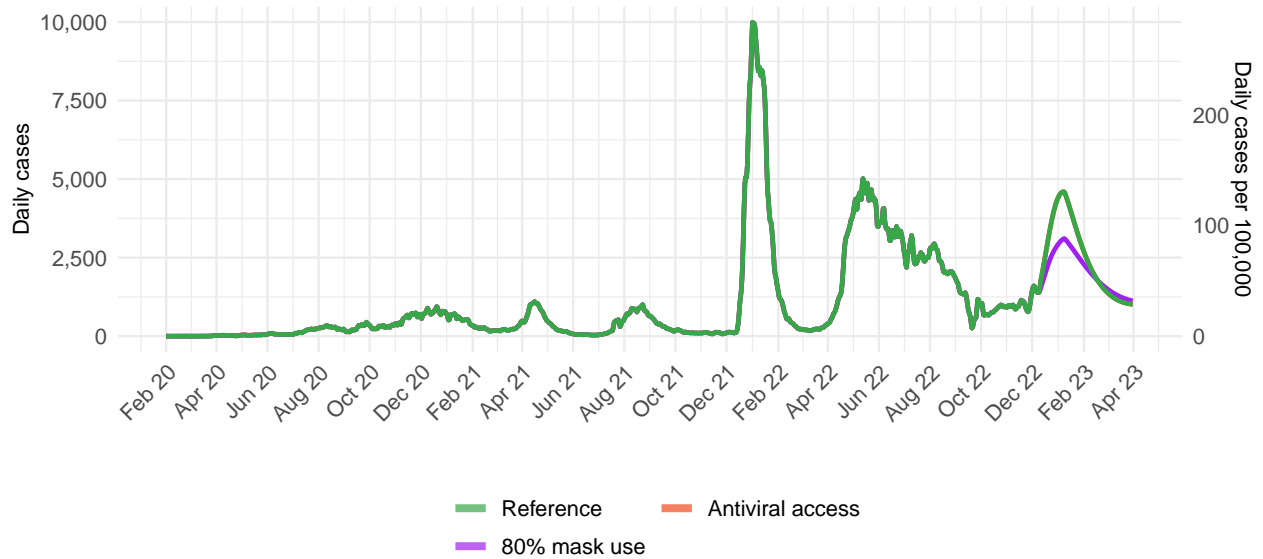


Figure 16.3: Daily COVID-19 hospital census until April 01, 2023 for three scenarios

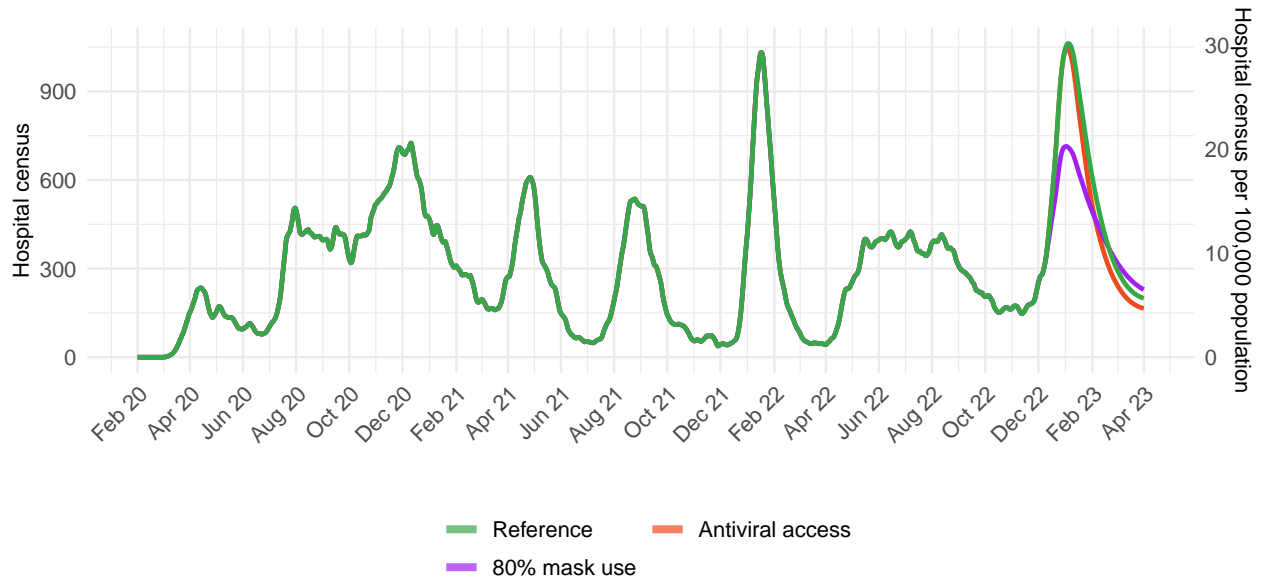


Figure 16.4: Reported daily COVID-19 deaths per 100,000

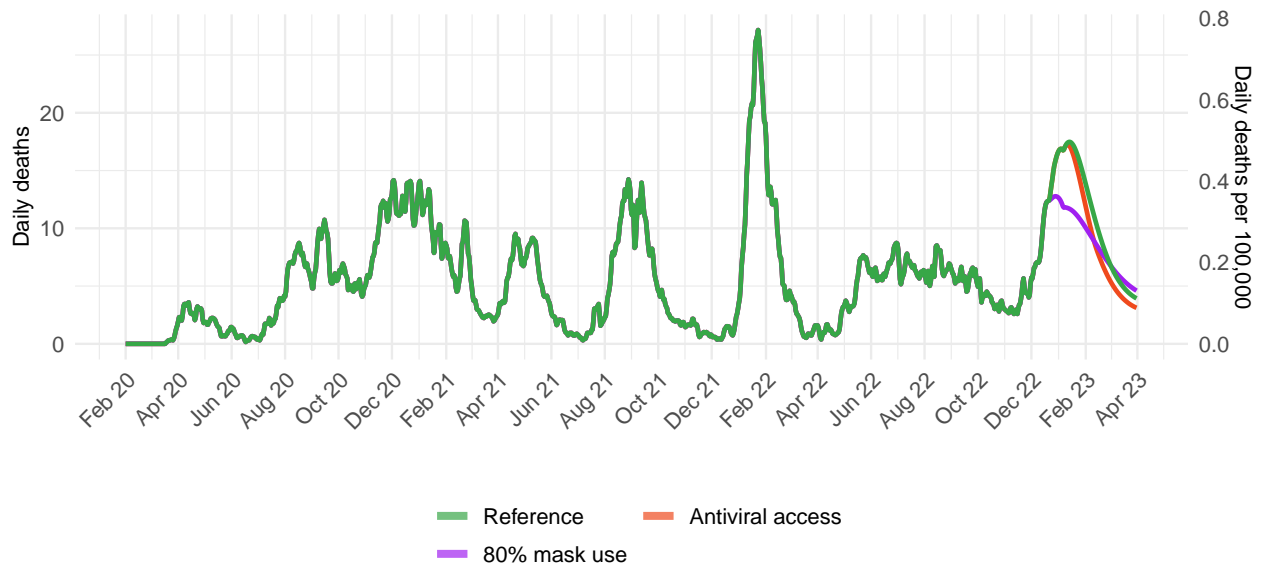


Figure 16.5: Total daily COVID-19 deaths per 100,000

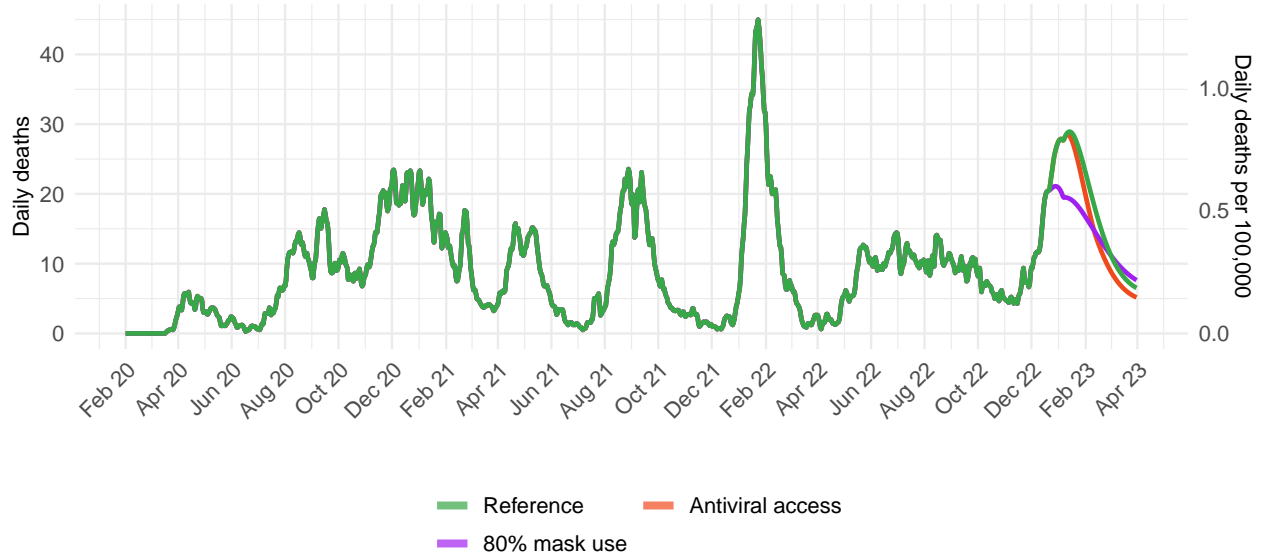


Figure 17.1: Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available, last model update in brackets: the SI-KJalpha model from the University of Southern California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

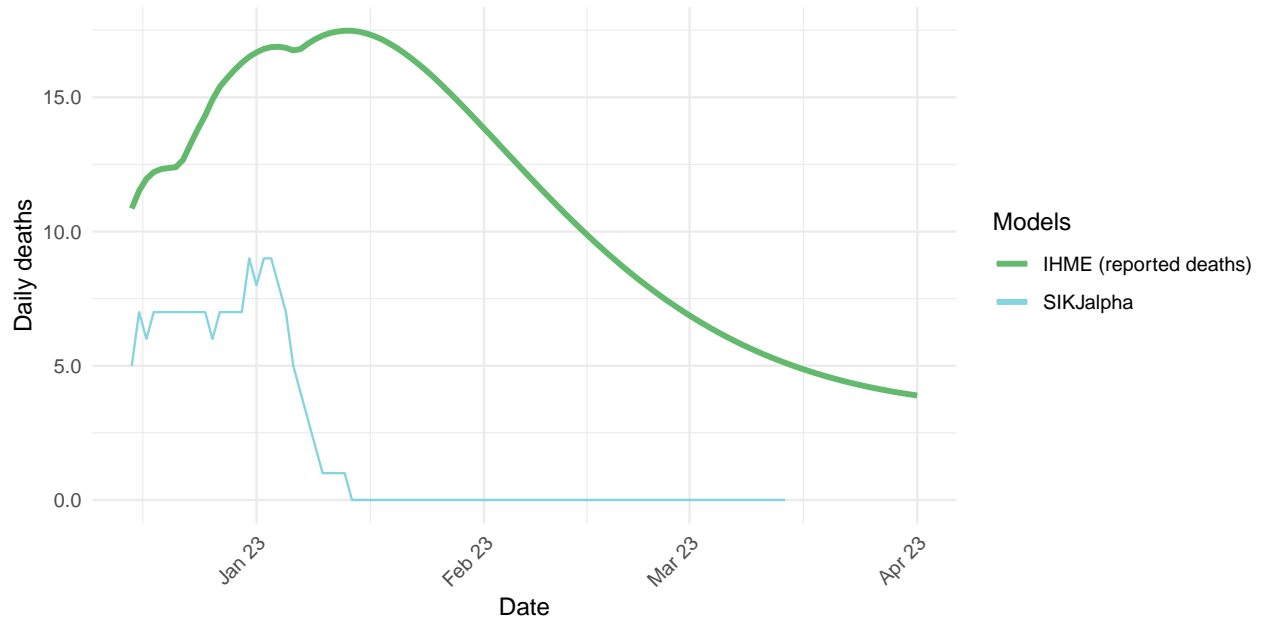


Figure 18.1: The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and 20% or greater is considered *extreme stress*.

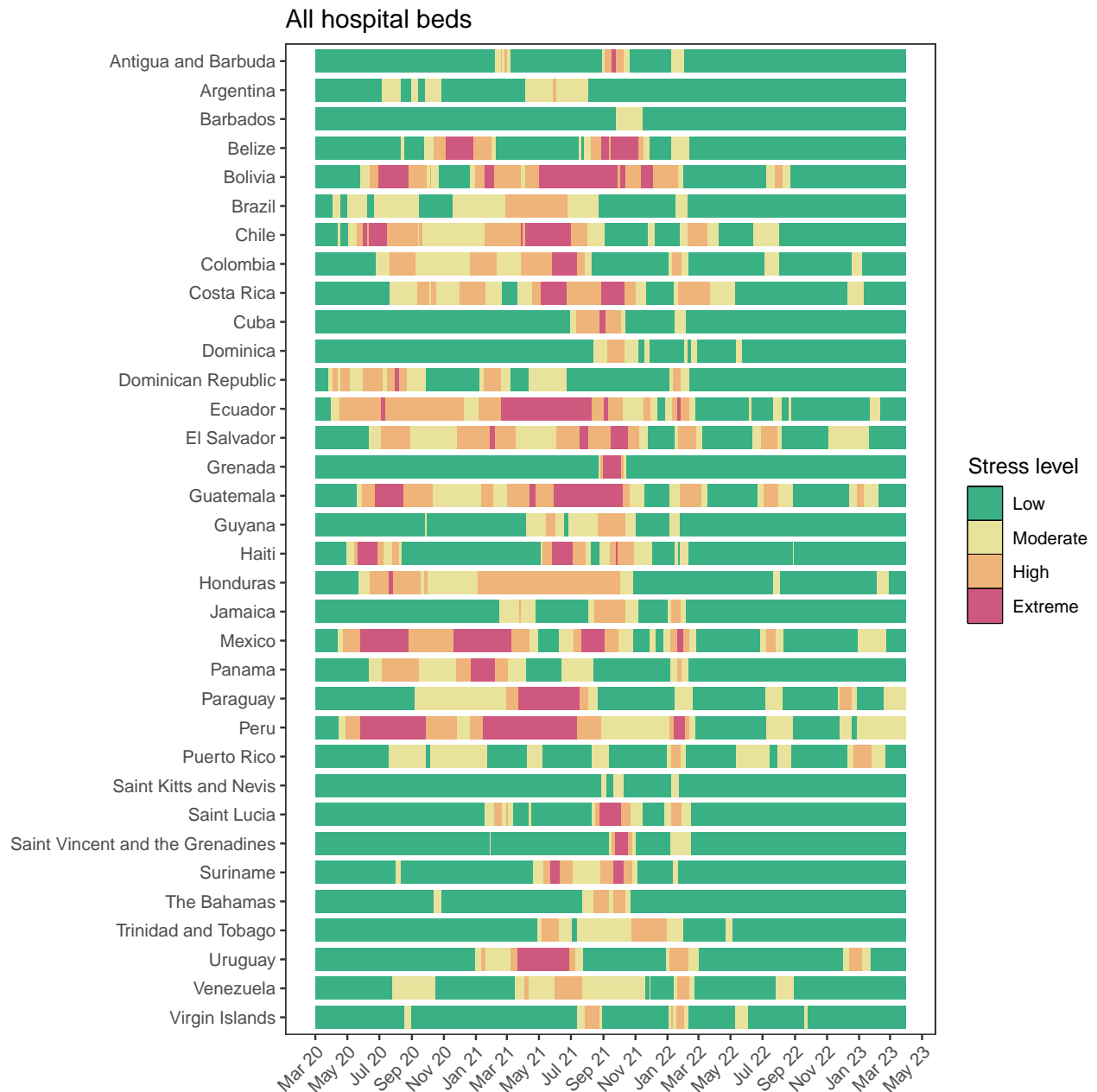


Figure 19.1: The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color-coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and 60% or greater is considered *extreme stress*.



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>.