COVID-19 Results Briefing
Spain
December 22, 2021

This document contains summary information on the latest projections from the IHME model on COVID-19 in Spain. The model was run on December 21, 2021, with data through December 13, 2021.

Current situation

- Daily infections in the last week increased to 96,900 per day on average compared to 52,800 the week before (Figure 1.1). Daily hospital census in the last week (through December 13) increased to 9,400 per day on average compared to 8,100 the week before.
- Daily reported cases in the last week increased to 15,300 per day on average compared to 10,200 the week before (Figure 2.1).
- Reported deaths due to COVID-19 in the last week increased to 43 per day on average compared to 36 the week before (Figure 3.1).
- Total deaths due to COVID-19 in the last week increased to 71 per day on average compared to 60 the week before (Figure 3.1). This makes COVID-19 the number 5 cause of death in Spain 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.
- No locations had daily reported COVID-19 death rates greater than 4 per million (Figure 4.1).
- The daily rate of total COVID-19 deaths is greater than 4 per million in 2 autonomous communities. (Figure 4.2).
- We estimate that 31% of people in Spain have been infected at least once as of December 13 (Figure 6.1). Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 19 autonomous communities. (Figure 7.1).
- The infection-detection rate in Spain was close to 50% on December 13 (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 (Figure 9.1-Figure 9.5). We estimate that the Alpha variant is circulating in 0 autonomous communities, that the Beta variant is circulating in 0 autonomous communities, that the Delta variant is circulating in 19 autonomous communities, that the Gamma variant is circulating in 0 autonomous communities and that the Omicron variant is circulating in 19 autonomous communities.

Trends in drivers of transmission

- Mobility last week was 10% lower than the pre-COVID-19 baseline (Figure 11.1). Mobility was lower than 30% of baseline in no locations.
- As of December 13, in the COVID-19 Trends and Impact Survey, 72% of people self-report that they always wore a mask when leaving their home compared to 72% last week (Figure 13.1).
- There were 266 diagnostic tests per 100,000 people on December 13 (Figure 15.1).
- As of December 13, 19 autonomous communities have reached 70% or more of the population who have received at least one vaccine dose and 18 autonomous communities have reached 70% or more of the population who are fully vaccinated (Figure 17.1). 84% of people in Spain have received at least one vaccine dose and 82% are fully vaccinated.
- In Spain, 95.8% of the population that is 12 years and older say they would accept or would probably accept a vaccine for COVID-19. Note that vaccine acceptance is calculated using survey data from the 18+ population. This is up by 0.1 percentage points from last week. The proportion of the population who are open to receiving a COVID-19 vaccine ranges from 85% in Navarre to 100% in Galicia (Figure 19.1).
- In our current reference scenario, we expect that 38.4 million people will be vaccinated with at least one dose by April 1 (Figure 20.1). We expect that 82% of the population will be fully vaccinated by April 1.
Projections

Infections
- Daily estimated infections in the reference scenario, which represents what we think is most likely to happen, will rise to 680,080 by January 15, 2022 (Figure 21.1).
- Daily estimated infections in the high severity of Omicron scenario will rise to 684,540 by January 15, 2022 (Figure 21.1).
- Daily estimated infections in the 80% mask coverage scenario will rise to 621,260 by January 15, 2022 (Figure 21.1).
- Daily estimated infections in the third dose scenario will rise to 663,090 by January 14, 2022 (Figure 21.1).
- Daily estimated infections in the reduced vaccine hesitancy scenario will rise to 679,590 by January 15, 2022 (Figure 21.1).

Cases
- Daily cases in the reference scenario will rise to 305,460 by January 27, 2022 (Figure 21.2).
- Daily cases in the high severity of Omicron scenario will rise to 308,150 by January 28, 2022 (Figure 21.2).
- Daily cases in the 80% mask coverage scenario will rise to 276,460 by January 28, 2022 (Figure 21.2).
- Daily cases in the third dose scenario will rise to 297,030 by January 27, 2022 (Figure 21.2).
- Daily cases in the reduced vaccine hesitancy scenario will rise to 305,110 by January 28, 2022 (Figure 21.2).

Hospitalizations
- Daily hospital census in the reference scenario will rise to 73,790 by February 11, 2022 (Figure 21.3).
- Daily hospital census in the high severity of Omicron scenario will rise to 114,060 by February 12, 2022 (Figure 21.3).
- Daily hospital census in the 80% mask coverage scenario will rise to 70,060 by February 11, 2022 (Figure 21.3).
- Daily hospital census in the third dose scenario will rise to 70,400 by February 11, 2022 (Figure 21.3).
- Daily hospital census in the reduced vaccine hesitancy scenario will rise to 72,930 by February 11, 2022 (Figure 21.3).

Deaths
- In our reference scenario, our model projects 106,000 cumulative reported deaths due to COVID-19 on April 1. This represents 9,000 additional deaths from December 13 to April 1. Daily reported COVID-19 deaths in the reference scenario will rise to 140 by February 7, 2022 (Figure 21.4).
- Under our reference scenario, our model projects 174,000 cumulative total deaths due to COVID-19 on April 1. This represents 15,000 additional deaths from December 13 to April 1 (Figure 24.2).
- In our high severity of Omicron scenario, our model projects 110,000 cumulative reported deaths due to COVID-19 on April 1. This represents 13,000 additional deaths from December 13 to April 1. Daily reported COVID-19 deaths in the high severity of Omicron scenario will rise to 220 by February 9, 2022 (Figure 21.4).
- In our 80% mask coverage scenario, our model projects 106,000 cumulative reported deaths due to COVID-19 on April 1. This represents 9,000 additional deaths from December 13 to April 1. Daily reported COVID-19 deaths in the 80% mask coverage scenario will rise to 130 by February 6, 2022 (Figure 21.4).
• In our **third dose scenario**, our model projects 106,000 cumulative reported deaths due to COVID-19 on April 1. This represents 9,000 additional deaths from December 13 to April 1. Daily reported COVID-19 deaths in the **third dose scenario** will rise to 140 by February 6, 2022 (Figure 21.4).

• In our **reduced vaccine hesitancy scenario**, our model projects 106,000 cumulative reported deaths due to COVID-19 on April 1. This represents 9,000 additional deaths from December 13 to April 1. Daily reported COVID-19 deaths in the **reduced vaccine hesitancy scenario** will rise to 140 by February 7, 2022 (Figure 21.4).

• Figure 22.1 compares our reference scenario forecasts to other publicly archived models. Forecasts are widely divergent.

• At some point from December through April 1, 0 countries will have high or extreme stress on hospital beds (Figure 23.1). At some point from December through April 1, 0 countries will have high or extreme stress on ICU capacity (Figure 24.1).
Model updates

In this update, we have substantially revised our model to explicitly account for several important factors that have a profound influence on the likely trajectory of the epidemic in the coming months. First, the model tracks infections from different variants separately, including ancestral, Alpha, Beta, Gamma, Delta, Omicron, and other. Second, we take into account that infection-derived and vaccine-derived immunity wanes over time. Immunity that prevents infection wanes more quickly than immunity preventing hospitalization and death, so we derive separate waning curves for infection and for hospitalization and death. Based on a systematic analysis of published studies, reports, and archived studies, we derive vaccine-specific waning curves. Third, infection with different COVID-19 variants can confer different protection for each variant in the model. The matrix of cross-variant immunity allows us to take into account the greater immune escape seen with Omicron. Third, we explicitly model the delivery of a third dose of vaccine (and second dose for J&J recipients). Fourth, the variant spread model is now based on both spatial spread and patterns of airline traffic. The technical appendix provides details of the model structure and the analysis of waning immunity. The critical driver of our forecasts in the next months is the spread of the Omicron variant. Critical assumptions about the Omicron variant are based on our analysis of all the available lab data on vaccine efficacy, test-negative vaccine effectiveness studies in South Africa and the UK, population-level data on PCR positivity in representative samples of the population, and detected cases, hospitalization, and deaths in South Africa, the UK, Denmark, and Norway. More details on this analysis are in the technical appendix. The key assumptions that substantially influence the forecasts include the following: First, prior infection provides 40% to 60% protection against infection with Omicron. Second, vaccine effectiveness in preventing infection is reduced by approximately 50% compared to the efficacy against the Delta variant, and vaccine effectiveness in preventing hospitalization and death is reduced by 25% compared to the efficacy against the Delta variant. Third, the fraction asymptomatic is assumed to increase from near 40% to 90%–95%; this fraction influences the future estimates of the infection-detection rate. Fourth, the infection-hospitalization rate for Omicron is estimated to be 90%–96% lower than for Delta variant. Fifth, the infection-fatality rate for Omicron is estimated to be 97%–99% lower than for Delta.
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

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<tr>
<th>Cause name</th>
<th>Weekly deaths</th>
<th>Ranking</th>
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<td>Stroke</td>
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<td>Chronic obstructive pulmonary disease</td>
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<td>3</td>
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<tr>
<td>Alzheimer’s disease and other dementias</td>
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<td>Tracheal, bronchus, and lung cancer</td>
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<td>Chronic kidney disease</td>
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<td>Lower respiratory infections</td>
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<td>Diabetes mellitus</td>
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</table>

**Figure 3.1.** Smoothed trend estimate of reported daily COVID-19 deaths (blue) and total daily deaths due to COVID-19 (orange)
Daily COVID-19 death rate per 1 million on December 13, 2021

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 13, 2021

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 13, 2021

![Map showing estimated percent infected in Spain](image)

Figure 7.1. Mean effective R on December 2, 2021. 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.

![Map showing mean effective R in Spain](image)
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 13, 2021

Figure 9.1 Estimated percent Alpha variant

Figure 9.2 Estimated percent Beta variant
Figure 9.3 Estimated percent Delta variant

Figure 9.4 Estimated percent Gamma variant
Figure 9.5 Estimated percent Omicron variant
Figure 10.1. Infection-fatality rate on December 13, 2021. This is estimated as the ratio of COVID-19 deaths to estimated daily COVID-19 infections.
## Critical drivers

**Table 2.** Current mandate implementation

<table>
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<th>Primary school closure</th>
<th>Secondary school closure</th>
<th>Entry restrictions for some non-residents</th>
<th>Individual movements restricted</th>
<th>Curfew for businesses</th>
<th>Individual curfew</th>
<th>Gathering limit: 6 indoor, 10 outdoor</th>
<th>Gathering limit: 10 indoor, 25 outdoor</th>
<th>Gathering limit: 25 indoor, 50 outdoor</th>
<th>Gathering limit: 50 indoor, 100 outdoor</th>
<th>Gathering limit: 100 indoor, 250 outdoor</th>
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<th>Bars closed</th>
<th>Restaurants / bars closed</th>
<th>Gyms, pools, other leisure closed</th>
<th>Non-essential retail closed</th>
<th>Non-essential workplaces closed</th>
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*IHME*  Spain

covid19.healthdata.org Institute for Health Metrics and Evaluation
Figure 11.1. Trend in mobility as measured through smartphone app use, compared to January 2020 baseline
Figure 12.1. Mobility level as measured through smartphone app use, compared to January 2020 baseline (percent) on December 13, 2021
Figure 13.1. Trend in the proportion of the population reporting always wearing a mask when leaving home

Figure 14.1. Proportion of the population reporting always wearing a mask when leaving home on December 13, 2021
Figure 15.1. Trend in COVID-19 diagnostic tests per 100,000 people

Figure 16.1. COVID-19 diagnostic tests per 100,000 people on December 13, 2021
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.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Ancestral Severe disease</th>
<th>Ancestral Infection</th>
<th>Alpha Severe disease</th>
<th>Alpha Infection</th>
<th>Beta Severe disease</th>
<th>Beta Infection</th>
<th>Gamma Severe disease</th>
<th>Gamma Infection</th>
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<th>Omicron Severe disease</th>
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<td>84%</td>
<td>95%</td>
<td>84%</td>
<td>72%</td>
<td>44%</td>
</tr>
<tr>
<td>Sinopharm</td>
<td>73%</td>
<td>68%</td>
<td>73%</td>
<td>68%</td>
<td>71%</td>
<td>67%</td>
<td>71%</td>
<td>67%</td>
<td>71%</td>
<td>67%</td>
<td>53%</td>
<td>35%</td>
</tr>
<tr>
<td>Sputnik V</td>
<td>92%</td>
<td>86%</td>
<td>92%</td>
<td>86%</td>
<td>89%</td>
<td>85%</td>
<td>89%</td>
<td>85%</td>
<td>89%</td>
<td>85%</td>
<td>67%</td>
<td>44%</td>
</tr>
<tr>
<td>Other vaccines</td>
<td>75%</td>
<td>70%</td>
<td>75%</td>
<td>70%</td>
<td>73%</td>
<td>69%</td>
<td>73%</td>
<td>69%</td>
<td>73%</td>
<td>69%</td>
<td>55%</td>
<td>36%</td>
</tr>
<tr>
<td>Other vaccines (mRNA)</td>
<td>91%</td>
<td>86%</td>
<td>91%</td>
<td>86%</td>
<td>88%</td>
<td>85%</td>
<td>88%</td>
<td>85%</td>
<td>88%</td>
<td>85%</td>
<td>67%</td>
<td>45%</td>
</tr>
</tbody>
</table>
Percent of the population having received at least one dose (17.1) and fully vaccinated against SARS-CoV-2 (17.2) by December 13, 2021

Figure 17.1 Percent of the population having received one dose of a COVID-19 vaccine

Figure 17.2 Percent of the population fully vaccinated against SARS-CoV-2
Figure 18.1. Trend in the estimated proportion of the population that is 12 years and older that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available. Note that vaccine acceptance is calculated using survey data from the 18+ population.

Figure 19.1. Estimated proportion of the population that is 12 years and older that has been vaccinated or would probably or definitely receive the COVID-19 vaccine if available. Note that vaccine acceptance is calculated using survey data from the 18+ population.
**Figure 20.1.** Percent of people who receive at least one dose of a COVID-19 vaccine and those who are fully vaccinated
Projections and scenarios

We produce five 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 is the mean of mask use over the last 7 days.
- Mobility increases as vaccine coverage increases.
- Omicron variant spreads according to our flight and local spread model.

- 80% of those who have had two doses of vaccine (or one dose for Johnson & Johnson) receive a third dose at 6 months after their second dose.

The high severity of Omicron scenario modifies the reference scenario assumption in two ways: * The infection-hospitalization ratio for Omicron is 2.3 times as high as compared to the reference scenario. * The infection-fatality rate is 4.6 times as high as compared to the reference scenario.

The 80% mask use scenario makes all the same assumptions as the reference scenario but assumes all locations reach 80% mask use within 7 days. If a location currently has higher than 80% use, mask use remains at the current level.

The third dose scenario is the same as the reference scenario but assumes that 100% of those who have received two doses of vaccine will get a third dose at 6 months.

The reduced vaccine hesitancy scenario assumes that those in each location who respond on surveys that they probably will not receive a vaccine are persuaded or mandated to receive a vaccine.
Figure 21.1. Daily COVID-19 infections until April 01, 2022 for five scenarios

Figure 21.2. Daily COVID-19 reported cases until April 01, 2022 for five scenarios
Figure 24.2. Daily COVID-19 hospital census until April 01, 2022 for five scenarios

![Hospital census graph](image)

Figure 24.3 Reported daily COVID-19 deaths per 100,000

![Daily deaths graph](image)
Figure 24.4 Total daily COVID-19 deaths per 100,000

Daily deaths

Days

Reference scenario
High severity of Omicron
Third dose
80% mask use
Reduced vaccine hesitancy
**Figure 22.1.** 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: Delphi from the Massachusetts Institute of Technology ([Delphi](https://covid.19.healthdata.org)) [December 21, 2021], Imperial College London ([Imperial](https://covid.19.healthdata.org)) [December 5, 2021], the SI-KJalpha model from the University of Southern California ([SIKJalpha](https://covid.19.healthdata.org)) [December 19, 2021]. Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.
Figure 23.1. 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 24.1. 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.