COVID-19 Results Briefing

European Union

April 21, 2021

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

It is possible that this week marks a watershed for the EU as a whole, with a peak in daily cases and deaths. Continued declines in seasonality and increases in vaccination – combined with sustained mask use and mobility reductions – should be enough for daily infections, hospitalizations, and deaths to decline steadily in the weeks ahead. In this week's analysis, we have corrected seroprevalence data for waning antibody test sensitivity, which has led to an estimate that 21% of the EU population has already been infected since the start of the pandemic. Combined with vaccination scale-up, this provides more breaks on transmission of non-escape variants than we had previously estimated. One unforeseen consequence of the B.1.1.7 surge is that B.1.1.7 appears to have suppressed the spread of the escape variants B.1.351 and P1 in the EU, even though these variants have been periodically sequenced in many Member States. B.1.1.7 may not, however, suppress all escape variants. The massive surge underway in India may be linked to the B.1.617 escape variant, which not only appears to have immune escape, but perhaps increased transmissibility commensurate with B.1.1.7. Introduction of this variant into the EU in sufficient numbers could alter our forecasts, and policy consideration should be given to restricting travel to and from India and neighboring countries. Expanding vaccination, sustaining vaccine confidence, sustaining mask use, and avoiding rapid return to high-risk behavior, such as larger gatherings, remain the main strategies for this phase of the epidemic.

Current situation

- Daily reported cases in the last week decreased to 138,800 per day on average, compared to 142,500 the week before (Figure 1).
- Daily deaths in the last week decreased to 2,500 per day on average compared to 2,600 the week before (Figure 2). COVID-19 remains the number 2 cause of death in the EU this week (Table 1).
- The daily death rate is greater than 4 per million in 12 Member States (Figure 3).
- We estimated that 21% of people in the EU have been infected as of April 19 (Figure 4). This estimate of the proportion previously infected is up from last week due to corrections we have implemented for waning antibodies in the analysis of seroprevalence surveys – ***see methods update below***.
- Effective R, computed using cases, hospitalizations, and deaths, is greater than 1 in 36 countries or regions in Italy, Spain, and Germany (Figure 5).

- The infection-detection rate in the EU was close to 43% on April 19 (Figure 6). The infection-detection rate is lower than previously estimated due to the corrections for waning antibodies in the seroprevalence survey analysis.
- Based on GISAID and national databases on sequencing (with reporting lags of 2–3 weeks) and our variant spread model, we estimate the current prevalence of key variants (Figure 7). B.1.1.7 is the dominant variant in nearly all parts of the EU. While B.1.351 and P1 have been sequenced in several Member States, clearly these escape variants are not increasing in the presence of B.1.1.7.

Trends in drivers of transmission

- Some mandates were lifted in Czechia and Hungary. New movement restrictions were imposed in Ireland.
- Last week, mobility was 33% lower than the pre-COVID-19 baseline (Figure 9), up from the Easter low the week before.
- This week, 70% of people self-reported in Facebook surveys that they always wore a mask when leaving their home (Figure 11). Mask use was lower than 50% in Austria, Croatia, Denmark, Sweden, and parts of Germany.
- There were 416 diagnostic tests per 100,000 people on April 19 (Figure 13).
- In the EU, 80% of people say they would accept or would probably accept a vaccine for COVID-19. The fraction of the population open to receiving a COVID-19 vaccine ranges from 27% in Latvia to 92% in Denmark (Figure 17).
- **In our current reference scenario, we expect that 436 million people in the EU will be vaccinated by August 1** (Figure 18). By early July, vaccination will be demand-constrained rather than supply-constrained.

Projections

- In our **reference scenario**, which represents what we think is most likely to happen, our model projects 763,000 cumulative deaths on August 1. This represents 92,000 additional deaths between now and August 1 (Figure 19). Daily deaths are expected to decline steadily until August 1 (Figure 20).
- If **universal mask coverage (95%)** were attained in the next week, our model projects 11,000 fewer cumulative deaths compared to the reference scenario on August 1 (Figure 19).
- Under our **worse scenario**, our model projects 787,000 cumulative deaths on August 1, an additional 24,000 deaths compared to our reference scenario (Figure 19). Daily deaths in the worse scenario decline steadily, but at a slower rate than in the reference scenario.
- By August 1, we project that 50,300 lives will be saved by the projected vaccine rollout. This does not include lives saved through vaccination that has already occurred.

- Daily infections decline in the reference scenario to under 50,000 by early June. In the worse scenario, they remain above 50,000 until August 1.
- Figure 22 compares our reference scenario forecasts to other publicly archived models. All the models shown suggest declines, except for the Los Alamos Labs model, which suggests that daily deaths will begin increasing again in late May.
- At some point from April through August 1, seven Member States will have high or extreme stress on hospital beds (Figure 23). At some point from April through August 1, six Member States will have high or extreme stress on ICU capacity (Figure 24).

Model updates

Estimates of infections by day are the critical input into SEIR models. Many early models assumed that cases equaled infections or that the infection-detection rate (IDR) was constant over time and across locations. Early scarcity of PCR testing for COVID-19 in some high-income countries and continued low testing rates in many low-resource settings means that it is very likely that the IDR varies over space and time. Until January 2021, the IHME model used deaths that have been less affected by PCR testing availability to estimate infections using empirical estimates of the infection-fatality ratio (IFR). Estimates of the IFR based on seroprevalence surveys matched to deaths vary over time and location. Starting with the January 21 release, we adopted an approach mapping: 1) cases to infections, 2) hospitalizations to infections, and 3) deaths to infections, and then generating a best estimate of past infections based on these three series. For the April 22, 2021, release, we made further improvements to this model to take into account the effect of waning immunity on seroprevalence surveys and a more appropriate method for predicting the IDR, infection-hospitalization rate (IHR), and IFR in settings without seroprevalence surveys.

Our approach has six distinct components. First, we address certain types of missingness and reporting anomalies present in daily reported COVID-19 statistics. Second, we correct seroprevalence surveys for vaccination rates, re-infection from escape variants (B.1.351 and P1), and test-specific information on antibody test sensitivity. Third, we use corrected cumulative infections derived from seroprevalence surveys that are representative paired with cumulative cases, cumulative hospitalizations, and cumulative deaths to get empirical estimates of the IDR, IHR, and IFR. Statistical models for each have been developed to project the IDR, IHR, and IFR for each location and day taking into account population age structure where appropriate. Fourth, a smooth curve of daily cases, daily hospitalizations (where available), and daily deaths is generated. Fifth, all three smooth series of cases, hospitalizations, and deaths are divided by the relevant IDR, IHR, and IFR to generate three estimates of past daily infections. All three of these series are combined into a single best estimate of past infections. Sixth, daily infections are used to estimate the cumulative percent of individuals with one or more infection, which can be compared to seroprevalence surveys to assess internal consistency in each step of the process.

A detailed description of the approach, available here, provides more on the statistical models used and the diagnostic plots generated as part of the analysis.

Figure 1. Reported daily COVID-19 cases

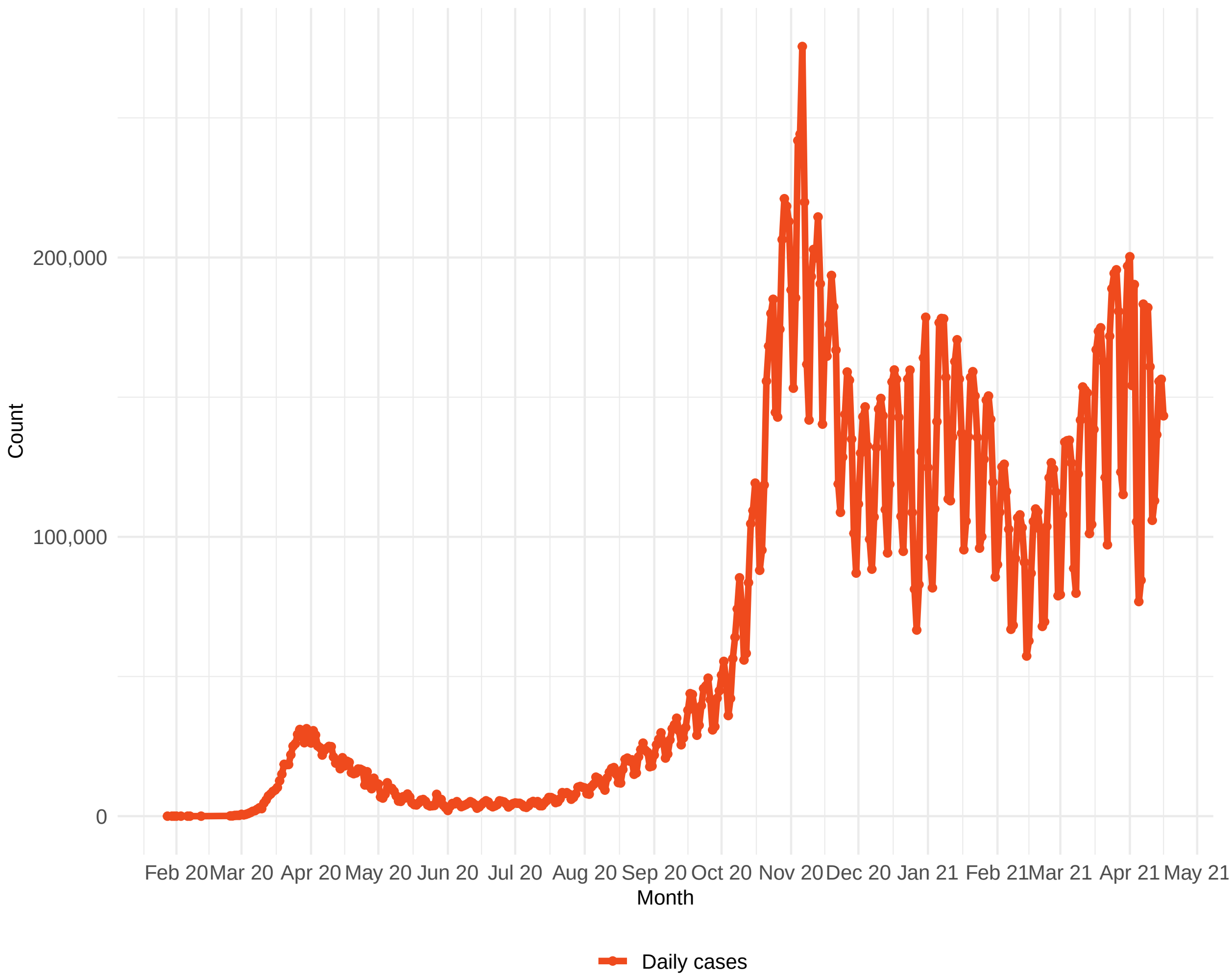


Table 1. Ranking of COVID-19 among the leading causes of mortality this week, assuming uniform deaths of non-COVID causes throughout the year

Cause name	Weekly deaths	Ranking
Ischemic heart disease	18,714	1
COVID-19	17,548	2
Stroke	10,303	3
Tracheal, bronchus, and lung cancer	6,216	4
Alzheimer's disease and other dementias	5,827	5
Chronic obstructive pulmonary disease	4,608	6
Colon and rectum cancer	4,100	7
Lower respiratory infections	3,503	8
Hypertensive heart disease	2,797	9
Chronic kidney disease	2,430	10

Figure 2. Reported daily COVID-19 deaths and smoothed trend estimate.

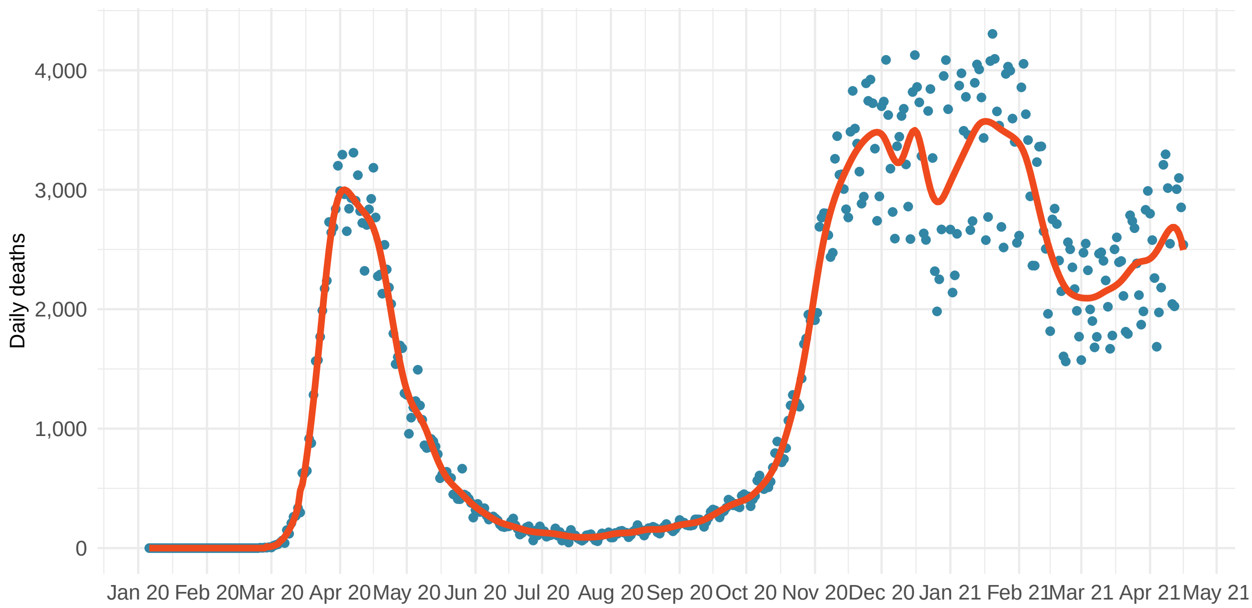


Figure 3. Daily COVID-19 death rate per 1 million on April 19, 2021

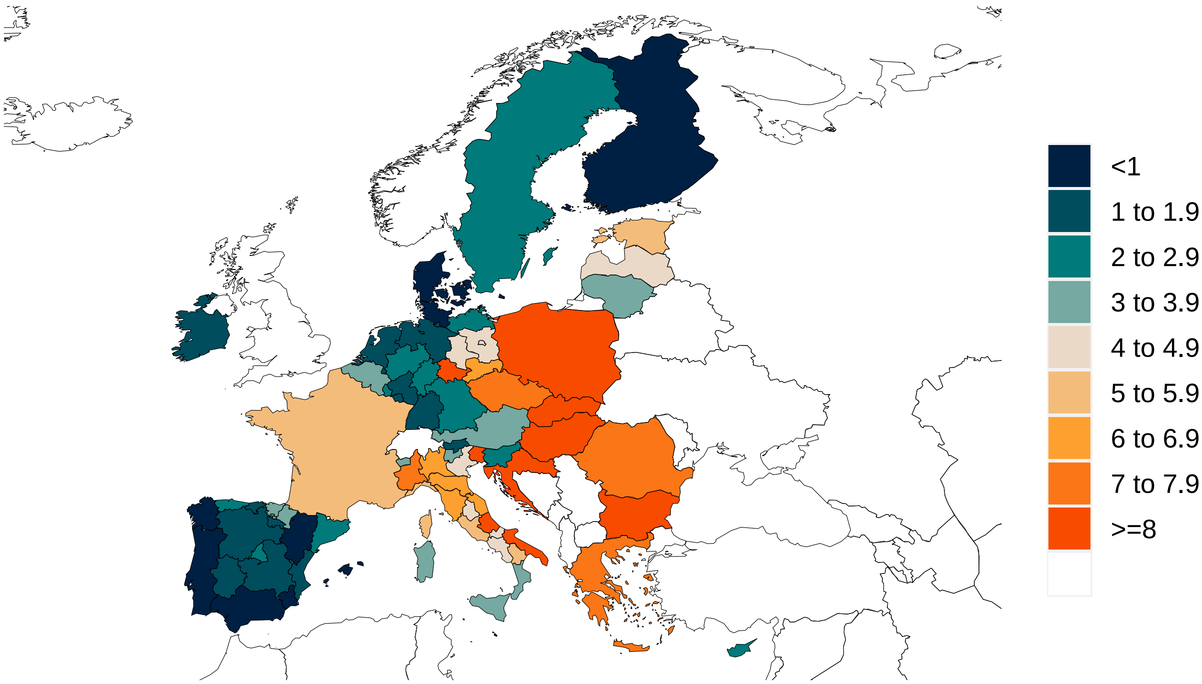


Figure 4. Estimated percent of the population infected with COVID-19 on April 19, 2021

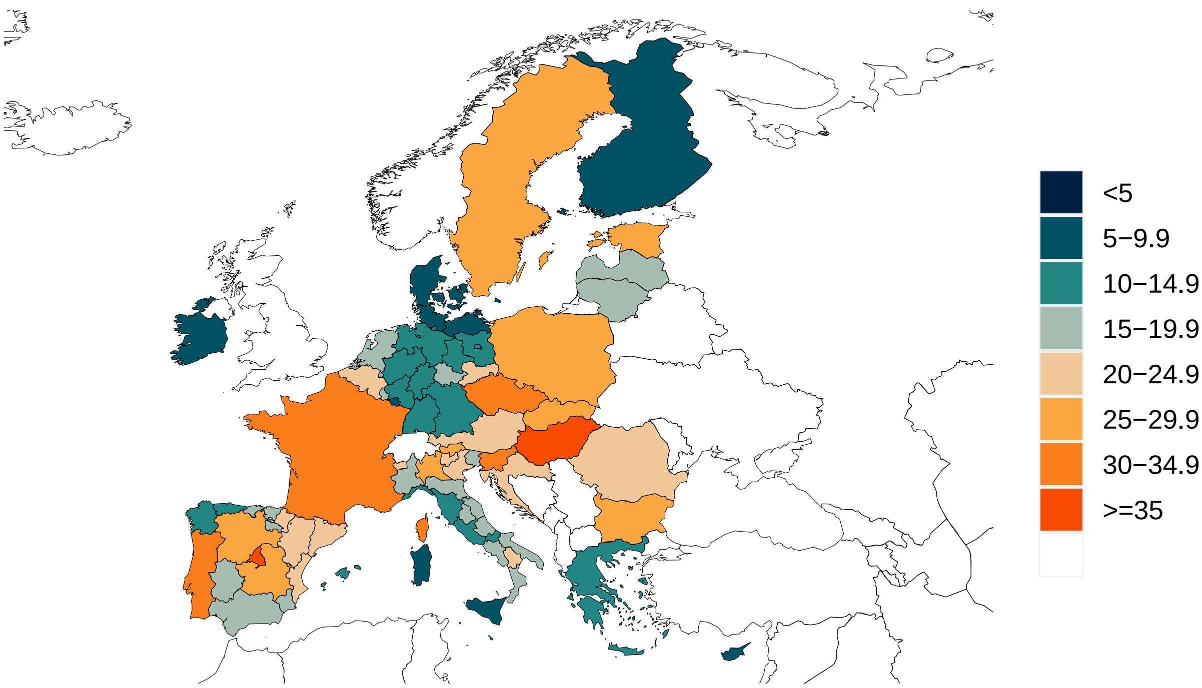


Figure 5. Mean effective R on April 08, 2021. The estimate of effective R is based on the combined analysis of deaths, case reporting, and hospitalizations where available. Current reported cases reflect infections 11-13 days prior, so estimates of effective R can only be made for the recent past. Effective R less than 1 means that transmission should decline, all other things being held the same.

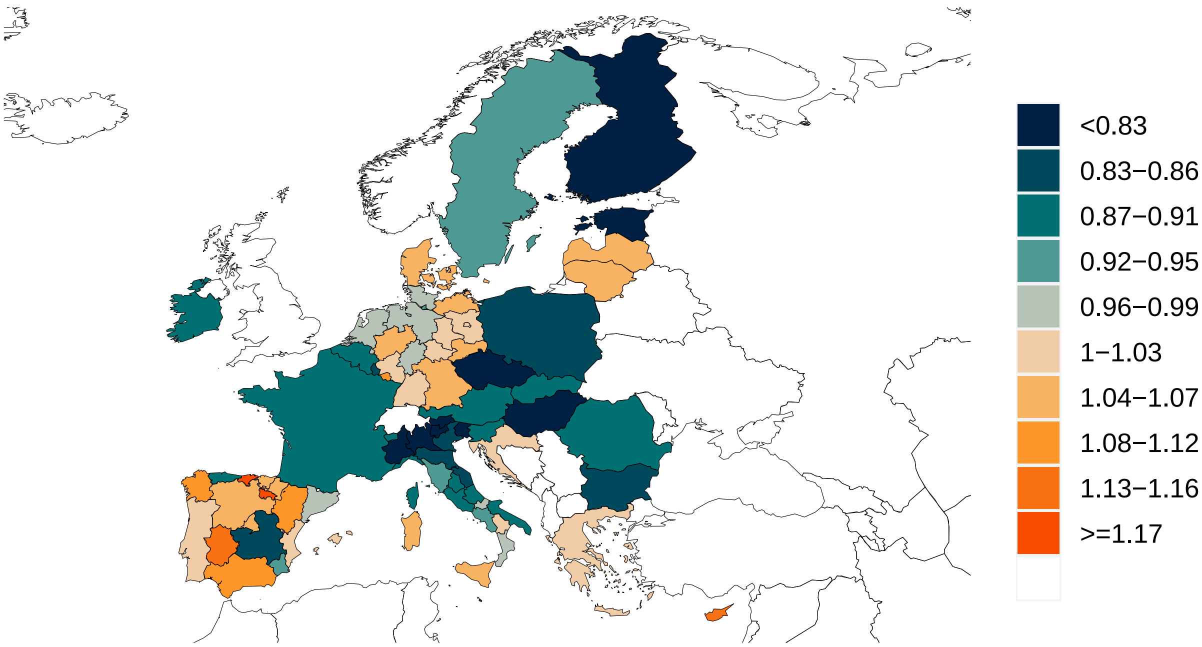
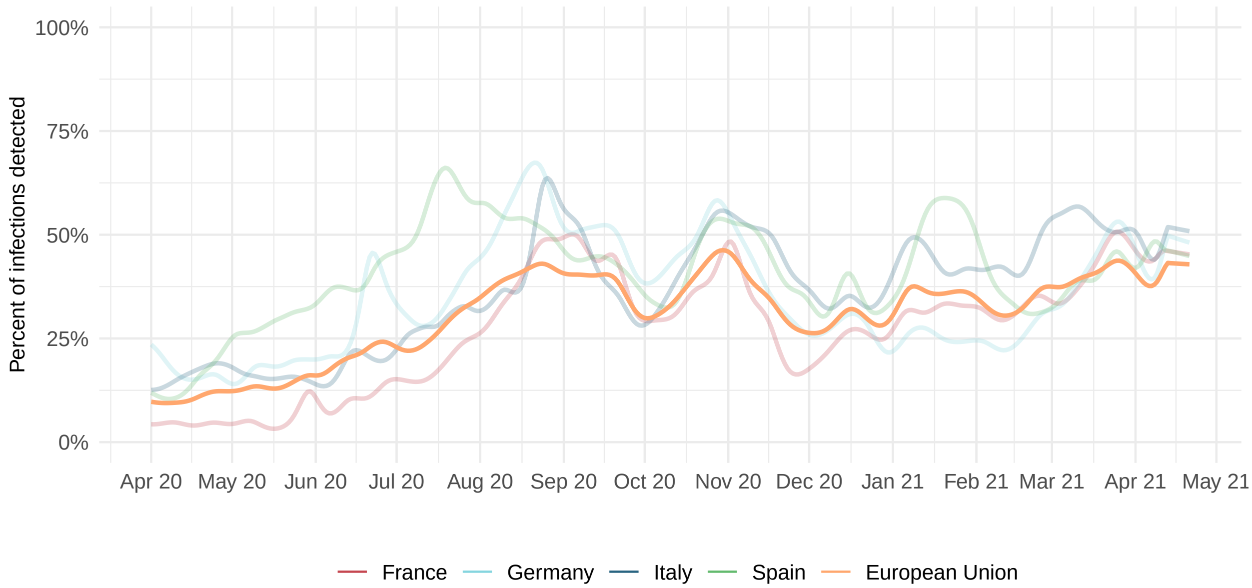


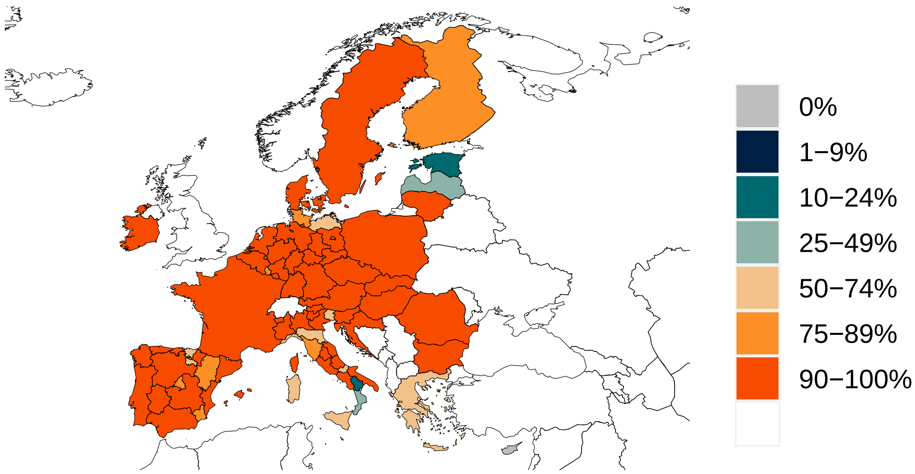
Figure 6. Percent of COVID-19 infections detected. This is estimated as the ratio of reported daily COVID-19 cases to estimated daily COVID-19 infections based on the SEIR disease transmission model.



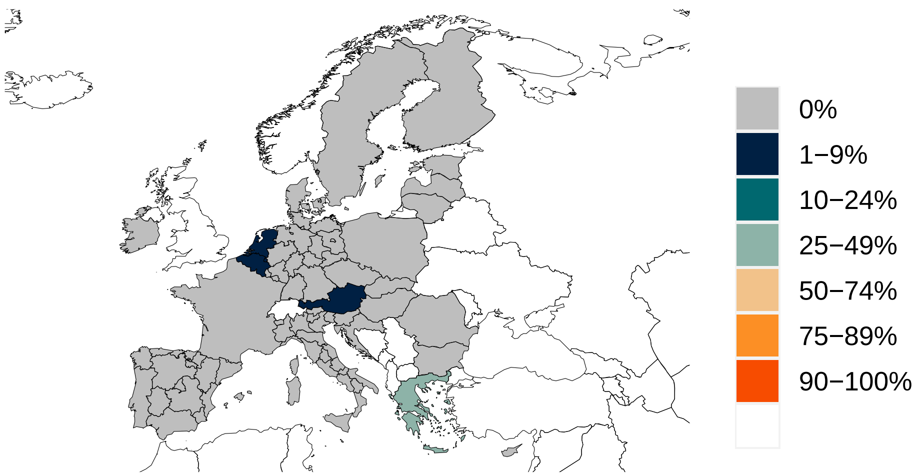
*Due to measurement errors in cases and testing rates, the infection to detection rate (IDR) can exceed 100% at particular points in time.

Figure 7. Percent of circulating SARS-CoV-2 for 3 primary variants on April 19, 2021.

A. Percent B.1.1.7 variant



B. Percent B.1.351 variant



C. Percent P1 variant

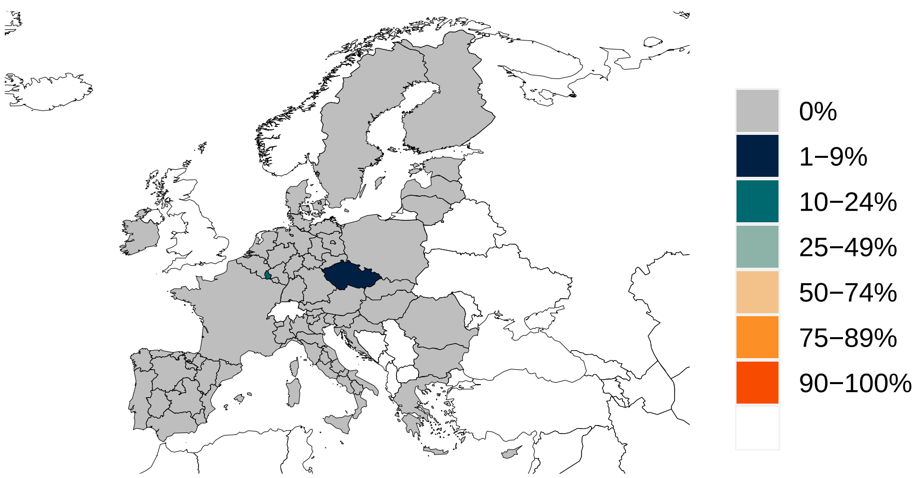
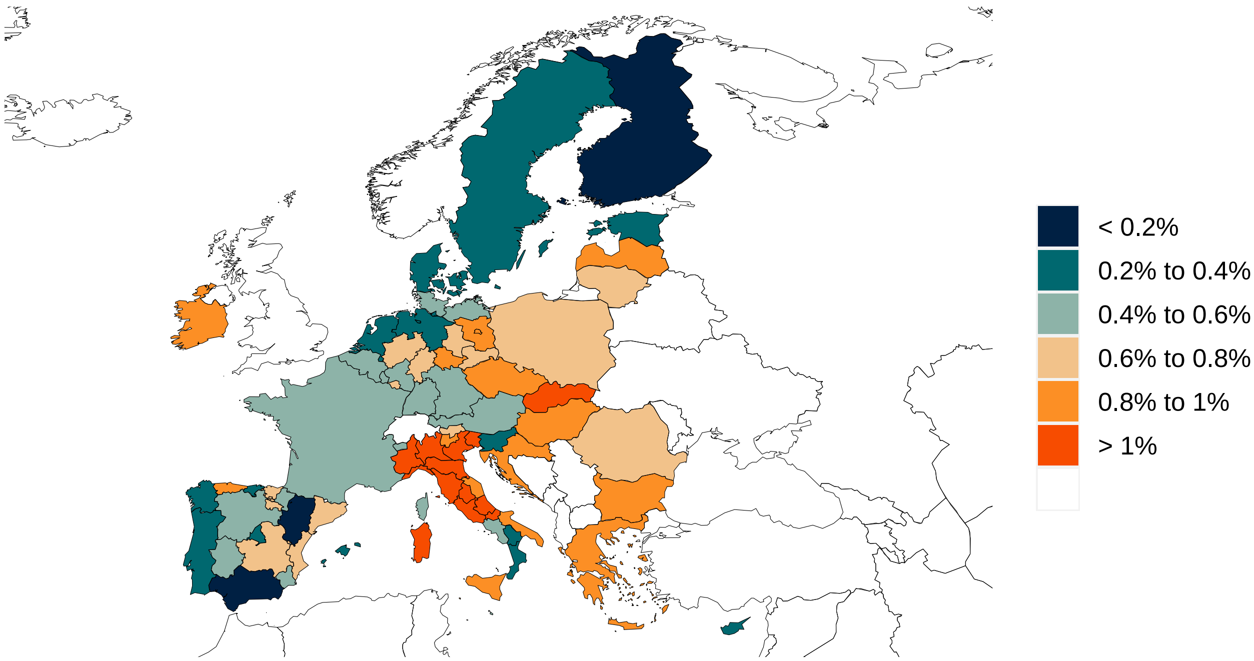
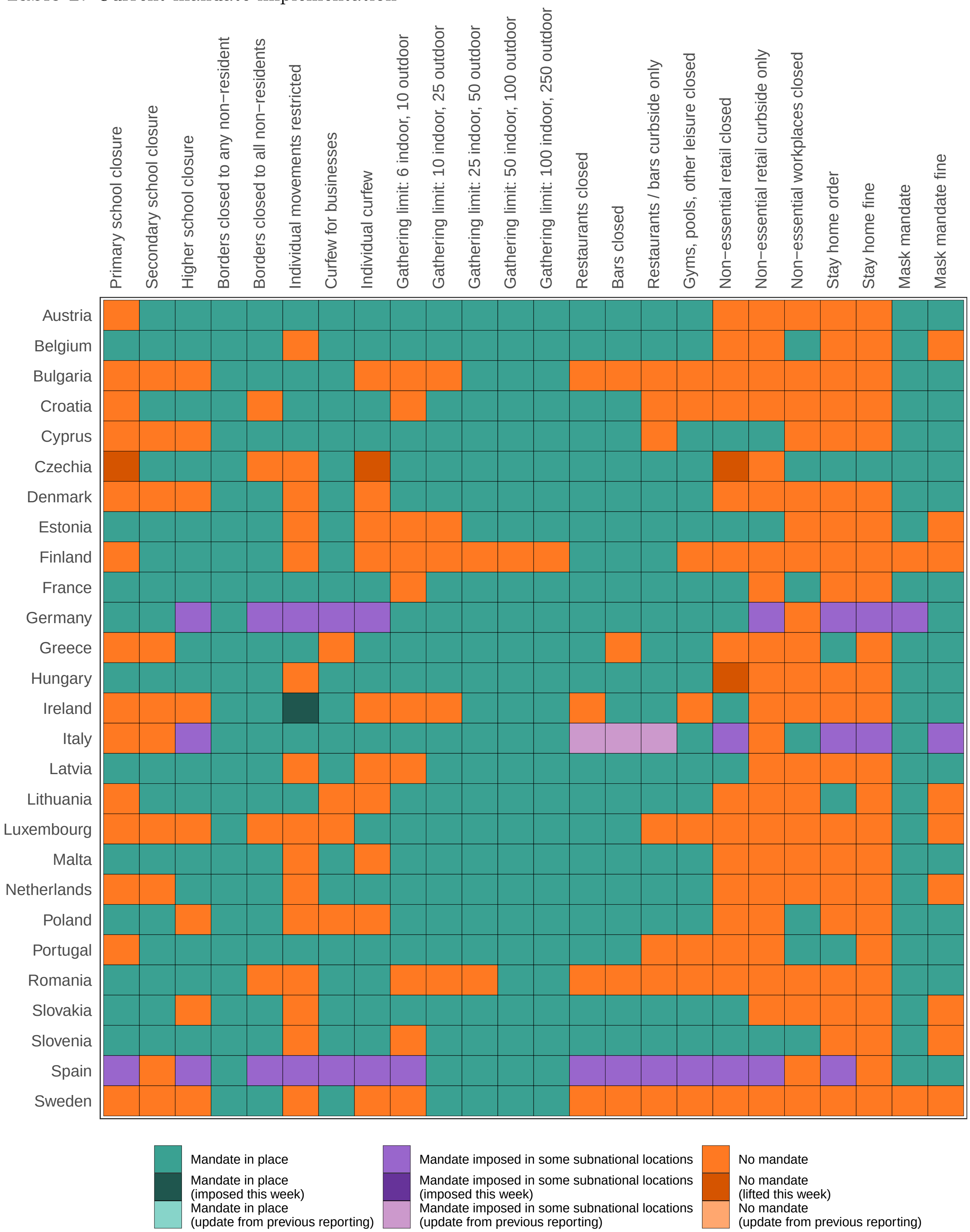


Figure 8. Infection fatality ratio on April 19, 2021. This is estimated as the ratio of COVID-19 deaths to infections based on the SEIR disease transmission model.



Critical drivers

Table 2. Current mandate implementation



*Not all locations are measured at the subnational level.

Figure 9. Trend in mobility as measured through smartphone app use compared to January 2020 baseline

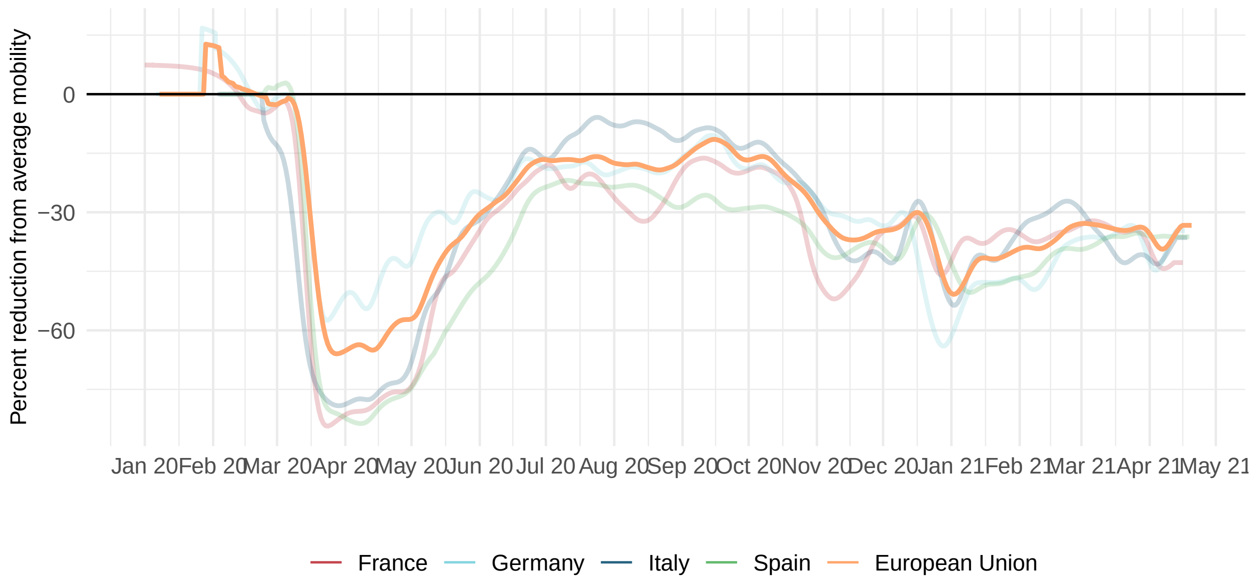


Figure 10. Mobility level as measured through smartphone app use compared to January 2020 baseline (percent) on April 19, 2021

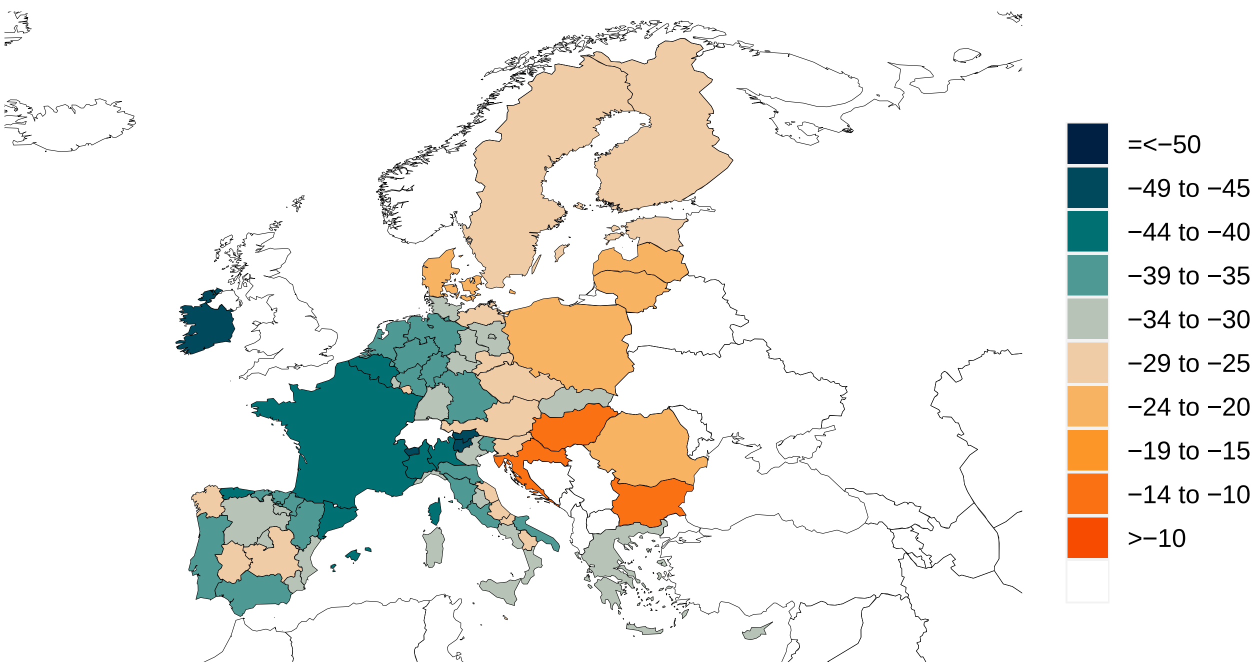


Figure 11. Trend in the proportion of the population reporting always wearing a mask when leaving home

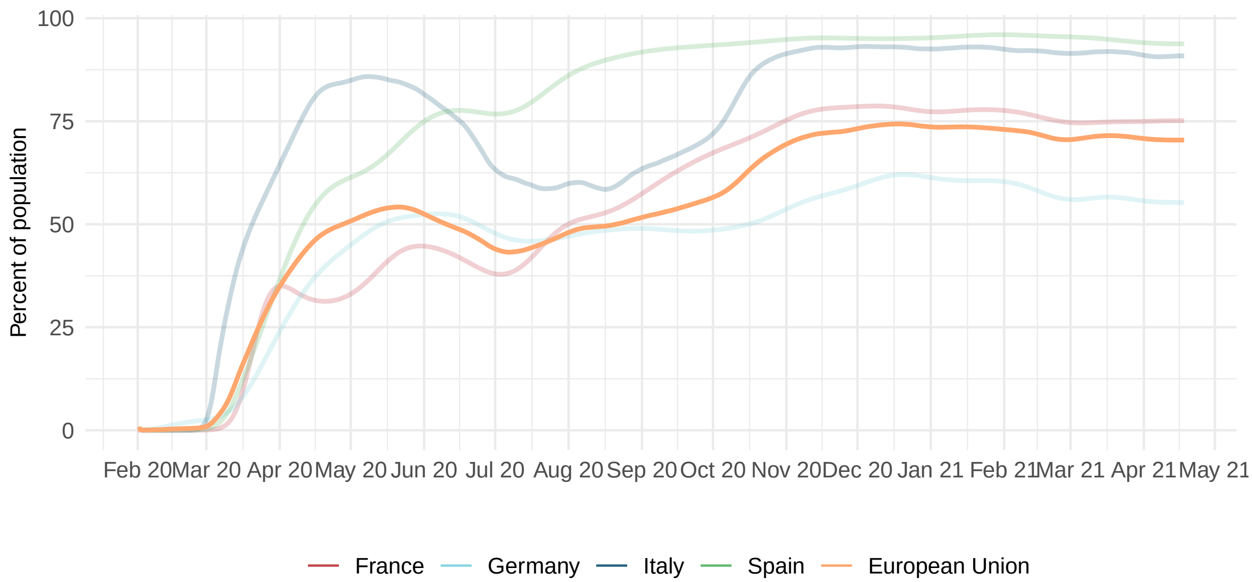


Figure 12. Proportion of the population reporting always wearing a mask when leaving home on April 19, 2021

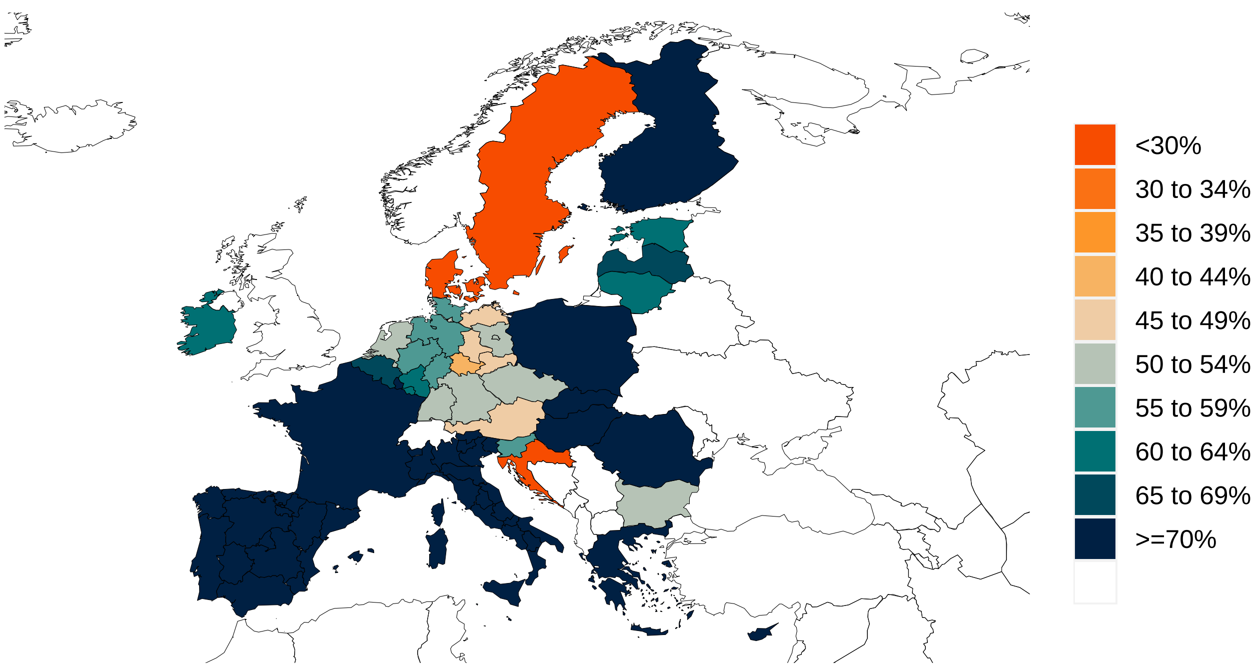


Figure 13. Trend in COVID-19 diagnostic tests per 100,000 people

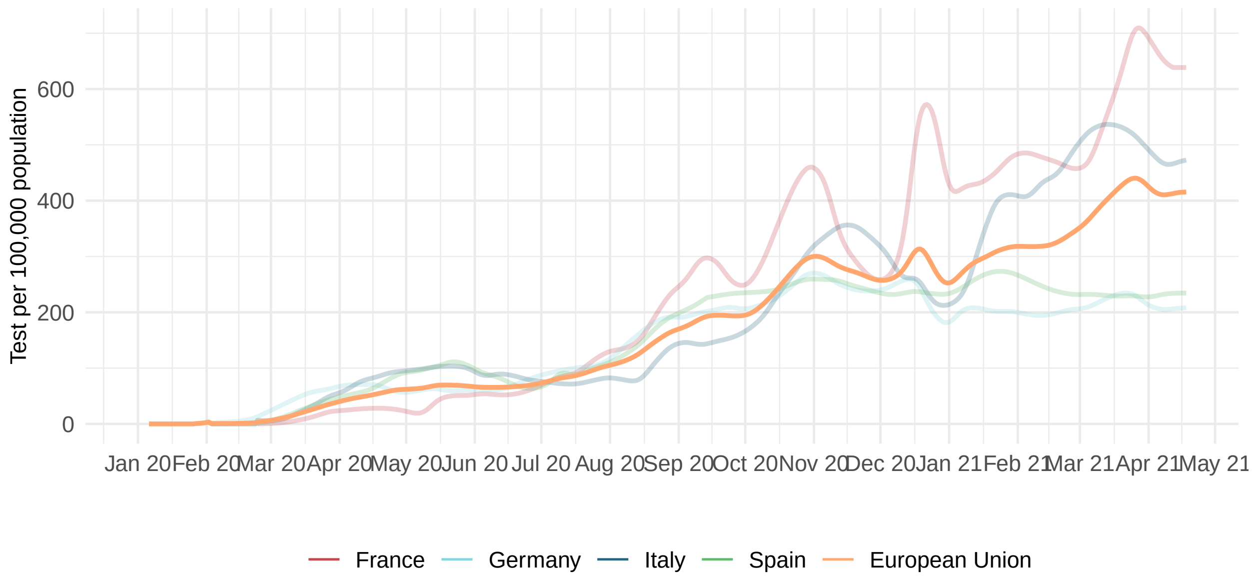


Figure 14. COVID-19 diagnostic tests per 100,000 people on April 19, 2021

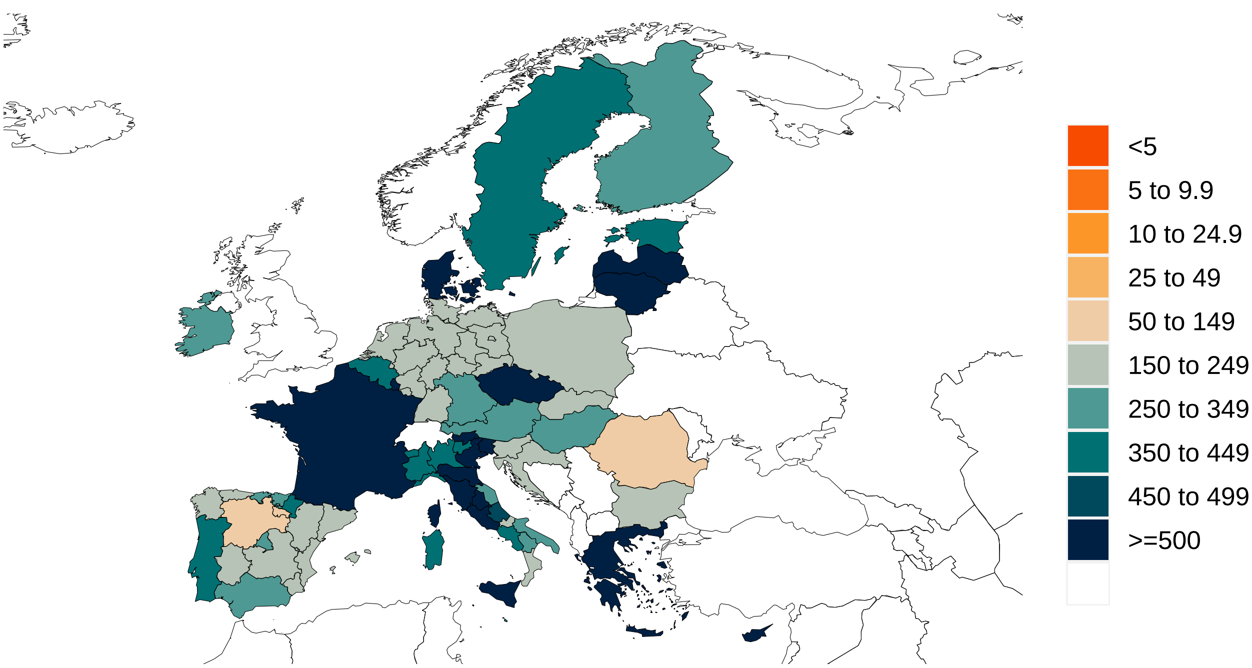


Figure 15. Increase in the risk of death due to pneumonia on February 1 2020 compared to August 1 2020

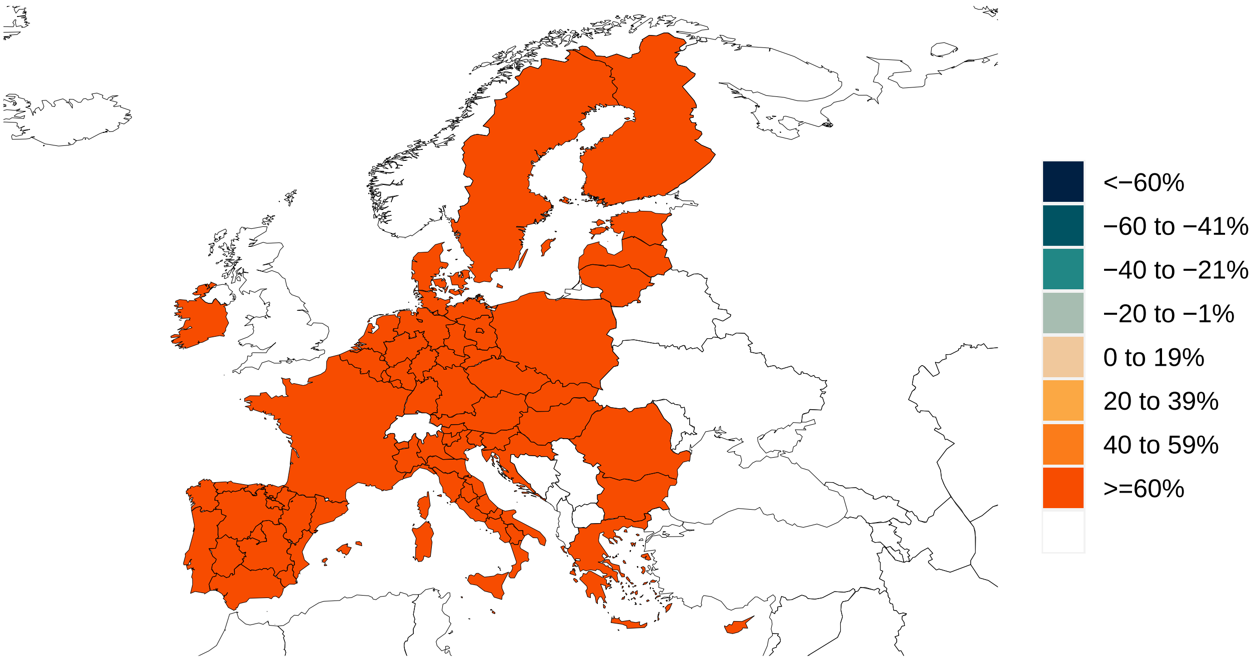


Table 3. The SEIR model uses variant-specific estimates of vaccine efficacy at preventing symptomatic disease and at preventing infection. We use data from clinical trials directly, where available, and make estimates otherwise. More information can be found on our website (http://www.healthdata.org/node/8584).

Vaccine	Efficacy at preventing disease: D614G & B.1.1.7	Efficacy at preventing infection: D614G & B.1.1.7	Efficacy at preventing disease: B.1.351 & P.1	Efficacy at preventing infection: B.1.351 & P.1
AstraZeneca	75%	52%	10%	6%
CoronaVac	50%	43%	38%	25%
Janssen	72%	72%	64%	42%
Moderna	94%	85%	72%	47%
Novavax	89%	77%	49%	32%
Pfizer/BioNTech	91%	86%	69%	45%
Sinopharm	73%	63%	56%	36%
Sputnik-V	92%	80%	70%	45%
Tianjin CanSino	66%	57%	50%	32%
Other vaccines	75%	65%	57%	37%
Other vaccines (mRNA)	95%	83%	72%	47%

Figure 16. Trend in the estimated proportion of the adult (18+) population that have been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

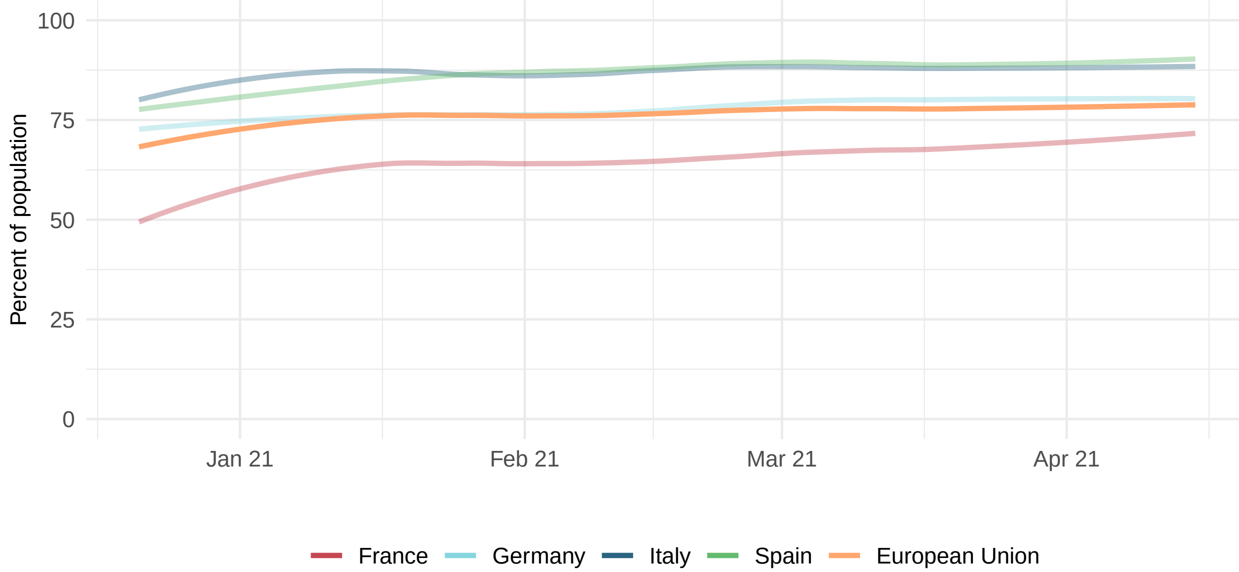


Figure 17. This figure shows the estimated proportion of the adult (18+) population that has been vaccinated or is open to receiving a COVID-19 vaccine based on Facebook survey responses (yes and yes, probably).

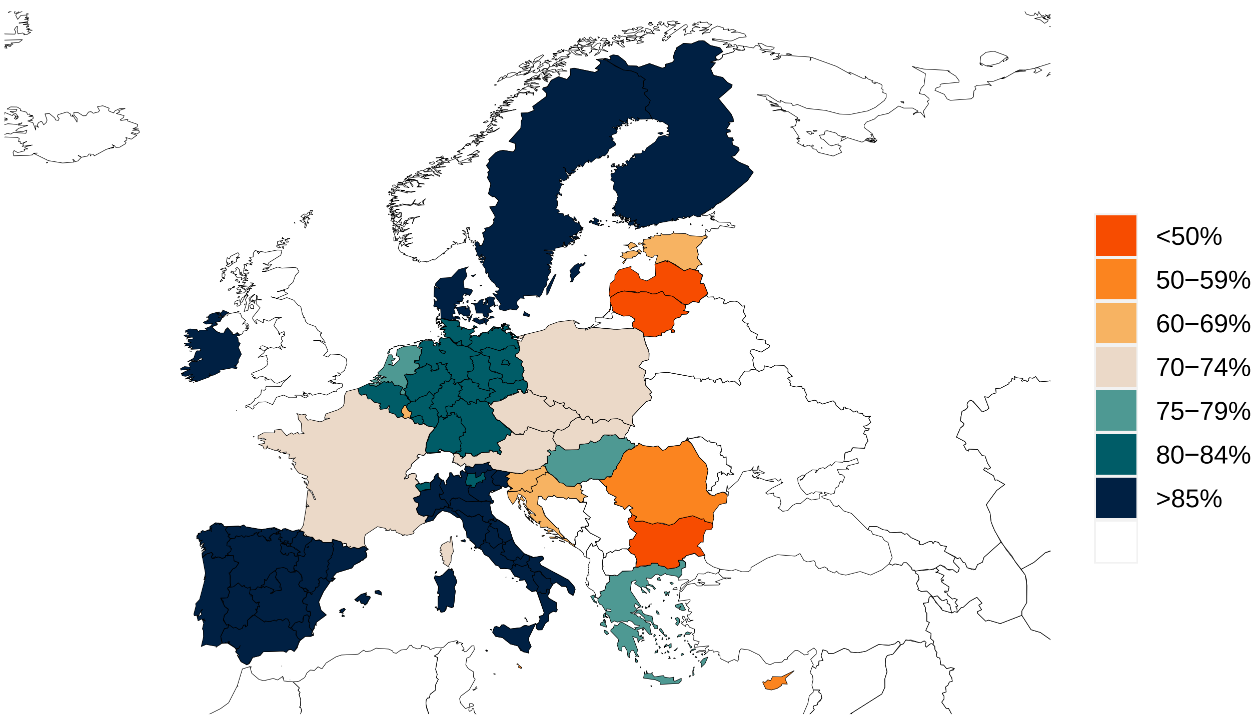
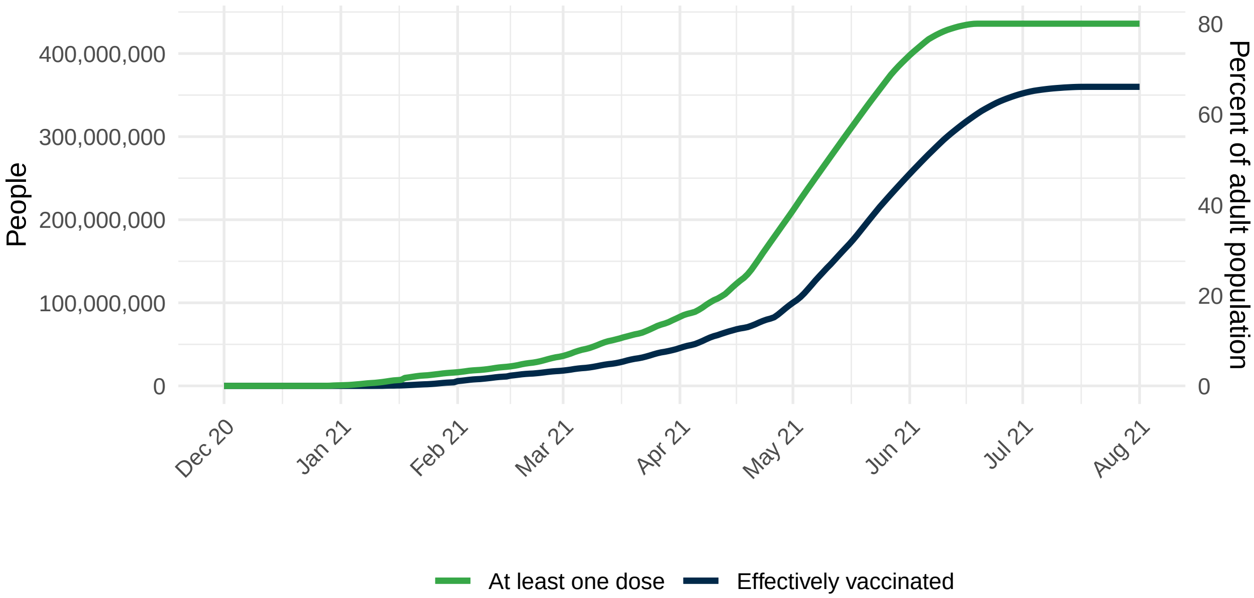


Figure 18. The number of people who receive any vaccine and those who are effectively vaccinated and protected against disease, accounting for efficacy, loss to follow up for two-dose vaccines, partial immunity after one dose, and immunity after two doses.



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.
- Governments adapt their response by re-imposing social distancing mandates for 6 weeks whenever daily deaths reach 8 per million, unless a location has already spent at least 7 of the last 14 days with daily deaths above this rate and not yet re-imposed social distancing mandates. In this case, the scenario assumes that mandates are re-imposed when daily deaths reach 15 per million.
- Variants B.1.1.7 (first identified in the UK), B.1.351 (first identified in South Africa), and P1 (first identified in Brazil) continue to spread from locations with (a) more than 5 sequenced variants, and (b) reports of community transmission, to adjacent locations following the speed of variant scale-up observed in the regions of the UK.
- In one-quarter of those vaccinated, mobility increases toward pre-COVID-19 levels.

The **worse scenario** modifies the reference scenario assumptions in three ways:

- First, it assumes that variants B.1.351 or P1 begin to spread within 3 weeks in adjacent locations that do not already have B.1.351 or P1 community transmission.
- Second, it assumes that all those vaccinated increase their mobility toward pre-COVID-19 levels.
- Third, it assumes that among those vaccinated, mask use starts to decline exponentially one month after completed vaccination.

The **universal masks scenario** makes all the same assumptions as the reference scenario but also assumes 95% of the population wear masks in public in every location.

Figure 19. Cumulative COVID-19 deaths until August 01, 2021 for three scenarios

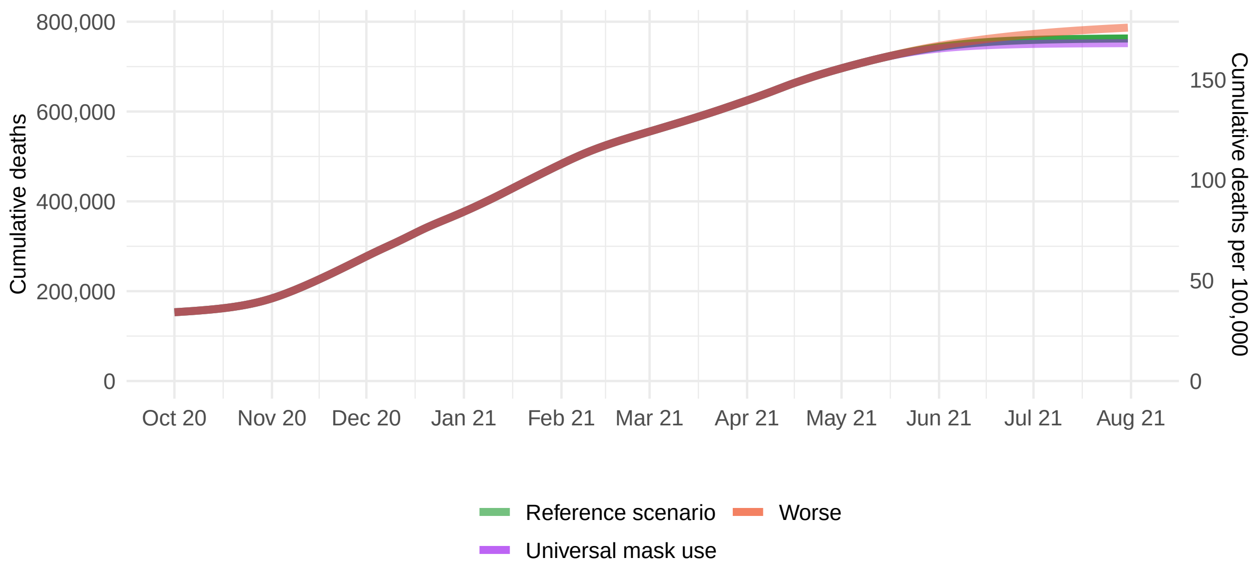


Figure 20. Daily COVID-19 deaths until August 01, 2021 for three scenarios,

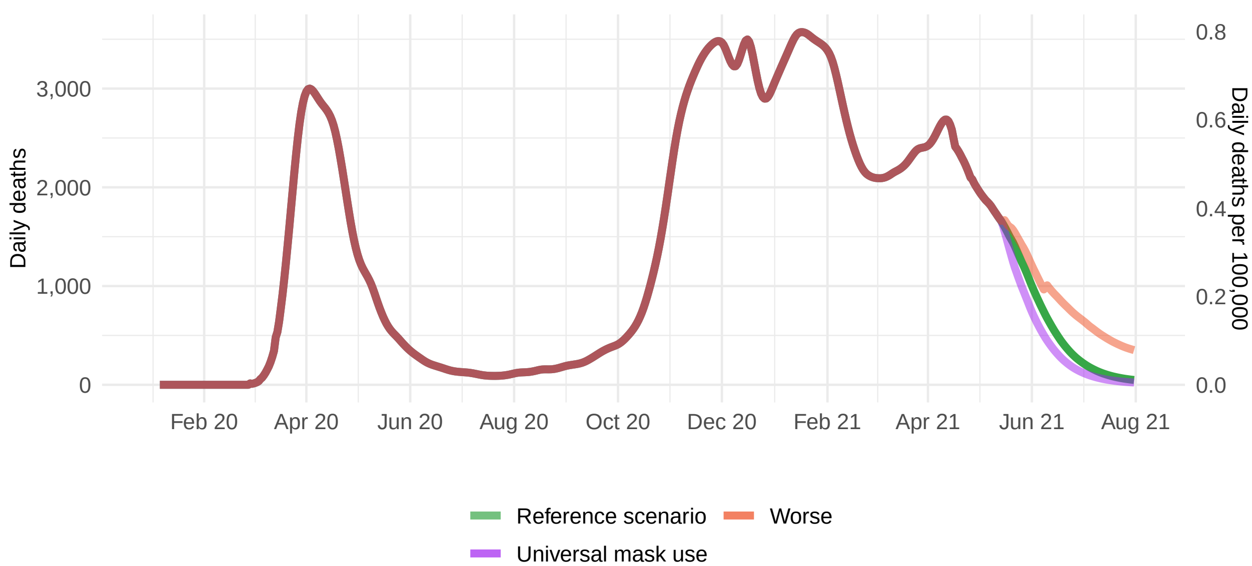


Figure 21. Daily COVID-19 infections until August 01, 2021 for three scenarios.

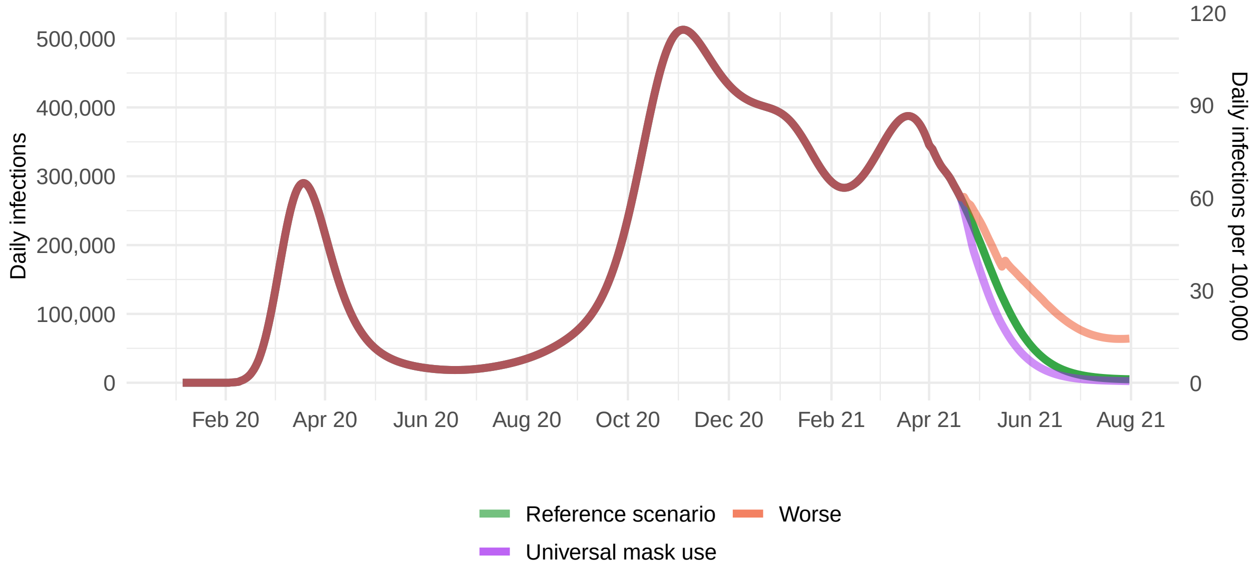


Figure 22. Comparison of reference model projections with other COVID modeling groups. For this comparison, we are including projections of daily COVID-19 deaths from other modeling groups when available: Delphi from the Massachussets Institute of Technology (Delphi; https://www.covidanalytics.io/home), Imperial College London (Imperial; https://www.covidsim.org), The Los Alamos National Laboratory (LANL; https://covid-19.bsvgateway.org/), and the SI-KJalpha model from the University of Southern California (SIKJalpha; https://github.com/scc-usc/ReCOVER-COVID-19). Daily deaths from other modeling groups are smoothed to remove inconsistencies with rounding. Regional values are aggregates from available locations in that region.

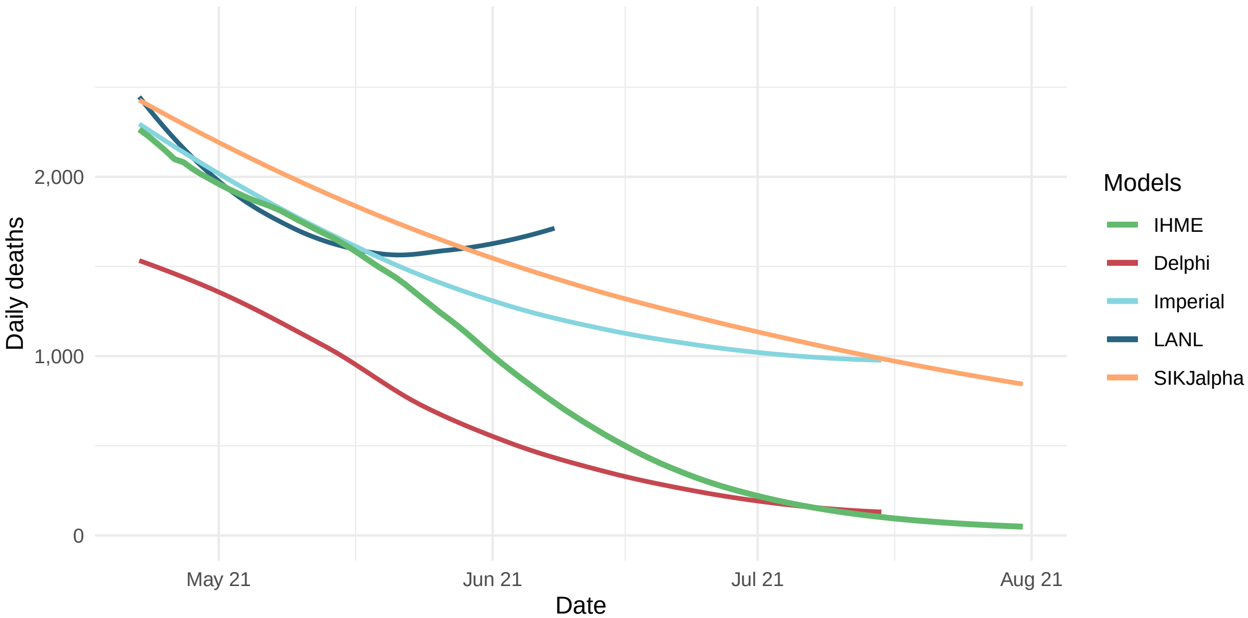


Figure 23. The estimated inpatient hospital usage is shown over time. The percent of hospital beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of beds occupied by COVID-19 patients. Less than 5% is considered *low stress*, 5-9% is considered *moderate stress*, 10-19% is considered *high stress*, and greater than 20% is considered *extreme stress*.

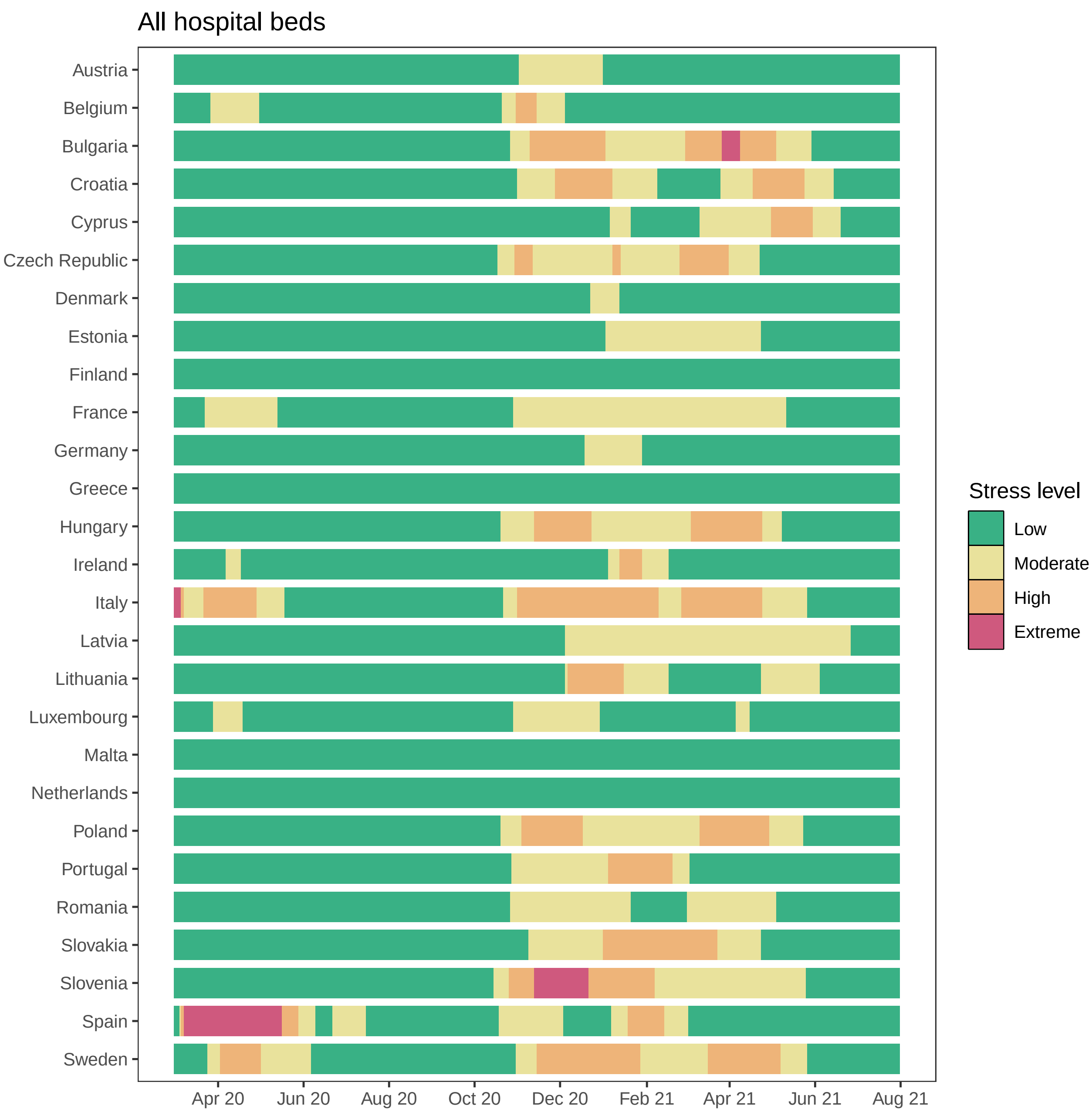
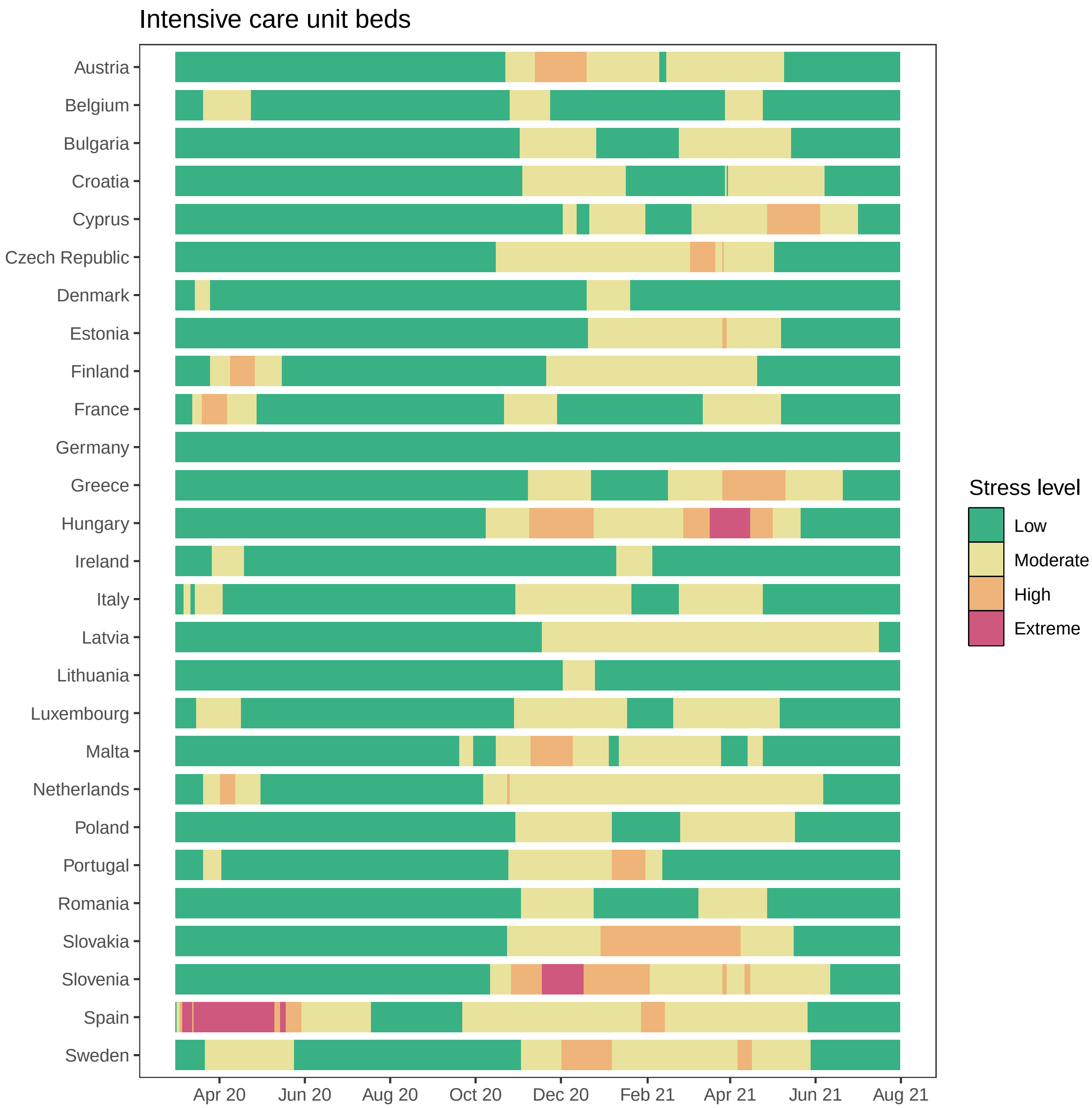


Figure 24. The estimated intensive care unit (ICU) usage is shown over time. The percent of ICU beds occupied by COVID-19 patients is color coded based on observed quantiles of the maximum proportion of ICU beds occupied by COVID-19 patients. Less than 10% is considered *low stress*, 10-29% is considered *moderate stress*, 30-59% is considered *high stress*, and greater than 60% is considered *extreme stress*.



More information

Data sources:

Mask use data sources include Premise; Facebook Global Symptom Survey (This research is based on survey results from University of Maryland Social Data Science Center) and the Facebook United States Symptom Survey (in collaboration with Carnegie Mellon University); Kaiser Family Foundation; YouGov COVID-19 Behaviour Tracker survey.

Vaccine hesitancy data are from the COVID-19 Beliefs, Behaviors, and Norms Study, a survey conducted on Facebook by the Massachusetts Institute of Technology (https://covidsurvey.mit.edu/).

Vaccine hesitancy data are from the Facebook Global Symptom Survey (This research is based on survey results from University of Maryland Social Data Science Center), the Facebook United States Symptom Survey (in collaboration with Carnegie Mellon University), and from the Facebook COVID-19 Beliefs, Behaviors, and Norms Study conducted by the Massachusetts Institute of Technology.

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.

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