IHME
Measuring what matters

COVID-19 estimation updates

View the COVID-19 projections

COVID-19: What's new for April 13, 2020

Main updates on IHME COVID-19 predictions since April 10, 2020

OUR NEW PRODUCTION SCHEDULE

Since switching to a three-day production schedule last week, IHME team members have been processing new data and testing updated methods since April 10. All estimation updates and results presented here reflect data captured for April 10, 11, and 12, with production models run on April 12.

Our next set of results for countries for which we are already producing estimates will be published on Wednesday, April 15.

IHME is working hard to process data for and generate COVID-19 predictions for more countries throughout the world. Our current plan is to publish estimates for several countries in Latin America by the end of this week. IHME's data intake team is systematically compiling available data across all countries with the aim of being able to publish data-driven estimates and projections for all countries soon.

MORE DATA, BETTER MODELS, IMPROVED METHODS

The data and knowledge landscape on COVID-19 epidemic patterns, health care demand or resource gaps, government response, and the effects of social distancing measures are rapidly evolving worldwide. At IHME, we strive to incorporate new evidence as soon as it becomes available. Our aim is to produce the best possible predictions given what we know today – and to continually improve these estimates to support further gains against COVID-19 tomorrow.

Today's release of COVID-19 predictions for deaths and hospital use primarily reflect updates to data inputs or sources, as well as adjustments for the social distancing policy covariate in a subset of European countries based on collaborator feedback.

Predicting COVID-19 deaths: expanding data inputs and refining model covariates

Daily death data inputs. As also discussed in prior updates, when and how COVID-19 deaths are reported for some locations fluctuates a lot day to day. This is quite understandable – routinely reporting and consistently classifying cause-of-death data can be challenging under usual circumstances, let alone during a pandemic.

At IHME, we strive to correct for known biases in the data we use. Further, as more reliable and comprehensive data sources are identified, we then use these data to inform our models.

Our release today involves the following data source changes for daily COVID-19 deaths:

- France: In late March, it was reported that a substantial number of daily COVID-19 deaths occurring in nursing homes were not being included in the same way as routinely reported COVID-19 deaths in hospitals. Especially given the toll of COVID-19 for older populations, it was important to start using data sources like the French governmental dashboard, in which daily deaths from different origins (i.e., hospitals *and* nursing homes) were being captured. Exact dates for COVID-19 deaths occurring in nursing homes are not yet clear in this source; consequently, we currently adjust total deaths from nursing homes and redistribute these COVID-19 deaths across the full time series in France relative to daily deaths reported in hospitals.
- Colorado, US: We have added an additional data source for Colorado, given reporting inconsistencies observed in our previous data source. The new data source is the daily death data reported through Colorado's Department of Public Health and Environment website. For each date of updated COVID-19 data the state provides a full time series of daily deaths reported. The challenge of lags in reporting still remains, with everyone striving to address and minimize lags however possible.
- Illinois, US: In a similar vein, we have used Illinois's Department of Health COVID-19 website to re-extract daily death data and benchmark inputs against the state's routinely updated 30-day cumulative COVID-19 death count.

Social distancing covariate for Denmark, Netherlands, and Norway. Since our April 10 release, we received feedback from several collaborators in the Global Burden of Disease (GBD) network on how social distancing policies were being implemented – and having effects on population-level movement – in Denmark, the Netherlands, and Norway.

Based on Google mobility data, policies on gathering restrictions and closing certain groups of non-essential businesses without instituting stricter or more sweeping non-essential business closure mandates appear to also have substantial effects on reducing mobility (i.e., a likely indicator of how much contact people are having with each other and thus potential virus exposure).

To account for this new evidence in our current COVID-19 death modeling framework, we have adjusted covariate values on social distancing for Denmark, the Netherlands, and Norway. As indicated in our April 10 estimation update, IHME's development team continues testing the inclusion of mobility-based covariates into the social distancing covariates and ensemble models. We hope to release the updated model on Wednesday, April 15.

As summarized in the tables below, this update has not yet changed predictions of daily COVID-19 deaths at peak and cumulative deaths for the epidemic's first wave. This is likely at least partly because the new model's results are being averaged from projections generated from the last two days' models. With today's release, we see a decline in estimates for the Netherlands, with its projected cumulative deaths now being 15,834 (6,207 to 35,968) through the first wave. The potential peak dates for daily deaths have also shifted later (approximately May 6 for Denmark and the Netherlands, and May 4 for Norway). As more recent data are incorporated into the COVID-19 prediction models, we anticipate that these projections will change substantially in these three countries and potentially in others as well.

Country	Predictions in daily COVID-19 deaths at peak from our April 13 release (today)	Predictions from our April 10 release	Change of average values since the April 10 release*
Denmark	45 (13 to 117)	42 (13 to 107)	↑ 3 deaths
Netherlands	440 (123 to 1,116)	468 (132 to 1,063)	↓ 28 deaths
Norway	19 (7 to 41)	24 (11 to 52)	↓ 5 deaths

*Change estimates do not include uncertainty; they are only based on the average value. If prediction values' uncertainty intervals (the numbers reported in parentheses) overlap a lot across different releases, changes in these estimates are not considered substantively different.

Country	Predictions for cumulative COVID-19 deaths through the first wave from our April 13 release (today)	Predictions from our April 10 release	Change of average values since the April 10 release*
Denmark	1,669 (657 to 4,051)	1,575 (696 to 3,519)	↑ 94 deaths
Netherlands	15,834 (6,207 to 35,968)	18,067 (6,541 to 41,614)	↓ 2,233 deaths
Norway	811 (339 to 1,792)	925 (448 to 1,904)	↓ 114 deaths

*Change estimates do not include uncertainty; they are only based on the average value. If prediction values' uncertainty intervals (the numbers reported in parentheses) overlap a lot across different releases, changes in these estimates are not considered substantively different.

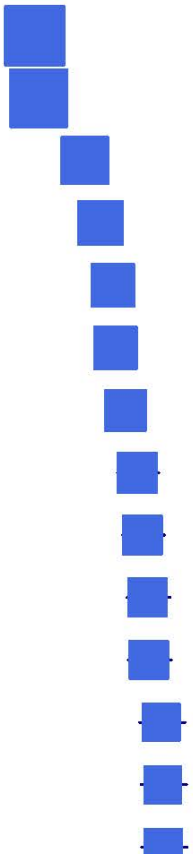
Predicting COVID-19 hospital use: expanding hospitalization-to-death ratio inputs

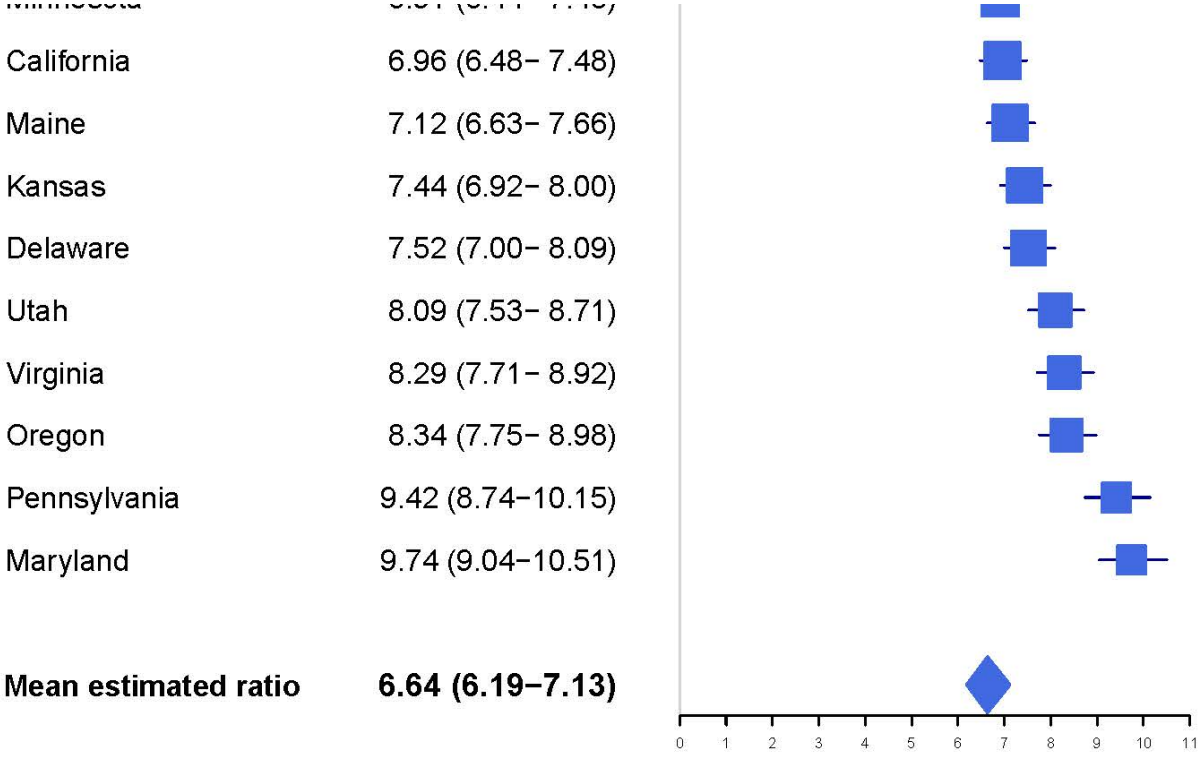
Similar to our April 5 estimation update, we have been able to incorporate additional data sources on hospital admissions and corresponding outcomes for COVID-19 patients. Such data are vital inputs for our estimates of hospitalization-to-death ratios, which then inform the model parameters used for predicting hospital bed need. In other words, thanks to several state governments and hospital groups, we now have a larger quantity of hospitalization data that also are likely to be more representative of current hospital resource needs of COVID-19 patients.

Our estimates released today use the 23 state-specific ratios noted below, and for states without state-specific ratios, the pooled ratio of 6.6 (95% confidence interval of 6.2 to 7.1) is applied. The previous pooled ratio estimate was 7.0 (95% CI 4.0 to 12.7); as result, predicted peak hospital resource use may be lower than previously estimated for some locations.

Random effects meta-analysis of the ratio of hospital admissions to deaths by state, for states with available hospitalization and outcome data

State	Hospitalization to death ratio (95% CI)
Massachusetts	4.14 (3.89– 4.41)
New York	4.23 (3.97– 4.51)
Alabama	5.23 (4.89– 5.59)
Georgia	5.57 (5.20– 5.96)
Alaska	5.83 (5.44– 6.25)
Tennessee	5.88 (5.49– 6.31)
Colorado	6.09 (5.69– 6.54)
Florida	6.35 (5.92– 6.82)
Idaho	6.46 (6.02– 6.94)
Mississippi	6.58 (6.13– 7.06)
New Hampshire	6.60 (6.15– 7.09)
North Dakota	6.87 (6.40– 7.38)
Hawaii	6.90 (6.43– 7.42)
Minnesota	6.91 (6.44– 7.43)





KEY FINDINGS FROM TODAY'S RELEASE (APRIL 13, 2020)

A focus on Europe

- **Predictions for cumulative deaths.** While cumulative death projections have changed for several countries since our April 10 release, the United Kingdom (UK), Italy, and Spain remain among the European Economic Area (EEA) countries with the highest predicted cumulative deaths from COVID-19 during this first wave (as shown below). Notably, the UK's projected cumulative COVID-19 deaths are 23,791 (estimate range of 14,076 to 50,820); the average projection is lower than the April 10 release, but uncertainty intervals still overlap.
- Also note that Sweden's currently high projections include wide, overlapping uncertainty intervals relative to the April 10 release. As more data become available, these estimates could change considerably.

Country	Predictions for cumulative COVID-19 deaths through the first wave from our April 13 release (today)	Predictions from our April 10 release	Change of average values since the April 10 release*
United Kingdom	23,791 (14,076 to 50,820)	37,494 (26,149 to 62,519)	↓ 13,703 deaths
Italy	21,130 (20,488 to 22,311)	20,333 (19,691 to 31,377)	↑ 797 deaths

Spain	18,713 (17,563 to 21,386)	18,363 (17,095 to 20,842)	↑ 350 deaths
Sweden	18,322 (6,780 to 44,694)	13,259 (6,237 to 25,987)	↑ 5,063 deaths
France	17,448 (15,497 to 22,550)	15,741 (13,668 to 20,714)	↑ 1,707 deaths

*Change estimates do not include uncertainty; they are only based on the average value. If prediction values' uncertainty intervals (the numbers reported in parentheses) overlap a lot across different releases, changes in these estimates are not considered substantively different.

- **Predicted peak for daily COVID-19 deaths.** Based on the latest available data, it appears that many EEA countries with the largest cumulative COVID-19 deaths may have already experienced their epidemic peaks – these include Italy, Spain, and France. Current projections suggest that the UK and Germany could reach their COVID-19 epidemic peaks this week. Other countries with potentially high peaks in daily COVID-19 deaths have large uncertainty intervals accompanying their average predictions at present; this means the model predictions point to potential peak dates that could remain several weeks away. As more recent data become available, such uncertainty could narrow.

Country	**Predicted potential peak date of daily COVID-19 deaths**	**Predicted daily COVID-19 deaths at peak: average projection (estimate range)**
United Kingdom	April 13	1,156 (247 to 4,255)
Italy	March 27	969*
Spain	April 1	950*
France	April 5	941*
Sweden	May 8	560 (184 to 1,416)
Belgium	April 10	496*

Netherlands	May 6	440 (132 to 1,116)
Germany	April 13	272 (73 to 829)
Switzerland	May 7	130 (6 to 559)

* Reported daily death data; no uncertainty estimates accompany these values.

- **Hospital resource use predictions**. Based on the current data and model, a number of EEA countries may have already reached their peak hospital use in late March or early April (Italy, Spain, and France). Others could have experienced over the last week or are currently experiencing peak demand for COVID-19 patients (e.g., Ireland, Austria, Portugal, Belgium, Luxembourg). Conversely, below are some EEA countries with projections pointing to high total hospital bed need, as well as other key hospital resources, that may peak between now and the end of April:

Country	Predicted potential peak date of hospital resource use	Predicted hospital bed need at peak	Predicted ICU bed need at peak	Predicted invasive ventilator need at peak
United Kingdom	April 14	34,318 (8,648 to 115,841)	8,643 (2,987 to 26,467)	7,731 (2,362 to 24,618)
Germany	April 14	6,743 (1,669 to 20,545)	1,805 (610 to 5,059)	1,619 (480 to 4,720)
Poland	April 27	2,494 (427 to 8,932)	627 (107 to 2,216)	557 (96 to 1,930)

A focus on the US

- **Predicted peak for daily COVID-19 deaths.** Nationally, the predicted peak for daily COVID-19 deaths could be around April 13, reaching 2,150 deaths (estimate range of 464 to 7,084). These projections suggest that the US is reaching its peak for COVID-19 deaths; however, this national average does not reflect the considerable variation in timing of epidemic peaks across states.

- Based on the latest available data, a number of states also may be nearing or reaching their epidemic peaks for daily COVID-19 deaths over the next week or so.

State	Predicted peak date of daily COVID-19 deaths	Predicted daily COVID-19 deaths at peak: average projection (estimate range)
Ohio	April 13	27 (4 to 117)
Maine	April 13	3 (0 to 11)
North Carolina	April 13	22 (2 to 110)
Tennessee	April 13	20 (1 to 68)
Pennsylvania	April 18	88 (13 to 366)
West Virginia	April 20	4 (0 to 20)

- **Predictions for cumulative deaths.** At the national level, projected cumulative COVID-19 deaths could reach 68,841 (estimate range of 30,188 to 175,965) across states during the epidemic's first wave. Today's release is somewhat higher than the average US predictions for cumulative COVID-19 deaths published on April 10 (61,545, with an estimate range of 26,487 to 155,315), though the uncertainty intervals overlap considerably. This change is at least partially driven by higher cumulative estimates for Massachusetts and New York, reflecting the latest COVID-19 death data that are publicly available.
- Based on the latest data and current model, the following states could have the highest cumulative COVID-19 death tolls through the epidemic's first wave:

State	Predictions for cumulative COVID-19 deaths through the first wave from our April 13 release (today)	Predictions from our April 10 release	Change of average values since the April 10 release*
New York	14,542 (11,008 to 23,000)	13,463 (9,382 to 24,236)	↑ 1,079 deaths

Massachusetts	8,219 (1,680 to 25,347)	6,739 (1,269 to 22,854)	↑ 1,480 deaths
Connecticut	5,426 (1,344 to 15,397)	4,614 deaths (1,143 to 13,559)	↑ 812 deaths
Florida	4,748 (1,250 to 13,759)	3,999 (1,218 to 10,293)	↑ 749 deaths
New Jersey	4,407 (2,684 to 10,033)	3,915 (2,133 to 8,700)	↑ 492 deaths
Georgia	3,718 (1,081 to 10,693)	3,564 (1,300 to 9,020)	↑ 154 deaths
Texas	2,704 (631 to 8,552)	2,350 (592 to 6,553)	↑ 354 deaths

*Change estimates do not include uncertainty; they are only based on the average value. If prediction values' uncertainty intervals (the numbers reported in parentheses) overlap a lot across different releases, changes in these estimates are not considered substantively different.

- **Hospital resource use predictions**. For the US, the predicted peak date for hospital resource use could be around April 14, with COVID-19 patients potentially requiring 59,592 total hospital beds (estimate range of 13,060 to 191,692) – with 15,696 ICU beds (estimate range of 5,162 to 45,374) – and 14,089 invasive ventilators (estimate range of 4,046 to 42,253). The average projected total hospital bed need is now lower than the April 10 release (a mean prediction of 86,379, with an estimate range of 24,290 to 232,948); as mentioned above, this change is related to the updated hospitalization-to-death ratios estimated across states.
- Based on the current data and model, several states may be experiencing their peak hospital use or have recently experienced this peak (April 7-9); these include New York, New Jersey, Michigan, Illinois, and Louisiana. Conversely, below are some states with projections pointing to high total hospital bed need, as well as other key hospital resources, that may peak between now and the end of April:

State	Predicted potential peak date of hospital resource use	Predicted hospital bed need at peak	Predicted ICU bed need at peak	Predicted invasive ventilator need at peak
Pennsylvania	April 16	4,287 (785 to 17,190)	856 (255 to 3,087)	738 (192 to 2,734)
California	April 17	2,004 (437 to	470 (136 to 1,464)	412 (108 to 1,330)

		6,657)		
Connecticut	April 25	5,730 (1,206 to 15,558)	1,450 (306 to 1,290)	1,290 (268 to 3,453)
Massachusetts	April 28	5,190 (739 to 16,170)	1,799 (263 to 5,625)	1,671 (241 to 5,294)
Missouri	April 28	1,780 (461 to 5,230)	443 (115 to 1,339)	393 (103 to 1,177)
Texas	April 29	2,824 (632 to 8,931)	661 (143 to 2,046)	577 (125 to 1,809)

DATA UPDATES SINCE OUR LAST RELEASE ON APRIL 10, 2020

Data and locations

- For all currently included locations, we have added reported data points on COVID-19 deaths and available information on social distancing policies through April 12 at 5:00 pm PST.
- Currently included locations are the United States (national level) and 50 states plus the District of Columbia, as well as EEA countries and Switzerland. Three EEA countries – Germany, Italy, and Spain – also have subnational estimates at the first administrative level.

WHAT'S IN THE DEVELOPMENT PIPELINE FOR IHME COVID-19 PREDICTIONS

Before we introduce new model components or improvements to our current analytical platform for predictions, IHME's COVID-19 development team members test these additions or changes.

Based on currently available data and model testing progress, we aim to include the following at these target release dates:

- **April 15:** Additional ensemble models that include mobility data to approximate adherence to and ultimately the impact of social distancing measures currently implemented (read more about this development pipeline area in our April 10 estimation update).
- **April 17:** Initial COVID-19 projections for a subset of Latin American countries.

Our team continues to work on initial infectious disease compartmental models that simulate if and how groups of people move from being susceptible, exposed, infected, and recovered (often referred to as SEIR). We will provide updates on timing of these models in the coming days.

A NOTE OF THANKS

None of these estimation efforts is possible without the tireless data collection and collation efforts of individuals throughout the world. Your work in hospitals, health care organizations, local health departments, and state and national public health agencies, among others, is invaluable.

We thank you for your dedication to fighting the coronavirus pandemic and we appreciate your willingness to share data and collaborate with the IHME COVID-19 team.

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

Questions? Requests? Feedback? Please contact covid19@healthdata.org.

Download summary tables of COVID-19 predictions as of April 13

European Economic Area (EEA) countries and Switzerland

United States (national and by state)

Previous posts: March 30, 2020 | March 31, 2020 | April 1, 2020 | April 2, 2020 | April 5, 2020 | April 7, 2020 | April 10, 2020