COVID-19: What's New for April 22, 2020

Main updates on IHME COVID-19 predictions since April 21, 2020

More data, improved models, better estimates

Our April 17 release involved many model updates and innovations, namely substantially improving our death model and including initial predictions of when US states could safely consider easing current social distancing policies while shifting to robust containment strategies (widely available testing, contact tracing and case-based isolation, restrictions on mass gatherings).

Today's release involves updated estimates for previously included locations in the US and Europe, and a more in-depth examination of the results. Further, we are pleased to announce that our updated manuscript, including up-to-date technical appendices, is available online as of today.

We also now provide COVID-19 predictions for Puerto Rico and by province in Canada. Thanks to the work of collaborators and the IHME COVID-19 team, we aim to publish estimates for a number of Latin American countries in the near future.
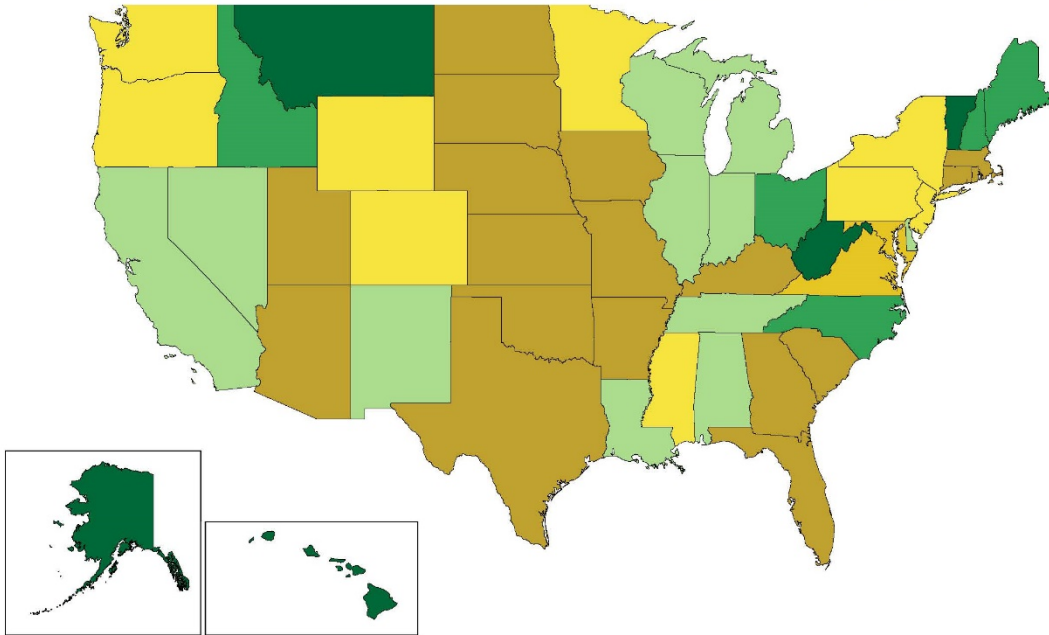
It is worth noting that, as we add new locations to our production pipeline, we will focus on producing estimates for locations that have reported a minimum of 50 cumulative deaths to date. For example, in today's release we show results for four Canadian provinces (Alberta, British Columbia, Ontario, and Quebec) that have met the threshold, but not for other provinces.

Updated estimates of when US states could consider easing social distancing if containment measures are in place

Yesterday, we published our second iteration of estimates of when states may be able to consider easing currently implemented social distancing policies if – *and only if* – strong containment measures already have been instituted**.** Results from today's release (April 22) are highlighted in the map below and are found in the online visualization tool.

Earliest date after which relaxing social distancing may be possible with containment strategies that include testing, contact tracing, isolation, and limiting gathering size

Threshold date: May 04 to May 10 | May 11 to May 17 | May 18 to May 24 | May 25 to May 31 | June 01 to June 07 | June 08 or later

A refresher on how these timing estimates are generated

As detailed further in the April 17 update, these estimated dates are based on projections of all-age COVID-19 prevalent infections – that is, all occurring infections in a location, not just new ones – and when these projections fall below 1 prevalent infection per 1,000,000 population for the upper bound of the 95% uncertainty interval. This threshold is viewed as a conservative estimate of what locations could potentially identify via active case detection and contact tracing given available public health resources. For some places, this may be an underestimate of public health capacity – in others, it could remain ambitious until containment efforts are scaled up. If or as such data become available, they can also be incorporated into the models.

Changes for timing estimates for the consideration of easing distancing measures

Between our first release (April 17) and yesterday's release (April 21) on potential timing for easing distancing measures in the US, states shifted an average of 1.3 days later; the median, a metric less sensitive to outliers, was 0 days. Relative to yesterday, today's release has a median change of 1 day later than what was previously estimated.

While the majority of states saw minor shifts in estimated dates over these releases, five states saw larger changes in their projected dates since our initial release on April 17: Washington, Florida, North Dakota, Arizona, and Kansas.

Prediction measure*		Washington	Florida	North Dakota	Arizona	Kansas
Estimated dates for potential easing of social distancing	April 17 release	May 18	June 1	June 29	June 8	June 1
	April 21 release	May 26	June 11	July 12	June 23	June 19
	April 22 release	May 28	June 14	July 19	June 26	June 21

* This prediction is based on when the upper bound of the 95% uncertainty interval for all-age COVID-19 prevalent infections falls below 1 per 1,000,000**.** To read more on this approach, please refer to our April 17 estimation update.

The exact reasons why the dates have shifted are unique to each state, but some shared characteristics are present. First, all five states now have higher cumulative COVID-19 death projections since the April 17 release. The updated death model, which now uses COVID-19 cases as a leading indicator to predict epidemic peak and overall shape, has resulted in longer peaks and tails for many states. Except for North Dakota, these states appear to have already experienced peaks in daily COVID-19 deaths, but the duration and shapes of their downward trajectories are changing as updated data can be incorporated into the models. For instance, in Washington state, an uptick in daily COVID-19 deaths captured in time series between the April 17 release (input data through April 16) and yesterday's release (input data through April 20) increased the state's total COVID-19 deaths to date by 30. Subsequently, Washington's descent from its epidemic peak is now slower than previously estimated – and thus the projected timing of potentially easing distancing measures is being pushed back further as well.

Importantly, the four other states had initial date predictions in June, a time period that is inherently less certain than estimates for May – especially when updated data inputs occur in terms of location-days. As emphasized in our April 17 release, these projections could change as new data become available and/or different policies are implemented. This is particularly true for states with comparatively fewer COVID-19 deaths (for example, North Dakota, Kansas, Arizona).

Key findings from today's release (April 22, 2020)
A focus on new locations: Puerto Rico and Canada
Puerto Rico

- **COVID-19 deaths.** Our initial predictions indicate that Puerto Rico experienced its COVID-19 epidemic peak around April 9, with nine COVID-19 deaths that day. Total COVID-19 deaths to date are 64, with cumulative death projections potentially rising to 75 (estimate range of 64 to 114) through the epidemic's first wave.

- **Hospital resource use.** Puerto Rico appeared to experience peak hospital resource demand on April 10, when 106 total hospital beds (estimate range of 97 to 115), including 28 (27 to 30) ICU beds, and 26 invasive ventilators (estimate range of 24 to 27) were needed to support COVID-19 patients.

Canada: nationally and by province

- **COVID-19 deaths.** Nationally, Canada may have reached its epidemic peak for COVID-19 deaths on April 16, when 183 daily deaths occurred. This corresponds with the peak for Quebec, which reported 143 COVID-19 deaths that day. Ontario's projected epidemic peak likely occurred on April 17, with 55 COVID-19 deaths.

- Based on the latest available data, cumulative COVID-19 deaths could reach 4,544 (estimate range of 2,176 to 11,750) through the epidemic's first wave in Canada. Projections suggest that Ontario and Quebec could have the largest toll in Canada, at 1,953 (1,186 to 4,101) and 1,481 (761 to 3,629) cumulative COVID-19 deaths, respectively. Initial projections for Canada and provinces with 50 or more cumulative deaths are listed below.

Location	Predictions for cumulative COVID-19 deaths through the first wave from our April 22 release (today)
Canada (nationally)	**4,544 (2,176 to 11,750)**
Alberta	626 (95 to 2,462)
British Columbia	278 (108 to 724)
Ontario	1,481 (761 to 3,629)
Quebec	1,953 (1,186 to 4,101)

- **Hospital resource use.** Nationally, Canada could be now experiencing its peak hospital resource demand: our initial projections show this peak at April 22, with a total of 5,091 hospital beds (estimate range 1,558 to 15,057) – 1,495 (537 to 4,244) of which are ICU beds – and 1,367 (444 to 4,012) invasive ventilators needed for hospitalized COVID-19 patients. Projections for peak hospital resource use suggest that Quebec has already seen peak demand, whereas other provinces may reach peak need over the next week or so (see table below).

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
Alberta	May 1	605 (50 to 2,380)	182 (17 to 692)	165 (15 to 638)
British Columbia	April 27	191 (38 to 497)	54 (12 to 140)	50 (10 to 130)
Ontario	April 23	1,527 (415 to 4,876)	450 (171 to 1,283)	409 (141 to 1,203)
Quebec	April 22	2,765 (924 to 7,735)	820 (314 to 2,178)	742 (255 to 2,055)

A focus on the US
Predicted peak for daily COVID-19 deaths

- Across the US, the predicted peak for daily COVID-19 deaths appeared to be on April 15, reaching 2,688 deaths. This is a slightly higher peak value for April 15 since our April 17 release (2,481 daily COVID-19 deaths) and very similar to yesterday's release (2,671). This shift upward since April 17 is mainly due to retrospective data updates that many states conduct as they are able to complete data backlogs.

- Below are states that either appear to have reached their peaks in daily COVID-19 deaths over the last few days or are projected to potentially reach their peaks by late April or early May.

  Note that here and in our visualization tool we report on predicted peak dates and corresponding predictions for COVID-19 daily deaths. Reported daily death data may be higher for earlier dates, but because of known data lags and heaping on certain days (as discussed in prior updates), we focus on predicted peak dates to avoid issues with highly noisy data.

State	Predicted peak date of daily COVID-19 deaths	Predicted daily COVID-19 deaths at peak: average projection (estimate range)
Connecticut	April 20	204
Maryland	April 20	121
Pennsylvania	April 21	266
Colorado	April 21	63
Indiana	April 21	58
North Carolina	April 21	27
Oklahoma	April 21	21
Alabama	April 21	20
Mississippi	April 21	14
Delaware	April 21	10
Utah	May 1	7 (1 to 30)
Wyoming	May 5	14 (1 to 69)

Predictions for cumulative deaths
- During the COVID-19 epidemic's first wave, the US could reach 67,641 cumulative deaths (estimate range of 48,058 to 123,157). Today's release is higher than the average US predictions for cumulative COVID-19 deaths published on April 17 (60,308, with an estimate range of 34,063 to 140,381) and April 21 (64,976, with an estimate range of 45,375 to 124,120), though the uncertainty intervals still overlap considerably.
- Since our release yesterday, Pennsylvania, Massachusetts, and Georgia had the largest increases in cumulative COVID-19 deaths projected through the first wave; nonetheless, each release's uncertainty estimates markedly overlap.

State	Predictions for cumulative COVID-19 deaths through the first wave from our April 22 release (today)	Predictions from our April 21 release	Change of average values since the April 21 release*
New York	23,232 (19,506 to 32,374)	23,471 (18,911 to 35,506)	↓ 509 deaths

Massachusetts	4,242 (2,362 to 9,547)	3,898 (2,037 to 9,397)	↑ 345 deaths
Pennsylvania	2,770 (1,825 to 5,457)	2,323 (1,484 to 5,045)	↑ 447 deaths
Georgia	2,254 (990 to 6,255)	1,981 (937 to 5,182)	↑ 273 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.

A focus on Europe

Predicted peak for daily COVID-19 deaths

- Our latest estimates indicate that the majority of European Economic Area (EEA) countries have likely experienced their epidemic peaks of daily COVID-19 deaths. The earliest were Italy, Cyprus, and Spain in late March to early April, followed by most other EEA countries (plus Switzerland) in early to mid-April.

- Six countries, including the United Kingdom (UK) (see below), have either recently experienced their peaks in daily COVID-19 deaths or are projected to potentially reach their peaks before the end of April or during the first week of May.

- In the table below and in our visualization tool, we report on predicted peak dates and corresponding predictions for COVID-19 daily deaths. Reported daily death data may be higher for earlier dates, but because of known data lags and heaping on certain days (as discussed in prior updates), we focus on predicted peak dates to avoid issues with highly noisy data.

Country	Predicted peak date of daily COVID-19 deaths	Predicted daily COVID-19 deaths at peak: average projection (estimate range)
Ireland	April 20	77
Norway	April 20	16
Finland	April 21	43
United Kingdom	April 22	1,161 (218 to 3,665)
Slovakia	April 22	11 (0 to 66)
Latvia	May 3	7 (1 to 29)

Predictions for cumulative deaths

- Since our April 17 release, cumulative COVID-19 death projections across EEA countries generally have not changed substantively; this was expected given that major death model changes were implemented between our April 13 and April 17 releases.

- For the UK, cumulative COVID-19 death estimates for the epidemic's first wave somewhat decreased since yesterday's release, though the uncertainty intervals sizably overlap: 31,929 cumulative deaths (estimate range of 19,580 to 67,802) for today's release versus 33,142 deaths (estimate range of 19,642 to 61,161) for yesterday's release. The table below summarizes changes in cumulative death predictions since April 21 for a subset of EEA countries.

Country	Predictions for cumulative COVID-19 deaths through the first wave from our April 22 release (today)	Predictions from our April 21 release	Change of average values since the April 21 release*
United Kingdom	31,929 (19,580 to 67,802))	33,142 (19,642 to 61,161)	↓ 1,213 deaths
Italy	26,867 (25,008 to 32,740)	26,660 (24,669 to 31,932)	↑ 207 deaths
Spain	25,104 (22,584 to 31,164)	24,624 (22,182 to 30,462)	↑ 480 deaths
France	23,304 (21,234 to 29,072)	23,104 (20,926 to 28,562)	↑ 200 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.

Data updates

Key changes to data sources and processing

- **New York**. As mentioned yesterday, about midway through the COVID-19 epidemic in New York City (NYC), reporting of confirmed and presumed deaths started to occur separately. To account for this important distinction, we have instituted an alternative data processing step for NYC and thus New York state. To better track with the time series of confirmed cases from the NYC Department of Health and Mental Hygiene (DOHMH), we now use the NYC data captured by the NY Times GitHub repository.

  To account for presumed deaths, we use the most recent day of reporting and now take the difference between NYC DOHMH total COVID-19 deaths (the sum of presumed and confirmed deaths from the virus) and subtract reported deaths for that day based on the NY Times dataset. We then redistribute the remainder of deaths proportionate to the daily COVID-19 deaths from the NY Times data source.

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 21 at 5:00 pm Pacific Time.

- Currently included locations are the US (national level) and 50 states plus the District of Columbia, Puerto Rico, Canada (nationally and for four provinces), and European Economic Area (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, these are some of our immediate- and medium-term priorities:

- **Shifting to containment strategies for EEA countries.** Our [April 17 release](#) brought initial estimates of when US states could safely consider easing social distancing policies conditional on the implementation of robust containment measures (widespread testing, contact tracing and case-based isolation, mass gatherings restrictions). We are currently applying these models to EEA countries and vetting results with collaborators.

- **Initial COVID-19 projections for a subset of Latin American countries.** Data collation and processing for a wider set of locations and countries worldwide are also in progress.

- **Infectious disease compartmental models capturing susceptible-to-recovered populations.** Our team continues to work on what is known as SEIR models – disease models that simulate if and how groups of people move from being **S**usceptible to **E**xposed to **I**nfected to **R**ecovered – to complement our current statistical approach.

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.](mailto:covid19@healthdata.org)