Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

# Coronavirus Disease 2019 (COVID-19)

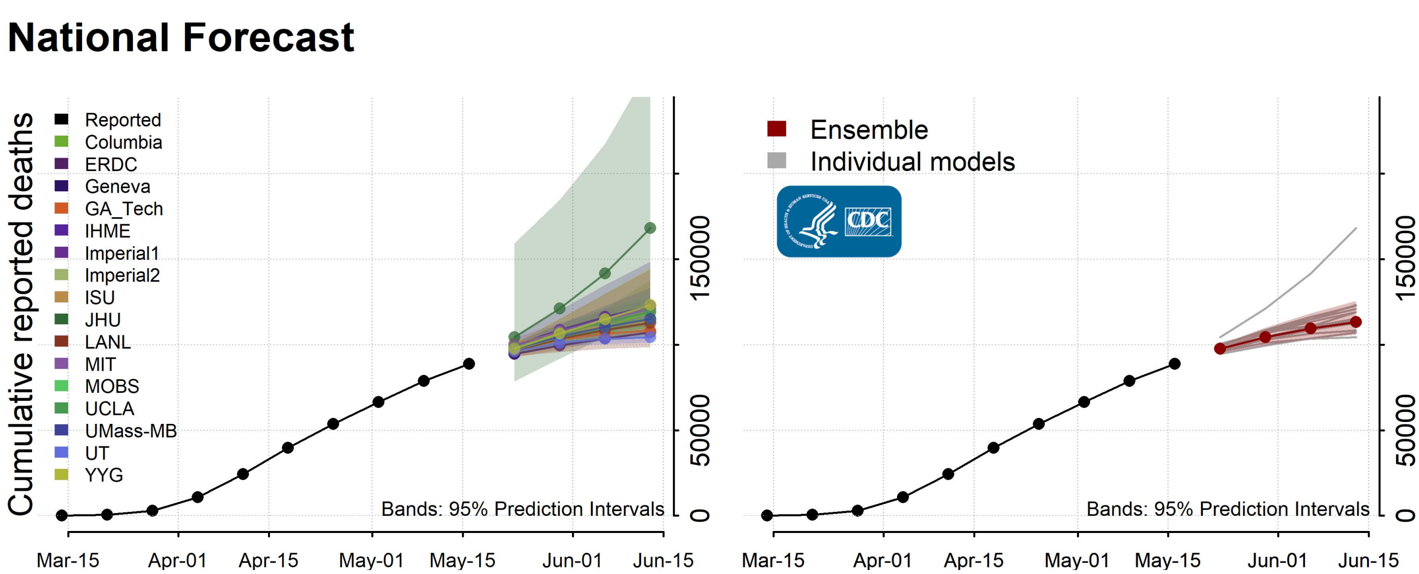
# COVID-19 Forecasts

Updated May 21, 2020

## Interpretation of Cumulative Death Forecasts

- This week's national-level forecasting includes 16 individual forecasts, and all indicate that additional COVID-19 deaths will occur in the coming weeks. Predicted rates of increase differ among the forecasts, depending on assumptions about the strength and coverage of social distancing behaviors.
- The national ensemble forecast suggests that the rate of increase in cumulative deaths is likely to slow but still exceed 110,000 by June 13.
- State-level ensemble forecasts indicate that states with low numbers of deaths reported to date are not likely to see a rapid rise in the coming weeks, while states with high numbers of deaths reported to date are likely to see increases at varying rates.

## National Forecast




- These forecasts show cumulative reported COVID-19 deaths since February and forecasted deaths for the next four weeks in the United States.
- Models make various assumptions about the levels of social distancing and other interventions. See model descriptions below for details.

# State Forecasts

State-level forecasts show observed and forecasted state-level cumulative COVID-19 deaths in the US. Each state forecast uses a different scale, due to differences in the numbers of COVID-19 deaths occurring in each state.

Forecasts fall into one of three categories

- The Auquan, CAN, ERDC, ISU, LANL and UMass-MB forecasts do not explicitly model the effects of individual social distancing measures but assume that implemented interventions will continue, resulting in decreased growth.
- The Geneva, GA_Tech, MIT, MOBS, UCLA, and UT forecasts assume that existing social distancing measures will continue through the projected time period.
- The Columbia, IHME, JHU, NotreDame, UChicago, and YYG forecasts make different assumptions about how levels of social distancing will change in the future.

Download state forecasts [12 pages]

Download forecast data [1 sheet]

# Why Forecasting COVID-19 Deaths in the US is Critical

CDC is responding to a pandemic of coronavirus disease 2019 (COVID-19) caused by a novel coronavirus, SARS-CoV-2, that is spreading from person to person. The federal government is working closely with state, tribal, local, and territorial health departments, and other public health partners, to respond to this situation. Forecasts of deaths will help inform public health decision-making by projecting the likely impact in coming weeks.

# What the Forecasts Aim to Predict

Forecasts based on statistical or mathematical models aim to predict changes in national- and state-level cumulative reported COVID-19 deaths for the next four weeks. Forecasting teams predict numbers of deaths using different types of data (e.g., COVID-19 data, demographic data, mobility data), methods (see below), and estimates of the impacts of interventions (e.g. social distancing, use of face coverings).

# Working to Bring Together Forecasts for COVID-19 Deaths in the US

CDC works with partners to bring together weekly forecasts for COVID-19 deaths in one place. These forecasts have been developed independently and shared publicly. It is important to bring these forecasts together to help understand how they compare with each other and how much uncertainty there is about what may happen in the upcoming four weeks.

## Auquan Data Science (state-level forecasts only)

**Model names:** Auquan

**Intervention assumptions:** These projections do not make specific assumptions about which interventions have been implemented or will remain in place.

**Methods:** Fitted SEIR model

## Columbia University

**Model name:** Columbia

**Intervention assumptions:** This model is based on assumptions about how levels of social distancing will change in the future. It assumes a 20% reduction in contact rates for each week that stay-at-home orders remain in place or are expected to remain in place. Once a state has re-opened, contact rates are assumed to increase by 5% each week.

**Methods**
Metapopulation SEIR model

## COVID Act Now (state-level forecasts only)

**Model name:** CAN

**Intervention assumptions:** These projections do not make specific assumptions about which interventions have been implemented or will remain in place.

**Methods:** Fitted SEIR model

## Georgia Institute of Technology

**Model name:** GA_Tech

**Intervention Assumptions:** This model assumes that the effects of interventions are reflected in the observed data and will continue going forward.

**Methods:** Deep learning

## Imperial College, London (national-level forecasts only)

**Model names:** Imperial1, Imperial2

**Intervention Assumptions:** These projections do not make specific assumptions about which interventions have been implemented or will remain in place.

**Methods:** Ensembles of mechanistic transmission models, fit to different parameter assumptions.

## Institute of Health Metrics and Evaluation

**Model name:** IHME

**Intervention Assumptions:** Projections are adjusted to reflect differences in aggregate population mobility and community mitigation policies.

**Methods:** Combination of a mechanistic disease transmission model and a curve-fitting approach.

## Iowa State University

**Model name:** ISU

**Intervention Assumptions:** These projections do not make specific assumptions about which interventions have been implemented or will remain in place.

**Methods:** Nonparametric spatiotemporal model

## Johns Hopkins University

**Model name:** JHU

**Intervention Assumptions:** This model assumes that the effectiveness of interventions is reduced after shelter-in-place orders are lifted.

**Methods:** Stochastic metapopulation SEIR model

## Los Alamos National Laboratory

**Model name:** LANL

**Intervention assumptions:** This model assumes that currently implemented interventions and corresponding reductions in transmission will continue, resulting in an overall decrease in the growth rate of COVID-19. Over the course of the forecast, the model assumes that the rate of growth will decrease over time.

**Methods**
Statistical dynamical growth model accounting for population susceptibility

## Massachusetts Institute of Technology

**Model name:** MIT

**Intervention Assumptions:** The projections assume that current interventions will remain in place indefinitely.

**Methods:** SEIR model fit to reported death and case counts.

## Northeastern University

**Model name:** MOBS (Laboratory for the Modeling of Biological and Socio-technical Systems)

**Intervention assumptions:** The projections assume that social distancing policies in place at the date of calibration are extended for the future weeks.

**Methods:** Metapopulation, age-structured SLIR model

## Notre Dame University (state-level forecasts only)

**Model name:** NotreDame

**Intervention assumptions:** The model accounts for each state's school-closure and stay-at-home policies.

**Methods:** Agent-based model

## University of California, Los Angeles

**Model name:** UCLA

**Intervention assumptions:** These projections assume that current interventions will not change during the forecasted period.

**Methods:** Modified SEIR model

## University of Chicago (forecasts for Illinois only)

**Model name:** UChicago

**Intervention assumptions:** These forecasts assume that the transmission rate will increase by 10% when stay-at-home policies are lifted.

**Methods:** Age-structured SEIR model

## University of Geneva / Swiss Data Science Center (national one-week ahead forecasts only)

**Model name:** Geneva

**Intervention assumptions:** The projections assume that social distancing policies in place at the date of calibration are extended for the future weeks.

**Methods**
Exponential and linear statistical models fit to the recent growth rate of cumulative deaths.

## University of Massachusetts, Amherst

**Model name:** UMass-MB, Ensemble

**Intervention assumptions:**

- UMass-MB: These projections do not make specific assumptions about which interventions have been implemented or will remain in place.
- Ensemble: The national- and state-level ensemble forecasts include models that assume certain social distancing measures will continue and models that assume those measures will not continue.

**Methods:**

- UMass-MB: Mechanistic Bayesian compartment model.
- Ensemble: Equal-weighted combination of 2 to 8 models, depending on the availability of national and state-level

forecasts. To ensure consistency, the ensemble includes only models with 4 week-ahead forecasts and models that do not assign a significant probability to there being fewer cumulative deaths than have already been reported.

## University of Texas, Austin

**Model name:** UT

**Intervention assumptions:** This model estimates the extent of social distancing using geolocation data from mobile phones and assumes that the extent of social distancing does not change during the period of forecasting. The model is designed to predict confirmed COVID-19 deaths resulting from only a single wave of transmission.

**Methods**
Nonlinear Bayesian hierarchical regression with a negative-binomial model for daily variation in death rates.

## US Army Engineering Research and Development Center

**Model name:** ERDC

**Intervention assumptions:** These projections assume that current interventions will not change during the forecasted period.

**Methods:** SEIR mechanistic model.

## Youyang Gu (COVID-Projections)

**Model name:** YYG

**Intervention assumptions:** The model accounts for individual state-by-state re-openings and their impact on infections and deaths.

**Methods**
SEIS mechanistic model.

### Additional Resources:

Previous COVID-19 Forecasts

FAQ: COVID-19 Data and Surveillance