

Covid-19 Model for the United States

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Update: April 4, 2020

The current Worldometer data (<https://www.worldometers.info/coronavirus>) show that US covid-19 deaths were 1321 yesterday (see **Figure 1**), largely consistent with the April 3 model, which includes the entire US. The model is based on the pattern of China deaths, which are almost all reported to have taken place in the epicenter of Wuhan (population 11 million). As shown in **Figure 2**, the China/Wuhan data fit a normal distribution, with an overall mortality of 0.03% (as a percentage of total Wuhan population), a standard deviation of 10 days, and a peak of 37 days after the first reported death. Applying these same Wuhan model parameters to observed mortality data for Italy (see **Figure 3**) results in a convincing fit and a March 29 peak.

Two possible models are now shown in **Figure 4**: the unadjusted Wuhan model applied to the entire US (light blue) and the approach proposed on March 22 (darker blue dots) applied to individual cities (expect 28 days to peak for the 15 largest). Both models give plausible fits to observed results, with peaks of either April 17 (unadjusted Wuhan model) or April 26. China largely kept the virus isolated within the Wuhan area, but that is unfortunately not what happened in the US or Italy, as both countries obviously have very different societies. The result for the US is a predicted death toll at the high end of the normal flu season: 98,900. As a resident of St. Louis, I've added a specific result for the St. Louis metro region (**Figure 5**), overlaid with the projections from the University of Washington's IHME group, which predict a major flattening for Missouri (<https://covid19.healthdata.org/projections>).

Disclaimer: This is only a model. As the saying goes: "All models are wrong - some are useful." So we know this model is wrong, but we don't know if it is useful. Nevertheless, perhaps it helps calibrate expectations for what is likely to come here in the US in the coming weeks.

Daily New Deaths in the United States

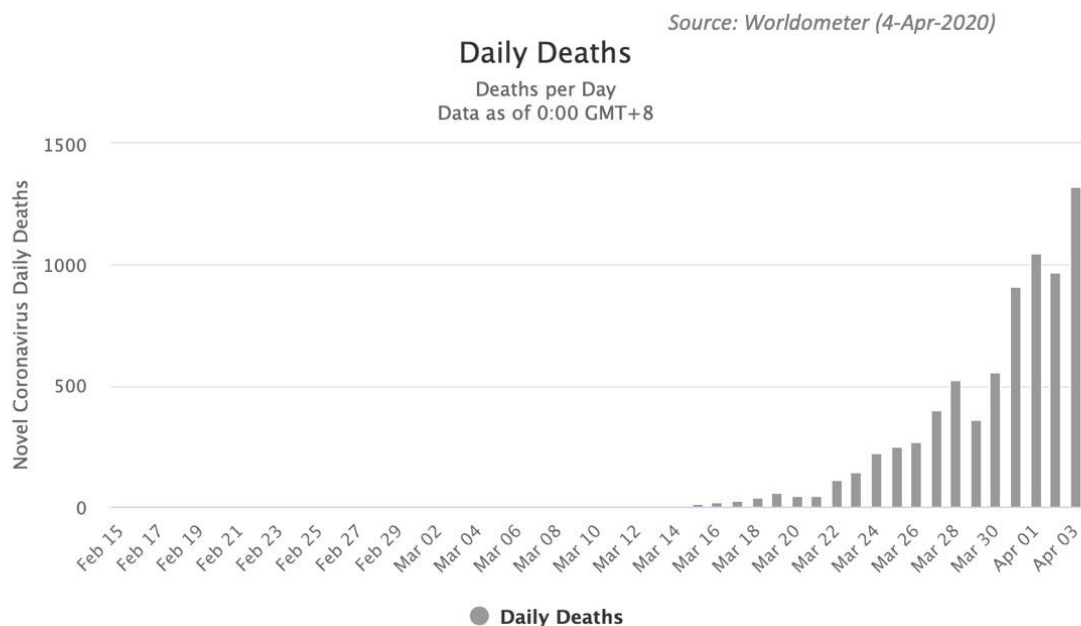


Figure 1. Covid-19 deaths per day in the US (source: Worldometer).

CHINA

37 days from first death to peak daily death rate
Standard Deviation: 10 days
Wuhan mortality: 0.03% of total population

Daily Deaths

Deaths per Day Source: Worldometer (22-Mar-2020)
Data as of 0:00 GMT+8

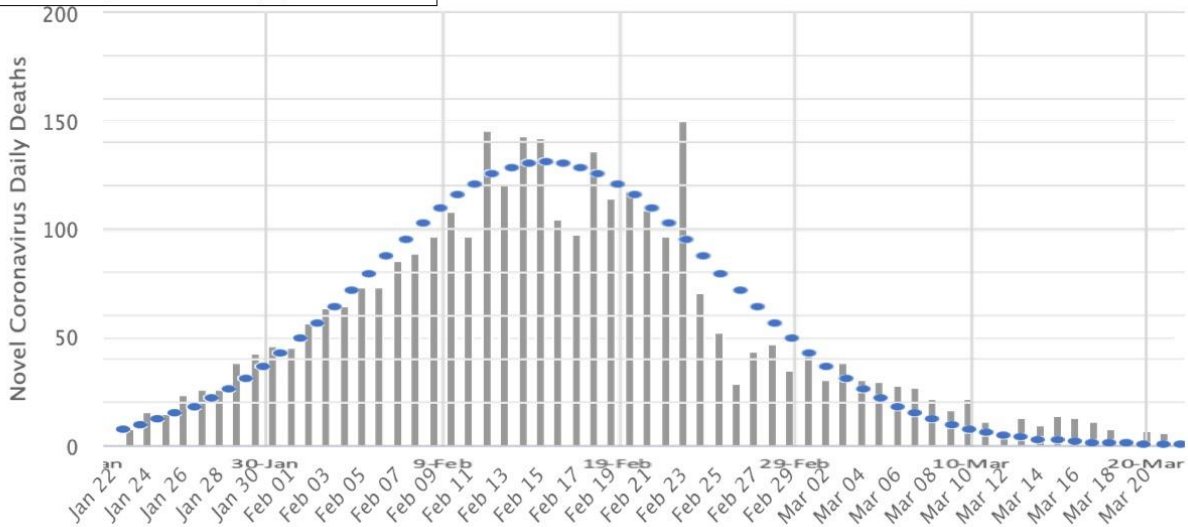
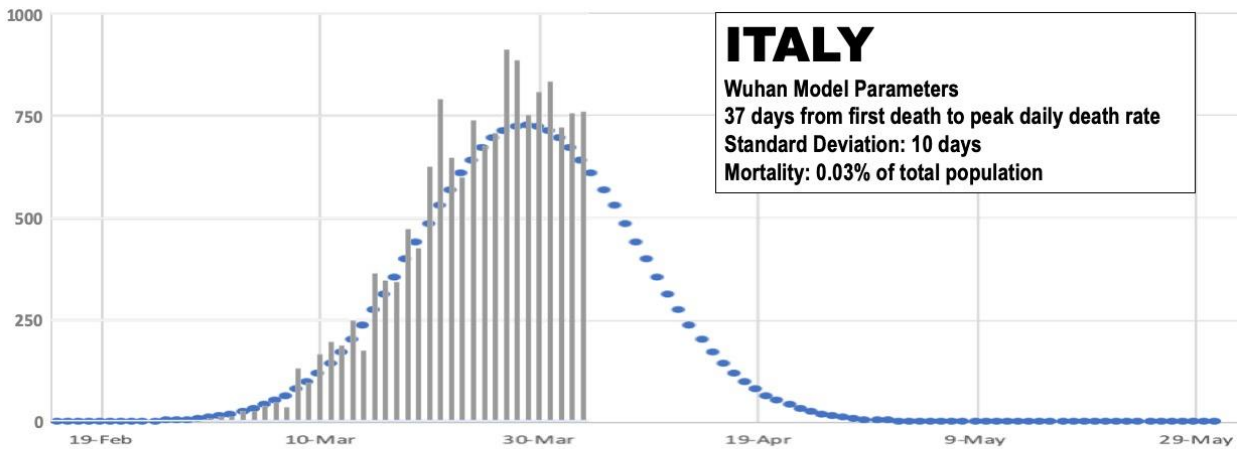


Figure 2. Normal distribution model for daily covid-19 death rates in China.

Daily Deaths

Deaths per Day
Data as of 0:00 GMT+8

Source: Worldometer (4-Apr-2020)



ITALY

Wuhan Model Parameters
37 days from first death to peak daily death rate
Standard Deviation: 10 days
Mortality: 0.03% of total population

Figure 3. Application of the Wuhan model to observed mortality data in Italy.

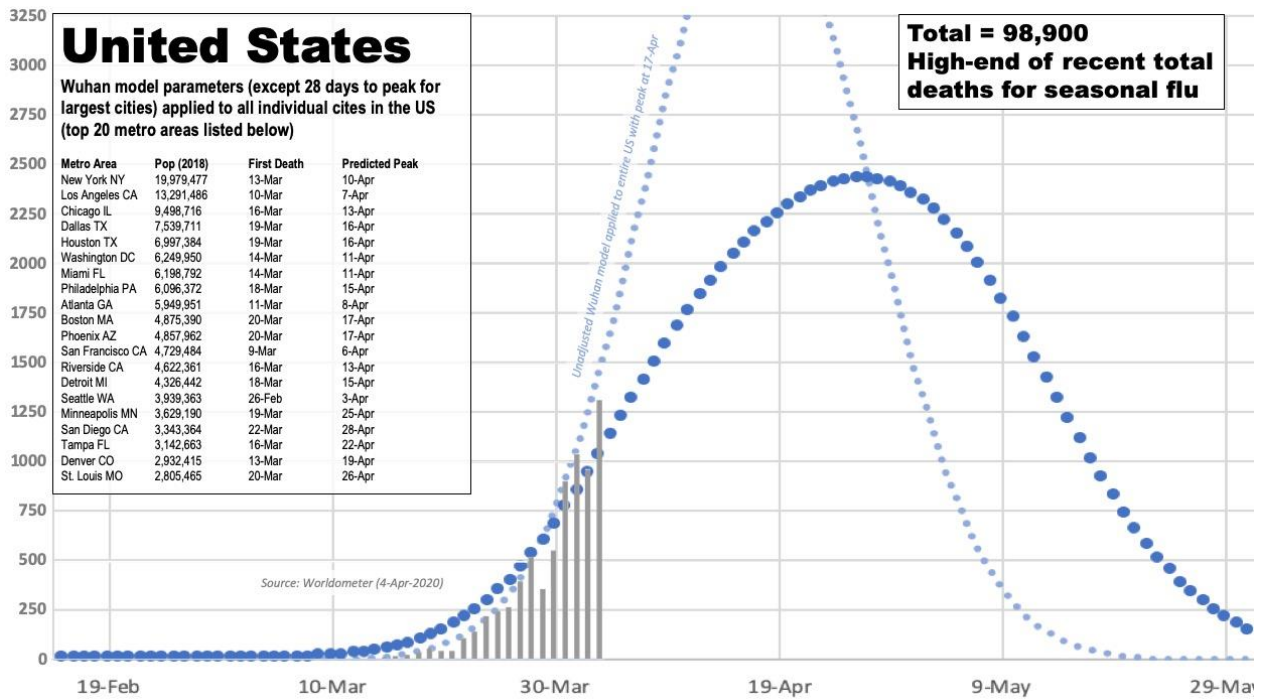


Figure 4. Application of unadjusted (light blue) and adjusted Wuhan models to the US, with the data observed thus far for the US overlaid at the lower left of the chart.

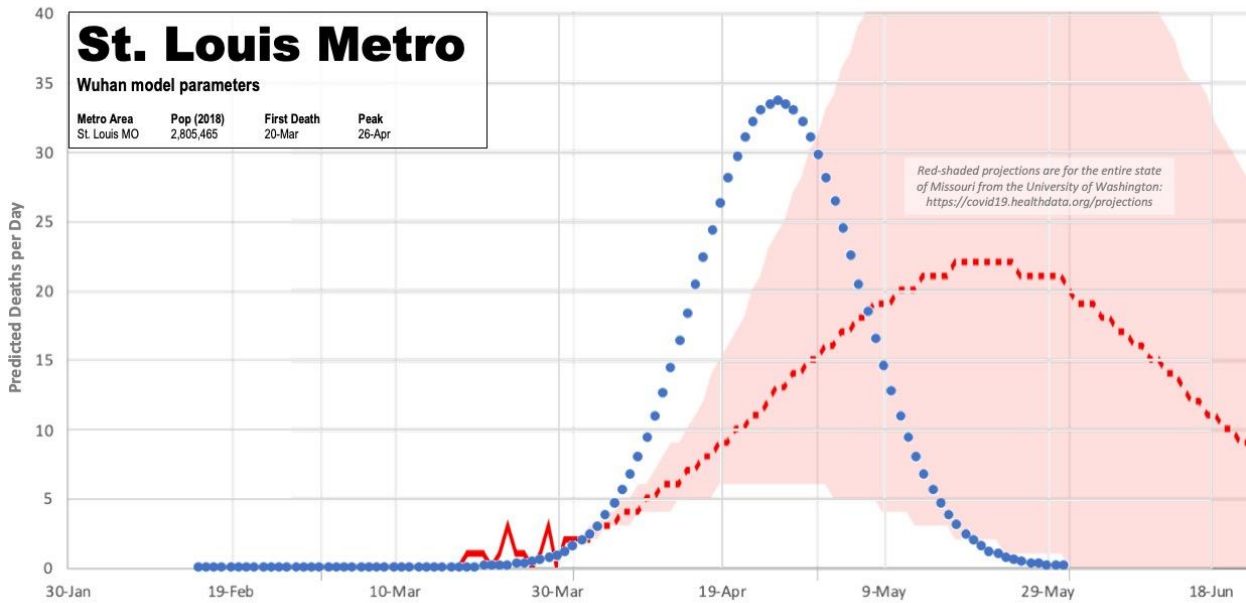


Figure 5. Application of the Wuhan model to St. Louis, with projections from the University of Washington for the entire state of Missouri shown in red.