

Covid-19 Model for Major US Cities

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Second Update: March 28, 2020

The current Worldometer data (<https://www.worldometers.info/coronavirus>) show that US covid-19 deaths reached 401 yesterday (see **Figure 1**), prompting a small update to the March 24 model. 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 an excellent fit, predicting a peak tomorrow, March 29.

The second US adjustment to the Wuhan model (made on March 28) shifts the peak to 30 days after the first reported death, rather than 37 days. Applying this model to the top 20 US metropolitan areas (**Figure 4**) results in a plausible fit to what has been observed thus far, and suggests the overall peak death rate will occur on April 14. 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, 37,500, among just these top 20 metro areas. As a resident of St. Louis, I've now added a specific result for the St. Louis metro region (**Figure 5**), overlaid with the somewhat higher projections from the University of Washington's IHME group (<https://covid19.healthdata.org/projections>), though we agree on timing.

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

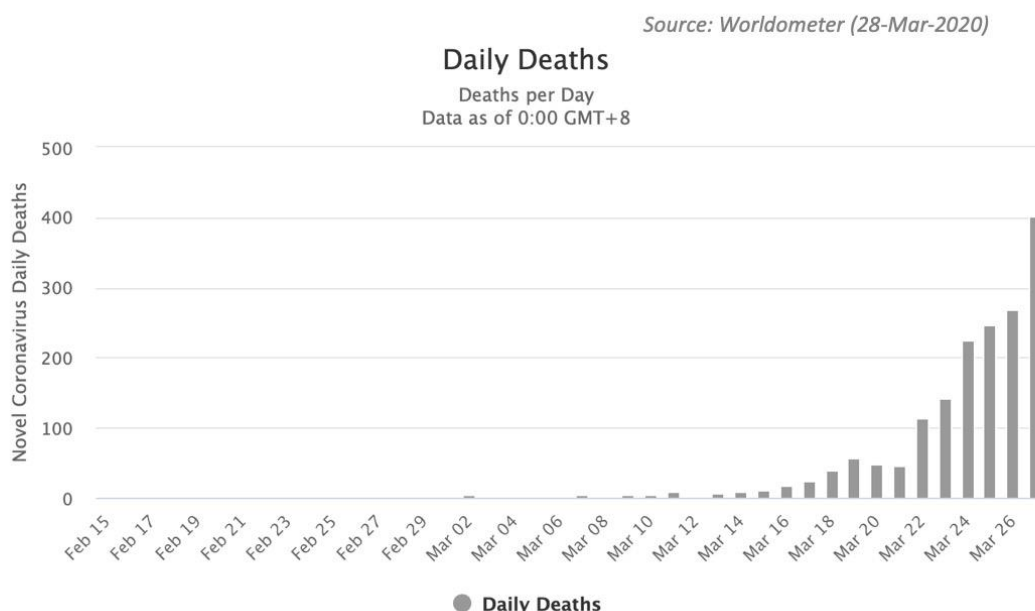


Figure 1. Covid-19 deaths per day in the US (source: Worldometer).

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
Data as of 0:00 GMT+8

Source: Worldometer (22-Mar-2020)

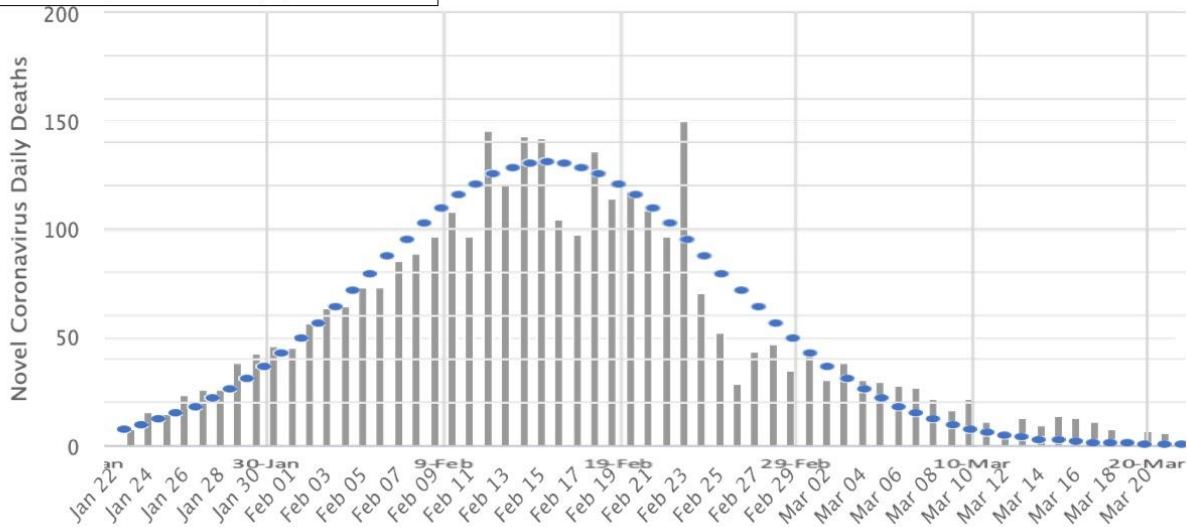


Figure 2. Normal distribution model for daily covid-19 death rates in China.

Daily Deaths

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

Source: Worldometer (28-Mar-2020)

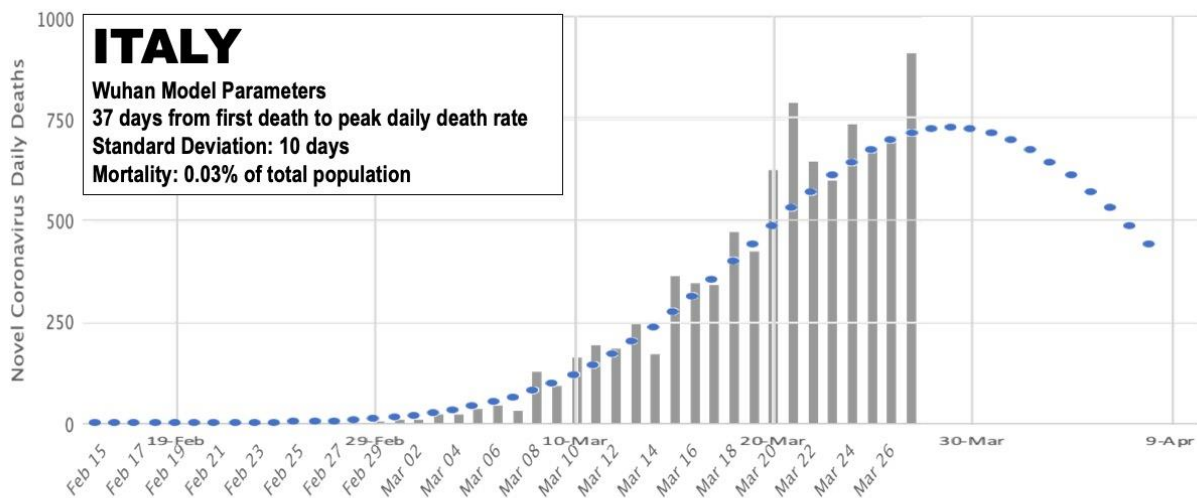


Figure 3. Application of the Wuhan model to observed mortality data in Italy.

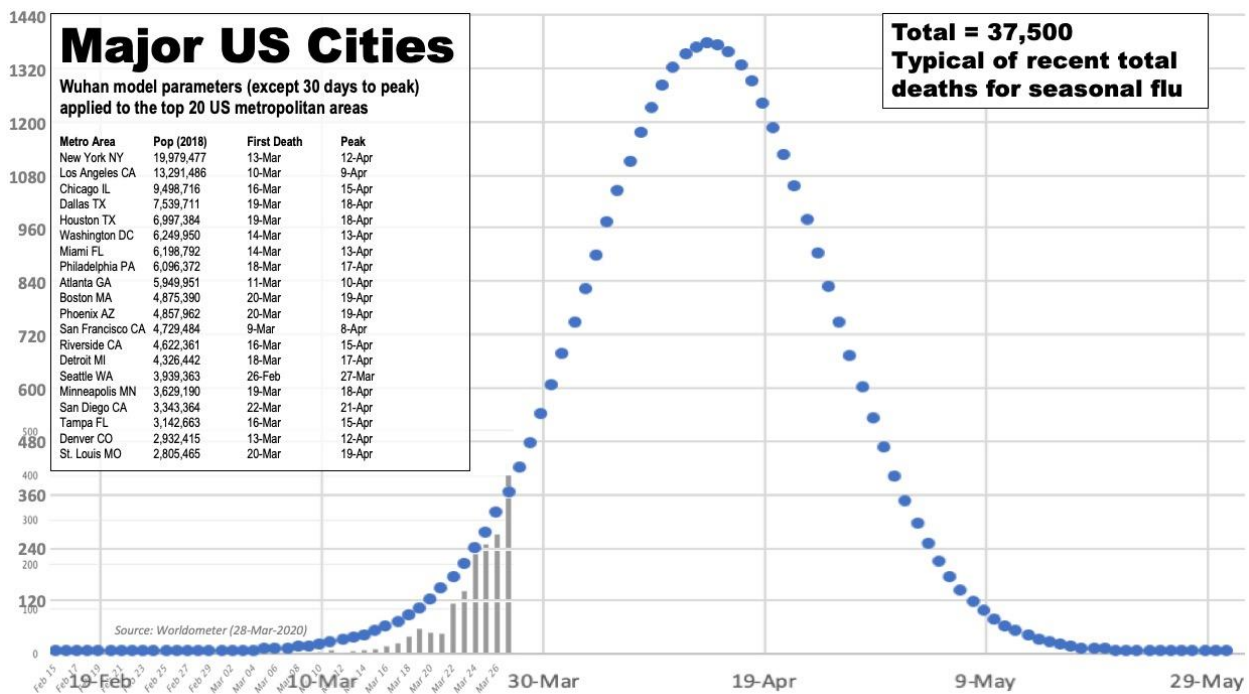


Figure 4. Application of the adjusted Wuhan model to major US cities, with the data observed thus far for the US overlaid at the lower left of the chart.

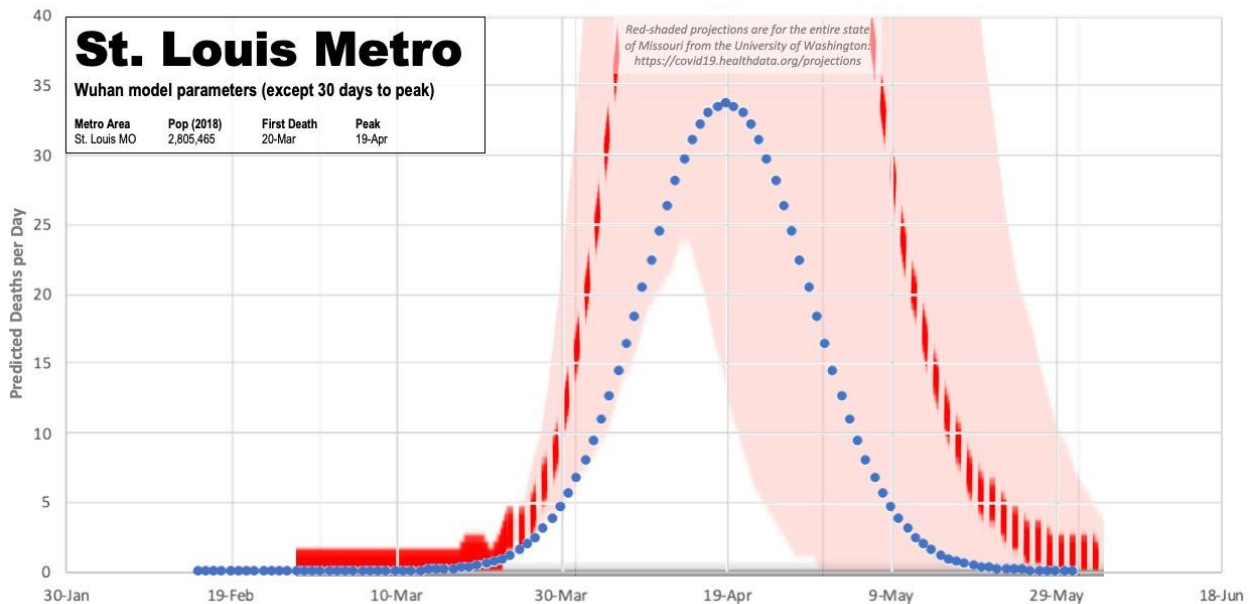


Figure 5. Application of the adjusted Wuhan model to St. Louis, with projections from the University of Washington for the entire state of Missouri shown in red.