

Covid-19 Model for the United States

David I Gustafson, Ph.D.

St. Louis, MO

Update: April 12, 2020

The current Worldometer data (<https://www.worldometers.info/coronavirus>) report 1830 covid-19 deaths yesterday (see **Figure 1**), still tracking near the model described here. That model is based on observed China deaths, 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 versions of the Wuhan models are shown in **Figure 4**: the unadjusted Wuhan model applied to the entire US (light blue, April 17 peak) and the approach proposed on March 23 (darker blue dots, April 26 peak) applied to individual cities. The model predicts a US death toll at the high end of the normal flu season: 98,900. The current IHME UW model for the US (<https://covid19.healthdata.org/projections>), released on April 10, is shown in red. It predicts lower total mortality and an April 10 peak. China claims to have 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. As a resident of St. Louis, I've added a specific result for the St. Louis metro region (**Figure 5**), overlaid with the April 10 projections from IHME for Missouri, now nearly identical to this model.

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

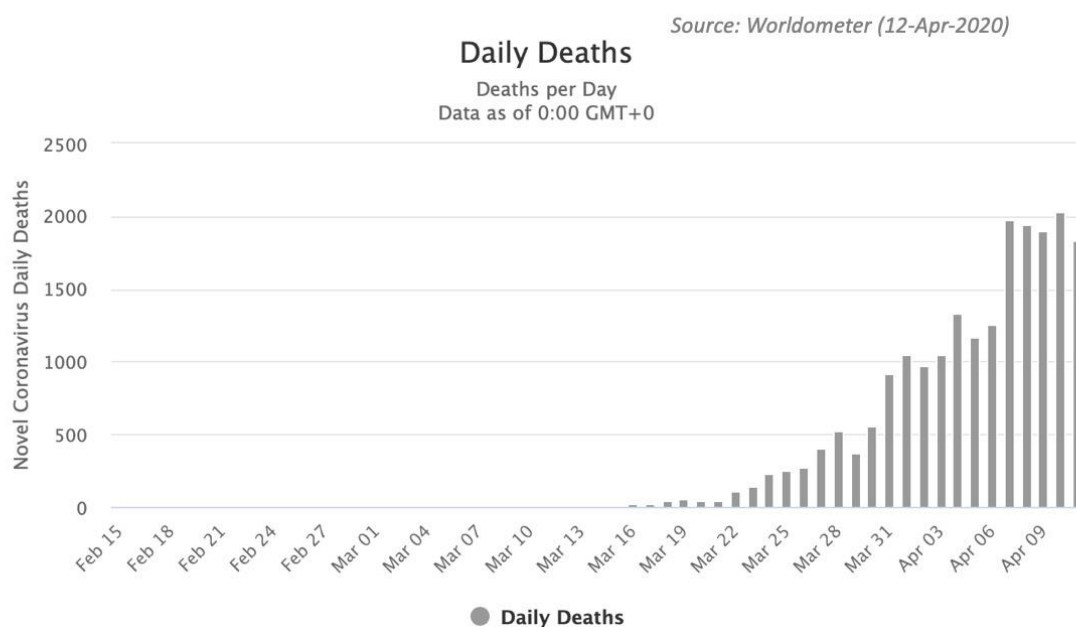


Figure 1. Covid-19 deaths per day in the US (source: Worldometer).



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

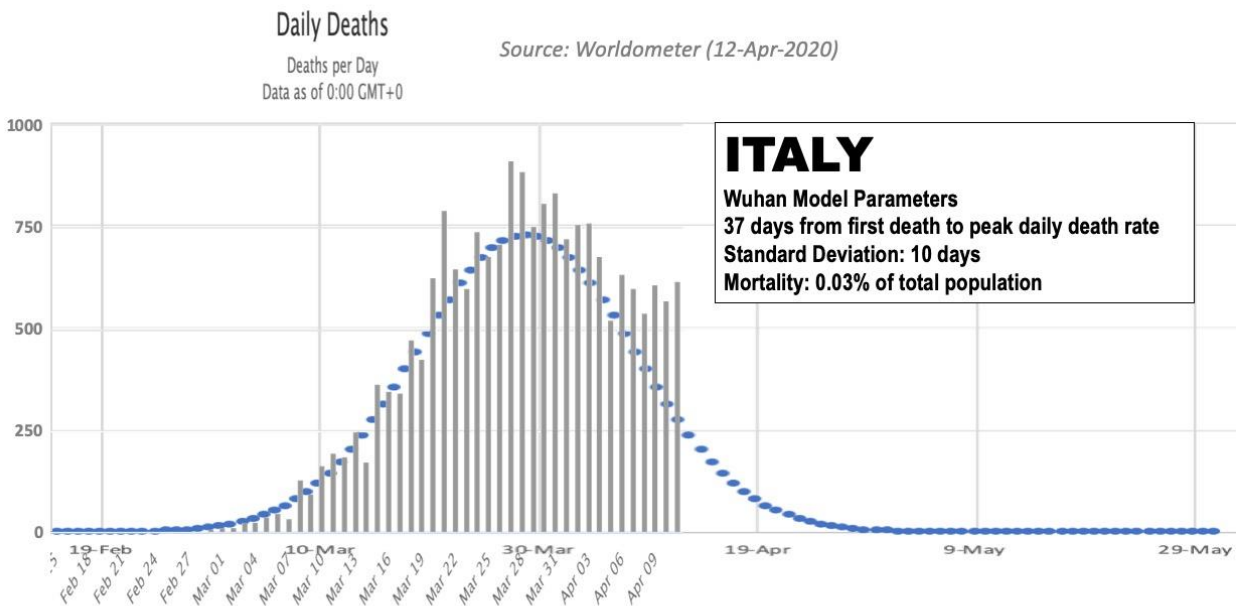


Figure 3. Application of the Wuhan model to observed mortality data in Italy.

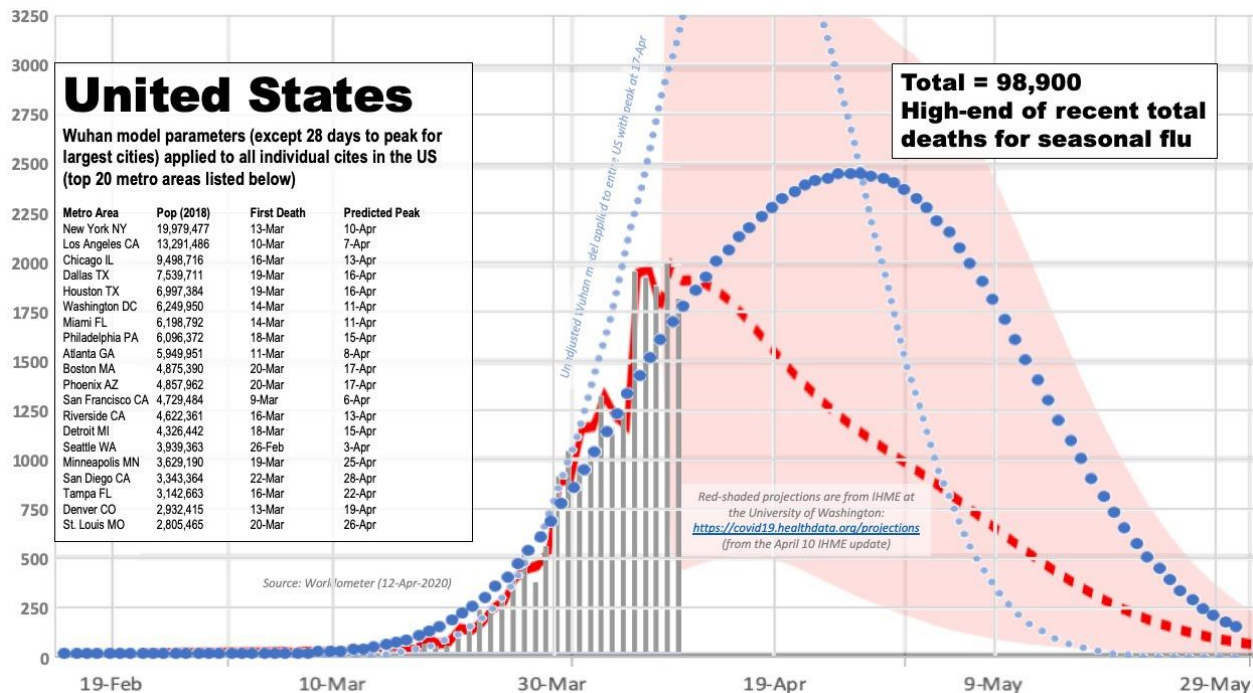


Figure 4. Application of unadjusted (light blue) and adjusted Wuhan models to the US, overlaid by data from Worldometer (gray bars) and IHME projections (shaded red).

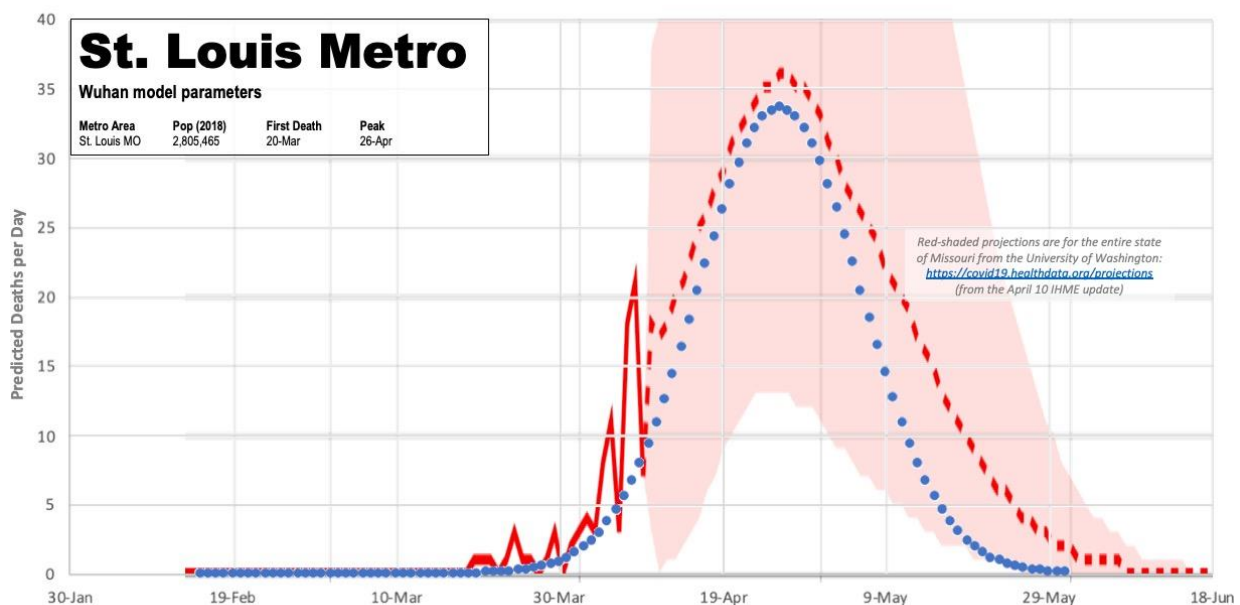


Figure 5. Application of the Wuhan model to St. Louis, with updated (April 10) projections from the University of Washington for the state of Missouri shown in red.