Social distancing has probably saved more than 1,000 lives in San Diego County.

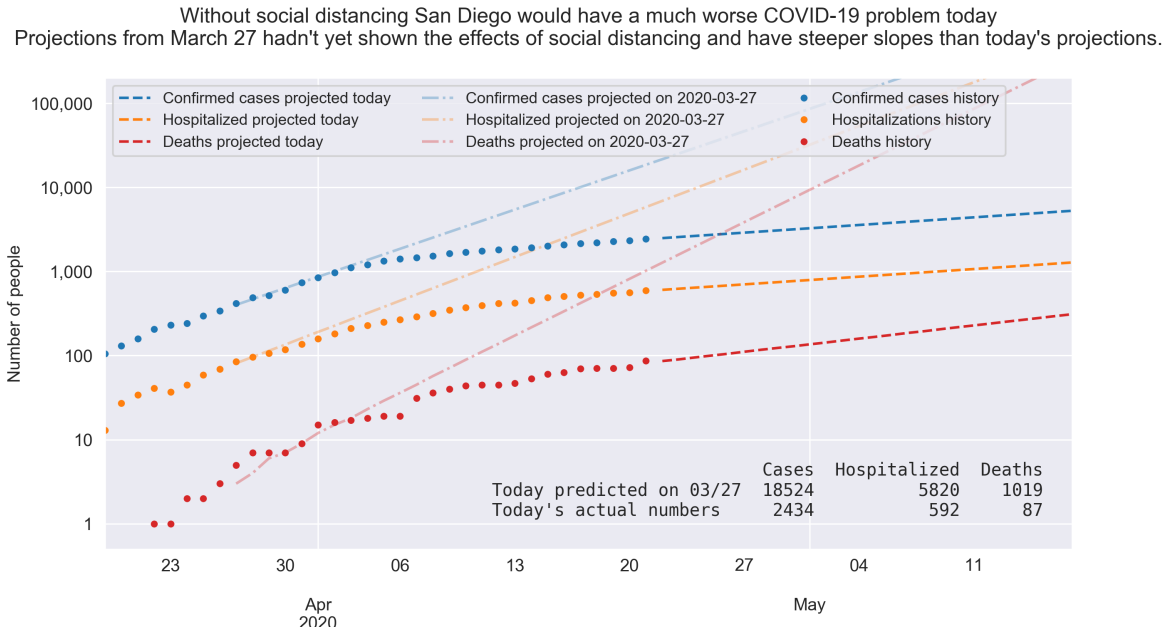
The closures of recreation and businesses have been hard to take, and people are understandably restless. But as we decide what to do, it's important to make an informed decision. Some have said that COVID-19 is just a flu, that we have overreacted. I want those people to understand why that thinking is wrong.

In the first part of an epidemic, the number of infected people grows exponentially: 2 becomes 4, becomes 8, 16, etc.. In 20 doubling steps more than one million are infected. The speed of doubling (is it 3 or 20 days to double the infected?) comes from how well the infection is spreading among people, which is determined at least partly by our social interactions.

I fit exponential curves to county data on COVID-19. In mid to late March the doubling time was about 4 days. Currently it's more like 23 days. What changed?

We started social distancing in many different ways, including shutdowns and stay-at-home. The doubling time for COVID-19 hospitalizations started to increase sharply in the days after April 3rd. It takes about two weeks for someone to get sick enough with the virus to end up in the hospital. Governor Newsom's stay-at-home order was March 19th, sixteen days before doubling time starts to get much better. This suggests that everyone staying at home dramatically reduced new infections almost immediately.

If we had not used social distancing and stay-at-home, we would have doubling times around 4 days throughout April as well. The graph below shows us what that looks like.



Let me explain the plot: Each line on that graph is an exponential doubling time. When an exponential curve is plotted on a logarithmic y-axis (1, 10, 100, etc.) as we have here, it comes out as a straight line. Blue shows confirmed COVID-19 cases via testing, Orange shows people hospitalized with the virus, red shows deaths of people who had the virus. Each colored measurement has two lines, one fit on numbers for March 19-26 (faded color dash-dots), and

one fit on the numbers from the last week (dashed). The actual numbers recorded every day are shown as circles.

If you want to see how many people would be dead today if we'd kept doubling every 4 days throughout April do this: find today's date on the x-axis, go straight up until you find the faded red dash-dot line, then go straight left and read the number off the y-axis.

If you do this, you'll get the same answer I did — about 1,000 people would be dead today of COVID-19 without social distancing. Instead we have just 87 dead, because our doubling time is now about 23 days. That results in the much shallower sloped lines you see projecting forward from today. The curve has flattened dramatically. Stay-at-home and social distancing are working!!

Clearly we can't assign all credit to any particular action, whether by individuals or the government. Please keep in mind that in the days ahead we will be running an experiment on ourselves, loosening one restriction or another, waiting for a few weeks to see if we get a return to bad doubling times. If so, restrictions may return.

The main point of this letter is that all the pain we've experienced did indeed save many lives. Here in San Diego, it's clear. I hope it's true across our state and nation as well. COVID-19 is not the flu, and without some combination of social distancing, stay-at-home, and various closures we would be in deep trouble.

Just how much trouble? Without those interventions, today the number of people projected to be hospitalized (orange faded dash-dot line) exceeds the number of beds we have available. San Diego today could look like northern Italy or New York City's worst hit hospitals, with patients lying in hallways largely unattended by medical staff. That's a recipe sure to increase the death toll.

If you would like to see more of this analysis visit my data blog at https://jasongfleischer.github.io/argo-navis/covid19/jupyter/epidemiology/2020/04/20/SanDiego-COVID-19.html, The software behind it is open source, the GitHub repo is linked inside the blog post. I welcome contributions to make the code better, or anyone who wants to apply the software to analyze the effects of social distancing in places other than San Diego.