Covid-19: An Engineer Trying to be an Epidemiologist (By: Art Shapiro)

California was the first state in the US to issue a shelter-in-place starting on March 17. This provided me a lot of free time to search the internet for all sorts of garbage. Then I become focused on Covid-19. There is quite a bit of misinformation and conspiracy theories. However, I eventually came across a few gems.

This first site provides basic definitions for epidemic theory (effective & basic reproduction numbers, epidemic thresholds) & techniques for analysis of infectious disease data (construction & use of epidemic curves, generation numbers, exceptional reporting & identification of significant clusters)

https://www.healthknowledge.org.uk/public-health-textbook/research-methods/1a-epidemiology/epidemic-theory

The next site presents some quick math behind the numbers for social distancing. The numbers support the point: any individual is unlikely to be infectious, but as you add them to groups, the chances skyrocket that there's at least one covid19 carrier in the group. This is why social distancing and limiting groups is so critical to stopping the spread.

http://systrom.com/blog/the-numbers-behind-social-distancing/

Covid-19 isn't going away anytime soon.

This next site provides state-by-state effective reproduction numbers. At the bottom of the web page are links to source code for the calculations. It shows that shelter-in-place coupled with social distancing, face masks, etc. is working. The graph shows the Covid-19 effective reproduction rate. If R_t is above 1, the virus will spread quickly. When R_t is below 1, the virus will stop spreading. Click the "6 weeks ago" tab and R_t for the majority of states is greater than 1. The "latest" tab shows only 2 states are above 1. The error bars are large, but on average, R_t for all the states hovers around 0.9. The question is, how long will it take for the infection rate to decrease by half. We need one more number to do the math, the incubation time. This is reported as 14 day (i.e., 2 week) quarantine time. So, we calculate the number of periods n using

$(0.9)^n=1/2$

Solving this, n=6.6. Then, multiplying this by the incubation time (6.6 x 2) = 13 weeks.

https://rt.live/?fbclid=IwAR0dKQtXNTCA5lDqs-22E5l-tml3qvGGHLjaKo8GITi1S9LmXnPkhoZjyzc

What happens next?

This next site presents playable step-by-step simulations covering:

1. The last few months (epidemiology 101, SEIR model, R_0 & R_t)
2. The next few months (lockdowns, contact tracing, masks)
3. The next few years (loss of immunity? No vaccine?)

https://ncase.me/covid-19/