

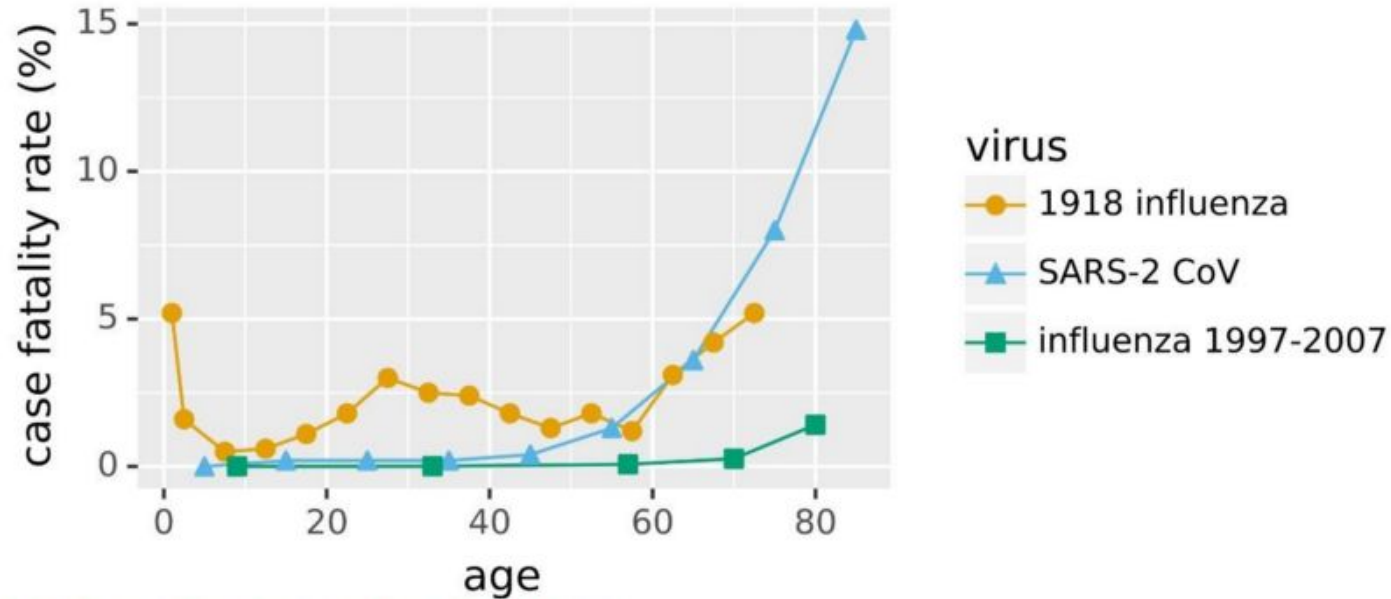
Data Visualization

And the Novel Coronavirus

Novel coronavirus

- Emerged in Wuhan in December 2019
- Spreads easily
 - each person infects 2-7 others
- High mortality
 - between .5 and 2%
- High need for medical interventions
 - 10-20% require hospitalization and many need oxygen or artificial respiration

Are you ok, Boomer?



Statistics for 1918 influenza from *Emerging Infectious Diseases*, 12:1 (2006)

Statistics from *China CDC Weekly*, 2 (2020): available at <https://github.com/cmriivers/ncov/blob/master/COVID-19.pdf>

Statistics for 1997-2007 influenza from *Am J Epidemiol*, 179:156-167 (2014) assuming 10% incidence in all age groups.

Notes: Statistics for 1918 influenza are from era prior to treatments for secondary bacterial pneumonia like antibiotics and pneumonia vaccination.

Statistics for SARS-2-CoV are from China up to Feb-11, and may be biased by two main factors: (1) epidemic is still growing exponential, so some cases that may eventually die have not yet, and (2) there may be substantial under-detection of lightly symptomatic cases.

Epidemiological characteristics

- 10-20% require hospitalization (even young people)
- .5-2% die (given adequate hospitalization)
- Doubles every 3-6 days (without intervention)

Other notes

- Smoking (and maybe air pollution) increase severity
- Worse for older people
- Asymptomatic transmission? Probably not much.

Why worry at Cornell?

- The US is still barely testing
- NY has 173 cases as of March 10
 - Highest in US / tied with WA
 - ...but maybe that's a good sign: few deaths, many cases -> good detection
- In Italy, 1.5% were infected in some villages before they recognized a problem
- Students live and work in close quarters
- Age distribution of faculty
 - 31% of TT faculty at Cornell are 60+
<https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/3/6798/files/2020/03/Age-Cohorts.pdf>
 - And best epidemiological estimate put mortality at 3.6% 60-69 and 8% 70-79
https://cmmid.github.io/topics/covid19/severity/diamond_cruise_cfr_estimates.html

COVID-19 testing per capita

COUNTRY/PROVINCE	POP.	# TESTED (AS OF)	TESTS PER MILLION PEOPLE
US*	329M	1,707 (Mar. 8)	5 
Japan	127M	8,411 (Mar. 4)	66 
UK	67.8M	23,513 (Mar. 8)	347 
Netherlands	17.1M	6,000 (Mar. 7)	350 
Israel	8.6M	3,451 (Mar. 8)	401 
Italy	60.5M	49,937 (Mar. 8)	826 
Guangdong, China	113.5M	320,000 (Feb. 28)	2,820 
South Korea	51.3M	189,236 (Mar. 8)	3,692 

*Based on CDC and does not include accurate test counts performed at state, local, private, and commercial labs.

US Census Bureau, World Population Review, CDC, FDA, KCDC, UK Dept. of Health and Social Care, Italian Ministry of Health, Japan Ministry of Health, Labour, and Welfare, Netherlands National Institute for Public Health and the Environment, WHO

BUSINESS INSIDER

The parable of the lilies

- Lilies grow on a pond
- Every day they cover twice as much area as the day before
- After 48 days, they cover the whole pond

How many days until they cover half the pond?

How long before COVID-19 swamps US hospitals?

- 1000 recognized US cases today
- We test only those hospitalized (approximately, varies by state)
- so maybe 5000 were infected at same time
- It takes about 2-4 weeks for symptoms to progress to hospitalization
- infections double each week
- So maybe $5000 * 2 * 2 = 40000$ currently infected
- All 840000 US hospital beds filled after 4 more weeks of exp growth

Hospitals swamped by early April under business-as-usual

Note Italy (already swamped) has about 3.18 hospital beds per 1,000 people, while the US has 2.73 per 1,000. (calculated using the total number of hospital beds in 2017, most recent data available, and total country populations as of 2018.) [2, 5, 6] <https://faithwashtub.livejournal.com/3816.html>

Do the math: hospitalization

- US has 2.7 hospital beds per 1000 people:
 - .27% hospital bed per person
- (conservatively) 10% of cases require hospitalization
- If 3% of population is sick at the same time
- Then .3% of US population needs hospitalization

Whoops! Not enough hospital beds

(And none left for any other health conditions...)

- Similar calculations for oxygen, ventilators, ...



Dr.E

Oregon | March 4



I am an infectious disease practitioner. We are desperate. We have less than three weeks of masks left, and about as many gloves. We can't order more. Other hospitals only have days of needed equipment. This is chaos of the greatest magnitude. We don't have enough testing kits. Every lab we have spoken to laughs at Pence and his 1 million tests by the end of the week. We simply can't do it. What is our government DOING. This is exponentially increasing EVERYWHERE in the US. The reason more cases haven't been found is we don't have tests!!!

We reached critical triage today with a single open ICU bed, no floor beds and our nurses are calling out sick with respiratory illness. We can't even test them to see what they might have so they are safe to treat patients. By the time the government gets a clue we are going to be dealing with people dying because we have no supplies and no space.

You can threaten to use war powers all you like, but it can't fix that we simply don't have the capacity in the US to make the masks or the gloves. Let alone the medicine.

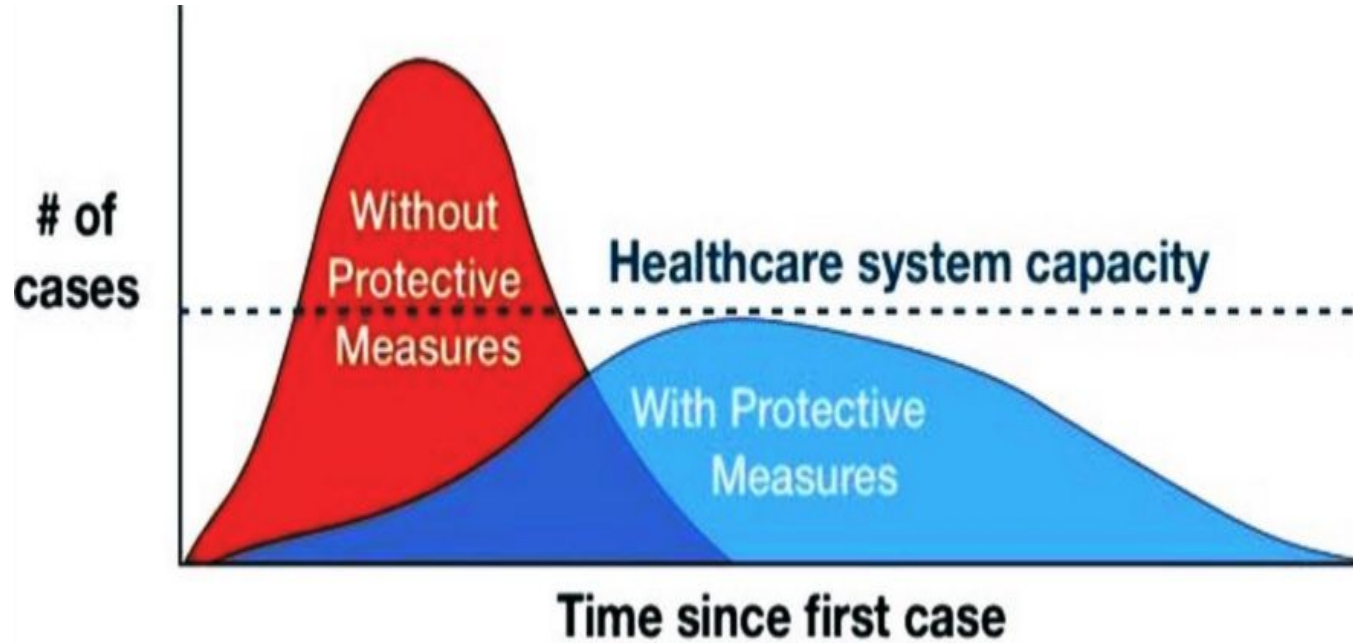
Do people realize the critical emergency this is?!

Why social distancing? Why quarantine?

[In the 1918 flu pandemic, quarantines and other public health measures like closing schools and prohibiting large gatherings lowered the peak death rate. \(Early closures were more effective.\)](#)

With a low peak death rate, patients can find care in hospitals. With hospital care, more patients will survive.

Also might make time for a vaccine



Adapted from CDC / The Economist

US is going slow...

So individuals have *greater* responsibility

Scott Gottlieb, MD @ScottGottliebMD
11:55 AM · Mar 4, 2020 · Twitter Web App

1/n The U.S. has about 130 cases of #coronavirus across 16 states. So, what are some mitigation steps other countries took when they were at similar (or earlier) stages in their outbreaks and epidemics?

53 Retweets 79 Likes

Scott Gottlieb, MD @ScottGottliebMD · 5m
Replying to @ScottGottliebMD
2/n With 39 confirmed cases, the U.K. is preparing no-go zones and a ban on mass public gatherings. They are reportedly considering instructing the public to work from home when possible for at least three months. [assets.publishing.service.gov.uk/government/upl...](https://assets.publishing.service.gov.uk/government/uploads/)

9 38 57

Scott Gottlieb, MD @ScottGottliebMD · 4m
3/n With 10 confirmed cases, Switzerland banned gatherings of more than 1,000 people; prompting the cancellation of the Geneva International Motor Show. admin.ch/gov/en/start/d...

3 12 39

Scott Gottlieb, MD @ScottGottliebMD · 3m
4/n When Italy had clusters with no known epidemiological link they canceled sports events, fashion shows and Venice Carnival, closed schools and universities; at 76 reported cases quarantined a dozen cities (so far) in regions representing 30% of the GDP



Symptoms

- [Cough, fever, fatigue](#)
- [shortness of breath](#).
- Runny nose is not a (diagnostic) symptom; present in 5% of cases.
- [fewer than half](#) of [children with COVID-18](#) have a fever
- Some young adults just have a sore throat, or other mild symptoms

Fever during hospitalization	
Patients — no./total no. (%)	975/1099 (88.7)
Median highest temperature (IQR) — °C	38.3 (37.8–38.9)
<37.5°C	92/926 (9.9)
37.5–38.0°C	286/926 (30.9)
38.1–39.0°C	434/926 (46.9)
>39.0°C	114/926 (12.3)
Symptoms — no. (%)	
Conjunctival congestion	9 (0.8)
Nasal congestion	53 (4.8)
Headache	150 (13.6)
Cough	745 (67.8)
Sore throat	153 (13.9)
Sputum production	370 (33.7)
Fatigue	419 (38.1)
Hemoptysis	10 (0.9)
Shortness of breath	205 (18.7)
Nausea or vomiting	55 (5.0)
Diarrhea	42 (3.8)
Myalgia or arthralgia	164 (14.9)
Chills	126 (11.5)

Transmission

- Small droplet transmission: coughs, sneezes, talking
- Stay in air a few minutes
- Fall onto surfaces and floor
- Or on your hands, inner elbow, etc
 - if you cover your cough / sneeze

The virus has weaknesses

- Feeble coat -> killed by soap or alcohol

What can you do to avoid getting sick?

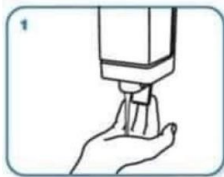
- Wash your hands frequently (for at least 20 seconds)
 - Clean your phone, too
 - Alcohol-based hand sanitizer works ok
- Don't touch your face
- Avoid handshaking
- Stay at home if you feel sick
- Keep your distance (6ft if possible)
- Clean surfaces with alcohol or bleach solution

What can you do to protect others?

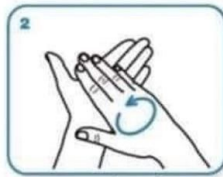
- Social distancing and hygiene
- Stay home when sick
- Cover your cough or sneeze with a tissue (or your sleeve) or wear a mask
- Cancel large events
- Teach your parents and grandparents how to stay safe
 - <https://www.cnbc.com/2020/03/09/many-americans-will-be-exposed-to-coronavirus-through-2021-cdc-says.html>
- Keep the economy going
 - How can you help hourly workers survive a quarantine?



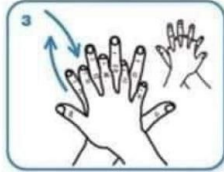
0 I must not fear.



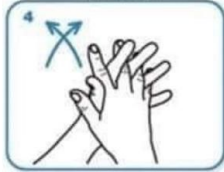
1 Fear is the mind killer.



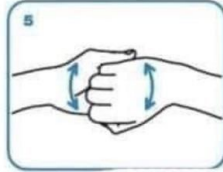
2 Fear is the little-death



3 That brings total obliteration.



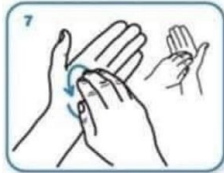
4 I will face my fear.



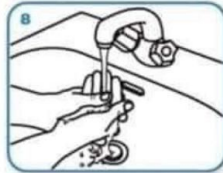
5 I will permit it to pass over me



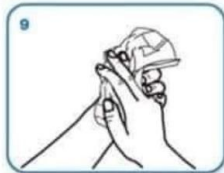
6 And through me.



7 And when it has gone past



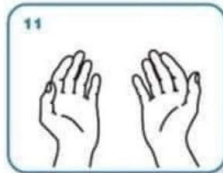
8 I will turn the inner eye to see its path.



9 Where the fear has gone



10 There will be nothing.



11 Only I will remain.

What can Cornell do?

- Encourage sensible public health
 - Handwashing, no face touching, sanitizer, stay home if sick
- Move classes online
 - Like UW, Stanford, Harvard, Columbia, Princeton, ...
 - Maybe not: Visa issues
 - <https://news.northeastern.edu/2020/03/06/northeastern-university-president-pushes-for-federal-protections-for-students-in-the-u-s-on-f-1-visas/>
 - Hence individual profs / students need to act
- Cancel spring break
 - Or end term at spring break and send students home:
 - <https://www.nature.com/articles/s41370-019-0196-4>

Data visualization

- Comparison: <https://www.technologyreview.com/s/615330/best-worst-coronavirus-dashboards/>
- Hopkins: <https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6>
- <https://www.worldometers.info/coronavirus/#countries>
- More: <https://coronavirustechhandbook.com/>

Data visualization with Tableau

Here are links to get you started:

1. [Download Tableau Desktop and Tableau Prep here](#)
2. Select each product download link to get started. When prompted, enter your school email address for Business E-mail and enter the name of your school for Organization.
3. Activate with your product key: TCG8-612C-B3D0-67A3-DD4B

More information

- Reading for this lecture:

<https://medium.com/@madeleine.udell/coronavirus-facts-figures-analysis-d08dbedf1476>

- Similar analyses:

- <https://www.statnews.com/2020/03/10/simple-math-alarming-answers-covid-19/>

- <https://docs.google.com/document/d/e/2PACX-1vQuHYLsCvNJuzydGL0H6hbRZhUhFeyYIku8HEg7ZleZ9HRpzKMuJ0JpVXF46F9En466S2M5k82-GIa5/pub>

- CDC

- NY Gov Cuomo (twitter)

- <https://coronavirustechhandbook.com/>

- <https://faithwashtub.livejournal.com/3816.html>