Link to March 11 update here.

OLD VERSION:
Last updated: Feb 28, 2020

The Coronavirus outbreak (note the disease is officially named COVID-19 and the virus SARS-CoV-2) is catching many technology startups unprepared. The second community transmitted case of the virus in California, with no known ties to others, was just reported in Santa Clara county. New cases were also reported Friday night 2/28 in Washington State and Oregon.

Below is a brief summary of some of the data behind the outbreak as well as what I have seen larger companies quietly adopt. I have also been on a number of small group calls with some of the epidemiologists working on this, so passing some of this on. These calls were under Chatham House rules. Hopefully this is useful for startups not in the loop.

1. What is happening?
In December 2019, cases of a new respiratory virus emerged in Wuhan, a major city of over 10 million residents in the Hubei region of China. Although information on this disease was initially suppressed by the Chinese government, the WHO was contacted on December 31, 2019 and a new virus was identified on January 7th. The first non-China cases were identified on January 13 in Thailand and January 16 in Japan. On January 23rd Wuhan was placed on lockdown by the Chinese Government. The virus is a coronavirus, which is a family of viruses that cause SARS and MERS, but also are endemic in people. Humans have at least 4 coronaviruses already that cause 10-30% of all seasonal colds.

At this point, over 80,000 people[1] are infected with the new COVID-19 virus and 2700 dead (mainly in China). Many epidemiologists believe these numbers from China are underreported by up to an order of magnitude, and it may be closer to 800,000 people infected in China alone.

There are major outbreaks happening in Korea, Italy (locked down 50,000 people in 12 small towns), Japan (Prime Minister asked people work from home and 38,000 person Tokyo marathon cancelled), Iran (deputy health minister infected and cases spread across middle east), and other countries.

2. What should we expect?
Despite the WHO's assurances that things can still be contained, every epidemiologist I have spoken to thinks the virus has broken out and will spread around the world. Many think >20% or more of humanity will be infected due to a lack of baseline immunity and therefore herd immunity for this disease (as an example, the 2009 H1N1 flu infected 16% of all humans)[3].

Data on the virus is quite preliminary. So far the following appears to be true (you can also play with primary data here):

- **Most cases are mild.** Most estimates suggest 80% of COVID-19 cases are mild and feel roughly like a flu. Estimates I have seen suggest that roughly 10-15% of cases will be more significant and may necessitate hospital visits (see also) with 1-3% potentially needing an ICU. The concern of many governments is the peak number of cases that occur in a given moment. For example, if 1,000 sick people show up overnight to a hospital that hospital would be overwhelmed. Many of the social engineering policies (shutting schools etc.) are focused on spreading infectious cases out over time, so hospital infrastructure can deal with all the sick. The higher death rate in Wuhan versus rest of China may reflect a local collapse of healthcare infrastructure.
- **Death rate:** The reported death rate has hovered around 2% but may in reality be 0.2% to 1% depending on country and healthcare system. Many estimates tend indicate an overall expected mortality rate of ~0.5% globally. The current existing fatality rate is biased upwards by Wuhan cases dominating the mix (which are closer to a 3-4% death rate and make up most cases). It is possible the virus is being undertested for in China / rest of world driving the real death rate down (as many more people are infected than is reported).
    - “"My sense and the sense of many of my colleagues, is that the ultimate case fatality rate ... is less than 2%," Dr. Anthony Fauci, director of the National Institute for Allergy and Infectious Diseases, told CNN's Jim Sciutto on "New Day". "What is likely not getting counted is a large number of people who are either asymptomatic or minimally symptomatic, so the denominator of your equation is likely much much larger."” Source.
    - Outside of Hubei and in China, the death rate in other regions has averaged around 0.7% when I have run it on primary data. Wuhan, where most cases are, has been in the 3-4% range likely due to a collapse in healthcare infrastructure in the region.
    - Outside of China, the death rate has averaged around 0.6% when I have run it on primary data. This is now getting confounded by Iran, which has a higher reported death rate - probably due to dramatic undercounting of cases.
- **R0 value:** The spread rate of the virus seems to be well over 2 and likely ~3. This means for every person infected at least 2 to 3 more get the disease. This compares to the flu at 1.5 or so.
- **Incubation period.** Realistically, the incubation period (time from infection to symptoms) appears to be under 14 days and likely 5 to 7 days for the majority of people. People appear to be infectious rapidly after infection, potentially as soon as 12-24 hours. Many experience only mild conditions early, which increases spread rate of the disease as people go to work or otherwise continue with life unchanged.
- **Elderly & pre-existing conditions.** The elderly and people with preexisting conditions appear especially susceptible to disease and severity or death. It is possible the elderly are susceptible largely because they are more likely to have pre-existing conditions. In contrast, very few cases have been reported in young children.

In general, much of the western world's policy to COVID-19 appears to be one of delaying arrival of the disease. In particular, delay the disease so that:

- We are out of flu season and free up hospital beds and healthcare infrastructure.
- We have more time to prepare in terms of diagnostic tests for the disease and potential treatments.
- We can work on a vaccine.

If the disease makes it to the US (or your country) the government may enact techniques to decrease spread. This usually means cancelling gatherings, sporting events, schools, or other situations in which groups of people will aggregate. It is possible your movements will be restricted (for example, the 50,000 people locked down in Northern Italy).

From the CDC website:

> ## What May Happen
>
> More cases are likely to be identified in the coming days, including more cases in the United States. It's also likely that person-to-person spread will continue to occur, including in the United States. Widespread transmission of COVID-19 in the United States would translate into large numbers of people needing medical care at the same time. Schools, childcare centers, workplaces, and other places for mass gatherings may experience more absenteeism. Public health and healthcare systems may become overloaded, with elevated rates of hospitalizations and deaths. Other critical infrastructure, such as law enforcement, emergency medical services, and transportation industry may also be affected. Health care providers and hospitals may be overwhelmed. At this time, there is no vaccine to protect against COVID-19 and no medications approved to treat it. Nonpharmaceutical interventions would be the most important response strategy.

3. What should a startup do?

In the absence of a vaccine or effective medicines,

- **Encourage hand-washing.** You can watch a video here for best practices. You may want to add a few purell dispensers around the office as a reminder.
- **Wipe down work areas regularly.** There is some evidence suggesting the virus may stick around for at least a few hours, if not more, on surfaces. You may also want to wipe your phone down on a regular basis.
- **Encourage flu vaccination.** This will decrease health burden on hospitals and also prevent people from getting the flu and thinking they have COVID-19.
- **Zero tolerance sick policy.** Anyone who is sick, or starting to feel sick, should take a sick day or work from home.
- **Curtail travel and conferences and move to video calls.** Your employees may generally want to decrease travel and in particular avoid countries where either COVID-19 has started to spread (China, Hong Kong, Iran, Italy, Japan, Korea, Singapore, Thailand) or if you want to be extra cautious, where it is highly likely to spread (Indonesia, much of the middle east due to Iran spread, most African countries with strong China ties).
    - If an employee is returning from one of these countries, they may want to consider self-quarantine for 14 days.

    - As a rule of thumb you can use the US CDC site to assess what countries should be on your no fly list. The CDC right now (Feb 28, 2020) lists China, Korea, Italy and Iran as the countries that are "level 3".
    - The reason to avoid this travel is (a) so your employees can avoid getting sick and (b) so your employees can avoid the potential for quarantine upon return and (c) your employees can avoid getting stuck in a country if a region is shut down.
    - Some countries, such as Israel, have asked its citizens to curtail all international travel entirely. Similarly, Nestle, which employees over 200,000 people has stopped all international travel.
- **Curtail visitors from other countries.** A number of companies are starting to adopt a "no visitor" policy for people traveling from the countries listed above and they suggest moving such meetings to a video call.
- **Plan for the remote work contingency.** It is worth planning how your company will work if the virus takes off in your country, or in countries where your employees work. Do you adopt a work from home policy or other approaches? What is the threshold for work-from-home? Coinbase has a guide like this.

Personal planning.
In addition, individuals may want to plan for a situation where either (a) they are or their loved ones are impacted by supply chain issues or (b) their city or region is placed on lock-down, or they are asked to self quarantine for 14 days or more. This is a "worst case" "abundance of caution" backup plan and each person can decide what they want to do.

The primary aspects of this may include:

- **Make sure your family has 2-3 months of medicine.** If a loved one is taking a medicine or drug regularly, you may want to ensure a few months extra supply. Approximately 60% of common pharmaceuticals are partially manufactured or packaged in China, and 20% of generics are made in India. FDA has just announced the first shortage due to supply chain issues in one drug.
- **Plan for the unlikely event you can not leave the home for 2 weeks due to isolation or quarantine.** This may impact food or other planning. Alternatively, countries may meter the number of people who can enter a supermarket at a given time.
- **Plan for caring for a sick loved one.** If hospitals are temporarily overwhelmed, family members who get infected, or who have pre-existing medical conditions, may experience delay in care. Plan ahead for your specific situation.

Good post on personal planning and supplies.

4. Macro economy & fundraising
Data from the 1918 flu and other epidemics suggest that social distancing and related techniques (shutting down group activities, sports, schools, etc.) can drastically change the impact of an epidemic on a per city basis. For example, St. Louis had half the death rate of Philadelphia in the 1918 flu (see references below).

The CDC has already hinted it would enact these techniques if needed, and we are already seeing lock downs of regions not only in China, but also Italy and Korea. The shutting down of businesses due to worker movement, lack of free movement, travel for business, and tourism should impact the global economy. Relatedly, a number of companies are already seeing their supply chains impacted due to a dependency on China for everything from car parts to the chemical components of medicines and pharmaceuticals.

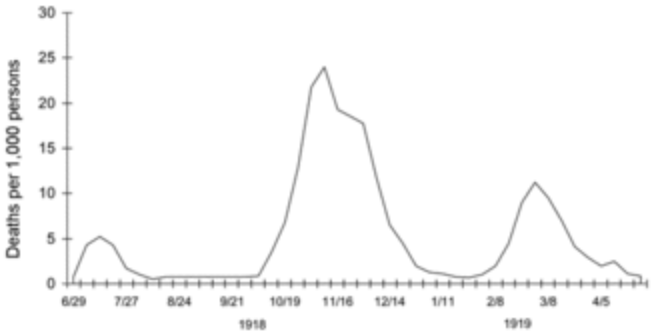
The economy has already been impacted, so the primary question is on length and degree of impact.

Usually when a macro storm is looming, and you are running a startup, it is a good idea to raise money so you do not need to in 6 months when times may be bad. If your plan is to fundraise in 3-6 months, it might be worth considering doing it now.

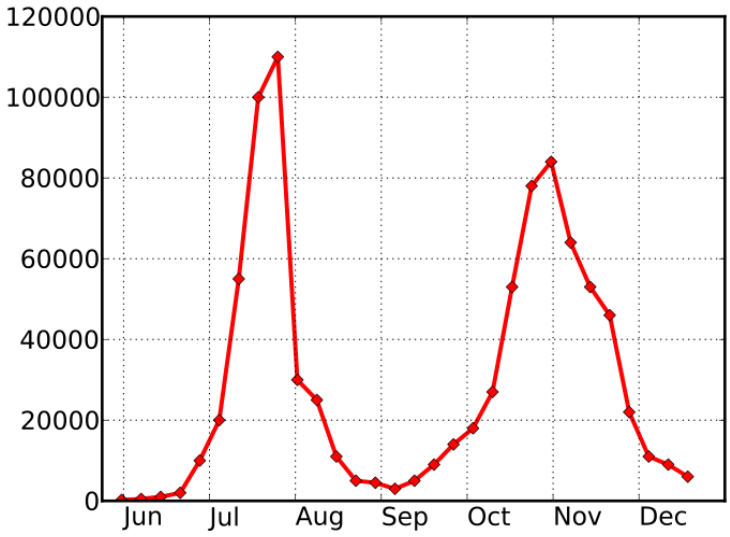
Papers on prior epidemics and social distancing include:
https://www.pnas.org/content/101/16/6146.long
https://www.pnas.org/content/114/15/4023
https://www.pnas.org/content/104/18/7582.long
https://jamanetwork.com/journals/jama/fullarticle/208354

5. Expect A Second Wave

In many epidemics disease course follows two waves. In wave one, an initial infection happens followed by governments tightening movements, shutting schools, and in general decreasing the spread of the diseases. Controls are eventually relaxed (people need to work, kids need to go to school etc.) and then a few months later a second wave of the disease hits and infects a subset of the people who were not infected in the first wave. Eventually, enough people get sick, develop antibodies, and there is a strong enough herd immunity in the population to decrease future out breaks in size.



1918 Spanish Flu had two predominant waves of virus spread.



2009 H1N1 flu in the UK had two waves.

6. Resources:

Data:
From John Hopkins University
Cases and deaths on Github
Seasonality and COVID-19

Science-y Twitter:
https://twitter.com/ScottGottliebMD
https://twitter.com/firefoxx66
https://twitter.com/sciencecohen
https://twitter.com/angie_rasmussen
https://twitter.com/HelenBranswell
https://twitter.com/florian_krammer
https://twitter.com/JeremyFarrar

Recent JAMA paper:
https://jamanetwork.com/journals/jama/fullarticle/2762130

7. Company policy examples:

- Coinbase: https://docs.google.com/document/d/1SRP4dnVCvKB7A5WXrESe-cL51i6_cg5nNGLNld6qch0/edit#
- Stripe: https://stripe.com/au/newsroom/news/covid-19
- Twitter: https://blog.twitter.com/en_us/topics/company/2020/keeping-our-employees-and-partners-safe-during-coronavirus.html
- Google: https://9to5google.com/2020/03/02/google-dublin-coronavirus/

Article on a few companies:
https://www.businessinsider.com/google-dublin-coronavirus-work-from-home-twitter-coinbase-2020-3

NOTES

[1] Many people doubt China's official numbers and think the number of cases may be many times this number.

[2] This is why vaccines are so important, of course.