

From the Paranoid

Let's run some numbers and consider some scenarios.

As of 22 February 2020, there are just under 77,000 confirmed COVID-19 coronavirus infections, around the world. The current total is 75,467 in mainland China. The non-China total is 1,331. The daily increase in non-China cases was 11%, overnight. The rate of increase of cases outside of China has been increasing lately. Cases in Korea quadrupled in 48 hours. Cases are now in Italy, in Iran and have been reported in Israel and Lebanon -- but those in patients repatriated from the Diamond Princess cruise ship.

One of the original articles about the coronavirus estimated the actual case count was 10 times the recorded total. That is good news and let's assume it's true. It is good news, because it would mean most cases are mild, like a bad winter URI, but not pneumonia and not requiring admission. Let's call the number of 750,000 an upper estimate of case counts.

The base reproductive ratio, R_0 or R naught. is a measure of how infectious something is. If R_0 is greater than 1, an epidemic will spread. If R_0 is less than 1, it will die out. The effective R_0 will be modified by presence of vaccination status, percentage of people in a population who are immune because of prior infection, and so on. The R_0 for common influenza is about 1.3. The R_0 for measles is 12-18. A retrospective analysis of the 1918 pandemic influenza yielded an R_0 value of 1.8. Pertussis (whooping cough) has an R_0 of 17. Tuberculosis has an R_0 of 10. The common cold (also a coronavirus) has a R_0 of 2-3. The estimates of a R_0 for COVID-19 are around 2.5-4. The SARS epidemic had an initial R_0 of about 2.5, but control measures reduced the effective R_0 to about 0.4. Because SARS had a case-fatality rate of about 35%, this was a very good thing.

Summary: COVID-19 probably has an R_0 typical of other coronaviruses, of around 2 to 3. It is more infectious and more deadly than common influenza, but much less infectious than many common illnesses. Case fatality rate is still unknown. The most susceptible people die early and any new epidemic always looks scary at the beginning. In hospitalized patients in China, in the early days of the epidemic, the CFR is about 2.5%. In cases outside of China, it looks much lower, but there are simply not enough reported cases to have any real confidence in any number.

The epidemic is less than 3 months old. The very first few cases were in Wuhan, China, in December. With less than 250 cases, the Chinese CDC recognized they had a new disease and the Wuhan virology lab was already isolating and characterizing the virus.

Now, some bad news. Wuhan had about 278 confirmed cases as of 20 January, just over one month ago, as I write this. Today, the cumulative Chinese total is over 76,000. That is epidemic spread, the result of a very high effective R_0 and a

probable “superspreading event”. Briefly, there was an annual Chinese New Year celebration in Wuhan, China around 20 January, which an estimated 40,000 families attended. You could not design a better mass-spreading event, unless you deliberately introduced to a confined population, as say a prison or a cruise ship (bad joke intended).

After the party, many citizens of Wuhan departed for other provinces, for the lunar New Year celebrations.

So, what’s the attack rate? That is, when the infection is introduced to a totally susceptible population, what percentage of potential victims will actually get infected?

From the Diamond Princess cruise ship, 634 of about 3,700 passengers and crew have so far been infected. This is an attack rate of about 17%.

What about in all of Wuhan? The mayor Wuhan estimated 5 million people left Wuhan for the holidays, from an estimated original population of 11 million. But, let’s consider two numbers. One is a net population of 6 million and a second, more conservative estimate of 10 million, because 5 million was an off-the-cuff estimate by the Mayor and because travel was being discouraged fairly early.

As of 21 February, Hubei Province has 62,662 cases. Ten times that would be 626,620. The recorded fatality rate (as of today) in Hubei is 2,144 deaths and the total of “recovered” cases 11,881. This equates to 5.54 recovered patients, for every fatality at about one month. $62,662 - 2,144 - 11,881 = 48,637$ patients still in the hospital. So, one month into the epidemic, 78% of patients diagnosed (some as recently as yesterday) are still hospitalized.

According to the NY State Department of Health, New York City has 26,451 hospital beds.

2,144 deaths divided by 62,662 gives a fatality rate of 3.4%. Dividing by the SWAG (sophisticated wild-ass guess) of a total count that is ten times that, or 626,620, yields a fatality rate of 0.34%, or about 3 tenths of one percent. That’s still a lot of people, but less scary in terms of risk of death, if you get infected.

I am assuming here that all 62,626 patients got hospitalized. My rationale for that is the case definition. On 13 February, China changed the case definition. Before that date, all confirmed cases had a positive PCR virus specific test. As of that date, patients who had compatible history, physical findings, and a CT scan showing compatible pneumonia, but who didn’t get a confirmatory PCR test (because of shortage of test kits) would still be counted. Oh, by the way, over 1,000 of those patients had also died. So, I consider it unlikely that mild cases, such as the ones in the make shift containment centers, at their convention center, were ever tested with the PCR test.

Clinical illness lasts weeks. From the literature, some patients who initially do well, worsen dramatically at 2 or 3 weeks of illness. Somewhere between 10 and 20% of patients who get hospitalized wind up in the ICU. 3.4% of those who require hospitalization will die, based on the initial statistics, which are likely to change.

There are several attack rate numbers which result. $62,626 / 10,000,000 = 0.626\%$, less than 1%. But, if the ten fold SWAG estimate is more accurate, the attack rate is less about 6.2%. That is about 1/3 the attack rate on the cruise ship.

But, if the Mayor's statement that 5 million people had left the city for the holidays is correct, then the attack rate estimates change. The confirmed case count yields at attack rate of 1.4%. The SWAG estimated total cases yields an estimated attack rate of 10.4% - much higher.

What does this mean for us, in the USA?

Let's assume the percentage of hospitalized patients who survive or who need intensive care remains the same in the USA. We can talk about how many Chinese patients smoke or any other qualifier you wish, but we only have one set of numbers, currently, so let's use those, and see what we get.

I am going to pick on La Crosse, Wisconsin, because that's where I live. We have two hospitals in town. I will round the total bed capacity up to 500 beds.

There are about 120,000 people living in La Crosse County. Just to simplify things, I am going to assume we blockage the bridge to La Crescent, Minnesota and barricade all roads leading into the County, so people in Sparta, Tomah, Cashton, Westby, Viroqua, Prairie du Chien, etc., will just be out of luck.

If our attack rates mimic the cruise ship, we can expect 20,400 cases of COVID-19 illness. Assuming 90% of those are mild, that leaves 2,400 who would need hospitalization and 200 to 400 who would need ICU beds.

If the attack rates fit the Wuhan data, then we can expect about 7,500 patients, of which 750 will need hospitalization. That equates to 75 - 150 persons needing an ICU bed. That's for the population of 11 million. Taking the higher attack rate (6 million population), we come up with about 16,800 cases, of which 1,680 need hospitalization and as many as 300 need ICU beds.

Looking at the Wuhan / Hubei province data, we can project a best case scenario of 750 patients needing hospitalization, all at the same time, with up to 150 patients needing an ICU bed. If the Wuhan population is significantly lower, then we are looking at higher attack rates, and we need 1,600 hospital beds.

If the attack rate is 17%, as in the cruise ship data, then we are looking at 20,400 cases, of which over 2,000 would need hospitalization. That's four times our bed capacity.

Every single one of these Wild Ass Guess estimates says we will be overwhelmed.

Let's hope the virus mutates and when it gets here, it will be the kinder, gentler variety.

I would not go to a casino to play those kinds of odds.

What's our plan for being overwhelmed? Where do we have contingency beds? How do we plan to activate them?

Oh, and if it's bad here, don't count on Madison or anywhere else for help.

There is an old military acronym: KMAG, YOYO (pronounced Kay Mag Yo-Yo) - kiss my ass good bye, you're on your own.

This is a highly infectious virus, just like the common cold. It's coming and we won't escape. Only about 3% of those who require hospitalization will die, so the vast majority of patients should recover. But a great many people will get sick, all at once. Our medical staff will get sick. We will fail to take care of everyone. We don't have enough resources on hand to take care of the patient load we can expect. It's time to start planning for a mass-casualty equivalent.

Prior Prior Planning Prevents Performance Problems.

Yours for constructive paranoia,

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