Coronavirus 2020
COVID-19 is the disease caused by the virus SARS-2-CoV.

- Coronaviruses are single-strand RNA viruses belonging to the family *Coronaviridae*.
- Coronavirus name is derived from the Latin *corona*, meaning crown.
- Other Coronaviruses, include:
  - Coronavirus for common respiratory coronavirus infections causing cold and flu symptoms.
  - SARS for the SARS-CoV virus, not known to circulate since 2002-2003.
  - MERS for the MERS-CoV virus, sporadic infections, mostly in the Arabian peninsula since 2012.
  - SARS-2-CoV (Covid-19) appears to have been a zoonotic (animal) infection that has adapted to humans. Origin is uncertain although bats and scaly anteaters are currently implicated.
- **Transmission**: Virus is found in respiratory secretions, saliva and on contaminated surfaces.
- **Incubation period:** Mean: 6.4 days; Range 2-12 days
- **Symptoms:** SARS-2-CoV virus causes *upper respiratory tract disease* and can cause *pneumonia*.
  - Fever (83-98%)
  - Cough (46-82%, usually dry)
  - Myalgia (muscle aches) or fatigue (11-44%)
  - Shortness of breath at onset of symptoms (31%)
  - Less common symptoms: sore throat, headache, productive cough (thick, colored sputum), nausea, bowel change, hemoptysis (bloody sputum)
- **Morbidity (symptoms):** Estimated ~80% of infections are non-severe, including asymptomatic infection
- **Mortality Risk**: New data **<** ~1.4%. Seasonal flu is ~0.1%. Deaths mainly in elderly & chronic lung disease
- **PREVENTION**: There is currently **no** preventative vaccine available for the SARS-2-CoV virus.
  - Avoid sick individuals.
  - Wash hands with soap and water x 20 seconds before eating, after cough/sneezing or bathroom visits.
  - Don't touch the face, eyes, etc.
  - Stay home, if ill.
  - Cover your sneeze. **BE MINDFUL**
  - Disinfect frequently touched household objects.
  - Current CDC recommendations do not suggest using a facemask for protection. Most face masks will NOT prevent infection. ONLY the *NIOSH-certified disposable N95 respirator* face mask will trap viral particles and prevent spread.
- **SYMPTOMATIC TREATMENT:**
  - **Bio-Botanical Research Biocidin TS Throat Spray.** *Available @ STARK HEALTH: Call 949-722-7070 $41*
    - Dose: 2 sprays every hour at the first sign of any sore throat.
  - **Vitamin A Liquid (A-Mulsion) (3,000 mcg), 1 Fl oz** *Available @ STARK HEALTH: Call 949-722-7070 $22*
    - Dose: 60,000 ugm or 200,000 IU **(Total 20 drops)** for **2 days only**.
    - **Note:** Pregnant patients should NOT take Vitamin A at high doses.
  - **Vitamin D3 (2,000 IU) Drops by Seeking Health** *Available @ STARK HEALTH: Call 949-722-7070) $24*
    - Dose: **25 Drops** (50,000 IU for **1 day**, then Reduce to **5 Drops** per day until illness resolves
  - **Zinc AG Chelated Tablets - Metagenics.** *Available @ Amazon.com*
    - Dose: **2-3 tablets per day,** divided doses with food, until illness resolves.

I think most people aren't aware of the risk of systemic healthcare failure due to #COVID19 because they simply haven't run the numbers yet. Let's talk math. 1/n

Let's conservatively assume that there are 2,000 current cases in the US today, March 6th. This is about 8x the number of confirmed (lab-diagnosed) cases. We know there is substantial under-Dx due to lack of test kits; I'll address implications later of under-/over-estimate. 2/n

We can expect that we'll continue to see a doubling of cases every 6 days (this is a typical doubling time across several epidemiological studies). Here I mean *actual* cases. Confirmed cases may appear to rise faster in the short term due to new test kit rollouts. 3/n

We're looking at about 1M US cases by the end of April, 2M by ~May 5, 4M by ~May 11, and so on. Exponentials are hard to grasp, but this is how they go. 4/n

As the healthcare system begins to saturate under this case load, it will become increasingly hard to detect, track, and contain new transmission chains. In absence of extreme interventions, this likely won't slow significantly until hitting >>1% of susceptible population. 5/n

What does a case load of this size mean for healthcare system? We'll examine just two factors — hospital beds and masks — among many, many other things that will be impacted. 6/n

The US has about 2.8 hospital beds per 1000 people. With a population of 330M, this is ~1M beds. At any given time, 65% of those beds are already occupied. That leaves about 330k beds available nationwide (perhaps a bit fewer this time of year with regular flu season, etc). 7/n

Let's trust Italy's numbers and assume that about 10% of cases are serious enough to require hospitalization. (Keep in mind that for many patients, hospitalization lasts for *weeks* — in other words, turnover will be *very* slow as beds fill with COVID19 patients). 8/n

By this estimate, by about May 8th, all open hospital beds in the US will be filled. (This says nothing, of course, about whether these beds are suitable for isolation of patients with a highly infectious virus.) 9/n

If we're wrong by a factor of two regarding the fraction of severe cases, that only changes the timeline of bed saturation by 6 days in either direction. If 20% of cases require hospitalization, we run out of beds by ~May 2nd. 10/n

If only 5% of cases require it, we can make it until ~May 14th. 2.5% gets us to May 20th. This, of course, assumes that there is no uptick in demand for beds from *other* (non-COVID19) causes, which seems like a dubious assumption. 11/n

As healthcare system becomes increasingly burdened, Rx shortages, etc, people w/ chronic conditions that are normally well-managed may find themselves slipping into severe states of medical distress requiring intensive care & hospitalization. But let's ignore that for now. 12/n

Alright, so that's beds. Now masks. Feds say we have a national stockpile of 12M N95 masks and 30M surgical masks (which are not ideal, but better than nothing). 13/n

There are about 18M healthcare workers in the US. Let's assume only 6M HCW are working on any given day. (This is likely an underestimate as most people work most days of the week, but again, I'm playing conservative at every turn.) 14/n

As COVID19 cases saturate virtually every state and county, which seems likely to happen any day now, it will soon be irresponsible for all HCWs to not wear a mask. These HCWs would burn through N95 stockpile in 2 days if each HCW only got ONE mask per day. 15/n

One per day would be neither sanitary nor pragmatic, though this is indeed what we saw in Wuhan, with HCWs collapsing on their shift from dehydration because they were trying to avoid changing their PPE suits as they cannot be reused. 16/n

How quickly could we ramp up production of new masks? Not very fast at all. The vast majority are manufactured overseas, almost all in China. Even when manufactured here in US, the raw materials are predominantly from overseas... again, predominantly from China. 17/n

Keep in mind that all countries globally will be going through the exact same crises and shortages simultaneously. We can't force trade in our favor. 18/n

Now consider how these 2 factors – bed and mask shortages – compound each other's severity. Full hospitals + few masks + HCWs running around between beds without proper PPE = very bad mix. 19/n

HCWs are already getting infected even w/ access to full PPE. In the face of PPE limitations this severe, it's only a matter of time. HCWs will start dropping from the workforce for weeks at a time, leading to a shortage of HCWs that then further compounds both issues above. 20/n

We could go on and on about thousands of factors – # of ventilators, or even simple things like saline drip bags. You see where this is going. 21/n

Importantly, I cannot stress this enough: even if I'm wrong – even VERY wrong – about core assumptions like % of severe cases or current case #, it only changes the timeline by days or weeks. This is how exponential growth in an immunologically naïve population works. 22/n

Undeserved panic does no one any good. But neither does ill-informed complacency. It's wrong to assuage the public by saying "only 2% will die." People aren't adequately

grasping the national and global systemic burden wrought by this swift-moving of a disease. 23/n

I'm an engineer. This is what my mind does all day: I run back-of-the-envelope calculations to try to estimate order-of-magnitude impacts. I've been on high alarm about this disease since ~Jan 19 after reading clinical indicators in the first papers emerging from Wuhan. 24/n

Nothing in the last 6 weeks has dampened my alarm in the slightest. To the contrary, we're seeing abject refusal of many countries to adequately respond or prepare. Of course some of these estimates will be wrong, even substantially wrong. 25/n

But I have no reason to think they'll be orders-of-magnitude wrong. Even if your personal risk of death is very, very low, don't mock decisions like canceling events or closing workplaces as undue "panic". 26/n

These measures are the bare minimum we should be doing to try to shift the peak – to slow the rise in cases so that healthcare systems are less overwhelmed. Each day that we can delay an extra case is a big win for the HC system. 27/n

And yes, you really should prepare to buckle down for a bit. All services and supply chains will be impacted. Why risk the stress of being ill-prepared? 28/n

Worst case, I'm massively wrong and you now have a huge bag of rice and black beans to burn through over the next few months and enough Robitussin to trip out. 29/n

One more thought: you've probably seen multiple respected epidemiologists have estimated that 20-70% of world will be infected within the next year. If you use 6-day doubling rate I mentioned above, we land at ~2-6 billion infected by sometime in July of this year. 30/n

Obviously I think the doubling time will start to slow once a sizeable fraction of the population has been infected, simply because of herd immunity and a smaller susceptible population. 31/n
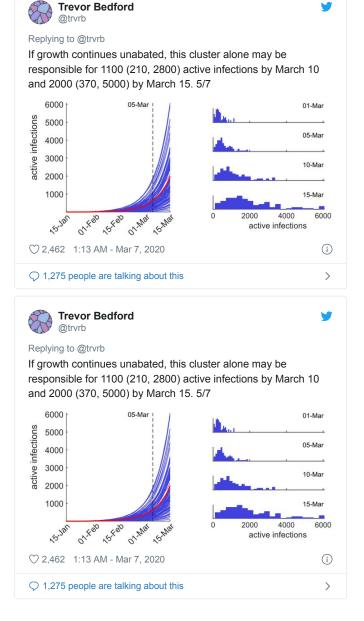
But take the scenarios above (full beds, no PPE, etc, at just 1% of the US population infected) and stretch them out over just a couple extra months. 32/n

That timeline roughly fits with consensus end-game numbers from these highly esteemed epidemiologists. Again, we're talking about discrepancies of mere days or weeks one direction or another, but not disagreements in the overall magnitude of the challenge. 33/n

This is not some hypothetical, fear-mongering, worst-case scenario. This is reality, as far as anyone can tell with the current available data. 34/n

That's all for now. Standard disclaimers apply: I'm a PhD biologist but *not* an epidemiologist. Thoughts my own. Yadda yadda. Stay safe out there. /end

Addendum: to anyone who found this useful or interesting, highly recommend you follow @trvrb who actually does modeling and forecasting for a living. This thread is a great place to start:

Trevor Bedford
@trvrb

Replying to @trvrb

If growth continues unabated, this cluster alone may be responsible for 1100 (210, 2800) active infections by March 10 and 2000 (370, 5000) by March 15. 5/7

♡ 2,462   1:13 AM - Mar 7, 2020   ⓘ

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