

The nCOV19/ COVID-19 Pandemic

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Abstract

The Novel Coronavirus nCOV19, officially named COVID-19 hit the headlines in January 2020 as it spread in Wuhan, China. By mid February it had become a pandemic with cases reported on 3 continents. The rapid spread of the disease in the most affluent and modern societies on the planet, despite prompt and stringent response well-informed by several prior outbreaks of severe respiratory epidemics, causes extreme concern at this writing. The dead include many medical personnel including senior administrators, well-trained in precautionary measures and with the best protective equipment and care at hand. Several drugs are under development or in trials, but no general cure has been identified. People of all genetic/racial/gender/age segments have been affected. The WHO has made courses available for the general public as well as for responder professionals. Quarantine with or without immediate access to care, has shown high concentrations of infected persons: whether this is a success in capturing infected persons, or led to infecting otherwise infection-free people, remains debatable, given the examples of Wuhan city and the Diamond Princess cruise ship - by far the two locations with highest number of infections. This article tries to capture an updated set of information, and eventually, perspective as we hopefully overcome this and head off repeats. The presentation is from a lay-person's perspective, but linking to sources for authentic medical and government administrative sources. It is motivated by the fear of common people including the authors, not any political, national, racial or economic motivation. How a virus mutated to get ahead of the best research of humanity, remains a matter of extreme concern, but beyond the scope of this brief. At the latest writing, the number of cured and discharged cases has exceeded the remaining active cases. The death rate was reported to be 6% in early March. As of March 22, the epidemic seems finished in China, with no cases for 3 days. But the number of active cases is rising sharply in Europe and North America. We are no longer optimistic about the pandemic. Efforts to control it are only partially successful. A simple simulation shows the extreme importance of preventing infected people from infecting anyone else, and diagnosing infected cases as early as possible.

Keywords

pandemic– epidemic–virus–vaccine–mutation–disaster–response–infection

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1. Introduction

As on most new topics, we start by checking Wikipedia [1]. The page had 584 references by February 20, 2020. In this brief, we extract only some rudimentary items.

The disease is believed to have been caused by SARS-CoV-2, and to have started being seen in Wuhan, Hubei Province, in the People's Republic of China (PRC) in December 2019. The time between exposure and disease onset appears to be typically 2 to 14 days, perhaps 24 days in some days. Symptoms at an advanced stage include pneumonia and acute respiratory distress leading to death. To date over 2000 deaths have been reported, all except about 10 being inside China, and at least some of the rest associated with people who travelled recently from China. The number of reported

cases is still well under 100,000, but it is less than 3 months since this was identified as a new threat, and at this writing, it is not certain that the rate of increase in the number of cases has levelled off. It is too early to say whether the vast majority of cases identified have recovered.

To put a pandemic in perspective, according to the US Centers for Disease Control[2], the "2009 (H1N1)pdm09 pandemic resulted in 60.8 million illnesses, 274,304 hospitalizations and 12,469 deaths in the U.S. alone" between April 12, 2009 and April 10, 2010. Since the (H1N1)pdm09 virus was very different from circulating H1N1 viruses, vaccination with seasonal flu vaccines offered little cross-protection against (H1N1)pdm09 virus infection. While a monovalent (H1N1)pdm09 vaccine was produced, it was not available in large quantities until late November—after the peak of illness during the second wave had come and gone in the United States. Additionally, CDC estimated that 151,700-575,400 people worldwide died from (H1N1)pdm09 virus infection during the first year the virus circulated."

The cumulative numbers of confirmed cases of COVID-2019 are shown in Figure 1. The data on cumulative cases are from the daily Situation Reports posted by the World Health Organization (WHO)[3]. Added to that are data on Active Cases and Cured Cases [4] from the Worldometer website. The jump in the number of cases on February 17 is due to a change in reporting rules that led to erroneous estimates from February 13 to 16. A better idea can be obtained by ignoring the data on the 14th through 16th, and using a straight line to plot the data from the 13th to the 17th. The early situation reports stated that 44 cases of a new viral disease had been reported from December 31, 2019 until January 3, 2020, from the PRC. On January 7, Chinese researchers identified the new virus as Novel Coronavirus (nCOV). On January 12, PRC scientists shared their finding of the genetic sequence of this new virus. On January 13, Thailand reported one case, the patient having arrived from PRC. On January 15, Japan did likewise, and on January 20, so did South Korea.

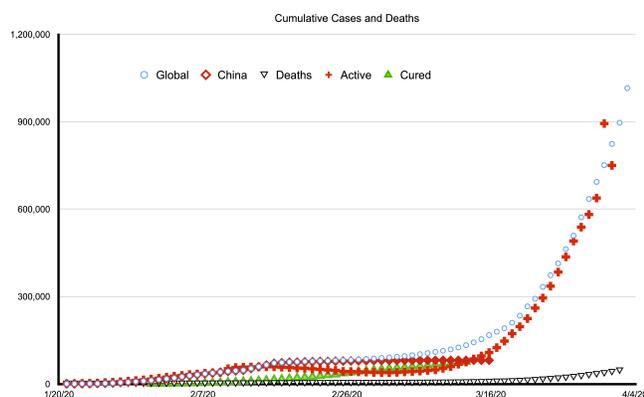


Figure 1. Cumulative reported cases and deaths from daily Situation Reports, US Centers for Disease Control. Current active cases and cumulative cured cases from the Worldometer site.

The nominal fatality rate appeared initially to hold steady at around 2.1%, rising in recent days to 3%. Some have expressed curiosity that the rate held very close to a constant 2.1% based on data coming from the PRC. This is frightening, no doubt, in comparison to the historic, final toll of recent previous pandemics such as the H1N1 mentioned above. At this early stage, however, one has to look at the death rate, not concurrently with cumulative number of cases reported, but with a delay of two weeks or more. This is to include the incubation time and the time since the case is reported. This does provide reason for fear. While we are not presenting that data here in graphical form, consider that it suggests that the death rate reported, with a 14-day delay applied, means that *all of the cases initially reported, died, and in fact others who were not initially reported also died.* This is not surprising: several cases were "reported" only at a terminal stage, and there are reports of people collapsing in the street and dying before any 'laboratory confirmation' could come through. In one case, an 80-year-old passenger arriving from China, checked into a hospital in Paris - and was reported to have gone critical and passed away within a couple of days.

The rate however, has decayed down to about 6 percent based on more recent data. Any way one looks at it, there is cause for extreme concern. Swift diagnosis and rapid care appear to be succeeding in over 90 percent of cases; however, survivors do report organ damage in some cases. There is reason to believe that more recently, in Italy and Iran, there was again a high initial rate of fatalities before the disease was recognized and response measures instituted.

1.1 Update as of March 12, 2020

The World Health Organisation (WHO) has posted the final report of the WHO-China Joint Mission on COVID-19 [5]. This includes a definition of the virus structure, and recommendations for countries facing various related issues. For the first time, we see confirmation from the WHO of the fatality rates that we have been reporting:

1. The disease is practically ended in China.
2. Italy, Iran and South Korea, in that order, have seen a large number of cases.
3. With many medicines denied by Sanctions, Iran has experienced a particularly traumatic time, with a high death rate. The disease has struck the Iranian leadership, starting with an outbreak in the holy city of Quom.
4. The USA and many nations have imposed various levels of bans and quarantine on incoming passengers. This controls a primary means of spreading of the disease.
5. As testing kits become more widely available the number of reported and active cases has seen a sharp rise in the past week.
6. Crude Fatality Rate CFR (deaths reported, divided by laboratory cases is 3.8 percent (see our update at the end, showing that it has come down to 3.4%)

7. In Wuhan the fatality rate was 5.8% circa February. We attribute this to the delay: Wuhan had cases reported at least 2 weeks, probably longer, before there were cases reported elsewhere. Our present 2-week delayed fatality rate came down to a low of 4.14% by March 3, only to rise to a present figure of 5.51% by March 11. This suggests that the peak is still about 2 weeks away, globally.
8. In China, overall CFR has decreased to 0.7%, attributed to improved response and care. We caution that this is also because many more cases are being reported and hospitalized. In early January it was difficult to identify cases as being due to the new virus, until the patient's condition became very serious.
9. As might be expected, mortality rate is significantly higher for people over 80 years with a CFR of 21.9%
- 10.

The Worldometer website lists Active Cases remaining, as well as the number of Cured (discharged) cases. It is clear that the number of active cases is dropping, but the rate of drop has been attenuated - mostly by the still rising rate in nations such as Italy. In China, the number of active cases is dropping fast (not shown separately) and as of March 2, it has been reported that one of the modular prefabricated hospitals set up in Wuhan by the People's Liberation Army, has closed and will be dismantled soon. The last prefab hospital is slated for shutdown by mid-March as the traditional hospitals regain the ability to handle all remaining patients. The WHO declared COVID-19 to be a Pandemic, adding to the panic in the stock markets.

2. Courses and Training

The World Health Organisation (WHO) has created a set of resources, including basic courses intended for all people, as well as being required for medical, emergency and public services personnel. They express an intention to develop these into for-credit courses with assessment and certificates of completion. These can be found at [6].

On February 18 WHO published a Technical Guidance note called 'Early Investigations' giving a protocol. [7]. A one-page summary of the same is given at [8].

Precautionary measures include:

1. All elements of basic hygiene
2. Wearing masks to prevent droplet emissions and ingestions.
3. Cleaning surfaces with ethyl alcohol (65%)
4. Cooking food before eating
5. Avoid skin contact

3. Diagnosis

The primary early symptom detection method is to measure body temperature. Infrared sensors are now in use all over China and some other nations, at transport stations and other locations. Nations such as Singapore have set up temperature-sensing portals for employees to pass through at workplace entrances.

Schirring [9] reported that a team led by Christian Drosten of the German Center for Infection Research in Berlin had published an assay protocol to detect 2019-nCoV via the WHO. The WHO also published interim guidance [10]. The first of the protocols (the German one referenced above) uses respiratory samples. The second, developed by Hong Kong University, details process using viral RNA samples from clinical specimens.

4. Drug Development

Duddu [11] reports drug development and clinical trials. Quoting:

1. A total of 30 therapies are planned to be tested, including Chinese traditional medicines.
2. China's National Medical Products Administration has approved the use of Favilavir, an anti-viral drug. Clinical trials had been done on 70 patients in Shenzhen, Guangdong province.
3. Serum Institute of India (SII) with US-based Codagenix is developing a vaccine using a vaccine strain similar to the original virus. Currently in the pre-clinical testing; market launch aimed for 2022.
4. Zydus Cadila is accelerating along two approaches. First is a DNA vaccine against the viral membrane protein of the virus. Second is an attenuated recombinant measles virus (rMV) vectored vaccine which will induce specific neutralising antibodies against the COVID-19 virus.
5. NanoViricides is developing their nanoviricide® technology. This develops ligands that can bind to the virus in the same way as a cognate receptor and attack various points of the virus.
6. Vir Biotechnology, announced on 12 February that it has identified two monoclonal antibodies that can bind to the virus that causes COVID-19. The antibodies target the spike (S) protein of the virus by entering through the cellular receptor ACE2.
7. Brilacidin by Innovation Pharmaceuticals is a defensin mimetic drug candidate with antibacterial, anti-inflammatory and immunomodulatory properties.
8. NO-4800 by Inovio Pharmaceuticals and Beijing Advaccine Biotechnology is in pre-clinical testing. They

have a \$9M grant from the Coalition for Epidemic Preparedness Innovations (CEPI).

9. Recombinant subunit vaccine by Clover Biopharmaceuticals uses their Trimer-Tag[®] technology, based on the trimeric S protein (S-Trimer) of the 2019-nCoV virus, which is responsible for binding with the host cell and causing a viral infection. They have identified antigen-specific antibody in the serum of fully recovered patients who were previously infected by the virus. Aims for production in 6 to 8 weeks.
10. Vaxart is developing an oral tablet recombinant vaccine using its VAAST platform. It is based on the published genome of 2019-nCoV.
11. CytoDyn is examining leronlimab (PRO 140), a CCR5 antagonist. In Phase 2 trials with fast-track approval by the US FDA.
12. Linear DNA Vaccine by Applied DNA Sciences and Takis Biotech will use Polymerase Chain Reaction (PCR)-based DNA manufacturing technology. BXT-25 by BIOXYTRAN treats late-stage Acute Respiratory Distress Syndrome (ARDS) is 5,000 times smaller than blood cells and efficiently transports oxygen through the body for nine hours before being processed by the liver. Helps in supplying oxygen to the vital organs.
13. Novavax's MERS (2013) coronavirus vaccine candidate is designed to primarily bind to the major surface S-protein.
14. Inovio Pharma's INO-4700 investigational DNA immunotherapy (GLS-5300) is delivered as vaccine intramuscularly, using the Celectra[®] delivery device. Was used against the MERS-COV in 1994.
15. Remdesivir (GS-5734) by Gilead Sciences is an Ebola drug (ineffective) is in phase III randomised clinical trial in partnership with China.
16. Biocryst Pharma's Galidesivir (BCX4430) is a nucleoside RNA polymerase inhibitor that disrupts the process of viral replication.
17. Regeneron's REGN3048-3051 combines neutralising monoclonal antibodies REGN3048 and REGN3051. In clinical trials by National Institute of Allergy and Infectious Diseases (NIAID).
18. An HIV protease inhibitor, lopinavir is being studied along with Ritonavir for MERS and SARS coronaviruses. The repurposed drug is already approved for HIV infection under trade name Kaletra[®].
19. Cipla is reportedly planning to repurpose its HIV drug LOPIMUNE, which is a combination of protease inhibitors Lopinavir and Ritonavir. A licensed generic of

Kaletra[®], LOPIMUNE is currently available in packs of 60 tablets each, containing 200mg of Lopinavir and 50mg of Ritonavir.

5. WHO's Introduction Course

The following annotated excerpts are from WHO's new introductory course on the COVID-2019

1. Acute Respiratory Infection (ARI) is a disease of the respiratory tract caused by bacteria or virus. Symptoms arise within hours to days, including runny nose, lethargy, sore throat, cough, fever, wheezing, shortness of breath, and breathing difficulty.
2. Upper Respiratory Tract Infections (URTI), infecting the nose and throat, are usually less serious than the Lower type (LRTI) which affect the lungs.
3. In Lower Income countries, LRTI are the Number 1 cause of death under 5 years of age. LRTI are especially threatening to the very young, old, pregnant women and those with chronic medical conditions.
4. Factors include pathogen model of transmission, transmissibility, virulence, host (patient's) age, underlying diseases, nutrition, occupation, immune status, smoking, concurrent other pathogens, air quality, crowding, temperature, humidity hygiene, healthcare access and quality, prevention measures (isolation, barrier nursing), counter-measures (vaccine, therapeutics)
5. Non-seasonal influenza viruses can hit people [12] who have little to no immunity: include animal-borne viruses [13]: no sustained transmission human-to-human. Reported in over 20 countries. Infections can be asymptomatic or can cause a range of symptoms from conjunctivitis (pink eye) to fever, cough and shortness of breath.
6. – Pneumonia (an infection in the lungs) may occur and may require hospitalization and intensive medical treatment. Some deaths have been reported. Gastrointestinal symptoms (vomiting, diarrhoea, and abdominal pain) have been reported in some patients.
7. Evidence that antiviral drugs can be useful with non-seasonal influenza.
8. Should be administered immediately without waiting for diagnosis, ideally within 48 hours of symptom onset.
9. Mechanical ventilation may be needed in case of respiratory system failure.
10. Avian flu (H5N1, H7N9, H5N6) [14, 15]
11. Swine flu (H1N1sw, H1N2sw, H3N2sw) [16]

12. Newly emerged influenza viruses from genetic mutation/ exchange. These are potential pandemics.
13. Major known Respiratory Syndromes (RS) include Severe Acute (SARS-CoV) and Middle Eastern (MERS-COV), novel (unknown) pathogens, pneumonic plague, Legionella.
14. Action: Detect and control virus infection in animal population ("One Health" approach)
15. Avoid direct and indirect (environmental) contact with animals where avian/swine flue is circulating.
16. Do not consume raw/undercooked animal products: Always cook thoroughly. [17]
17. Practice good hygiene including hand washing before and after touching animals, visiting markets, farms etc.
7. Boarding up homes of patients (presumably after they had been taken to hospital)
8. Spraying a Chlorite solution on the streets using tanker trucks.
9. Using industrial incinerators to destroy contaminated clothing and other articles (unknown specifics)
10. Constructing two modular 1000-bed hospitals (not tent-based field hospitals given the cold weather) inside urban Wuhan

6. Major ARI Outbreaks

1. Influenza pandemics (1918, 1957, 1968, 2009)
2. 1997: avian influenza A (H5N1) in humans (HK SAR)
3. 2002: SARS-CoV emerged in China
4. 2003: avian influenza A (H5N1) spread in Eurasia and Africa caused human infections in 15 countries.
5. 2012: MERS-CoV [18, 19] was detected in Saudi Arabia. Human-human transmission, but mostly inside medical facilities. Most infections traced to Arabian peninsula. Incubation 2 - 14 days. No current specific treatment: only supportive, including mechanical ventilation.
6. 2013: avian influenza A(H7N9) emerged in humans in China
7. 2019: 2019-nCoV emerged in China

7. Special Needs To Deal With COVID-2019

Knowledge on this is evolving. China reacted by

1. Insisting on people wearing masks when around others
2. Protecting food and water
3. Receiving patients with symptoms and putting them in isolation wards
4. Administering ventilation support including oxygen in serious cases
5. Sealing off transport avenues to and from the entire city of Wuhan with roadblocks and train stoppage.
6. Converting apartment blocks into in-place quarantine

The cruise ship "Diamond Princess", with over 3700 passengers and crew, instituted some form of quarantine on board. There are reports that people still had to mix at the food service galleys where it was not possible to be wearing masks.

Masks became a high-priority need. There were reports that fine-particle surgical-quality masks were needed, rather than mere industrial particle masks, since the virus dimensions are in nanometers. However, the reality may be that the virus is carried on water droplets and other particles suspended in air. Thus frequent sanitizing of the mask may be more important than using nano-membrane masks.

The city of Wuhan, and the cruise ship Diamond Princess, are today listed at the top of the list for infected persons, far ahead of other locations. In addition there are reports that Chinese prison populations have been heavily infected. Thus there is reason to question the practice of quarantine/confinement in closed environments. The HVAC system may be a prime avenue for contamination.

8. Folk Remedies

This section is a collection of observations: not vetted by any official medical circles.

1. Masks: There is a growing shortage of breathing masks around the world. The early word was that standard single-layer Particle Masks were inadequate to stop the virus or virus-carrying particles. This MAY have been based on the notion that the virus flew around in the air by itself. It is more common, based on medical observations, that transmission could be by virus-carrying liquid (aerosol) droplets generated by sneezing, or breathing out moist air. In this case the particles would be many orders of magnitude larger than the virus itself.

During the H1N1 epidemic, surgical masks (a 3-inch wide rectangular light green or blue multi-layered cloth article, with elastic loops to go around the ears or neck) became standard wear in East Asia and at airports. Presumably these are better than the standard dust mask, being used by medical personnel in hospital settings specifically to control infection.

Thicker particle masks designated 'N95' are available at hardware stores, specified for use when using toxic

paint, or when sanding painted surfaces. Several variations are available, for instance on the Internet portal Amazon.com. As of February 24, they were still available, but prices had shot up at many sellers. To avoid price-gouging restrictions, sellers were 'accidentally' switching the Price and Shipping Cost fields. For instance we found a Box of 10 N95 masks advertised for '\$3.95' but with a shipping cost an outrageous '\$299'. Clearly these masks are in demand; many sellers were quoting 4 to 6 weeks delivery. More exotic features such as the 3M N95 Model 8511, include a 'cool flow valve' on the front of the mask, which allows exhaled air (during exertion such as painting or sanding) to leave directly, rather than be forced around the edges of the mask (clouds goggles). It is noted that the Cool Flow Valve then does not prevent exhaled, virus-infected air from the wearer entering the atmosphere.

2. A mask with a silicone seal fits better. This is to prevent leakage of exhaled air, or ingestion around the edges.
3. '3M says it's Disposable masks protect for 8 hours or until the mask is wet. Chinese brands say they protect for 20 to 30 hours in less polluted areas.'
4. So-called P100 masks are more complex, cumbersome and costly.
5. One can create a surgical mask using three layers of facial tissue sandwiched between two layers of cloth or porous paper.
6. Surgical masks minimize transmission, and to a much lesser extent, reception.
7. Referring to airline seats: *'Alcohol swabs are cheap, what's wrong with bringing your own and wiping down your own seat and trays?'*
8. Saplakoglu [20] states that *'some coronaviruses can linger on surfaces for up to 9 days'*. They cite a CNN report that China's central bank is destroying currency notes to prevent them transmitting the virus. Quoting excerpts: *'previously published papers on human coronaviruses (other than the new coronavirus) ..found that these coronaviruses can linger on surfaces for over a week but that some of them don't remain active for as long at temperatures higher than 86 degrees Fahrenheit (30 degrees Celsius). Specifically quoting from [21]: The authors also found that these coronaviruses can be effectively wiped away by household disinfectants...For example, disinfectants with 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% sodium hypochlorite (bleach) can "efficiently" inactivate coronaviruses within a minute, cautioning that these results are for previous strains, not known to be effective against the present COVID-2019...The World Health Organization recommends alcohol-based hand rubs for decontamination of the hands, the authors wrote.*
9. Recent reports clarify that beards and facial stubble hinder the functioning of almost all types of masks, permitting outside air to enter through the edges of the mask.

9. Unknown Aspects

One very frightening aspect is that the People's Republic of China is today one of the most technologically advanced nations in the world. They have experienced seasonal outbreaks of deadly virus infections in past decades and thus the general population, not to mention the medical and administrative personnel, are far more experienced in dealing with such infections than their counterparts elsewhere. Medical research in China is well-funded, very competently (in fact brilliantly) staffed. The ability to implement mass changes whether through industrial production or administrative control, is unparalleled elsewhere.

Yet, in late 2019, as the COVID-2019 was identified, it was evident that the virus was spreading, and was causing fatalities, beyond the ability of China to control early. One wonders why: did a previous virus mutate, to anticipate and circumvent known human countermeasures? Can swarm intelligence be that deadly? If so, what is the prognosis for other nations and the future?

As of February 24, 2020, the disease had been reported from Iran (including several deaths) and Italy (2 deaths), Kuwait, Lebanon, Turkey, Bahrain and several other nations in addition to those immediately around the PRC. Stringent containment measures were being instituted. For instance, Austria shut down the train link from Italy. Iraq closed the border with Kuwait.

10. Some Reason For Optimism

As of February 26, we reported reason to believe that the epidemic is subsiding in China: both new reported cases and deaths are down, suggesting that preventive, containment and treatment measures are all beginning to work. Note that Wuhan, on total lockdown, contains 11 million people. With air transmission it appears to be highly possible that the vast majority have been exposed to the virus at some level over the past 2 months. The rest of China has also started recovering from the initial wave. It may be hoped that most people are developing some level of immunity - or that the virus itself is mutating.

Elsewhere in the world, the initial wave is still spreading, even as nations scramble to institute responses. However the wave amplitude appears to be receding, in terms of fractions of the population infected. Looking at the Chinese experience, a 2-month window of danger may be anticipated. Rather than post detailed charts looking at the same data, we direct the reader back to Figure 1.

Initially (Feb. 26-27) the triangles (Cases from the PRC) were diverging from the circles (global) because the cumulative PRC cases were leveling off, as the number of new cases

dropped. Cumulative cases outside were also leveling off, but less rapidly as there was still spreading to populations that have not been exposed before. As of February 29, we have to report some reason for concern. While the PRC cases appear to be falling off or at worst, holding steady, the slope of the upper curve (cumulative worldwide) *appears to be increasing*, probably as the disease is noticed in more countries. South Korea, Iran and Italy have reported a large number of cases, with the rate of deaths in Iran resembling the initial rate in Wuhan back in January. The swift suppression of the disease expected in other countries, given the Wuhan experience, has not been fully successful. The situation in Iran is particularly of concern as the fatalities now include very senior government officials, who (we presume) received swift and the best care. The Sanctions on Iran appear to be hindering response, even in their ability to receive medicines. On the other hand, there has also been a swift spreading of the disease in South Korea.

While the concurrently-reported death rate now stands at 3.4%, the 2-week-delayed death rate has been steadily declining and has now dropped to 5.72%. There is some indication that many of the initial deaths were of aged people who had other health issues, and that young people are generally recovering; however it must be noted that the medical personnel who were reported to have died in Wuhan include people in their 30s through early 50s. We are yet to perform such a delayed analysis to interpret the Worldometer data on Active Cases and Cured Cases, but the results should be evident by looking at the Figure: The Worldometer reports that 94% of reported case are recovering and will be discharged, while 6% are still dying, worldwide. Extrapolating the curves, we suggested at the start of March that in another two weeks (by mid-March), the disease would have receded into the background and normalcy should be getting restored in most nations. We said that precautionary measures may continue for another 2 months at points of entry and perhaps at mass gatherings - and cautioned that this was of course just our speculation at that point.

11. Relapse: The Appalling Rise in Europe and America

We were wrong Italy, and then Spain, had virtual explosions of the infection, overwhelming their ability to respond. This shot down the narrative of calm that was being propagated by the Administration, forcing them to come out and reveal their extensive preparations (which if revealed earlier and in full scope would surely have set off panic!) A nursing home with many old patients in the State of Washington, suffered a sudden spreading of the disease, leading to a high death rate in the State. New York and Massachusetts also reported large numbers of cases.

As April 2020 starts, many nations have locked down borders. International commercial flights are almost entirely shut down; domestic air, train and road travel have been shut down

in many nations. Italy and Spain show declining numbers of cases, though after very high cost. But most alarming is the rampant rise in the United States, despite months of the most sophisticated and well-funded medical and emergency response planning.

Several communities in Canada and the USA have gone into lockdown. Schools have closed or been asked to prepare for closures; community emergency services are no doubt racing to prepare. Standard precautions in the face of the risk of storms include stocking up drinking water and canned food. In this case there is no reason to expect electrical or heating systems to go down; however, transport is constrained as done in Chinese cities. It is possible that water systems may be affected until they can be disinfected, usually implying heavy doses of chlorination.

The danger remains high in the congested nations of the Indian subcontinent; however, well-informed and determined response appears to be holding steady, with tight controls at the airports, as well as remarkably effective hospitalization and treatment. At this writing, Italy reports no increase in number of cases: the wave appears to have peaked; South Korea is fast returning to normalcy. But the US explosion is not projected to end until late April at the most optimistic. The total number cases in the US, which is over 254,000 already dominates the world total of just over a million as of April 3; we project that the US total will exceed 530,000 before it can level off, and perhaps 600,000. At even a 5% death rate (when measured at the end), that implies over 30,000 deaths, which many others left with serious lung damage and other organ damage.

12. Tentative Conclusions/Recommendations

1. Absent rapid care, COVID-2019 appears to cause essentially 100% fatality in older patients.
2. Incubation time without symptoms is in excess of 14 days, and there are some reported cases of people freed from 14-day quarantine, developing symptoms after another 1 to 2 weeks.
3. Regardless of the source of initial infection of humans, it is now apparent that the virus spreads through the air as well as other means.
4. In this respect, the COVID-2019 displays some of the special characteristics rumored to be characteristic of so-called 'weaponized' pathogens, and hence response modes should be referred to procedures to deal with such attacks.
5. Persistence of the virus on solid surfaces has been seen to exceed 9 days.

Given the above, a few items for thought

1. The experience on board the Diamond Princess cruise ship which is in quarantine, as well as reports from Chinese prisons and from quarantined areas in urban China, all suggest further thought regarding the standard practice of quarantine in large collections of people in confined proximity.
2. The same consideration suggests re-thinking the practice of building large centralized hospitals.
3. Proximity of medical staff to patients should be minimized, consistent with the need to provide care.
4. Transporting patients over several kilometers is difficult when areas have to be shut down, as has happened in China where patients report walking several miles from home to hospitals, only to be turned away for lack of beds, and then trying to reach other hospitals.
5. Portable and home-use oxygen and forced ventilation facilities should be distributed on a priority basis, rather than stockpiled in central hospitals
6. The above suggests investment in local-area facilities at the village / Panchayat levels.
7. Web-based courses are available for rapid education and training. Some of these from the WHO are cited in the references here.
8. Telemedicine for diagnosis and advice, appear to be essential and critically urgent capabilities.

13. Addendum: Basic Simulation Results

Many sophisticated simulations have been done by experts and we cannot hope to match their precision and inside knowledge. However, some statements that have appeared in the media. Researchers from the Imperial College of London, England, were quoted by mediapersons at a Press Conference at the White House. The cited a prediction that several million Americans were likely to die of COVID-19. Some of the Mainstream Media claimed that this report was the reason for what they claimed to be a sudden change in the US administration's perceived urgency in preparing to respond. Next, the director of the US National Institutes of Health (NIH) made an astonishing statement: that by the end of the week of March 23rd, some 70 % of the American population could get exposed if not infected.

Below we try to make some sense of these claims with some elementary calculations. Let us assume that on Day 0 of the pandemic, Patient 1 was somehow infected with the virus. Digression: It does not matter whether you believe in Single-Point Origin or not: the same calculation would hold if started after a few had been infected. End digression. For 3 days Patient 1 went around unaware of the infection while the virus caught hold in her body. From Day 4 onwards, she was contagious, though she had no symptoms. Somehow, X

other people got infected from her, per day, until Day 6. By Day 6, Patient 1 knew that something was very wrong, and she checked into a hospital. Thereafter, we assume that she was in an isolation ward and therefore did not infect anyone else. The parameter X turns out to be the most important in this simulation: the average number of people infected per day by each infectious patient.

We used a spreadsheet for this calculation. The results for first few days are seen in Table 1, and you can check them by hand. We set X to be 0.815 by trial and error, to see what it would take to have the epidemic end within 120 days (it did in China, based on reported origin). The non-integer number is not an issue: this is an average over several days and many people. The results are plotted in Figure ???. They show that over 4 million people will be infected before the disease peaks, and the number of infected people drops to zero because more people are removed from infection than are infected.

If the number is reduced from 0.851, the disease ends before 120 days and the total number infected also drops: it is a sensitive calculation. But increasing it above 0.851 drives the numbers up very fast.

A second result is shown in Figure ??. What if the Patient is allowed to walk around until Day 8, not 6? We had to reduce X to 0.7 before we could get the disease to end in 120 days. But look at the number infected: A shocking 90 million!

This may be the reason why such ominous warnings are being sounded by responsible researchers from their far more detailed and sophisticated modeling of the situation. The answer comes down to what they have telling us to do:

1. Stay safe and try not to get caught by the virus. It is EXTREMELY contagious.
2. Try your very best not to spread it to anyone else. If it has caught you it will be several days before even you are aware of that fact: in those days you may end up spreading it to many others if you are not extremely careful to practice good hygiene and "social distancing".
3. Respect and help those who must go out there to help others: such as medical professionals, first responders, those trying to trace and inform infected people, law enforcement personnel. They are human too, and they have families who care about them and that they must take care of.
4. Yes, it is going to be inconvenient. Far better than the alternatives.
5. And YES! the pandemic will pass. But only after a very high spike and 40 days to 2 months of very tough measures and struggle.

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