Learning from Wuhan — there is no Alternative to the Containment of COVID-19

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What we have to learn from China to understand adequately the COVID-19 crisis and to avoid a horrendous catastrophe

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Abstract

In the past few weeks, virtually all experts quoted in by media stated that a pandemic-like outbreak of COVID-19 in Western countries is becoming unavoidable. The present search for individual cases will have to be given up in favor of mitigation measures like cancelling mass events or social distancing. The declared objective is to spread out the epidemic over time. However, all available data from China in addition to the concrete experience of people in Wuhan and now Iran shows that this change of policy would lead to a horrendous situation. Due to the overloading of healthcare systems, most people coming to hospitals with severe and critical pneumonia, gasping for breath and chocking as a result of water accumulating in their lungs, will have to be sent home to die when they could otherwise be saved.

Two figures, among others, indicate that even in case of an epidemic spread out over time, every healthcare system will be totally overwhelmed by the sheer number of cases. Even with optimal preparation and organization, it will be possible to only treat a tiny fraction of critical cases. In all of China, the spread of SARS-CoV-2 has come to a halt after less than 80,000 cases of infection, thanks to the tough measures taken since the second half of January. Most of them got infected before January 23. In many cases, their state deteriorated only progressively. As of Feb. 23, almost 10,000 people were still hospitalized and considered "severe" cases. Now consider that experts estimate that 40-70% of the adult population will get infected. This gives you an idea of the numbers we can expect. This virus kills slowly, but if patients don't get optimal care, it kills massively. Every outbreak out of control will overload even the best healthcare system, but it will do so incrementally, so that we don't realize it before it is too late.

Then again, if we expand testing capacity now and make it efficient enough, we could keep this under control and have a normal life, including intense social and cultural activities, with few occasional cases that would get adequate treatment. The recent developments in mainland China, Hong Kong and Taiwan have shown this. And this is where we must look for solutions.

Introduction

In recent weeks, we have seen the emergence of widespread misinformation about COVID-19 in the most prestigious Western media outlets. Many people with the necessary competence in this matter, like doctors, health officials, political leaders and experts watch in shock and disbelief how those experts whose voice is multiplied by the media seem to have actually given up the fight to contain the pandemic and advocate some half-hearted "mitigation" measures.

This virus is probably more difficult to contain than any other bacteria or virus which have ever been contained successfully in the past without having either cure or vaccine. At the same time, if containment fails and it spreads through whole regions and countries, mortality will increase massively because of the huge number of cases with severe and critical pneumonia, which will also lead to the collapse of even the most efficient healthcare systems. We are talking about a probable case fatality rate of well over 5%. Even in high-income countries, this is a question of millions of deaths. Therefore, it needs to be emphasized that containment is a must and failure is not an option.

Containment in this context does not necessarily require putting entire cities under lockdown, as it happened in Wuhan, China. It simply means to take the necessary measures in order to prevent the spreading of the virus. If successful, each local outbreak, after an initial increase in the number of infected people, will see a flattening out of the number of new cases. Even if it is not necessarily possible to fully eradicate the illness, this will maintain the number of cases permanently at a low level. We will see that in most cases, that goal can be achieved large-scale testing and efficient contact tracing of infected people, combined with individual quarantine measures. Another approach is mitigation, where the hope to contain the virus is given up and the virus stops spreading when it runs out of people it can infect while efforts focus on providing care for those who need it.

At this point it is paramount to learn about everything we know from China's experience. The Chinese approach has clearly demonstrated that containing the outbreak of COVID-19 is possible. The number of daily confirmed new cases outside of Hubei province have remained consistently below 10 between Feb. 27 and March 3, after a maximum of more than 700 per day between Feb. 2 and Feb. 5. New daily cases in hardest hit Hubei province have hovered around 300-600 between Feb. 23 and Feb. 29 and below 200 between March 1 and March 3, after a maximum of more than 2000 per day between Feb. 2 and Feb. 10. This shows that even in the most unfavorable case where the virus could spread unimpeded until it was recognized as a deadly threat and until tests were available, it is possible to limit and ultimately stop its expansion.

It is all the more worrying that in Western countries, more and more voices, including from renowned experts in this field, recommend a transition from containment to mitigation, and in particular suggest the uselessness of lockdowns, travel restrictions and contact tracing, once the number of cases exceeds a certain threshold. In other words: trying to delay the outbreak, but when this becomes more difficult, simply giving up and letting the virus spread.

Lockdowns, travel restrictions, contact tracing and mass testing: these are the measures that the Chinese authorities are using with success to contain the outbreak, after less radical measures failed to show a sufficient impact. Those who advocate the transition to mitigation

ignore much of what is known from reliable sources about the virus and refuse to learn anything from the valuable experience acquired by Chinese authorities and health workers. This is not to say China offers a ready-made blueprint that other countries should simply copy. But not learning in detail from China's success would be irresponsible.

We only have to look at the terrible situation in Wuhan, where the epidemic started. Before efficient measures were taken, roughly 0.5% of the population was infected. Due to the high number of pneumonias caused by the virus and speed of distribution, the local healthcare system collapsed. Chinese social media and numerous Western media reports describe the terrible ordeal that sick persons and their families as well as health workers went through. Now imagine Western countries have to face a situation in which the rate of infection is multiplied by 10 or 50, and you get an idea of what Western experts consider unavoidable and acceptable.

The Chinese authorities on the mainland have never given up to contain the virus, and even under the most difficult circumstances, they got it done albeit accepting high economic losses. To this purpose, they implemented not only broad measures like lockdowns of whole cities, travel restrictions, extension of school holidays and confined 100s of millions to their apartments. China's approach does not only consist of these draconian measures. It also includes large-scale contact using both labor-intensive traditional methods and big data based AI. Combined with a massive number of lab tests of everybody with the slightest cold and of the huge number of people revealed by extensive contact tracing, they got the outbreak under control. Similar in Hong Kong: through its geographical proximity with the mainland and its status as international transport hub. It was at high risk and has seen many cases, but less than most Chinese provinces and has been able to detect and contain each one of them before it spread through community transmission using much less severe measures. The same is true of Taiwan. All three of them could draw on their experience with the SARS crisis in 2003, which was caused by another type of coronavirus. It is terrible to see that in Western countries, neither experts nor media are willing to learn from this valuable experience, and even deny to report adequately about it.

We argue that by looking at all the available information it becomes obvious that a well-organized and efficient effort can contain each single outbreak with relatively non-invasive measures like efficient large scale contact tracing, systematic testing and individual quarantines. Once these measures are in place, normal life is possible and even mass events can be held without having to fear a massive outbreak.

This article first scrutinizes problematic aspects of Western mainstream expert and media discourse. Western media reporting unfortunately buried the most important news from China. In a second step, we explain why the discourse described in the first step is so problematic and would necessarily lead to a horrendous disaster if government approaches remain uninformed by what we can learn from China's failure and success.

1. Western expert and media discourse regarding COVID-19

The worrying evolution in Western public discourse started with several articles written by or based on the works of psychologists and sociologists who claim that for a variety of reasons, the new Coronavirus triggered irrational panic reactions which are not justified by the facts

we know. Whereas some stuck to the facts known at the time of writing, others were much more problematic. An article in Wired not only hypothetically underestimates [see an in-depth analysis below] the fatality rate we must expect: "The coronavirus may be broadly comparable in risk to a bad seasonal influenza, or, at worst, the 1918 influenza pandemic." It also casts serious doubt about the potential efficiency of any action which might be taken: "The third response was to engage in action, however pointless, intended to "do something" about the threat." Another piece by the New York Times is even more problematic. At first, we find a similar hypothetical underestimation of the fatality rate: "There remains deep uncertainty about the new coronavirus' mortality rate, with the high-end estimate that it is up to 20 times that of the flu, but some estimates go as low as 0.16 percent for those affected outside of China's overwhelmed Hubei province. About on par with the flu." A few lines below, this information is then again distorted: "While the metrics of public health might put the flu alongside or even ahead of the new coronavirus for sheer deadliness […]." The whole article then characterizes those who are alarmed by the virus as "unconsciously" using "mental shortcuts", as acting according to their "instincts", as being "conditioned", etc. Now that the situation in Italy preoccupies the whole world, at least two similar and articles have been published denouncing "panic reactions" with regards to this country.

More recently, renowned experts in virology and epidemiology have tuned in with another message, namely that the spreading of the virus to a major part of the world population could not be avoided anyway. One major public face is Marc Lipsitch, Professor of Epidemiology at Harvard. He is quoted in various press articles as claiming that a "global pandemic of coronavirus, with 40 to 70 percent of the world's population likely to be infected this year" has become "likely" (this quote from The Hill on Feb. 15). Various experts are quoted in the articles above and elsewhere with similar predictions. It seems quite difficult to imagine how this could happen if tough and efficient measures like those implemented in China prevent the virus from spreading. In fact, this discourse is generally combined with calls to relax or give up containment measures like tracking contacts of infected people, lockdowns and quarantine measures once the number of cases has exceeded a certain threshold.

At first, such calls could be found mostly on social media. On Feb. 14, Marc Lipsitch posted the following in two consecutive tweets on his 18.6k followers account:

> *Equally important, as @CDCDirector has implied and PM of Singapore has stated, it may get beyond the stage of individual cases [...] at which point will have to shift to mitigation rather than containment, and we must make sure that restrictions on travel, quarantine, and the like do not outlast their usefulness -- they are costly to individuals, families and economies and shd only be used as long as justified*

On Feb. 23, in another tweet he called an article featuring risk communication experts Peter Sandman and Jody Lanard "must read" and quoted in particular the second paragraph below with the mention "I wish that I had written this paragraph":

> *We are near-certain that the desperate-sounding last-ditch containment messaging of recent days is contributing to a massive global misperception about the near-term future.[…]*

> *But the P[andemic] word alone won't help the public understand what's about to change: the end of most quarantines, travel restrictions, contact tracing, and other measures designated to keep "them" from infecting "us", and the switch to measures like cancelling mass events designed to keep us from infecting each other.*

The most alarming is the following paragraph:

> *The FAQs on the Singapore Ministry of Health webpage (https://www.moh.gov.sg/covid-19/faqs) can serve as a model that other developed countries can adapt to start talking to their publics about this now, to reduce the shock and anger when governments stop trying to contain all identified cases.*

We also find the hypothetical case that the virus could actually be much less lethal than we believe now:

> *Whenever we introduce the word "pandemic," it's important to validate that it's a scary word – both to experts and to non-experts – because it justifiably contains the implication of something potentially really bad, and definitely really disruptive, for an unknown period of time. This implication is true and unavoidable, even if the overall pattern of disease ends up being mild, like the 2009-10 "swine flu" pandemic.*

It clearly characterizes the unchecked large scale spreading of the virus as a certainty:

> *One horrible effect of this continued "stop the pandemic" daydream masquerading as a policy goal: It is driving counter-productive and outrage-inducing measures by many countries against travelers from other countries, even their own citizens back from other countries. But possibly more horrible: The messaging is driving resources toward "stopping," and away from the main potential benefit of containment – slowing the spread of the pandemic and thereby buying a little more time to prepare for what's coming.*

The problem is not that these voices try to prepare their audience for a spreading of the virus to many other countries and regions. This is what is actually happening, and we must prepare for this. The problem is that they recommend giving up on contact tracing and other case-based measures like isolation and quarantine, when these are absolutely necessary to contain the virus and keep the number of cases low, as the example of China has shown. Many other experts, like Swiss epidemiologist Christian Althaus, has tuned in to this irresponsible discourse in an interview with Swiss daily newspaper NZZ.

Marc Lipsitch explains his concept of containment versus mitigation quite well in a series of tweets from Feb. 23 which can most conveniently be read in a tweet thread utility:

> *2. Among the temporary countermeasures, some (case-based) depend on identifying cases and reducing their transmission (treatment, isolation, quarantine) and some don't (general social distancing, cancelling gatherings, encouraging cough hygiene/handwashing, etc.*

Case-based interventions work best if the identifiably sick people are also the only or the main transmitters. They worked really well in SARS (2003), we think, b/c infectious people were all or almost all sick enough to be identifiable as cases.

For SARS-CoV-2 (#COVID19) it seems clear from individual well-documented cases that people can transmit before symptoms (or before they are distinctive enough to prompt suspicion of CoV infection) and that pre-symptomatic people shed virus (evidence from evacuation flights)[...]

In sum, looks like case-based interventions for this infection will be partially effective but may not bring R-effective below 1 (R-effective or R_e is the average number of secondary cases from each primary case, which must be <1 to control the epidemic locally)

3. Among the non-case-based interventions, what is likely to work? This is perhaps the hardest to answer with a virus we don't yet understand well. Some have interpreted the decline in reported cases following "lockdowns" in China as evidence that these reduce transmission.

That may be the case, but some of us are skeptical that the reported case numbers in China reflect the true numbers -- because ability to get to health care, get tested, and get a positive test may be limiting. IMO this is an open question.

It seems likely these restrictions are reducing transmission somewhat, but how much is unclear. If presymptomatic transmission (more generally, transmission from individuals who aren't readily identified as cases) is common, then a relevant comparison is pandemic flu.

It is obvious from this and another thread that Lipsitch's knowledge about the situation in China is incomplete. This is probably the case with many other experts in this field. It can explain a major part of misunderstandings about the virus itself. And yet, finding information about the situation and measures taken in China is not difficult, even without speaking Chinese. The Global Times tends to have a shrill propaganda drum beat, but their Real-time update on coronavirus outbreak is a valuable resource that sums up the main official statements. In addition, Western and Chinese English language media, especially the stellar reporting by Caixin and South China Morning Post, and academic papers provide detailed information.

First of all, experts such as Marc Lipsitch are wrong in believing that China has taken only non-case based measures. Of course, lockdowns of whole cities and provinces are not case-based. However, it was apparently clear to the Chinese leadership that this alone would not suffice. Right from the start, they did everything they could to increase contact tracing, testing and treatment capacity, with success. Except in Hubei province, most of the tough restrictions have been lifted, with only moderate prevention, efficient testing and contact tracing measures in place, and the number of cases has stayed very low. Another thread reveals that Lipsitch seems unaware of this, and that the virus can successfully be contained without permanent

tough measures like lockdowns and travel restrictions, as cautiously optimistic experts in China note.

Right from the start, many experts and media framed news about China as condescending narrative regarding Chinese government, often based on nonsensical arguments and some voicing open racism. For example, the quarantine on Wuhan and Hubei province was criticized by many media outlets, with here an excerpt from an article in the New York Times:

> *James G. Hodge Jr., director of the Center for Public Health Law and Policy at Arizona State University, said the shutdown would almost certainly lead to human rights violations and would be patently unconstitutional in the United States.*
>
> *"It could very easily backfire," he said, adding that the restrictions could prevent healthy people from fleeing the city, perhaps exposing them to greater risk of infection. "In general, this is risky business."*

It would have been appropriate for a health expert to point out that at that time, and until now, the huge problem is precisely to know who is "healthy" and who has already been infected, at a stage when even a lab test might not yet be positive. At the moment when this lockdown was imposed and when this article was written, it was not possible yet to test all those with severe symptoms, not to forget those with mild symptoms, or those who would have liked to leave the city.

The argument that Chinese official figures cannot be trusted or don't give us the whole picture is advanced by many experts and media reports. This skepticism is of course understandable. Yet, with all communications between governments, the WHO mission and the daily numbers provided by Chinese authorities alongside with media reporting the situation was much more transparent than the usual narrative suggests. We will see below to what extent this skepticism has prevented authorities and experts around the world from learning the crucial lessons from China's fight against the virus, and to what extent this mistrust is actually unjustified. For example, Didier Pittet, professor at the University Hospital Geneva and WHO expert, wrote the following in an op-ed on Feb. 26 in the Swiss daily newspaper Le Temps:

> *There are today 78,000 confirmed cases in China, but the true number is probably 300,000 to 500,000. This means that the fatality rate is overrated in China, because primarily only the most severe cases are tested, but 80% of infected cases are mild. [Il y a aujourd'hui 78 000 cas répertoriés en Chine, mais le nombre réel est probablement de 300 000 à 500 000. Cela signifie que le taux de mortalité est surévalué en Chine, car on ne teste avant tout que les cas les plus sévères. Or, 80% des cas infectés sont bénins.]*

Ironically, Pittet's analysis, which is in line with many other epidemiologists, was published the day after the WHO Feb. 25 press briefing, where Bruce Aylward stated that the Chinese figures were reliable and that in particular there was no evidence for any significant number of undetected mild or asymptotic cases. Pittet's op-ed might have been sent in before this statement, but we will see that such a hypothetical inflation of the "true number" of cases was unrealistic even before. Such overestimations of total case numbers have contributed in several other articles to the underestimation of the severity of the virus, leading to the

suggestion of giving up on containment. Marc Lipsitch's colleague Michael Mina, Assistant Professor of Epidemiology at Harvard, uses a very similar argumentation in a tweet to his 5k followership:

> *The 2% [fatality rate] is going to come down significantly once very mild and asymptomatic cases (likely the vast majority of cases if we could measure them) are taken into account.*

Why virologists assume that the case fatality rate is much lower than it seems now is exemplified by Germany's leading SARS-expert, Christian Drosten. As Prof Drosten explains, he does not trust Chinese data set and excludes them alongside with data from Iran and Italian when he calculates the "real" fatality rate. As we will see, Dorsten's assumptions though seemingly plausible contradict what we actually know from China.

The most extreme underestimation of the fatality rate was provided by Maria Rita Gismondo, the director of the biology laboratory in the University Hospital of Milano responsible for doing the lab tests required by the present outbreak in northern Italy. In a Facebook post, which she has since deleted, she complains that she has had hardly any sleep for the last couple of days due to all the tests, in order to contain an outbreak which was hardly more severe than a flu:

> *To me, this seems madness. You took an infection which is hardly more serious than a flu for a deadly pandemic! [A me sembra una follia. Si è scambiata un'infezione appena più seria di un'influenza per una pandemia letale.]*

On Twitter, her post found almost universal support, as a Twitter search shortly afterwards revealed; the same is true for some media reports. In some others, she was harshly criticized, in particular by Roberto Burioni, a colleague of hers from the same city. But even he draws a picture of the virus which is much less alarming than what the information from China tell us.

By now, if you don't know what you should think about the present article, just might ask some Chinese friends or colleagues to read it in front of you and watch how they are in shock and disbelief after reading up to here.

Kai Kupferschmidt, a journalist working for various newspapers and magazines, combines many of the questionable arguments listed above in an article in Science Magazine from Feb. 10.

> *For some, that strategy verges on appeasement. For instance, [WHO Director-General] Tedros [Adhanom Ghebreyesus] has joined the Chinese government in criticizing other countries for closing their doors to travelers from China, but has remained silent about the fact that China has closed off entire cities and penned in tens of millions of people, a measure some scientists believe may not help much and infringes on basic human rights. "I absolutely believe these measures should be called out, both for their human rights implication and their very limited public health impact," says Alexandra Phelan, a global health law expert at Georgetown's Center for Global Health Science and Security. But, she adds, China's cooperation is*

> *so critical that she can see why Tedros might not speak out. "I just worry what it means going forward."*

The WHO indeed did not speak out against China's policies. Is this because the WHO did not have the courage to do so? Or because China's policies were actually highly efficient, as the WHO repeatedly stated, e.g. during the [WHO Feb. 18 press briefing](#)? Here is the exact wording:

> *You can argue whether those measures are excessive or whether they're restrictive on people but there's a lot at stake here, there's an awful lot at stake here in terms of public health and in terms of not only the public health of China but of all people in the world. So what we like to see is well-thought-out evidence-based public health measures that pay due respect for people's individual liberty and individual human rights and finding that balance is sometimes difficult but right now the strategic and tactical approach in China is the correct one.*

To know whether the various experts and journalists quoted above are right or whether their view is problematic, we need to take a look at what an analysis of the most reliable sources about COVID-19 can tell us. It is not claimed that the analysis below represents the ultimate wisdom in this matter; however, crucial information is virtually absent from the Western expert and media discourse. This lack of knowledge is critical to plan adequate regional and national strategies against the virus presently spreading to other countries.

2. An extremely lethal virus; failure is not an option

Let us first deal with the question of the lethality of the virus. Most experts provide estimates ranging from roughly 2% to a little more than 0.1%; the latter would roughly be equal to the fatality rate of a bad flu season.

It is crucial to understand the impact of having a major number of COVID-19 infections within the population. This is probably the single most important reason for the presently inadequate media reporting. According to the [latest large scale study of patients in China](#), a little more than 80% of the infected people develop no or only mild symptoms like headache, a sore throat or a mild pneumonia, but around 15% or somewhat less will develop a severe pneumonia. Roughly 3% of infected people will get into a critical condition but survive and 1-2% will eventually die (see below for a more detailed discussion of the case fatality rate).

This means that one out of five patients requires medical attention. What this implies to the medical system can be seen in Wuhan. Before it became clear that the virus was a deadly threat whose spread can only be stopped through the toughest measures, the virus could spread almost unimpeded for roughly two months. As a result, for a few weeks, before massive help from outside of Wuhan could be organized, the healthcare system in Wuhan collapsed. Even patients with severe pneumonia could not be admitted to hospitals and were sent home.

The overwhelming of Wuhan's quite modern health system can only be understood if we realize what is required to provide care to patients infected with the virus. In the case of COVID-19, all the people in contact with the patients must be qualified health workers

wearing full personal protection equipment, and even if all the procedures are followed by qualified experts, infection remains still a risk. The fact that on the Diamond Princess cruise ship, six Japanese health ministry officials and a paramedic from the fire department were recently infected shows this very clearly, in addition to all the health workers who got infected by SARS and COVID-19 even when wearing full protection equipment. Simply instructing non-experts to wear protection equipment when they don't have a solid training in how a virus is transmitted will thus still multiply the number of infected health workers.

The care for patients with severe cases of pneumonia is even more demanding; only a fraction of all doctors and nurses are qualified and experienced for some of the required tasks. Others can of course be trained. But this takes time. The necessary equipment is also a limiting factor. For example, patients with shortness of breath, a common symptom with COVID-19, are usually treated with an oxygen mask, which requires important quantities of oxygen. Even in a major industrial power like China, the supply for medical oxygen quickly became problematic, even though the virus had only spread very partially in one major city, and on a much smaller scale to other provinces. Patients in critical conditions often require intubation for invasive mechanical ventilation, the aspiration of liquid which has accumulated in the lungs, or surgery to install a drain in case of a pneumothorax, which require specialized experts and even more specific equipment. In the worst case, if the lung is unable to provide enough oxygen to the body despite all possible technical assistance, ECMO machines can simply replace the heart and lungs for some time by pumping newly oxygenated blood through the body. However, only a limited number of such machines is available. If the kidneys stop working, dialysis can replace them, but here again, capacity is certainly limited.

When looking at the situation in Wuhan, it is obvious that only massive material support and men power from the rest of China could allow the healthcare system to increase its capacity to the point where it could quarantine all the suspected and confirmed cases and provide care to those in need. As of Feb. 20, 11,000 severe cases needed specialized care in Wuhan. Handling such a situation would have been impossible without both military and civilian medical teams, the first of which came to the rescue of the city by Jan. 24, and a huge amount of additional equipment, among which 81 ECMO machines. Private initiatives have donated and delivered thousands of additional respiratory machines. As of Feb. 22, more than 38,000 health workers from all over the country had been sent to Hubei province. To this, we have to add massive logistical help including construction workers to build and equip whole new hospitals and even more quarantine facilities for mild cases. Bruce Aylward, the expert who had led the WHO mission to China, reported when he was back in Geneva:

> And I think people were also looking sometimes at this and saying, but in China, they don't have this, they don't have that. If I had COVID-19 I'd want to be treated in China.

> We'd go into these hospitals and how many ventilators [i.e. machines to do mechanical ventilation of the lung in case of respiratory distress] do you have? 50, 60. Just a scale we're not used to thinking of. And then you'd ask how many ECMO systems do you have? And I thought, seriously, you're going to ask about ECMO? Extracorporeal membrane oxygenation, when the lungs simply, even if you ventilate, aren't going to get enough oxygen. And the place would say five. And I remember being with Tim from

the Robert Koch Institute, five in one hospital? We don't have that in Europe. And we're using three of them to… And we said, do people come on them? Yes.

So, when we look at how dangerous this disease is, I think we have to be careful looking at the China data, because China knows how to keep people alive from COVID, they're super committed to it, and they're making a massive investment in it as well. That's not going to be the case everywhere in the world. And as you've seen, we have tragically lost people, people in G7 countries are dying of this disease. So, it is a serious disease and I worry sometimes that if we look at the China numbers, people are going to get a false sense of security. These people know and they care about keeping these people alive, and they do it successfully. They're really good at it.

Actually, the first of a whole series of temporary hospitals in Hubei province, run by a crew from Shanxi province, closed on March 1 because it had run out of patients; others will follow. Compare this to Marc Lipsitch's condescendence towards China, and the fact that he did not even care to get any detailed information about the measures taken there, and to similar attitudes from most Western experts. Especially in Wuhan, only a combination of extremely strict quarantine measures and massive outside help have prevented the situation from becoming truly apocalyptic.

However, despite these massive efforts, according to document with official Chinese figures mentioned above, as of Feb. 11, the mortality in all of Hubei province (whose capital is Wuhan) was 2.9%, whereas for the rest of China, it was standing at 0.4%. Since then, as the number of new infection cases dropped fast, but the death toll keeps increasing, these preliminary case fatality rates (CFR) are increasing. As of March 3, CFR rates are standing at 4.6% for Wuhan, 3.3% for Hubei province outside Wuhan, 0.8% for China outside Hubei, and the rates still keep increasing. Now, consider that even in Wuhan, the healthcare system collapsed only for a few weeks and had to reject patients with severe pneumonia before massive outside help set in. If, as virtually all Western experts recommend, we give up contact tracing, lockdowns, travel restrictions etc. as soon as the number of cases exceeds a certain threshold, the situation would become much worse than it has ever been in Wuhan, with no possible improvement before the end of the epidemic. In short, if China can only deal with one Wuhan, no other country can afford more.

In Wuhan, most patients with severe cases ended up getting adequate treatment, sometimes after a few weeks without treatment, even though it was obviously not as perfect as in other less affected places. Despite this, CFR is standing at 4.4%, and still increasing. So what would be the CFR in case of a widespread epidemic in Europe or the US, without non-affected areas protected by travel restrictions able to send help, and without a radical quarantine setting in long before the epidemic had reached its natural maximum extent? And remember that in Wuhan only roughly 0.5% (!) of the population got infected, i.e. about 50,000 out of a population of 10.5 million. Without tough and successful measures to contain the virus, experts consider that 40-70% of the adult population could be infected. Remember, 20% of the infected get a severe (!) pneumonia; mild pneumonias are counted among the 80% "mild cases". The CFR would certainly rise above more than 5%, but of course, it is difficult to say

how much higher. Perhaps 7% or 10% like SARS? Due to its properties the virus is perfectly adapted to a modern human society and spreads much faster than SARS, as impressively shown by an article in the NYT from Feb. 7. This is the reason why SARS has not overwhelmed any healthcare system through the sheer number of patients. Let us be clear about this: we don't claim that COVID-19 might have the same case fatality rate as SARS. We claim that without professional medical care (because of an overwhelmed healthcare system), COVID-19 could come much closer to the CFR of SARS with the best available care. That pathogens have a differentiated CFR in terms of locality and age group depending on the care provided to patients is too often overlooked. In the case of COVID-19, taking this into account is crucial.

All the reliable data shows that in the case of COVID-19, the fatality rate goes up the more the number of infections increases. This is precisely the characteristic which makes this virus so dangerous. And this is why a failure to contain it is not an option. Now consider the fact that Lipsitch refers to data from previous flu epidemics to argue that in the case of COVID-19, case fatality rate decreases with higher infection rates. Instead, the data we have from China relating to COVID-19 suggest the opposite.

Many experts expressed the hope that the virus might mutate to become "less deadly". However, this is not more than just wishful thinking. It is also simply incorrect to claim that the virus responsible for COVID-19 could spread more easily if it were less severe. There are several cases, among which the recent outbreaks in South Korea and Italy, where the virus initially spread through hospitals. This would not be the case anymore if it mutated to become milder. Furthermore, due to a long incubation time and a long symptomatic case history, death occurs relatively late, which means that the relatively high fatality rate does not impede its propagation. In addition, the long delay between infection and eventual death makes it more difficult to evaluate the danger of this virus adequately. For all the above reasons, mutating to become milder would confer the virus no competitive advantage. Here again, experts mentioning this mechanism through which viruses are claimed to become less fierce in time is one more questionable argument which contributes to downplaying the extent of the threat.

Now, let us put the things together and have a look at what this means in the crude reality of human existence. If we take into consideration what a majority of Western experts advocate or predict, namely giving up containment in favor of mitigation, Wuhan is the place to look at. Not because in Wuhan, they gave up on containment, but because in Wuhan, until the virus was identified, recognized as deadly threat and tests were available, the virus had spread to such an extent that ultimately, 0.5% of the population got infected.

There are numerous Western media reports about the terrible situation before massive help arrived from the rest of China. The following excerpt is from a BBC article:

> They were diagnosed with the novel coronavirus on 29 January, but were only admitted to a hospital three days later.

> But the hospital was so full that there were no empty beds. His grandparents had high fever and difficulty breathing, but were only offered seats in the corridor. He begged the hospital staff and he managed to get a long chair and a folding bed.

> *"There's no doctor or nurse in sight," Huang wrote in his diary, "Hospital without doctors is just like a graveyard."*
>
> *The night before his grandfather passed away, Huang was with his grandparents in the corridor. He kept chatting with his grandmother so that she wouldn't know that his grandfather was experiencing delirium, he says.*
>
> *A bed was finally available three hours before his grandfather died. Huang was by his bedside till the last minute.*
>
> *He wrote on Weibo, China's Twitter-like platform: "Grandpa, please rest in peace. There's no pain in heaven."*
>
> *"Many patients died without the company of family members and couldn't even get a last look at each other."*
>
> *His grandmother is battling for her life in the hospital, and he spends as much time as possible with her.*

From a [New York Times article](#):

> *Bella Zhang hung an intravenous drip on a spindly tree branch and slumped down on a large stone planter outside the crowded hospital. Her mother and brother sat wearily beside her, their shoulders sagging, both also hooked up to their own drips.*
>
> *In recent days, Ms. Zhang, 25, a perfume saleswoman with tinted blue hair, had watched helplessly as one by one, her relatives were sickened by the coronavirus that was tearing through her hometown, Wuhan. First, her grandmother got it, then it spread to her grandfather and mother. She and her younger brother were next.*
>
> *The family had pleaded for help, but the city's hospitals, faced with an extreme shortage of beds, could not take them. On Feb. 1, Grandfather Zhang died at home.*
>
> *"They tell us to wait," thundered Ms. Zhang's mother, Yang Ling. She nearly ripped the intravenous needle out of her hand as she waved her arms in frustration. "But wait until when? We've already lost one."*

No such articles are available with regards to the present situation in Iran, but [social media reports](#) draw a similar picture. These articles could have warned experts worldwide about the danger of health care systems collapsing if the number of cases exceeds a certain threshold. But they did not. Officials and experts outside China sound confident about the ability of their healthcare system to cope, in particular if they have got a little more time to prepare. How is it that this warning was not heard?

One explanation for why Wuhan's predicament has not spurred action lies in the fact that reporting has been framed as a scathing criticism of the Chinese authorities and government. Things are always presented in such a way that administrative hurdles or the lockdown imposed on Wuhan were to blame. This framing makes it too easy to discard the warning,

blaming a hypothetical inefficiency of the Chinese administration and limited press freedom for all the problems.

What should be done instead is to look at what happened in Wuhan and do the math. First rule is to calculate actual numbers instead of rates. Calculate the number of projected cases, even in optimistic scenarios stretched across two flu-seasons (pessimistic is 40-70% of adult population, provided by renowned experts); calculate the number of people with severe pneumonia who would need a hospital bed and at the very least oxygen to survive; calculate the number of hospital beds we have got, the oxygen capacity we have got; calculate expected number of the cases with critical pneumonia, where few would survive without intensive and time consuming care by medical personnel specialized in this sector. After running through these numbers you will understand what nobody wants to see right now, even though all the information is out there. At every stage of the epidemic, even in the worst case where we have got tens of thousands of cases in a country, we must still contain the virus with all the means available to *stop* the virus from spreading further.

So, if we consider that the virus is much more deadly than virtually any expert is willing to admit, that in particular its CFR (case fatality rate) will become extremely high if the case density within the population increases, what measures should be taken? What do we know about how the virus spreads? What do we know about the measures taken in China? Which ones were crucial in stopping the outbreak, and which ones might have been excessive? Do we know for sure that China has actually been able to stop the outbreak, or do their figures not tell the (whole) truth? How will the situation likely evolve in China over the next weeks and months? What do we know from more recent outbreaks in other countries?

3. This virus is not only deadly, but extremely contagious

First the bad news. As the present failures to contain the virus in several high income countries show, it definitely spreads more easily than probably any pathogen humanity has been able to contain without cure or vaccine so far. Only extremely tough and well organized measures combining massive human labor with high-tech tools have been able to overcome it in China. The key message from China, however, is that *it can be done*. The good news is that, if we are willing to shed our orientalist attitude with regards to China, we can focus on their experience, benefit from it and use the tools they developed. This would allow us to stop the various outbreaks popping up now and in the future at a much lower financial and, more importantly, human cost.

First of all, it is unlikely that we are able to eradicate the virus once and for all. Many experts, including from WHO, have said this, and all data coming in confirms it. Stopping an outbreak means: when cases start to multiply in a community, we take the measures to find all or almost all the cases and make sure that they get treatment if necessary and stop spreading the virus further. Finding (almost) all the cases in a community is done through contact tracing, i.e. trying to find all the people with whom the infected people were in close contact. However, there will always be cases which escape even the most sophisticated search. This means that a few weeks later, other outbreaks will pop up in the same place, or in another place, probably for a long time. We must therefore develop the tools to effectively "stop" these little sparks at the lowest possible cost according to the situation, so that we can live with these measures for years to come.

Regarding the ease with which the virus spreads, news from China are alarming. Using high-tech contact tracing, Chinese researchers were able to trace back the precise moment when a known infected person infected another person, and in some instances relied on surveillance videos of the precise moment. If now you think that this sounds like Big Brother, then yes, that's what we are talking about. In a country with tens of thousands of infected people, Chinese researchers were able to find several instances where they could pinpoint the moment of contagion down to a precise moment and precise location and to see it on video surveillance footage from days or weeks ago. In one case (GT 1:30 pm Feb 6), this happened when people in the street queued to buy roast duck. The video footage clearly shows the two people standing in the same queue without facemasks. Since this was the only instance of the second patient being in close contact with an infected person, they concluded that this was the moment when infection occurred. In another case (GT 10:27 am Feb 27), a woman contracted the virus just by waking past a patient in a hospital.

This virus is not only highly lethal and extremely contagious, it also has the capability to remain hidden for a long time. The longest measured duration between infection and the first symptoms is 27 or even 38 days (GT 2:01 pm Feb 22 and Washington Post). In another case, a person was tested positive after she had tested negative in eight previous tests (GT 12:26 pm Feb 25). Such cases are rare, but this will be those which escape screening and will lead to new outbreaks later on. In an article in the German newspaper *Tagesspiegel*, Professor and Director of the Charité Institute for Virology Christian Drosten explains why this virus is much more contagious than SARS, but also why the symptoms (or at least the first symptoms) are often hardly felt by the patients when they are already highly contagious. He provides the first mention we found of the differentiated fatality rate according to case density, leading to "people dying because they cannot get a hospital bed." He also suggests a more recent CFR of 3-4%. Of course, after this extremely useful but also alarming information, the expert who provides it goes on explaining why we should not be overly alarmed:

> *The precise CFR can only be estimated right now, because of the still incomplete available data. It is true that information from China indicates that 3-4% of the patients die. "However, this simply cannot be true", said Drosten, because this would be a higher mortality than during the Spanish Flu in 1918, when more than 50 million people died in the world. Experts consider that many mild or asymptomatic cases were not counted. If we take this into consideration, the virologist, who emphasized that he is not an epidemiologist, estimated that the mortality is probably around 0.3%.*

> *[Wie hoch die Fallsterblichkeit ist, das lasse sich derzeit nur schätzen – aufgrund der nach wie vor nicht vollständigen Datenlage. Zwar deuten die Informationen aus China darauf hin, dass etwa drei bis vier von hundert Patienten sterben. „Da kann etwas nicht stimmen", sagte Drosten, denn das wäre eine höhere Sterblichkeit als bei der Spanischen Grippe von 1918, als weltweit etwa 50 Millionen Menschen starben. Experten gehen davon aus, dass sehr viele milde oder gar symptomfrei verlaufende Infektionsfälle gar nicht registriert werden. Das einberechnet, schätzte der Virologe, der extra drauf hinwies, kein Epidemiologe zu sein, auf eine Sterblichkeit von etwa 0,3 Prozent.]*

Right, so because the mortality calculated based on Chinese figures cannot be true, because it would be higher than the mortality of the Spanish Flu. This is definitely reassuring. It shows how even the few Western experts who get many facts right systematically end up finding some kind of argument to downplay the danger.

4. Contact tracing, the modern weapon against epidemics

Even though cases of extremely long incubation periods or of infection through very short random contacts are considered to be rare, they highlight the difficulty of finding all the "contacts" of infected people. Simply asking what people a patient has met will not do. You cannot remember all the people standing in a queue with you when buying roast duck in the street. The Chinese authorities have been massively using big data to do the most efficient contact tracing they could, and this information has been published in various Western media reports. An article in the Wall Street Journal describes how the Chinese authorities had been able to trace back a subway ride by an infected person in order to find all those who might have been infected and several other applications. WHO expert Bruce Aylward confirmed all of this and its importance for contact tracing:

> *They are using big data and AI in places. [...] And from a distance, I hadn't appreciated that. But what they've done is when it came to the response, they had to manage massive amounts of data, massive numbers of contacts, because remember, they're trying to find every case, trace every contact of 70,000 cases across vast areas and know where they were, follow them and manage all of that data. And then you've got to be able to map that, link it to other sources of data, etc.*

Remember Marc Lipsitch and others above who claimed that China had taken primarily undifferentiated non-case based measures to fight against the epidemic? How can you learn from the extremely precious Chinese experience in this absolutely crucial sector when you simply deny that they even did it?

So what are the concrete tools we can use, and how can they be applied? "Big data" and "AI" are vague concepts. What is the most precious information to perform efficient contact tracing? Without any doubt, it is constant location tracking. Most smartphones know exactly where their owners are, and many apps use this information, for example to show you where you are on a map, or to help you find restaurants around you. In many cases, your precise location is not just used by the app in your phone, it is sent to the server behind the app to help it to provide the right data to the phone.

The server might use the location information and then discard the information, or store it permanently in a database for further use. The New York Times recently featured an article about a private company which collects and sells such data about millions of users in the world. The authors had gotten access to a huge dataset which contained the precise location of 12 million phone users over several months. Here is how they describe the kind of information they could extract from it:

> *One search turned up more than a dozen people visiting the Playboy Mansion, some overnight. Without much effort we spotted visitors to the*

estates of Johnny Depp, Tiger Woods and Arnold Schwarzenegger, connecting the devices' owners to the residences indefinitely.

It requires little fantasy to figure out the potential for abuse as we have argued elsewhere. But in the current situation the power of big data can and must be used to save lives.

We have now seen that this virus is not only extremely lethal, but also highly contagious, with many infected people and instances of infection being extremely difficult to detect. For all these reasons, contact tracing is absolutely crucial to stop the various outbreaks. So what would be the concrete solution? It's quite simple. State institutions need to develop an app which will track the location of every single person on the territory of the country and send this location information in real time to a central government-controlled server. This information can then be used, in combination with other information, to increase the efficiency of contact tracing. This app can also be used to send out important updates about the localized epidemic and to require personal information.

In itself, such an app would be the least disruptive and probably most efficient measure to contain every outbreak. In none of the recent community-transmitted outbreaks in Japan, South Korea, Italy, Iran, Germany or the US, "patient zero", i.e. the person who started the outbreak in these countries, is known, and this worries every single health expert. Everybody is aware of the fact that many more undetected cases are still out there. The information that China massively used big data and AI is also out there. And each single doctor who has ever wondered where a certain patient was infected has certainly dreamed of some location tracking database with some decent AI algorithm to provide life-saving information. So why is this solution not even discussed in relation to COVID-19? In the article mentioned above, Prof. Christian Drosten and another expert provide some clues:

Independently from the mortality rate, Drosten expressed hope that SARS-CoV-2 [the virus causing COVID-19] "spreads slowly enough so that we make it until the summer", i.e. a time when viruses spread less easily because of increased UV-radiation, a dryer air and the fact, that less people are crowded into badly ventilated rooms. China has "given the world a couple of weeks of additional time through a heroic epidemiological act."

After Drosten's presentation, Osamah Hamouda, Director of the Department for epidemiology of infectious diseases at the Robert Koch-Institute, declared: "In Germany, we don't even nearly have the possibility to take the kind of measures they took in China." From all parts of the country, the central government has sent 40,000 doctors and other health workers to Wuhan within a short time span in order to get the epidemic under control. "If only the whole world was like China, I am sure that we would get the epidemic under control."

However, this is not the case, certainly for a good number of reasons which are unrelated to the fight against epidemics. South Korea, where on Thursday alone more than 500 new cases were confirmed, but also Iran and Italy "make us worry", said the epidemiologist. Even if everything tends to indicate that an interruption of the chain of contamination outside China is not possible anymore, the Robert Koch Institute still plays the card of

containment, "in order to get some additional time", said Hamouda. Every additional day gives us more time to prepare for the pandemic.

[Unabhängig von der Sterberate äußerte Drosten die Hoffnung, dass sich Sars-CoV-2 „langsam genug verbreitet, dass man es bis in den Sommer" schafft – eine Zeit, in der es die Viren aufgrund von vermehrter UV-Strahlung, Trockenheit und der Tatsache, dass sich weniger Menschen eng beieinander in schlecht belüfteten Räumen aufhalten, schwerer haben, sich zu verbreiten. China habe der Welt „sicher mehrere Wochen Zeit verschafft, und zwar durch einen heroischen epidemiologischen Akt".

In Deutschland werde es „nicht annähernd möglich sein, Maßnahmen wie in China durchzuführen", sagte Osamah Hamouda, Abteilungsleiter Infektionsepidemiologie am Robert Koch-Institut (RKI) anschließend an Drostens Vortrag. Aus allen Teilen Chinas habe die Zentralregierung 40.000 Ärzte und anderes medizinisches Personal in kürzester Zeit nach Wuhan geschickt, um die Epidemie in den Griff zu bekommen. „Wenn die ganze Welt wie China wäre, dann bin ich mir sicher, dass wir die Epidemie eindämmen können."

Aber das sei so nicht – und sicher auch aus guten, nicht-epidemiologischen Gründen. Südkorea, wo allein am Donnerstag über 500 Neuinfektionen festgestellt wurden, aber auch der Iran und Italien „machen uns Sorgen", sagte der RKI-Epidemiologe. Auch wenn inzwischen alles darauf deutet, dass eine Unterbrechung der Infektionsketten außerhalb Chinas nicht mehr möglich ist – das RKI setze weiter auf Eindämmung, „um Zeit zu gewinnen", so Hamouda. Jeder Tag mehr verschaffe Zeit, sich auf den Pandemiefall vorzubereiten.]

Aside from the usual mistake of getting blinded by the huge numbers involved in almost anything that happens in China, this is an embarrassing confession expressed in a rather indirect way: China, through its heroic measures, has both contained the outbreak on its territory and allowed the world to gain several weeks to prepare for the pandemic. If the whole world was like China, the virus could be contained successfully on a global scale. However, because Germany is a democracy, we are not able to enforce such tough measures. Therefore, while sticking to containment measures, we already know that we will fail in containing the epidemic, but this will allow us to have more time to prepare for the worst, hoping that the summer will make it harder for the virus to spread.

No, this is not a CCP United Front screenplay to praise the inherent advantage of communism over Western style multi-party democracy. These are two highly regarded German experts quoted in a renowned newspaper. It is now time for all those who believe in democracy to watch in shock and disbelief, not because China has achieved a successful containment through a heroic effort (this is obvious), but because too many eminent experts declare defeat in Western countries before the battle even started. It goes without saying that we reject their evaluation of the chances to successfully contain the pandemic.

Setting up an efficient contact tracing system using location tracking and other data is not a real problem within a Western-style democracy with the corresponding rule of law. Even

much tougher measures like quarantines have been imposed by both Italy and South Korea when it seemed necessary. Technically, it would be an app that all users can (or ideally must) install on their mobile phone just for the duration of the epidemic. This app continuously transmits the location and gets general or personal updates and information about policies and measures from the server. Once the epidemic is over, users simply delete the app, which would also be disabled by the server. The whole thing would be submitted to national regulations and under constant supervision of privacy protection experts who watch over this aspect in every administrative unit of our state authorities.

5. Large-scale testing and quarantine

With this in mind, we might now turn to the extremely important topic of the combination of lockdown/quarantine/isolation and large-scale testing. Together with contact tracing, these are the basic measurements of every efficient containment plan regarding the virus. Two caveats are warranted here: first, regarding the efficiency of the various quarantine and isolation measures, everything said here must be considered preliminary. At the present stage, we don't have the necessary information to evaluate the precise contribution of each possible measure. However, the conclusion regarding testing is clear: it must be extremely massive and at the same time well-informed. Second, to understand the precision of China's large-scale approach to testing, one has to understand first that the testing practices are embedded in a larger emerging system of health control. The CCP has mobilized existing local elements of the socialist control system across the entire nation. It has taken work units (*danwei*), housing blocks, street-level grid management (*she qu*) and combined them with the use of high tech (drones, smart traffic systems, AI, CCTV cameras, thermal scanners, mandatory health-status apps) and low-tech measures (roadblocks, sealing off of quarantined quarters, health checks at various locations etc.). This response demonstrates not only the startling surveillance power of the CCP – with the flick of a few switches, the government has been able to gather daily health data of practically every person in the country — this system also provides exact knowledge where everyone is, whether they have moved out of their apartment and compound, as well as with regards to the temperature of their bodies, and thus helps immensely to identify persons that should be tested for the virus.

So, let us first have a look at the situation where the number of cases is relatively small, like a few hundred or a few thousands for a mid-sized country of roughly 50 million people (like Korea or Italy) or an average Chinese province. This corresponds to what happened in many Chinese provinces except Hubei, and since all of them got the outbreak under control, we can use them as reference.

One thing is the necessity of testing. We don't have official figures about how many tests were done in China as a whole. All we have got is the following declaration by Bruce Aylward from the WHO:

> *And in one place, it might have been Guangdong, they had tested 320,000 samples for the COVID virus. 320,000 is going to give you some sense of what's going on. And when they started the sampling of those, about 0.49% of them were positive, so less than 05%. And in the recent period, it's something like 0.02%. So, I know everybody has been out there saying, this*

> *thing is spreading everywhere and we just can't see it, tip of the iceberg.*
> *But the data that we do have don't support that. What it supports is sure,*
> *there may be a few asymptomatic cases, and that probably is a real issue,*
> *but there's not huge transmission beyond what you can actually see*
> *clinically.*

So, when they started testing, one out of 200 was positive. Recently, one in 5000. That adequately describes the effort and also suggests that the outbreak is indeed under control. We can compare these figures with other countries. As of Feb. 29, UK announced having tested 10,483 people of which 23 were confirmed positive, a ratio of roughly 1:450. In South Korea, as of Feb. 28, the number of tests was 70,940 for 2,337 cases, a ratio of 1:30. In Italy, as of Feb. 25, 8,600 tests were done, within the framework of an outbreak which is roughly synchronous with the outbreak in South Korea according to the number of deaths. As of Feb. 25, they had found 229 cases, which would mean a ratio of 1:40, but how is it that South Korea has found as of Feb. 28 2,337 cases, whereas Italy found 650, despite a higher number of deaths in Italy? Is the virus more lethal in Italy? And why do so many Italians test positive in foreign countries, when there are so few cases in Italy itself? The figures simply don't add up. By March 3, the ratio of positive tests to the total number of tests had decreased to 1:10 in Italy, and even 1:7 in Lombardy, the most affected region. Claiming that the number of cases is high in Italy because they do more tests than their neighbors is not very helpful. At the same time, the number of deaths in Italy has soared past South Korea's numbers. Italy is finding only a fraction of infected people. As a result, the virus is spreading almost unimpeded, like in Iran. At least some regions of Italy are heading towards a disaster much worse than what has ever happened in Wuhan, on par with the situation we will see in Iran.

Japan, which has confirmed community transmission, does not even do 100 tests per day, when South Korea is doing 7.500, according to a Japanese TV channel quoted by korea.net. In the US, as of Feb. 29, 472 tests were made, for 15 positive results (not included cases repatriated from foreign countries), a ratio of 1:30. The fact that community transmission seems to be ongoing for weeks in Washington State and Illinois has been revealed not by specific testing for the virus responsible for COVID-19, but by a standard flu monitoring test. This comes amid reports that National Institutes of Health official Anthony Fauci was muzzled by the Trump administration.

The number of tests, or its ratio to the number of positive results, draws only an extremely incomplete picture. The related policy is another important factor and the ease for people to get tested. In China, tests are not only free, people are actively encouraged and in fact forced by law under threat of penalty to come forward as soon as they feel the slightest symptoms of a cold. Few local authorities pay people with symptoms or any suspicion of contact to get tested (GT 9:56 am Feb 27 and 1:44 pm Feb 9).

In contrast, we find numerous media reports from several Western countries, where people with well-founded suspicions that they might have COVID-19 were unable to find an institution which accepted to test them. A patient in the US who tried to get tested and was ultimately tested positive had to wait for four days because she did not "meet the criteria". In an extreme case in the US, a patient was ultimately found positive for the flu virus, not for COVID-19, but because he said he suspected that he was infected with COVID-19, he had to pay more than $3000 out of his pocket because the test was done under quarantine conditions.

If he had not first asked to get a flu test, they would have done a CT scan first, with certainly a much higher cost.

Making the test free for everybody, automatically including highly vulnerable groups, scaling up the testing capacity and inviting all those with even specific symptoms to get tested are absolute preconditions for being able to detect and then contain every local outbreak. If we wait until a case of severe pneumonia seeks medical attention or somebody dies from the new coronavirus, it is too late: too many people with mild symptoms are already out there spreading the virus. Yes, in early March, with many people having the flu or a simple cold, this means performing tens of thousands of tests each day and there is the problem of false positives, or even hundreds of thousands. But this is still much easier and cheaper than not doing it.

Moreover, we can already assert with high certainty from the Chinese experience that to put in place massive testing is far from enough. Many people with no or extremely mild symptoms will not come forward, but they might be contagious. When somebody tests positive, what do we do? Manual contact tracing, as it is done in Western countries, is of course absolutely necessary, but this will not allow us to trace back all the possibly infected people, as we have seen above. China's Guangdong province, the ratio tests to positive results was 200:1 during the growth phase and 5000:1 in the late phase. A big data driven tool to detect potential contact people is indispensable to reach a higher number of possibly infected people. We must also put this into perspective with the total population. Guangdong province has got roughly a population of 110 million. 320,000 tests represent one for 300 people. It would have been impossible to test the whole population. Therefore, testing a great number of even relatively improbable contact persons is extremely important.

The second question is what we do when we find confirmed cases, and also what we do with contact persons of the infected. In the very first phase of each outbreak, authorities tended to send infected people who did not require hospital care home. Before the large-scale all-out effort in Wuhan to curb the epidemic started, there was simply no other option at hand. Since then, they have not only expanded hospital capacity in Wuhan for severe cases, they have also improvised to set up a huge number of quarantine facilities in appropriated hotels, schools, sport stadiums and so forth, one type for those tested positive and another type for "suspected" cases, i.e. cases which were in contact with confirmed cases, but have not (yet) tested positive. For example, a few days ago, when one case was discovered in an office tower in Beijing (GT 12:00 pm Feb 27), all the employees were tested, nine more tested positive, and 178, even though they tested negative, were sent to quarantine facilities for "suspected" cases, where they will be tested repeatedly. As mentioned above, one "suspected" person in a quarantine facility was tested eight times negative before testing positive.

If we look at how European countries handle the still relatively small outbreaks, it seems that they walk down a road towards disaster. In many cases, even infected people who don't require hospital care are simply being sent home. Quarantining "suspected cases", i.e. contact persons which did not test positive, is unheard of in Europe. As we saw above, even for people who wanted to get tests for good reasons, often enough there was simply no way.

And then there is the question of how measures are actually implemented. The case of the Diamond Princess Cruise ship docked in Yokohama, Japan illustrates this. When it was known that one patient who had already disembarked several days before had been tested

positive, the Japanese authorities imposed a 14-day quarantine on the ship, started to test everybody on board and took all those who tested positive out to a hospital. In other words, they did everything right. And yet, three weeks later, more than 700 people on board the ship have been tested positive, at least one after returning to their home country. The problem was not the measures taken, it was more about how those were implemented. Media reports have revealed extreme shortcomings.

The case of the Diamond Princess also shows something else. The passengers on this ship were all relatively wealthy, had a level of education above the average, they were well aware of the danger and had been timely informed, and they had access to internet and nothing to do during the quarantine. Many of them spent a lot of time looking for information about the virus and about the best way to protect themselves. Still, almost one in four were infected. It is obvious that there was not much they could do. A virus like this can be contained only by well-organized and efficient action by authorities. Our media dream of informing the public being the solution to every problem is misleading. Informing the public is extremely important, but if it is done with a constant hostility against efficient and decisive action by the authorities, it will certainly not work. If we put all this together, it becomes obvious that the US, Japan and Iran have all given up on containing the virus and are heading for the most horrendous scenario, many times worse than what we could see at any time in Wuhan, this time not in one city, but possibly throughout the entire territory.

Remember Ms. Maria Rita Gismondo from the biology laboratory in Milano where all the provincial testing is done? She is certainly not to blame for being exhausted after a few weeks. Nor are the doctors and nurses in the hospitals in Wuhan who had to refuse many patients who urgently needed care. People can only work the whole day and part of the night. All of them did that. Organizational problems must be solved at a much higher level. No matter whether we talk about a city where 0.5% of the population was infected before it was clear what happened and the necessary tools were available, or whether a lab must get the necessary support to conduct tens of thousands of tests per day, efficient action must come from higher up. The problem is that in Europe, we had all the information for several weeks now, which was simply not the case in Wuhan. China's failure and success provides everything we now need to know. And yet, few in Western countries seem aware of the fact that the existing labs, hospitals and quarantine facilities don't have the required capacity. Everywhere, capacities are far below what we need even in the best of cases that it would be laughable if millions of lives were not at stake.

Especially with regards to testing capacity and the related policies, this is absurd. With adequate time for preparation, these tests can be conducted at a large scale in a perfectly cost-optimized way. PCR machines and competent operators are available in sufficiently large number in every single Western country. It has also been known for quite some time now that throat swabs are equivalent or even better than collecting liquid from the lung for these tests, and this is how they do it on a huge scale in China, with obvious success. Precious time has been wasted and Western countries are unprepared. They lack the necessary capacity to put an end to the pandemic when it could otherwise be done relatively fast. The same is true for setting up the data infrastructure required to make the testing as efficient as possible, in particular location tracking. If we look at all we know, there is one main reason for this delay: the habitual arrogance towards China, which has prevented Western leaders, experts and media benefiting from China's experience in containing the virus.

6. Debates about cancelling mass events

In their recent reaction to the flaring up of cases, many Western governments have taken strict measures to ban mass events, in line with the recommendations of most experts. With regards to the initial response to the epidemic in Wuhan, the local authorities have also been harshly criticized for holding a huge banquet for 40,000 people a few days before announcing that the virus was spreading from human to human, and putting the whole city in lockdown three days later.

Banning mass events is certainly not a bad thing but we must put this into perspective. If we take the example of Wuhan, what is the biggest mass event? It's the Wuhan subway, which puts in close contact more than 3 million passengers each day. A Chinese style banquet is not at all similar to the Oktoberfest in Munich, as the readers familiar with China might know. Banquets in China generally consist in round tables for ten people, with open space between the tables. One characteristic of the virus is that it does not travel far through the air. Contamination can be very fast, but only at a short distance. When taking the subway, an infected person will therefore most likely infect more people than when taking part in a banquet. Now consider that more than three million take the subway daily, and probably an even larger number travel by bus. Canceling a banquet would have made no difference at all.

The importance of understanding the specifics about the situation in Wuhan shows that if the efficient detection of relatively small outbreaks fails, it is illusory to think that we can limit spreading within the community through cancelling sporting and cultural mass events. Especially in large cities, without the mass transport system, economic life becomes almost impossible because people simply cannot get to work. It is therefore a question of *either* taking rather symbolic measures and rely on case-based measures (massive testing and contact tracing), *or* imposing an almost total lockdown (see below).

Preventing the massive spreading of the virus in the mass transportation system is probably the most difficult task of all, especially with a virus where two people standing close to each other for a few seconds is enough for transmission. Preventing transmission from happening is probably impossible. The only way of containing each outbreak will be to trace all the even highly improbable occasions of possible transmission and to inform and repeatedly test all the possible victims. Here again, it boils down to massive testing and location tracking.

7. Total lockdown

The considerations above apply only to places where the case density is still relatively low. In the case of Wuhan, it was too late to solve the problem in this way. The Chinese authorities imposed a total lockdown not only on Wuhan, but (often to a lesser degree) on many other cities in Hubei province. [Italy](#) and [South Korea](#) introduced comparable measures.

Especially the lockdown of Wuhan has often been described as a way of "[sacrificing" Wuhan](#) for the rest of China and even of the world. As mentioned above, many Western experts and media claimed that it violated human rights norms and that such measures would be impossible to implement in Western countries, or in multiparty democracies in general. There is no doubt that the lockdown is a "[living hell](#)" to cite from the diary of a Wuhan resident. For

ten thousands of families [the situation in Wuhan](#) was and is certainly a humanitarian crisis, as social media postings show.

It is crucial, however, to understand from a health policy perspective that in a situation where the case density is too high, there is probably no other way of containing the epidemic, i.e. of making sure that at least most of those who are not infected yet will also not get the virus in the near future. This can only be understood if we consider the problem as a relationship between speed of contamination and speed of testing. If a test for the virus could be conducted as easy as distributing flyers (e.g. let somebody spit on a stick and it gets blue within one second if the person is infected), even with a high case density, it would be easy to test everybody in the street, in the subway, at the entrance to a football stadium etc. Unfortunately, this is not the case. Testing for the virus requires a PCR machine, a test kit and competent experts to conduct the test in a reliable and safe way.

There are indications from [model simulations](#) that in Wuhan, the present day number of total confirmed cases was almost reached at the time of the lockdown on Jan. 23. If this is correct, despite working with extreme efficiency, it took the Chinese authorities roughly one month to build up the necessary healthcare, quarantine and testing capacity and to find the huge majority of the cases, in part by doing systematic house to house searches. Again, this would not have been possible at all with Wuhan's own resources; massive manpower and material from the rest of China were necessary for this.

It is therefore clear that the lockdown of Wuhan alone, or any other lockdown, does not represent a solution in itself. It has only one function: providing more time for the authorities to build up the necessary capacity to catch up with testing all remotely suspected cases as well as treating and isolating the sick and infected. Lockdowns are beneficial and necessary only in the short term, when an outbreak remained undetected for too long and the number of cases has become too large for the available capacities to deal with it. If testing capacity is built up in time, lockdowns are not necessary at all.

8. The outbreak of a Covid-19 pandemic must be stopped at all cost

This is a one-in-a-century epidemic, as Bill Gates [has pointed out](#). "Disease X" has [finally arrived](#) and it will not be over anytime soon. Unless we find an efficient cure or vaccine, each single outbreak must be contained using the methods mentioned above. If we don't want this containment effort to destroy our economy and social life through repeated lockdowns, there is only one approach: we must massively expand our capacity to detect new cases with maximum speed and precision. This issue must not be dragged into an ideological war between the West and China, or between rivaling political parties within a country. Collaboration and the ability and willingness to learn from each other are the only way to success. When the present danger is firmly under control, rigorous and unsparing research will have to evaluate how the various actors handled or mishandled this outbreak. This includes not only governments and their administration, but also media and academic experts.

Concretely, what is required can be set up in a matter of days or a few weeks at most. There are three relatively simple, but extremely urgent tasks: setting up a comprehensive location tracking database, increasing testing capacity and setting up quarantine facilities.

Enabling ubiquitous location tracking through a small app developed for this purpose that can initially be very simple. Experienced developers can set up the necessary servers and develop the app and make it available for download within a few days. Everyone without a smart phone needs to get one for free. The biggest problem will be the legal issues. Many health experts have complained in the past that the increasingly strict privacy regulations end up limiting our ability to save lives. It is time that this issue is seriously discussed, but not in relationship to the containment of COVID-19, where we need immediate action. Once the infrastructure is ready, citizens should be immediately encouraged to download it. If adequately confronted with the extent of the threat, most people will do it probably out of free will. This would already provide considerable help with contact tracing, even though a mandatory use of the app would be more efficient. Setting up the data gathering has got the highest priority. Developing and testing the search algorithms is more complex and will take more time, even though a very simple but useful algorithm can also be developed within a few days.

Building up adequate testing capacity might be a little bit more challenging. However, in each country, the necessary PCR machines and people able to operate them are available in sufficient number. Of course, most people who operate these machines now are not trained to handle samples with a deadly virus and in some cases (e.g. cheap private genetic testing), the quality might not be up to the task. In the case of an outbreak, quality issues are not that important. The available tests are not 100% reliable anyway. In China, they consider that two positive tests are necessary to confirm a case and two negative tests on two consecutive days for discharge from the hospital. Many patients were tested multiple times until the test was positive. Safety issues must of course be taken seriously, but it is much easier to deal with a contagious sample, which can be handled in a lab chapel, than with an infected person which talks, sneezes and coughs.

Delocalization of testing is an option. [According to reports](), China is able to test more than 200,000 samples per day. They might be willing to test our samples until we can build up the necessary capacity. Countries with a warm climate did not see any community spread so far and could be another solution. Among others, India and to a lesser extent Bangladesh and other countries have got a modern pharmaceutical industry. They are able to produce the test kits and to perform the tests. Due to the massive reduction in air traffic because of the virus, air transport capacity is easily available to carry the samples in great number to other continents with a high frequency (e.g. once or twice a day). It is obvious that samples would be anonymized and quality checks would be required. Delocalization might be the only way of scaling tests up to the required capacity fast and at an acceptable cost. Massive testing will be with us for months and probably years to come. Alternatively, Chinese health providers could also be invited to European countries to rapidly build testing facilities and share hands-on expertise.

Employ a layered approach to isolation. The more we test and the better we know whom to test, the less patients in severe condition we will have, but the more infected people with mild symptoms will have to be isolated. Simply letting them live at home is probably not an option, because it would lead to further infections, even if they live alone, as experience in Hong Kong has shown. It is of course possible that when we understand the various modes of transmission better, we will find ways of allowing this without risk. Meantime, the armed

forces or civil defense organizations can set up quarantine facilities, which would of course have limited comfort. Underused tourism infrastructure could be another option.

We must test massively, and do it now. This is certainly the most important lesson to retain. Start with testing all those who come to the doctor or hospital with pneumonia or a bad cough. Remember that in Italy, it took them too long to start testing when they had several cases of pneumonia in one hospital. Then test all the contact persons found through a manual search process (family members, colleagues, other people possibly exposed, people living and working in the same building, etc.), home-quarantine them and test them repeatedly, not just once. As soon as available, test more contact people revealed trough big data algorithms like location tracking. Systematically test people from areas with major outbreaks. Then test all people with cold symptoms more specific to COVID-19, like persistent cough or high fever. Test even samples of people with the most ordinary cold symptoms all over the country. Build up a massive testing capacity, and use it to the full extent by working through the list above by descending priority. The ratio of positive results to the total number of tests is a good indicator whether the capacity is sufficient. We must target a ratio of 1:100 right now, 1:1000 in the short term, and around 1:5000 to 1:10000 in the medium and long term, when the present outbreaks have been brought under control. Being transparent about the number of tests is crucial. In comparison, in Italy, right now, the ratio is 1:10. In Lombardy, the most affected region, it stands at 1:7. They find only a fraction of the cases. As a result, the virus is spreading almost unimpeded.

This epidemic can and must be brought under control in the sense that we stop every larger outbreak and keep the number of cases consistently low. ***Failure is not an option.*** If the number of cases gets out of control, this will become horror. Just keep in mind that in Wuhan, only 0.5% of the population got infected. Read the media reports to see the consequences. In all of China, there were less than 80,000 cases, but only because of the tough measures they took. Most of them got infected before January 23. In many cases, their state deteriorated only progressively. As of Feb. 23, almost 10,000 people were still hospitalized and considered "severe" cases. This virus kills slowly, but it kills massively if people get no treatment. Every outbreak out of control will overload even the best healthcare system, but it will do so slowly, so that we don't realize it before it is too late. As a result, huge numbers of patients with severe and critical pneumonia, gasping for breath and chocking as a result of water accumulating in their lungs, will be sent home to die when they could otherwise be saved. This is what is at stake. On the other hand, with sufficient and efficient testing capacity, we can keep this under control and have a normal life, including intense social and cultural activities, with few occasional cases that get adequate treatment.