Editorial

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New coronavirus pandemic: an analysis paralysis?

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In 1854, Dr. John Snow laid the foundations of epidemiology by applying statistical thinking to the investigation of the cholera epidemic in London, but also by acting on it despite the great uncertainty that reigned (Snow 1856). This is a tale known to all epidemiology students, the prevailing theory of which was that, at the time, cholera was caused by miasmas – bad smells. Snow carried out the first statistical study, which one would qualify today as “ecological”. He observed that cholera occurred more often among people living in buildings with higher proportions of subscribers to a water pump drawing its water downstream of a river-borne sewage spill in the Thames, compared to those subscribed to a pump drawing its water upstream of such a landfill. He then carried out a study, the equivalent to a “case-control study” as we called them nowadays, comparing cholera patients to otherwise healthy people (non-cholera sample) at an individual level and checked which pump they were subscribed to precisely. Upon calculating the “odds ratio” that played against the downstream pump, he concluded that cholera was probably transmitted through consumption of sewage-contaminated water. Despite his innovative reasoning, Snow did not succeed in convincing his contemporary peers with mere statistics. Of a decisive character – a reputed obstetrician he twice assisted Queen Victoria through childbirth with experimental anesthesia – he removed the handle of the incriminated pump himself, rendering it ineffective. The cholera epidemic resolved soon after. It is only almost 30 years later that Robert Koch convincingly demonstrated that a vibrio, first isolated by Filippo Pacini in 1854, caused the disease (Bentivoglio and Pacini 1995; Howard-Jones 1984). Yet, Snow had demonstrated statistically and empirically, by means of action, that the pump was the real cause of the problem at hand, the epidemic. One can draw from this experience that sound epidemiology may be as powerful as microbiology at identifying determinants of diseases when what it actually showed was that epidemiology is good at finding causes of epidemics, without needing to even know the cause of the disease itself. The biggest lesson, in fact, is however often forgotten: the importance of acting under uncertainty and that epidemiology is a science of probability with no real impact if not followed by action. Indeed, a large number of epidemiologists have since become exactly the opposite of what Snow demonstrated. Becoming specialists in identifying uncertainty in any scientific endeavor, epidemiology can often put the brakes on action. From this perspective, the unfolding account of the COVID-19 epidemic is deeply instructive.

On December 30, 2019, two days after being admitted to hospital with respiratory symptoms, a first case of a so-called “coronavirus-SARS” was diagnosed in Wuhan, known today as the epicenter of the COVID-19 pandemic (Report of the WHO 2020). Launched by the emergency department at Wuhan Central Hospital, the first alert was rebuffed by a staff inspector who instructed the physician not to speak out to prevent alarming...
the population. Also on December 30, a young ophthalmologist warned his medical school classmates about a possible “SARS” outbreak affecting seven people using We Chat – he also became infected with SARS-CoV-2 some weeks later, which eventually took his life. That same day, the head of the Chinese Center for Disease Control and Prevention (hereafter, Chinese CDC) upon reading about the SARS cases in Wuhan, immediately sent a team of experts to Wuhan on a 6:45 am flight the following day (Team NCPERE 2020; Zhu et al. 2020). The Chinese CDC claims having informed the World Health Organization (WHO) as early as December 31, 2020. After partially-effective actions, the Chinese authorities made confinement mandatory in Wuhan from January 23, 2020, and soon similar actions were taken all across China. The news spread worldwide. Restriction of movement increased by the day, affecting all 23 Chinese provinces that were already under closure orders, what everyone knows today as “confinement”. This was done just in time to prevent the mass movement of people ahead of the Lunar New Year celebrations taking place on January 31 all across the country. Justifiably criticized for how early management of the crisis was done locally, considering it took the Chinese authorities 3 to 4 weeks to put a comprehensive plan into action, this is light speed compared to how slowly the crisis was dealt with in many other countries. In an article published some weeks after, Chinese scientists acknowledged that the actual number of cases of COVID-19 could have been significantly higher than initially thought (Tsang et al. 2020).

Prefabricated hospitals were erected in China in less than 10 days to rapidly isolate the sick to the surprise of Western countries. People were summoned to stay at home and individual movement was heavily under control using smartphone location data. Unable to contemplate the visceral impact of such enterprising action at a time when the West had not experienced any outbreak yet, many voices were raised against measures considered excessive and typical of authoritarianism. Chinese authorities did not hesitate at escalating freedom-limiting actions. A few other countries or states have almost done the same afterwards. However, a series of three additional actions implemented by the Chinese authorities, which no other country was able to implement as quickly and as exhaustively, also made a real difference. First, according to a WHO report, 1,800 teams of at least five people were delegated in Wuhan to investigate, one by one, each symptomatic case and every person who might have been contracted the infection by proxy and all confirmed or suspected cases were to be kept in isolation (Report of the WHO 2020). Second, every person related to the confirmed case was systematically tested, reinforcing the first action. Third, use of protective masks became mandatory when people needed to move about in public - this was in fact the first instruction given to her team by the emergency department director who first alerted the authorities of an SARS-like respiratory virus that could potentially trigger another SARS outbreak. On February 28, the WHO mission visiting the country reported that the epidemic was being effectively contained all throughout China (if not completely under control) as early as February 20. Around 68,000 patients were diagnosed in the Hubei province, of which about 3,300 were reported dead (equivalent to one in 20,000 people). However, only 130 people of a total population of 1.3 billion were reported to have died from COVID-19 outside Hubei, the equivalent to one in 10 million people. Chinese and scientists worldwide agree that the number of cases was largely underestimated at the start of the epidemic, and probably again thereafter. However, even if China’s underestimation of the number of fatalities was 10 times that reported, it would still be an incidence of COVID-19 related mortality that all Western countries would have dreamed of with the virtue of hindsight.

The relative risk of dying from SARS-CoV-2 virus in Western countries is likely to be hundred times higher than that in China as a whole. It must be acknowledge also that the West had much more than 3 weeks to react and that by the time its countries were finally struck by the pandemic in late February, there was virtually no uncertainty left. Chinese scientists had not only identified the virus by then but also shared its RNA sequence with the world (World Health Organization (WHO) 2020). The five means of action proved sufficient to deter a pandemic in a population as large as Europe, North America and Russian Federation combined were known: masks, epidemiological investigation at the micro level, testing around each case and each and every suspect of having the disease, confining people at home and trace them if needed.

These efficient mitigating measures have not been implemented in full, or only partially or very imperfectly elsewhere. As a result, millions of persons have been contaminated across the West – the real figure of which is not accurately known because tests are not applied evenly and thoroughly and epidemiologic surveillance is scarce. While most released figures are being derived from models, the death toll, a more solid
but not entirely reliable figure, officially surpassed 130,000 in Western countries by mid-April 2020, and it is likely to at least double as worldwide figures are fully available.

It is legitimate to not apply authoritarian measures blindly

The so-called inaction for a while in the West stems partially from what we know as “political choices”. Population confinement and systematic tracking using mobile phones are measures of freedom deprivation that cannot be applied lightly. It is not unusual for democratic societies to balance out the freedom of movement with risk. In essence, this is the very basis of democracy. It is thus understandable that Western countries adopted a waiting period strategy before advising virtually every citizen to stay home, with stricter lock-down measures implemented by countries worst affected by the pandemic, risking incommensurable losses. As of February 28, by the time the WHO mission reported that the epidemic was coming to an end in China, there were c. 4,000 cases positive to SARS-CoV-2 in the rest of the world, a thousand in Italy, and a couple of dozen more in countries like France and the US. This was a situation of the same magnitude as that of SARS-cov-1 outbreak back in 2003, with c. 3,000 cases reported outside of China. Luckily that epidemic never turned into a major pandemic, despite affecting up to 26 countries, the reasons of which remain to be explained. No one could say with certainty that the COVID-19 epidemic would finally “blow up” to millions of cases in Europe and America: nearly 2 months had gone by since the first case was allegedly reported in Wuhan at this point. There was a strong possibility it was an outbreak that had yet to develop yet into a full-blown pandemic but no government was ready to condemn their citizens to freedom deprivation at risk of increasing unemployment and poverty for hundreds of millions of people only on a mere possibility. Even China did not do that from the start, the epidemic was already underway when its Government enacted mandatory confinement for nearly all its population, putting Wuhan in strict lock-down. Western societies must be urged to discuss democratically whether it was legitimate at that time to hold the decision to enact confinement rule while restricting the rights of its citizens to freedom of movement. The only “evidence” available to alert for a pandemic of this magnitude was at the time confined to a few mathematical models and the long-forgotten experience of a pandemic affecting the West like that of the 1918 Spanish flu. The earliest recollection of a similar event was the 1918 pandemic, one century ago. The worldwide pandemic had been called at least twice before, using very similar models, over the last 18 years for the SARS-CoV-1 and H1N1 flu, in addition to other minor threats. Since some would have lost considerably by betting on the SARS-CoV-1 and H1N1 epidemics as the major ones, many experts remained reluctant to bet on it happening a third time. By the end of February 2020, in a WHO’s official own words, “all was possible”.

If hesitancy in enacting strict confinement in the West, up until the present epidemic surpassed in numbers that caused by SARS-Cov-1 in 2003, may be understandable, this reasoning does not apply to technical, medical and basic public health actions, which have been severely hampered by undue hesitancy and contradictions.

Simple, effective measures were not political and had no reasons to be delayed

Wearing masks and making them available, making hydro-alcoholic gels available, identifying positive cases by testing and making testing widely available, investigating each and every case and everyone around by specialized teams, do not result in violation of any right.

What prevented public health and political decision-makers in most Western countries from ordering the production of these technical tools when the scale of the epidemic in Europe was deemed still not “certain”? Why wait 2 months or longer for the sky to fall on their heads? Strange coincidence that epidemics should mean what comes from above -epi- and falls on people -demos.
The cost of these measures has been invoked by many. However, it would be petty to put the blame on economists desiring to save costs. By mid-February, 2020, stock exchanges worldwide started to plummet and the cost of masks, hydro-alcoholic gels and test reagents became incommensurately low compared to the other economic consequences of the epidemic threat. Why then? As I see it, the main reason for this inaction lies in the so-called analysis paralysis by the overwhelmed and ill-advised decision makers across Western countries. This state of over-thinking seems to be dangerously gaining ground in modern academia: the obsession with what is known as “evidence-based medicine”, “proof of causality” and “avoidance of bias”, the notions of which have little operational value when faced with the exponential growth of an epidemic.

“Evidence-based medicine” does not apply to epidemics (and many other public health decisions to be taken under uncertainty)

The evidence supporting the efficacy of the aforementioned five measures was undeniable: together these succeeded in halting the epidemic in Hubei, in the very epicenter of COVID-19, from spreading and blocking the epidemics in a country of 1.3 billion inhabitants, resulting in 130 fatalities reported across China’s remaining provinces as a whole, each of them as populated as Germany, France, the UK and the most populated states of the US altogether. But this evidence is not the kind of evidence modern science would rather adopt: one that is based on observation rather than experimentation, lacking double blind randomization, thus feared to be “biased”.

The mask is a good example of such reasoning. Their protection performance against all viruses considered unproven and masks were therefore deemed useless by many. This has undoubtedly depreciated the value of accelerating mass production of an otherwise much needed and equitable item of protection equipment. This lack of judgment was repeated for weeks. Anecdotally, on February 7, this author’s son was the only person wearing a mask on a Los Angeles–Paris flight. On March 17, it was my turn to experience a similar situation as one of the very few people wearing a mask on a London-Montreal flight. In early April 2020, the world is still debating if the use of masks can create a false sense of security and whether the remedy is worse than the disease, and so forth. The WHO only just is considering changing its guidance on whether healthy individuals should also wear masks in crowded public places. If in line with this reasoning, Snow’s pump would still be contaminating the water consumed by the people of London [For anyone familiar with basic statistics: say masks decrease the RO from 2.36 to 2.19 over 4 days – a small efficiency of 7.5% to decrease the proposed rate of reproduction of COVID19 –, how many cases less do you have after 35 days? Almost 50% less. Say you start with 50 infected, how many cases does this means? 46,951 instead of 93,053. Not sure, of course, but worth a try, no? Imagine if masks turned out to be more efficient … ]

Epidemiology has become a science of etiology and has moved away from its primary vocation as a science of public health action and risk assessment. Causality may be partial, but it knows no half-truths. Hence some epidemiologists believe that they cannot utter any partial or uncertain evidence without committing a sin. Obsessed with etiology, modern epidemiology often delays action unless certainty is established, often forgetting that the very essence of epidemiology is that of a science of risk and not a science of causality. If there is one area of epidemiology that can work on risk and not causation, it is that of epidemic modeling. Any public health decision maker who does not call upon the help of mathematical models for predicting and analyzing epidemics can be deemed guilty of professional misconduct. One hundred years on, it has become evident that one cannot wait for all “evidence” to be made available before attempting to comprehend what is or may be happening during a new epidemic. Such was the case for the bovine encephalopathy crisis when a decision had to be made about the requirements for anyone slaughtering cattle and processing beef, for the importation of meat or blood donation in Europe for example; we used this approach for the SARS-cov-1 crisis in 2003 and for multiple other epidemics. Using epidemic modeling does not mean abusing it and decision makers familiar with these methods know this all too well. Mathematical simulation models necessarily include an extreme cataclysmic hypothesis and a very reassuring one. The truth is rarely in the middle. In the case of COVID-19,
contemplated models seemed to yield contradictions, from those tipping for group immunity (herd immunity) through to models advocating for strict confinement or limited confinement, theorizing already that almost complete exposure of the population would occur. Yet, it is the understanding of the assumptions in each of these models and how acting on this or that may change outcomes which is extremely valuable. There is little to no doubt that the answer will be given by serological testing. The purpose of models is to help people think of all the possibilities and assess what actions may be more or less effective. One that never grows outdated, the famous quote attributed to George E. P. Box that “Essentially all models are wrong, but some are useful” encapsulates the very essence of epidemiology that bio mathematical models are not black and white equations capable of explaining the grayscale subtleties of complex biological phenomena such as infection and spreading of diseases among humans (Box and Norman 1987). To that extent, and in light of the current COVID-19 crisis, it is about time that public health decision makers understand how to put epidemic modeling into practice. Failure to do so entails a further great risk of analysis paralysis, compromising anticipation and action. It should be noted that in the SARS-CoV-2 pandemic, the closest-to-reality “predictive model” was, in the absence of mitigation measures, the one simply using the transmission rate derived from the Chinese experience at the epicenter of this pandemic.

Testing, another misdeal. In many Western countries, SARS-CoV-2 testing has been understood as a tool for clinical diagnosis, or at most a means of epidemiological surveillance, and not as a tool for intervention on asymptomatic individuals and populations. It was therefore deemed unnecessary to undertake tests at a higher scale. Worse than that, epidemiological surveillance was most often interrupted at stage 3 of the epidemic across several Western countries, without it being known whether it was due to disinterest or lack of tests. No one knows really the prevalence of a virus with a death toll exceeding hundreds of thousands globally, affecting many more, with an impact on the global economy in the order of trillions of dollars, ruining small businesses, skyrocketing unemployment, throwing many people into poverty. Why? How is it possible? It was undoubtedly the search for contaminated people around those falling sick, and their subsequent isolation, that was proposed as the decisive tool to win the war against the epidemic at its very epicenter, used by some other countries. Recall the 1,800 teams of 5 “epidemiologists” sent to Wuhan to investigate every single positive case to SARS-CoV-2? Unlike most of their European counterparts, the US CDCs and their Epidemic Intelligence Services typically operate in a such manner, but did they have the testing capacity? That the head of WHO dared to almost reproachfully said “test, test, test” to the world almost 3 months into the pandemic, having omitted to issue operational recommendations affecting any policies in this matter is appalling. Not nearly enough guidance was provided as who to test: the sick? The people who were in contact with those symptomatic or testing positive? The population (for surveillance or for screening?) in general? This lack of guidance contributed to the inconsistency and uncertainty reigning with tragic outcomes worldwide.

Conclusion

The common point between errors committed along the way and procrastination is the paralysis of action resulting from the search for bias in face of the evidence and probability that determined which type of actions will undoubtedly have a positive impact. This is the quest for a certainty that will never quite be achieved.

Epidemiology needs to return to its roots as a science of action if it is to remain relevant as a scientific discipline. There are many ways to achieve this: whether adopting an empirical or a mathematical solution, I have no doubt the solution must be rooted in the desire to solve problems and enable decision making rather than cast doubt.

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