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# What Cost Scientific Illiteracy in Time of Global Pandemic?

## **Abstract**

*This paper traces the course of the ongoing pandemic as it was reported in some of the established world media as well as in scientific journals. The author has been following the various sources since practically the beginning of the pandemic in Europe and here will try to assess the role and the actual practice of scientists, politicians and other actors throughout the pandemic, from its beginning in China at the close of 2019 till end of February 2021. The key questions addressed in this paper are: Why the events of the ongoing pandemic unfolded as they did, with so many misguided decisions by politicians (as well as experts at times), with so much misinformation and fake news and so many missed opportunities for decisive and life-changing action? What is the reason behind prolonged intervals of silence in the communication chain? And what cost the insufficient familiarity with science – its facts, methods or means of communication – in the time of global pandemic? The main thesis is that the insufficient level of scientific knowledge – and at times of basic scientific literacy – as witnessed from the highest places of political power to the so called conspiracy theorists, costed us all too many lives lost and an unforeseeable suffering to come. The responsibility is shared between virtually all actors and it must be given due*

*consideration, in some cases even at the courts of justice, if we are to learn all the valuable lessons for the future of public health, world economy and, indeed, the survival of humanity.*

**Key words:** *SARS-CoV-2 pandemic; scientific literacy; communication of science; responsibility of different actors; media and political manipulation.*

### **Introduction: panic or understatement**

Ever since the global pandemic of a new type of SARS virus (SARS-CoV-2) broke out, the public was flooded by halftruths, unwaranted information, or, simply, disinformation. In the period between the first month or two of the outbreak of the epidemic in China up to the first confirmed cases in Europe and other countries of the West, the public of the developed (!) countries (certainly of Europe and the US) suffers from incomplete and often even contradictory information upon which most people's health and income, and, for too many, even their lives, will depend. Only after the epidemic reached its peak in China and had spread in several other countries worldwide (by which time it should and could have been clear to everyone how serious the new disease is and what impact it could have on global societies and economies worldwide), the WHO declares the state of global pandemic, and only much later the general public comes to understanding of what is the true nature of the disease. Why such a sequence of events<sup>21</sup>? What the reason behind so many delayed decisions and prolonged intervals of silence in the communication chain? Were the decisions or publicly expressed views of either politicians or the experts always prompt and appropriate?

The main thesis is that the insufficient level of scientific knowledge – and at times of basic scientific literacy – as witnessed from the highest places of political power to the so called *conspiracy theorists*, costed us all too many lives lost and an unforeseeable suffering to come. The responsibility is shared between virtually all actors and it must be given due consideration, in some cases even at the courts of justice, if we are to learn all the valuable lessons for the future of public health, world economy and, indeed, the survival of humanity.

First we assess the course of events as they happend from the begining of the ongoing pandemic in China at the close of 2019 to almost the moment of finishing the manuscript (end of February 2021) and offer a description of not only events and some of the persons involved, but also of the general sentiment of the time. Then the main facts and methods of science required to understand

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21 One report of the sequence of some of the most important and most interesting events is found on *Nature's* website (22nd April 2020) starting from 21st of January up to 22nd of April 2020 and covering scientific and media resources worldwide almost day by day.

the pandemic and better make decisions are espoused. Finally, some of the main ethical dilemmas, according to the author, are debated. All in hope to show the paramount importance of not only the (basic) familiarity with science, but also of prompt, reliable and adequate communication of science.

From the very beginning of the ongoing pandemic we have all been exposed to an unprecedented amount of disinformation and manipulation (perhaps comparable only to what was going on during the cold war, but subtracting for the absence of internet and social media networks in those decades of the 20th century). And the cacophony, as an early editorial in *The Lancet* expressed (Flahault 2020), is continuing at all levels – from the social networks where different groups or individuals are promoting various (more or less credible conspiracy theories<sup>22</sup>) to leaders of respectable democracies promoting pseudo-science or simply deliberately misinforming the public to who-knows-what ends. One could think that, at least initially, everybody, including the experts, were stricken by the sudden emergence of a new and unfamiliar fiend from the world of the unseen and given its potential to spread (the so called *basic reproduction number*, or  $R_0$ ) as well as the problem of asymptomatic spreaders, the world was indeed not prepared for this pandemic. Given, also, that panic is always best to be avoided, one could perhaps try to explicate the course of events that were to take place from the early outbreak in China of already at least November 2019 until today. The faults with this kind of general and forgiving account are, however, too many, and all too grievous.

To begin with, the Chinese were not communicating all their findings promptly to the rest of the world causing the general delay in dissemination of scientific information as well as in scientific research which followed. Given the subsequent scale of pandemic it is now evident that virtually every day was important for saving lives. Moreover, there were reports by Chinese scientists (*New York Post* 10th July 2020) to their own authorities about the possibility of human-to-human transmission as early as at least December 2019 and yet the director-general of WHO, Tedros Adhanom Ghebreyesus, declares that: “At this time there is no evidence of human-to-human transmission outside China,” as late as 23rd January 2020 (*Nature* 22nd April 2020). The now infamous case of Dr Li Wenliang (*Los Angeles Times* 6th February 2020), who was perhaps the first person to warn of the potential for human-to-human transmission and who was arrested for inciting panic (although he was trying to warn everybody of the coming catastrophe) and who subsequently died from Covid-19, is perhaps the most striking case of government manipulation which was unfortunately not endemic just to the Chinese authorities as we all could have witnessed on so many occasions worldwide.

Unfortunately the trend of misinformation, hiding vital and life saving information and manipulation of the public has continued long after the original outbreak and far away from China. In many countries in the West we heard all too often and from the highest places (for analysis cf.

22 The question of which conspiracy theory is more credible or, indeed, is any of them credible at all, can and should be assessed seriously, as now – in the era of light speed communication technology – as well as back then – in the cold war era, certain conspiracies seem to be more plausible than others. The question of the origin of the SARS-CoV-2 virus is still a matter of an ongoing international investigation.

eg. *New Statesman* 23rd December 2020) that the public are not abiding by the anti-pandemic rules (the recommended or obligatory mask wearing, social distancing, personal hygiene etc.) as late as January 2021, whereas the real causes of continued outbreaks were quite different (*New Statesman* 14th January 2021). Namely, the relaxing of measures during summer, for example in the whole of Europe, or not instigating the quarantine in time to prevent the outbreak, but waiting till the ICU units become scarcely available (like in Italy in November 2020, or Britain in December 2020), or simply allowing for an increase of movement due to work or insisting on keeping the schools and universities open even though there is clear evidence that the contagion spreads (*New Statesman* 26th November; *The New York Times* 4th December 2020). On top of it all the new mutated<sup>23</sup> virus strains appeared some of which (the British and the South African strains) are 30 % more virulent and up to 60 or 70 % more easily spread. Surely the decisions that, say, the British government was making at the time did not help to prevent the mutation to appear or to spread into population, as Professor Anthony Costello, a member of advisory committee to the government (SAGE), points out (*The Guardian* 22nd December 2020): “The recent surge cannot be blamed on a mutant virus alone; in fact, government mismanagement of the pandemic meant that many more people became infected, creating the conditions for mutations to occur.” One, however, does not need to be a specialist virologist, or an epidemiologist, not even a biologist or a medical doctor in order to foresee the course of events if no further – and more stringent – measures are taken. One only needs to know the basic facts of genetics and evolutionary biology: that viruses, and microorganisms in general, mutate fast and that some of the mutations might be in the direction of increased virality or fatality for the host, the probability for which increases with natural selection acting in an accelerated way given the number of hosts in a situation of a pandemic.

In fact the delays of decisions which would mean the difference between life and death and resulting from the noise in the communication channel arising either randomly or by deliberate choice of certain agents, was one of the few permanent features of the current pandemic. Beginning with the WHO delaying to declare the state of pandemic till as late as 11th March 2020 (*Nature* 22nd April 2020, under 11th March), followed by the delayed responses of the Western governments to instigate nationwide quarantines and cancel at least international flights which later proved to be of major importance for curbing the contagion in China, Australia and elsewhere, finally, even after the quarantines were announced, in many European countries relaxation periods followed from summer onwards presumably called for by different lobbies from the business sector<sup>24</sup>. What these lobbyists, and all who call for relaxation of measures, do not seem to take into account is that the longer the proper quarantine is delayed, when all the statistics point to the necessity of introducing it, the longer

23 Viruses and microbes in general have a huge potential for mutations, some to their benefit, some harmful or lethal. SARS-CoV-1 disappeared from the world stage, among other reasons, perhaps because a mutation to its genotype attenuating its replication occurred during an early stage of the then ongoing pandemic (Muth et al. 2018). Unfortunately, the mutations of the SARS-CoV-2 took it to another path.

24 How this kind of lobbying could be detrimental to not only wellbeing (public health), but also, in the long run, economy itself was well articulated by Russell (1935/2004, Ch. 1) already in the thirties as will be further discussed in Conclusion.

will the outbreak last and the worse the consequences will be, and, consequentially, the longer the period of recovery of either public health system or economy. It appears that shortsighted interests had been in many occasions put in front long term gains in both human or other forms of capital as was clearly stated by the then head of the OECD José Ángel Gurría (*El País* 2nd November 2020): “The dilemma between health and the economy is absolutely false: we should not waste any more time with this.” Again, it should be quite obvious that the economy cannot properly function in the time of global pandemic and that extraordinary measures are required, such as state interventions and simply a higher degree of solidarity in all layers of society.

But perhaps the most appalling, is the absence of empathy throughout the pandemic and witnessed at all levels of societal hierarchy, from political leaders to common people and, most disturbingly, in some of the scientists and experts. There are many dangers and harms of a prolonged period of pandemic and not least are the psychological (Rajkumar 2020). Most dangerous of all is to underestimate the potential risks. For example, by saying, as so many have been saying, including some well-known intellectuals (cf. e.g. the text by Italian philosopher Agamben (2020)), that since the rate of mortality in general is not that high and given that mostly elderly people develop more severe symptoms, there is no real reason to introduce lockdowns and paralyse economy. The problems with this statement are many and all could be related to insufficient familiarity with science. For, it was known from early on (Bi et al. 2020) that children are as likely to get infected as any adult group, it is just that on average a child’s immune system is more rapidly fighting the virus even before the onset of symptoms (Weisberg et al. 2021). Actually, the most recent study (Hippich et al. 2021) written after the results of an extensive public health antibody screening was conducted in Germany shows that children are infected at a rate six times higher than previously thought.

It most definitely does not do any good in declaring in public that the pandemic is at peak and it would be a matter of weeks or a month or two before everything turns to normal – and doing so before the new winter season has even begun. Such statements were not infrequent (*New Statesman* 27th January 2021) on several television networks in different countries and by various experts, e.g. by a reputable oncologist Professor Karol Sikora in Britain (*The Guardian* 1st January 2021). And in a recent interview for the Croatian television network (*N1* 20th January 2021) a renowned Croatian-French geneticist and microbiologist Professor Miroslav Radman exclaimed that the people who have died from COVID-19 and also had comorbidities would have died anyway and that these are mostly elderly people. When confronted with the fact that perfectly healthy young people die too, he was quick to reply that in every age group there is bound to be a percentage of fatalities. Just that week there was a report on Croatian national television that a young boy age ten died from multiple organ failure related to SARS-CoV-2 infection. Such seemingly positive personalities are actually doing great harm to society. Firstly, giving false hope in time of increasing anxiety (Cullen et al. 2020) and ravaging pandemic is mildly put cynical and can have dire consequences such as an increased scepticism towards experts after such hopes are dispersed, as so many a time we have already witnessed throughout this pandemic. It can also provoke scepticism towards science itself and

its methods and discoveries, such as vaccines. Is it then surprising that the anti-vaccination mood is growing stronger as is the so called *anti-vaccination movement*? Furthermore, reducing human lives to the margins of a statistical error is inducing apathy and can lead to depression (Cullen et al. 2020) and even suicide (Gunnell et al. 2020) on one side, or to escalation of selfish tendencies and further disintegration of already much compromised society on the other.

## **The science behind the pandemic: what and how it should have been communicated**

### **A) Matters of taxonomy, or science begins with naming**

It is a well-known fact of biology that microscopic organisms are more difficult to classify than the macroscopic plants or animals and that the classification of viruses is one of the underdeveloped parts of taxonomy (Mavrodiev et al. 2020)<sup>25</sup>. Therefore, it was to be expected that there will be issues regarding the classification of the novel type of coronavirus as it appeared at the close of 2019. What was more surprising and hardly to be expected from the scientific community, if perhaps expected from the lay media reporters, is that the name of the virus, or rather relating it to the proper genus, took so long to be communicated to the public, or to catch the ear of the public. But true science, as any serious work, begins by naming the thing or the phenomenon, or the concept under investigation. So one wonders (as indeed the author asked himself in February 2020 when the pandemic already spread to several European countries) which germ (which virus) is causing all the havoc and if it is related to any of the germs which previously caused outbreaks of infection on a larger scale. For it is not the same if the virus is related to the influenza, or flu-viruses, or to the now well known (but before the appearance of SARS-CoV-2 virus causing the current pandemic, not so familiar to the public) coronavirus family.

The problem which all the health authorities and therefore all the governments confronted from the day the new virus with a pandemic potential was discovered in Wuhan was to estimate its rate of spreading ( $R_0$  factor) and the mortality it could cause. These, however, are very difficult to determine until more testing and tracking are performed, which also means until more people contracted it and so the governments decided to wait and see and to understate the danger rather than cause panic. Especially given that one must weigh in not only public health risks, but all sorts of other hazards, not least the risk to economy. It might appear the more cautious approach until one discovers that the virus is closely related to the SARS virus which was known to the Chinese from early on, already in 2019 (the speculations for about a year now have been that it in fact originated

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25 The true, scientific, name of the new SARS-CoV virus, according to Mavrodiev et al. (2020, p. 15), would then be: *Sarbecovirus* sp. SARS-CoV-2, belonging to the subgenus *Sarbecovirus*, sp. standing for *species* (in both Latin and English), the trivial name SARS-CoV-2 standing for *severe acute respiratory syndrome related coronavirus 2*, genus being *Betacoronavirus*, family *Coronaviridae* (subfamily *Orthocoronavirinae*), order *Nidovirales*, realm *Riboviria*.

in the laboratory in Wuhan where there was ongoing research on bio-weapons), and the genome of which was sequenced and published by end of January 2020. It was found that the genome of the novel coronavirus was 79,6 % sequence identical to the previous SARS-CoV which caused a large scale epidemic in 2002/03 and 96 % identical at the whole genome level to a bat coronavirus (Zhou 2020, p. 270).

Now, the very fact that a new (sub)species of a SARS virus was discovered should (and we may as well believe would) have caused reason for great concern, especially before the detailed studies of its potential for spreading and causing death to people are undertaken. For it is known (Chu 2004, p. 1349) that the first SARS-CoV virus had fatality of anywhere between 7 and 17 % and the reasons for such variation were manifold and not all well understood, at least at the time of outbreak. So the question suggests itself: is it more prudent to wait and *not panic* or to inform the public immediately as the genome of the novel virus was sequenced and start devising schemes for fighting the potential pandemic outbreak nationally and internationally calling for a global collaboration at all levels and among all professions? Most importantly, planning ahead for an unforeseeable future – until the vaccines are manufactured and the significant portion of global population vaccinated – delegating funding and calling for public support and solidarity with those who will be most affected (such as the elderly, the front line workers etc.). But none of this was to be, or at least not as organized as reason would demand it.

Moreover, and as was already discussed in the Introduction, the important decisions kept being delayed, beginning with the declaring of the state of pandemic by the WHO. And the experts, unfortunately, were not altogether blameless. Especially concerning were the public statements from certain Chinese scientists, e.g. Guo Deyin, a virologist from the Sun Yat-sen University in Guangzhou: “That name can cause panic to people, and may cause gross economic loss to the affected countries when the virus is circulating,” speaking more like an economist, or a lobbyist rather than a virologist (*Nature* 22nd April 2020, under 13th February). Now, is it more sensible to battle the virus, not hesitating from regional or even nationwide lockdowns (as indeed was the case first in China and then elsewhere and on multiple occasions) rather than letting the virus into circulation and causing a long term damage to health of not only those who contracted the virus, but also those who have to care for them, those who suffer from chronic illnesses for not having readily available care due to overcrowded hospitals from COVID-19 patients, those who are mentally more fragile and will not cope well with the long term or multiple lockdowns etc. Not to mention the overall cost for economy after the pandemic becomes global and long term. Indeed, some of the Chinese scientists, working presumably under pressure, exerted detrimental influence in the various institutions, most prominently the WHO, when the decision to name the virus was delayed and multiple names were offered, but all with the view of hiding the fact that IT IS the new type of the SARS virus which would entail declaring the state of global pandemic given the nature of the previous type of the virus and the percentage of genetical likeness. For example some of the names proposed were: TARS-CoV,



CARS-CoV, RARS-CoV (*Nature* 22nd April 2020, under 13th February),<sup>26</sup> so practically anything but SARS. Indeed, the Latin saying *Nomen est omen* applies here as well.

## **B) Basics of chemistry and mathematics required to understand the spreading of virus and fake news**

Further question we could ask as soon as we have understood what kind of virus we are dealing with is: whether the concentration of the viral particles to which a person is exposed matters for getting infected? The rationale behind this question is actually some basic chemical kinetics, namely, that as with other small particles of micro- and smaller size, it might be the case that the reactivity will depend on their concentration, say, in air. This is learnt already at high school level in almost any Science course (definitely in Europe and the English speaking world). For some viruses or microorganisms already a small quantity of pathogen could be enough to get infected, but with SARS viruses this is not the case, the more particles one is exposed to, the more likely it is that one will get infected. The number of particles found in the patients' nasopharyngeal swabs and sputum (so called *viral load*) either initially or later was related since the earliest studies (Chu 2004) to more severe outcomes of the disease caused by either SARS-CoV-1 or SARS-CoV-2 (Liu 2020). Unfortunately, this simple fact to appreciate and, in fact, to understand was not always communicated and not always related to the various risks of exposure and the measures to mitigate these. With the knowledge of the risk for contracting the virus increasing with the number of particles, it becomes immediately clear why the social distancing or frequent ventilation of closed spaces is a must, and why the number of people should be generally reduced in all circumstances. So much of the (unreasonable) public outcry in so many countries ought to have been easily averted if only everybody from the various experts to media and the politicians tried to get the basic facts of science across more straightforwardly and more rapidly.

As far as the spreading of the new virus is concerned, again some very basic knowledge of mathematics together with the fact or two from epidemiology will suffice to stay alert in all situations and not to underestimate the risks. The problem is that given the protean nature of COVID-19 disease (Christakis 2020), the fact that while it can cause most severe symptoms such as acute respiratory distress syndrome (ARDS) or multiple organ failure and even death, most of the infected get through the illness with just a mild cold or flu like symptoms, there is a tendency for both the public and the politicians to minimize the risks and hence not to react timely to a new outbreak. Over and over again we witnessed how different groups tried to understate the severity of the outbreak in a certain country just because they were not aware of the long period during which the virus is latent or that the curve of the number of fatalities will generally be lagging behind the curve of infected. Therefore, one must take this fact into account when devising policies or anti-pandemic measures,

<sup>26</sup> The meanings are, respectively: *transmissible acute respiratory syndrome, clustered acute respiratory syndrome and rapid spread respiratory syndrome coronavirus.*

that these are not to be set on daily or weekly basis, but with a view of long term prospects. Finally, that the exponential nature of the spreading of a pandemic means that, by definition, we will at first not see so large increase in numbers, but in a matter of weeks or months we might experience a public health system collapsing if nothing is done early on.

But SARS-CoV-2 brought another sinister surprise with it which, indeed, is not so obvious or easy to appreciate. Namely that there is a so called *mismatch period* for the virus between the *latent period* (from the time one is infected to the time one is able to spread the virus) and the *incubation period* (from time one is infected to the time one develops symptoms). For SARS-CoV-2 the incubation period is longer leaving so many asymptomatic carriers to spread the virus without notice (Christakis 2020). It takes about seven days to show symptoms, but the disease will start spreading 2-4 days before the infected are symptomatic. From the manner the pandemic was being handled world over and in spite of the new – and more dangerous – mutants emerging, it would appear that still many governments or employers did not really appreciate or calculate with this fact.

### **C) Immunity, detection and vaccination**

All of the above discussed questions affect decisions of policy makers and in the remaining section on the science behind the pandemic we shall consider the three questions which are the most discussed if not the best understood or researched.

Let us begin with the often debated question of immunity, especially the so called *herd immunity*. In order for a certain population to acquire immunity against the new germ there either has to be a significant number of people who have already had a disease and recovered or a large percentage of general population vaccinated. The second option is obviously preferable especially if the pathogen is causing severe symptoms in significant proportion of the cases. It is, however, important to emphasize that a large percentage of *general* population must be vaccinated – above at least 60 or 70 % in the case of SARS-CoV-2 (Heywood and Macintyre 2020) – and for the disease to be eradicated it will not suffice to merely vaccinate certain vulnerable groups and hope for the best in the case of everybody else. Eradication of a disease refers to reducing the number of cases of infection to zero worldwide whereas disease elimination only means no re-current community transmission in a country or a large geographical region.

It should have therefore come as a shock, as it indeed did for most of the scientific community but, alas, not for all the involved, what was attempted in early stages of the pandemic in Britain or Sweden. Both countries have in the meantime retracted those policies with much harm done, not only in terms of loss of lives, but also in terms of forging a rift between politics and science in an age which already has witnessed rise of pseudo-science from flat-earthers to climate-change-deniers. The long term reverberations of such policies not really informed by science or sometimes in stark opposition to the accepted scientific truth can be devastating for achieving greater degree of cohesion

or solidarity in a society as well as for protecting the society, especially the most vulnerable. Most disturbingly, certain politicians tried to twist the meaning of scientific terms as in the example of herd immunity which could, according to those politicians, be acquired just by letting the virus into the population, but which has no scientific foundation whatever (Heywood and Macintyre 2020), and which is actually acquired only after a significant percentage of general population is vaccinated. A worthy initiative (The John Snow Memorandum) has been taken on by concerned scientists, doctors and health care professionals to warn against the risks of not having ready and readily communicated scientifically informed anti-pandemic policies especially given the past un-scientific or pseudo-scientific, or simply wrongheaded approaches by various governments or authorities. The memorandum was originally published in *The Lancet* (Alwan et al. 2020).

Given especially the problem of asymptomatic carriers and the fact that as with any pandemic, or epidemic, it is difficult to estimate the right number of infected or the right fatality rate, there was a lot of suspicion about the numbers reported and the appropriate testing and detection strategies in practically every country of the world. However troublesome the matters might have been and perhaps in certain respects still are (especially in underdeveloped countries where testing kits were not always available in required numbers), one could have from start assumed, regardless of who it might be, that the reported numbers are not correct and that they are presumably (much?) higher in all categories. This follows simply from the basic knowledge of statistics and if one was following the evening news on any network, one would notice various problems reported almost on daily basis. At first, problems with developing and acquiring the testing kits; further, with achieving the consensus on how many people and on which principle should be tested or how to regiment the actual testing process given different and often conflicting interests (say, for reasons of privacy), or problems with estimating the total numbers from the reported ones. But all too often we heard from many sides, either the corona-virus-sceptics or the politicians if it suited their, usually short term, agendas, how the numbers are not so alarming or perhaps are inflated. Finally, the problem can be said to be resolved after the study which used reliable statistical methods was published last summer (Böhning et al. 2020) which proves that the numbers are indeed higher in all the countries for which they were analysed (and presumably for all the countries in general) and by a factor of 2.3.

The most hotly debated topic, of course, from the moment first hopes were raised in the possibility of obtaining it, was the vaccine. The world needed the vaccine as soon as the true nature of the disease and the potential of the virus to spread was appreciated, but the process of making and testing vaccines is multistage and usually takes years if not decades. However, given the severity of the coming crisis national or pan-national health authorities enabled the so called *emergency use authorization (EUA)* which allows the vaccine to be approved for restricted use even before the third or fourth stage of testing is completed. Now, once the vaccine is approved under EUA, the manufacturer would be under pressure due to ethical considerations to report this to the trial participants of, both, the group which received the vaccine as well as the group which received placebo,

which might make some of the participants from the reference group decide to move to the vaccinated group. The justified fear the health authorities, as well as companies and experts, expressed was that this will jeopardize the whole process of testing as the statistics will be compromised especially in judging the long term effects such as safety, the duration of the immunization and whether the vaccine protects against the infection or just against the development of the disease (Cyranoski 2020). The question that now suggests itself is: whether this is safe enough a procedure and why is this not always communicated to the public who definitely has the right to know all the relevant details before receiving the vaccine or the new drug? One cannot put all the disputable details in the fine print and then be surprised when the anti-vaccinationists start rallying the public under their agenda. All the relevant data regarding a scientific research should always be communicated as well as the accompanying difficulties and ethical conundrums together with the possible scientific and well thought through ethical solutions. Only this way science will always win its campaigns. In the end, the statistics can be somewhat adapted to even accommodate for the crossing over of participants of vaccine trials (Cyranoski 2020, p. 19), but it should perhaps be noted that not equally convincingly for every type of vaccine.

At the moment (end of February 2021) there are 26 vaccines which are in phase three clinical trials and have been approved under emergency regime in one or more countries or are under contract for one of the international projects of vaccination, such as COVAX (Wouters 2021, p. 2). From the comprehensive table published in the same paper (p. 2) which contains entries on efficacies, temperatures of storage, whether the vaccine was approved by a major health authority or WHO etc., one can see that only a handful can be said to be sound candidates for achieving global vaccination targets, namely: the American Pfizer-BioNTech (with efficacy of 95 % when administered in two doses) and Moderna (with efficacy of 94 % when administered in two doses), the Chinese Sinopharm with Beijing Institute (with efficacy of 79 % when administered in two doses) and the Russian Gamaleya (with efficacy of 92 % when administered in two doses). Of interest, and perhaps affecting even the efficacy or relevant for developing the side effects, or for long term benefits, is the method of preparation of the vaccine. So far all the vaccines were prepared by using the microbial particle in an attenuated or dead form, but in the case of some of the above vaccines, only a part of the virus RNA molecule is used, and particularly in the case of the Pfizer-BioNTech vaccine a new and revolutionary technology was developed which is utilizing only a part of the mRNA molecule and so presumably poses minimal risk for human health. The pioneer behind this new approach to creation of vaccines and medicaments in general is the Hungarian-American biochemist Katalin Karikó whose is a heroic biography of a lifetime spent in dedication to her science. “I always wanted to help people, to try and get something into the clinic, that was the motivation for me, and I was always optimistic. But to help that many people, I never imagined that. It makes me very happy to know that I’ve played a part in this success story.”, Karikó exclaimed (Cox 2020).

**Concluding remarks: solidarity, responsibility and manipulation**

The ongoing pandemic is not leaving the whole world with just millions of dead or dying and who-knows-how-many suffering from long term effects from COVID-19, it is also affecting almost every other aspect of wellbeing and organization of society as was recently exposed with great clarity in a book, one of the first of its kind, by Christakis (2020). From the world of work which is changing from day to day, with many professions being affected, to online schooling, from the new travelling routines to new ways of socializing which would involve social distancing and mask wearing, from providing care for the chronically ill or elderly to protecting the front line workers such as doctors, nurses, medical staff in general or teachers. In all the above mentioned areas undergoing major transformations, as well as many more, there are multiple issues which could be debated, and many of these issues are appearing more and more in the media and even scientific journals (as can be seen from the references cited) as the pandemic persists relentlessly on its course. Here we will focus on just a few in which perhaps the notions of responsibility, solidarity and manipulation are most obviously in need of review especially as founded on sound scientific reasoning.

The problem of how to organize work under the conditions of a global pandemic is, alongside the matters related to public health, perhaps the most important, and yet in too many situations we have been witnessing neglect for the wellbeing of the workers, from factory workers who had to continue the manufacturing process in giant halls with too many people inside and not enough space in between to teachers and support staff in schools and universities who in many countries worked in presence and in some cases without basic protection such as masks for them or the students. We heard many a time the voice of protest throughout the Western world of the small business owners, or bars and restaurants owners that they will not survive if the restrictions to their establishments staying open last. But too few, it would appear from daily media coverage in almost any of the developed countries, seem to think that they should actually be demanding their right to work online, if that is a possibility, or to ask for additional emergency funding from the local or national government. The public is told the same narrative over again, that everybody needs to remain in work unless the contagion is already spread throughout a working community or unless their nature of work is such that it doesn't really matter whether they are working online or in person. To this is usually added that the country's GDP will otherwise fall too much causing the economic recovery to last longer and cost more. This rests on at least several tacit assumptions, none of which is actually warranted by any of the sciences. Namely, first, that there is only one way of performing a certain type of work and that this cannot change under any circumstances. Second, that it is still possible to do any type of work under the conditions of a global pandemic regardless of the cost in human health or lives. Third, that it is more profitable (at least to the employer) to pay (if that!) a certain number of days of sick leave per employee rather than properly protect all the employees which sometimes might mandate quarantine for all of them and work from home. That, fourth, in the case of products or services which are to be delivered within a certain time framework, the customers cannot display more patience than they would have otherwise shown,

under normal circumstances. Finally, that economic interests are confronted with the interests of public health and precede the latter in importance. The motivation behind all the above seems to be that short term profits of certain interest groups or, worse, individuals, come before the long term gains for the whole of society.

The quick responses to each of the above tenets would be: to first, performing any type of work can and is, moreover, expected to change under changed working conditions. After all, is not this what the much praised quality of flexibility at work place is all about? To second, it should be obvious and self-understood by all the involved that certain types of work might need to temporarily cease and while the work is disrupted or happening with lower capacity, the owners should be compensated from some emergency type of funding (such as the grants or loans given by the EU to the member states). In answer to third tenet, it should be realised by all the employers that the highly skilled or highly educated and competent work force is the one constant they could rely on and, therefore, they should take all the necessary measures to keep it in good condition and with the company. How many factories or companies, or small businesses will be facing loss of human capital during or in the wake of this pandemic? How many will be forced to expand their recruitment pool to include workers with not as reliable degree certificates or not so skilled as the original workers in whose training the owner already invested? And so will be faced with not only the losses in workforce, the money already invested, the money which will need to be invested into training of the newly recruited workers as well as the potential earnings if the product or service is not as expected or the production falls, all due to unskilled labour. To fourth it might be replied that it goes without saying that more patience as well as solidarity in general would be required in time of any crisis and there is no particular reason not to expect those from the public. Actually, not expecting so and not encouraging noble virtues will inevitably result in the opposite sentiments growing within the body of people. Finally, and as was already quoted in the Introduction, even the former head of the OECD, José Ángel Gurría, denounced the dilemma between health and economics as the false dilemma.

But there is yet another supposition which seems to be haunting many employers around the globe, which is that their employees will not be working equally productively if they work from their homes (for which there is no evidence at face value, rather it is more likely that by staying healthy, avoiding stressfull morning and evening rush hour etc., their productivity will increase). Unless by productivity is usually meant working longer hours and actually pretending to be more productive. This is an old theme, that just working longer hours will lead to an increase of productivity or at least will keep the people away from vices of idleness and so promote the building of a better society<sup>27</sup>. It was, first of all, shown not to be scientifically or, simply, rationally justified by an argument put forward by Russell (1935/2004, pp. 5-6) and then the whole of such ethic of work was denounced by him as follows:

<sup>27</sup> Recently Heyward made use of Russell's arguments against working longer hours in *New Statesman* (2020) in a similar way, but not focusing so much on the current situation caused by the pandemic.

“Modern technique has made it possible to diminish enormously the amount of labour required to secure the necessaries of life for everyone. This was made obvious during the war. At that time all the men in the armed forces, all the men and women engaged in the production of munitions, all the men and women engaged in spying, war propaganda, or Government offices connected with the war, were withdrawn from productive occupations. In spite of this, the general level of physical well-being among unskilled wage-earners on the side of the Allies was higher than before or since. The significance of this fact was concealed by finance: borrowing made it appear as if the future was nourishing the present. But that, of course, would have been impossible; a man cannot eat a loaf of bread that does not yet exist. The war showed conclusively that, by the scientific organisation of production, it is possible to keep modern populations in fair comfort on a small part of the working capacity of the modern world. If, at the end of the war, the scientific organisation, which had been created in order to liberate men for fighting and munition work, had been preserved, and the hours of work had been cut down to four, all would have been well. Instead of that the old chaos was restored, those whose work was demanded were made to work long hours, and the rest were left to starve as unemployed. Why? because work is a duty, and a man should not receive wages in proportion to what he has produced, but in proportion to his virtue as exemplified by his industry. This is the morality of the Slave State, applied in circumstances totally unlike those in which it arose. No wonder the result has been disastrous.”

And the results of applying such ethics of seeming virtues could be a much bigger disaster waiting to happen in the wake of the pandemic, after the industries world over will have been through the period of deflated production anyway, loss of capital as well as loss in human resources and no lessons learnt. In stead of fostering the spirit of solidarity throughout the societal hierarchy during the crisis and so coping better at all levels, both, during and after the pandemic – avoiding the sharp edge of the austerity blade – also paving the way for the future enterprises, thinking in particular about keeping the older workforce to educate the young as well as thinking of education and new ways of teaching and learning imposed on us all by the pandemic and using them to make ourselves better rather than allowing them to bring the worst out of us. One could always preach the all-important GDB rise in connection with unemployment rate and wages cuts etc., but one could, with not too much effort, try to appreciate Russell’s argument. First, that even in the darkest hour of humanity, the first (and later second) world war period, the populations on the side of the Allies enjoyed relative prosperity; further, that modern science does not seem to cease bringing about technological innovation which can be and was successfully used to combat food and other shortages, unemployment and hardship; next, that technology (inspired by science) can ultimately lead to improvement of lives of many (if not all) and not just a few privileged business owners, but in order for this radical change to happen there also needs to be political will and social cohesion to instigate it. In a nutshell, when the hardship comes upon us, one should learn to live on less and procure for as many as possible and be patient, for the good times are sure to return if a little solidarity is shown when most needed.

The profession whose practitioners have from the very beginning suffered most is, of course, medicine, and there is no end in sight to the pains and sorrows the doctors, nurses and medical staff will have to witness before the pandemic is finally behind us. Put aside their Hippocratic oath, the noble motivation or the undisputed bravery in the face of a global catastrophe, no one should be asked to work overnight for who-knows-how-many days, to be deprived from sleep, from seeing their family or from living a decent life. It is self-understood that all the medical staff have more responsibility in the face of a medical crisis and, indeed, will without saying have to endure more, face more difficult challenges and risk more. But we should, after having witnessed, if not always in person, but more through media coverage, all the horrors this pandemic brought with it, ask whether all that was asked from men and women dedicated to medicine by the politicians in the line with bravery or does some of it border on absurd and even criminal? Today, world over, the medically trained professionals are in high demand even in developed countries. Not going into the manifold reasons for this dire situation, we could ask ourselves, can we risk – under such conditions – losing one doctor or one nurse more than is absolutely unavoidable in the face of a new danger? Tens of thousands of doctors, nurses and medical technicians have already lost their lives, how many will still have to risk it all? The useful metaphor could be the one with chopping the large oak tree because of someone's will of the whim, not thinking how long does it take for another to grow and produce acorns or to give shade. How long does it take to train a doctor? How long to train an experienced nurse? These are the questions all should have been asking themselves from the very beginning, and one wonders how many among the politicians as well as the ordinary people did. It is highly commendable to read (Gallagher et al. 2020) how enthusiastically and in what numbers the young doctors and not yet graduated students of medicine volunteered to fight the pandemic, but the question remains, was the society promoting sacrifice on one side and profiteering on the other. Profiteering from other people's sweat and blood and other people's misery, all with a view of saving a dollar or two more by some business owner who went on lobbying the politician who was then reluctant to introduce proper anti-pandemic measures when and where needed as the world witnessed so many a time in the past year.

How many among the medical staff will experience long term effects detrimental to their health and the health and wellbeing of their families (Galbraith et al. 2020) in health systems which usually do not take this into account, especially if the problems are related to the mental wellbeing? Furthermore, can anyone with a sound mind claim that an overworked and underslept doctor or a nurse is a fully competent to do his or her duty as under normal conditions? Finally, does the society have the right – through the shortsighted decisions made by politicians – to put so much responsibility on just people from the medical profession? The ethical dilemmas medical staff was facing and is continuing to face in virtually every country of the world were many, sometimes quite intricate and too often unbearable (Robert et al. 2020). Ranging from decisions on family visits to the hospitalized patients, some of who would never see their families again, to – literally (as in the case of one of the most famous such battlegrounds of Bergamo in Italy) – deciding who lives and who dies, given the availability of the ICU units or the infamous respirators.



The issue with availability of the ICU units or respirators is an especially interesting one, but not only for the reason of saving lives, also for the ramifications – some of which potentially touching on the constitutional rights or the rule of law as such – which ensue from the issue. Take, for instance, the fact that in many countries it happened on several occasions or through prolonged periods of time (weeks if not months!) that all the ICU capacities were full nation-wide and so if another person is in desperate need of intensive care, there is a real danger that it will not be provided to him or her. Indeed, such cases were happening routinely<sup>28</sup>, especially in the early days of the pandemic, where it was left to the doctor in charge to flip a coin or appeal to higher power in order to decide which patient lives and which dies. But consider now the issue from the point of view of the patient being guaranteed the place in intensive care, not to mention a patient who was contributing to the healthcare system regularly from his or her salary throughout his or her working life, this right is surely guaranteed by the constitution of the state itself, not to mention the international laws and conventions. So it would appear that the situation brought about by the inept or insufficiently scientifically informed politicians, or simply politicians who did not have the best interests of their nation at heart, implied that the constitutional rights are not always guaranteed, even though the country is perfectly able to guarantee them by employing better organization and by enforcing the application of science into daily political decision making processes. Can anyone of sound mind and rational outlook deny there were gross oversights and mispractices happening in almost every country around the world when the people of those countries needed their leaders most? Is it not a time for a team of clever legal experts to evaluate all those mispractices and embark on preparing law suits with potentially massive compensation sums claimed?

With those worries and proposals we come to our final question, surely the most significant one, if not the first to answer: wherein the responsibility lies? Who is to be blamed, which groups or individuals? Unfortunately, and before we find out for sure that the virus was not manmade or spread as a result of a human error, the responsibility, generally speaking, is shared by virtually everybody. It would be easy to point a finger to this or that government or this or that political leader or party, even the lobbyists from the business sector are not to be blamed for all. No, the person next door is responsible too, responsible that the government of his or her country was allowed so many obviously avoidable mistakes which led to treating human lives as numbers; responsible for not having informed him- or herself on the latest scientific development concerning the new virus or the course of the pandemic; responsible for allowing the fake news to spread; responsible for underestimating the power of knowledge – the power of, simply, correct information promptly communicated. Responsible for having allowed oneself to be so easily manipulated: from the protests against obligatory mask wearing to anti-vaccination movements, to not holding your government responsible for delivering on the rights and freedoms guaranteed by the constitution or the international law. Unfortunately, all too often one can hear about thinking positively, staying grateful – counting your blessings – which

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28 Institute for Health Metrics and Evaluation from Seattle, Washington, is maintaining a website of all the requisite statistical data presented in easily accessible charts (*IHME* 2021).

would make sense if there was anything to stay positive about and if those were the real blessings and not pretexts to avoiding to confront the true nature of the latest enemy or the dire reality which we find ourselves living. In the times of pandemic of global proportions and consequences not seen for a long while even in the most developed countries, there is a darker side to practicing plain gratitude and positive outlook (both proven tools of modern day psychology) as was so sharply recognized in a recent article from *New Statesman* (26<sup>th</sup> January 2021). It may provide us with a period of a reasonable peace of mind, but it may also be a deterrent from political and true moral action, from insisting on truth to be communicated to all; from demanding basic human rights – including the rights to stay informed and stay alive – to be upheld and from demanding justice for all who deserve it.

Finally, we should not live under now an obviously false impression that somehow human lives are above all at least in reputable democracies (how then to justify half a million lives lost to COVID-19 just in the United States of America?!) and that the average citizen does not need to worry much when the catastrophe strikes, and therefore does not need to learn anything new, that might potentially save his or her life, so long as he lives with the belief that the government knows best. But, for what he or she knows, this belief might merely be a necessary illusion fostered by the government for ends different than those immediately thought of by an average voter. This was perhaps never emphasized with more conviction than in a passage from Chomsky (1989, Preface, p. 7-8):

“The issues that arise are rooted in the nature of Western industrial societies and have been debated since their origins. In capitalist democracies there is a certain tension with regard to the locus of power. In a democracy the people rule, in principle. But decision-making power over central areas of life resides in private hands, with large-scale effects throughout the social order. One way to resolve the tension would be to extend the democratic system to investment, the organization of work, and so on. That would constitute a major social revolution, which, in my view at least, would consummate the political revolutions of an earlier era and realize some of the libertarian principles on which they were partly based. [...] My personal feeling is that citizens of the democratic societies should undertake a course of intellectual self-defense to protect themselves from manipulation and control, and to lay the basis for more meaningful democracy.”

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## Kolika je cijena znanstvene nepismenosti u vrijeme globalne pandemije?

### Sažetak

*Rad prati razvoj i dalje prisutne pandemije kako je o njoj izvještavano u nekima od vodećih svjetskih medija kao i znanstvenih časopisa. Autor je pratio razne medije još od praktički početka pandemije u Europi i ovdje će pokušati vrednovati uloge i stvarnu praksu znanstvenika, političara i drugih aktera tijekom pandemije od njenih početaka u Kini krajem 2019. pa do potkraj veljače 2021. Ključna pitanja na koja je pokušano dati odgovore u ovom radu su: Zašto su se događaji koji su se zbili tijekom pandemije odigrali kako su se odigrali, uz toliko neodlučnih poteza političara (kao i, povremeno, nekih stručnjaka), uz toliko dezinformacija ili netočnih informacija i uz toliko propuštenih prilika za odlučnije poteze koji su ponekad mogli i spasiti živote? Koji je razlog pozadi produljenih razdoblja šutnje u komunikacijskom lancu? I koja je cijena nedovoljne upućenosti u znanost – njene činjenice, metode i načine komunikacije – u ovo vrijeme globalne pandemije? Osnovna je teza da je nedovoljno poznavanje znanosti – a ponekad, jednostavno, i znanstvena nepismenost – kako smo mogli vidjeti od onih na najvišim položajima vlasti pa do tzv. teoretičara zavjere, koštalo sve nas previše kako u izgubljenim ljudskim životima, tako i u nepredvidljivoj patnji koja tek slijedi. Odgovornost dijele gotovo svi akteri i ista se mora razmotriti, u nekim slučajevima i na sudovima pravde, ukoliko nam je naučiti sve vrijedne lekcije za budućnost javnog zdravstva, svjetskog gospodarstva i, doista, opstanka čovjeka.*

**Ključne riječi:** SARS-CoV-2 pandemija; znanstvena pismenost; komunikacija znanosti; odgovornost različitih aktera; medijske i političke manipulacije.



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