COMMENTARY ARTICLE

Precaution, Resilience, Faith, and COVID-19

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Abstract

The scene for the COVID-19 crisis was set in the decades that preceded it. These decades can be characterized by increased profusion of market thinking in the care sector and by continuous but largely ignored warnings. International bodies and national institutes repeatedly warned that a worldwide influenza pandemic was very likely in the medium term and the potential consequences would be catastrophic. In risk management theories, resilience has become accepted as a new way of dealing with risks. By "engineering-in" resilience, it is argued that it is logical to expect that a system will be better equipped to absorb, resist and bounce back from adverse events. More recently though some have viewed resilience as an alternative to relying on precautionary risk management and it has obtained a more ominous meaning, supporting the idea that such precautionary measures are unnecessary and unjustified, given the opportunity costs of committing money for events that may not happen. As a result, the risks of a pandemic were accepted, in spite of the "science", without any additional, specific, or noticeable precautions. But in a modern democracy "science" cannot prescribe political decisions. People are often inclined not to spend money on precaution, or prevention, and are more inclined to complain only after a risk has materialized in a disaster, or crisis. These are always value judgments at best and power broking at worst. Judgments are essentially subjective and the exercise of power is the ultimate political game. This may be hard to swallow for some in the "scientific" risk profession. The COVID 19 situation is moving fast. It changes even while we are writing this paper. Since our understanding of the coronavirus behavior, will determine to a certain extent any judgment on the way the risk is being dealt with, this paper reflects our current perception.

Keywords: pandemic; safety science; risk governance

1 Introduction

The corona situation is moving fast. It changes even while we are writing this paper. Since our understanding of the Corona Virus determines to a certain extent any judgment on the way the risk is being dealt with, this paper reflects our current perception[1].

In the early stages of the pandemic, data from China[2] indicated a death rate of about .5% to 1%. This means that ultimately 1% of the population could be expected to die as a result of being infected by the virus unless herd immunity is reached, or a vaccine is found, whatever comes first. On the basis of this early data, the probability of death is almost zero for people under 60, after which it rises sharply, which means that a significant part of the elderly population would be expected to be wiped out. There are two underlying assumptions to these inferences: (1) Anybody who is infected and survives is immune and (2) anybody who needs treatment can get it. The latter of the two assumptions is the one that has driven most reactions and measures taken, until now. The current estimate[3] is that the number of people needing treatment is roughly three times the number of people that die. This means that between 1% and 3% of the population will end up in hospital. If they cannot be treated, these people will also die, bringing the fraction of the population that will perish to around 2% to 4%, about four months later. Information on the actual numbers of infected, numbers needing hospitalization and numbers killed from the Netherlands, as per 17-05-2020[4] show that for each 1% of the population infected, approximately 1 in 10000 ends up dead and another 1 in 10000 ends up in hospital. Similar proportions follow from UK data. These outcomes seem to confirm the original estimates based on data from China.

The decision-makers were therefore confronted with two extreme options: letting the virus do its thing and accept a temporary huge increase in the number of people killed, with the associated pictures of the sick on hospital corridors and mass graves, or to try to dampen the effect and smear it out over time to, at least, not overwhelm the health care system, while incurring huge costs. This decision had to be made in a situation where the knowledge about the virus, how and how fast it was spreading was limited, and when protection equipment was running out, as were testing facilities. The only reference example available, was Wuhan, where the authorities had chosen to essentially lock the population inside their homes. In this paper, and in the context of the economies of western Europe, we discuss how thinking

about safety, precaution and resilience led to the situation as it occurred. We briefly discuss the cost benefit equation of the reactive measures, and draw some conclusions about the prospects of handling similar crises in the future.

2 The Risk Picture

The scene for the COVID-19 crisis was set in the decades that preceded it. These decades can be characterized by increased profusion of market thinking in the care sector and by continuous but largely ignored warnings that a crisis was imminent.

2.1 *Health care and market*

In the last decades there has been an almost universal tendency to move health care from the public to the private sector. The original idea was that having more "market" in health care would lead to more efficiency and therefore lower costs for the consumer. This move has had a number of effects that made health care systems more vulnerable to disturbances.

In the first place the result was that the sector became fragmented. Hospitals became enterprises of their own, which competed for clients – i.e. patients – with other hospitals. Other care facilities behaved the same way. Often to the horror of the variously qualified health care staff, the financial departments had significant influence on the level of cooperation and coordination within the system.

In the second place, the sector tried to reduce the costs of staff. Therefore, health care workers were "imported" from countries where incomes are lower. The pure fact that by this mechanism in health care, just as in many other industrial sectors, cheap labor was readily available, drove down the wages paid to the extent that in countries such as the United Kingdom, nursing was characterized by implication as unskilled labor[5]. Qualified nursing and other care staff became difficult to source among the local population. As the source countries became wealthier and staff could more easily find work in their own country, shortages of staff became an ever more serious problem. At the beginning of 2020 the UK had 100,000 vacancies in their National Health Service. In the Netherlands the care system had 38,000 vacancies[6]. These large numbers of vacancies are themselves cause for concern as precursors of further problems. The ageing of the population also causes a higher demand for care workers. Large staff shortages increase the workload of the remaining staff, making the work even less appealing. In the Netherlands a

significant number of new staff members leave after only two years of service, making recruiting, a work of Sisyphus.

In the third place, the sector also reduced the cost of supplies. It increasingly relied on "just in time" delivery of goods from the cheapest possible supplier. This reduced the volumes and hence the costs of storage and maintenance of stock. Since there always is only one supplier that is really the cheapest, the whole health system converged on sources of such suppliers, which for the most part happen to be located in China. Even if the names on the product suggest that the supplier is local, in many cases the whole product, or significant and essential parts, originate in China. This is very efficient as long as China can deliver. But if anything goes wrong in the long chain from the production location and the transport and delivery system, such as closing off areas and borders for reasons of quarantine, the delivery stops and stocks run out in a very short time.

In the fourth place, in further efforts to be economical, most countries reduced staff – i.e. staff positions; many positions were vacant – and assets reduced to the bare minimum without any spare capacity, just as industries have done. This means that any demand that goes significantly beyond the average demand, cannot be met without the procurement of additional assets. In the case of a pandemic, which hits the locus of production first and the rest of the world later, the additional assets cannot even be procured, because the supply chain is broken at the source.

In the case of a real emergency the above factors combine to make things even worse; because even when assets such as intensive care beds (IC-beds) can be procured, due to the many vacancies, there are not enough staff available for them to be to utilized. With specialized staff in particular, this problem cannot easily be solved, because training of existing staff in these specialized areas of work needs time. So, when this kind of staff is needed urgently, it becomes apparent that the work is not as low skilled as management and governments have previously assumed.

3 **The Warnings**

There have been abundant warnings about the imminence of a catastrophic pandemic.

3.1.1 ***Pandemics***

In their report "emerging systemic risks in the 21st century"[7] the OECD states that the potential consequences of a worldwide influenza pandemic, considered very likely

by epidemiologists in the medium to long term8, is likely to become more disastrous in regions where the elderly's share of the population is growing.

The national safety profile of the Netherlands 2016[9] ranks a pandemic as second in potential consequences, after a catastrophic flood, which, for the Netherlands, looks like a reasonable ranking as a catastrophic flood would kill about 50000 people almost instantaneously.

The profile report states: "The severe influenza pandemic scenario is characterized by both a relatively large impact and a relatively high probability. This high impact differs in some respects from that of the "physical disasters". For example, a pandemic (a global infectious disease crisis) is by definition an international disaster (threat from 'outside'), which can make combating and limiting the consequences more difficult. A serious pandemic is also characterized by many deaths and sick people, with the potential consequence of large-scale staff loss, which in turn can lead to economic damage, loss of vital infrastructure and the functioning of society".

The number of people estimated killed in this report[9] was estimated at 12000. Only four years after this report the COVID-19 pandemic and based early data this could lead to up to approximately 10000 people killed in the Netherlands by June 2020, be it under relatively extreme measures of social distancing and confinement. However, the report mitigates the warning by saying "The "Spanish flu" (1918-1919) is often labeled as a "worst case", with approximately 20,000 deaths in the Netherlands. However, this pandemic took place at a time when medical science, healthcare and resources to combat it were at a significantly lower level than today. The pandemics of 1957-1958 (Asian flu) and 1968-1969 (Hong Kong flu) caused fewer victims".

This statement came after the Swine-flu pandemic. The Swine-flu epidemic may have influenced the assessors, because the Netherlands spent 340[10] million euros on vaccines, which were never used, as this pandemic largely passed by the Netherlands.

The number of deaths caused by the Spanish Flu actually was much higher than the 20,000 estimate, as there were an additional 40,000 deaths listed as caused by pneumonia, a direct effect of the infection by the flu. The total of 60,000 deaths from a population of just over 6 million, amounts to a death rate of 1%.

3.2 ***Zoonosis***

There have also been abundant warnings about zoonosis, the transfer of illnesses from animals to humans.

The OECD[7] reports that in the years 1980 to 2000 approximately 30 new diseases have emerged, including HIV/AIDS, Ebola virus, Hepatitis C and the Hanta virus. Over the same period, tuberculosis, malaria and cholera have gained in virulence. Six infectious diseases – HIV/AIDS, tuberculosis, malaria, pneumonia, diarrheal infections, and measles – are responsible for around half of all premature deaths worldwide. As international movements of people and merchandise intensify, so too does the risk of disease. To compound these problems, many diseases are becoming more difficult to treat, not least due to the misuse of antimicrobial medications and lost opportunities to tackle infectious diseases on a major scale in poorer developing countries. With 1.6 billion people expected to be travelling abroad each year by 2020, a lethal disease, flu epidemic or drug-resistant "super bug" could pose a heightened risk of major proportions. Without adequate capabilities to identify, report and monitor such events, the prospects of controlling disease are indeed grim.

Since the report more zoonoses emerged, such as the swine-flu (2009) already mentioned, BSE (Bovine Spongiform Encephalopathy) and its connection to the Creutzfeldt-Jakob disease (1994) and Q-fever, a disease which has been known since 1935, but has led to at least 74 deaths in the Netherlands between 2007 and 2011.

3.2.1 ***Common cause failures***

Similarly risk experts have been warning about the risks of a single source of supply, regardless whether this is an enterprise, or a country. If such a single source of supply fails, the goods can no longer be obtained. There can be many causes. Industrial action by the transporters caused petrol shortages over all of France in 2016. Industrial action at a refinery in 2010 in France did the same. In 2013 in the Netherlands there was a shortage of baby-milk-powder because the whole production of the only factory, was bought by a non-Netherlands entity.

Also, experts have been warning against transferring production of critical goods completely to foreign nations, without retaining some production capacity at home. But low-cost production and cheap transportation has essentially made China the workshop of the world. The production of many medicines has been concentrated in

India. The risks are well known. Some twenty years ago many car manufacturers had to recall their cars because the automatic brake system did not work. As it turned out the procurement departments of many car producers went for the optimal price: i.e. the cheapest chip they could get. This happened to originate from a single factory and the chip was cheap because it did not work properly. A single source of supply became a single source of failure.[11]

3.3 *Risk analysis*

As described above there have be many signals that the health care system, as part of the global drive towards cost reduction and short term efficiency, had become vulnerable to large scale changes in demand. In countries such as the Netherlands and the United Kingdom, it was already difficult to manage a severe seasonal flu, such as the one in the Netherlands in the season 2017-2018, which resulted in 9400 excess deaths.

Risk analyses in various reports, also pointed to the increased risk of pandemics, due to the increasing density of population and the increasing travel, by which sections of the population are mixed and infectious pathogens can spread more easily. A pandemic was characterized as likely and the potential damage was characterized as catastrophic. In the next section we investigate why then, the COVID-19 pandemic seems to have taken most countries by surprise.

4 **Resilience and Precaution**

Resilience used to be a property of a system, or a society, without a particular connotation. In recent risk management theories, resilience itself has become a term for a way of dealing with hazards and risk. By “engineering-in” resilience, a system will be better equipped to absorb, resist and bounce back from adverse events. Resilience can be improved by spare capacity and additional strength. A stock of material that can quickly be deployed in case of an emergency, can be invaluable to keep a system functioning after a major upset. However just as spare wheels in cars are more and more replaced by tire repair sets, after which the remaining maximum speed and action-radius is reduced to “making it to the work-shop”, in many other areas full reserve capacity has been reduced. As was described in[12], resilience has obtained a more and more ominous meaning, which supports the idea that precautionary measures such as spare capacities in stocks are both unnecessary and unjustified, in view of the opportunity costs of committing money for events that may not happen. As the opinions as given in[13]

emphasize, preparing for low probability events is not worth the money, hence parsimony slowly replaces precaution.

As a result, the health care systems have relied on the army to supply additional medical staff in case of an emergency, against the background of the armies' reducing their medical capacity because under normal circumstances, they can bring patients to regular hospitals. Emergency hospitals can be built, but the materials have to be flown in and sometimes procured, which takes time. Personal protection equipment can be ordered on a 24-hour delivery system, but that assumes the production can follow the demand, even if it increases dramatically, airports are open and airplanes fly. Resilience of one system – say health care – more and more relies on the resilience of other systems, such as manufacturers of ventilators – to absorb a shock. A pandemic is such a case that triggers a common cause failure of all the systems involved. If nobody has stock, and everybody wants supplies immediately and the same pandemic has incapacitated the manufacturers and or the transporters, there is no resilience left. It can even be argued that the late actions of the EU in a demand driven market actually contributed to the scarcity, higher prices and opportunities for bogus companies and products.

A more precautionary approach can prove to make a large difference. The main difference between Germany and the rest of western Europe seems to be that Germany had stockpiles of items such as PPE and test kits and the other countries did not. Therefore, even at the peak of the pandemic, German hospitals could still help out their neighboring countries with IC beds.

The purely accidental fact that a factory in the Netherlands did not throw away old ventilators, but kept them in the cellar, made a difference. This stock could be reactivated in a matter of days rather than the month it took to expand the production of new ones.

As a result, the temptations posed by the idea of being able to absorb a crisis without other costs than the paperwork needed to make a plan, lured many countries into dependencies that proved to be as vulnerable as they were themselves and caused a massive common cause failure.

5 **Risk Governance**

The risks associated with dense populations, the close proximity of animals and people, the concentration of people in large cities and the changes in climate have been described since the early seventies[14]. Urbanization has been described as one of the major challenges for

this century[15]. A pandemic has been called imminent.

When the COVID-19 pandemic hit the world for real, the expectation of resilience proved to be due more to a faith in that "things will take care of themselves", rather than on analysis-based engineering of emergency response. Risk analysts and many others pointed out the risks and especially the potential negative consequences of a large-scale disruption, but it was decided that the risk was worth the cost. Does that mean that the risk governance system has not worked?

After the fact it seems obvious that governmental agencies and health institutions must be prepared for a broad spectrum of eventualities. In fact, many health professionals and risk scientists found that was obvious before the fact. 2019 saw industrial action of health professionals asking for increased budgets all over the EU. Nevertheless, politicians decided otherwise.

Whether the risk governance system has worked as intended, depends on whose intentions are meant. As illustrated by the above, massive vulnerabilities have been accepted by politicians and by the public at large, mostly for financial gain. This includes in France, where reduced money was spent on health care and care for the elderly, in order to maintain their level of state supplied benefits; and the Netherlands where the health care system was reduced to its bare bones. These actions were intentional and they were warned of the associated risks, which were by default, implicitly accepted. Similarly, decades of austerity had brought the UK National Health Service to the brink of collapse, which was illustrated by the problems during the 20019-2020 winter flu. The intentions of the decision makers apparently were different from the risk experts, who by some are called single minded professionals[16].

6 Crisis Management

When a disaster has struck, the time for risk analysis and risk management seems over. However, contrary to an industrial accident, or a flood, in an epidemic, or a pandemic, the consequences are continuously developing over time; and thus the way the crisis is managed, can have a significant influence on the consequences, making crisis management return essentially to real time risk management. The behavior of the COVID-19 virus was completely unknown initially; and still the mechanisms by which it spreads and the damage it does, are only slowly being revealed. What makes managing this crisis even more challenging, is that the time between infection, the appearance of

symptoms and the development of serious illness, may take several weeks. Therefore, the result of any counter measure taken, can only be observed after weeks. The decisions to close all restaurants and other public gatherings mid-March met with criticism, because the R0 factor, (which is a measure for the rate of spread and should be kept under 1, to prevent exponential spread of the disease), was already going down and approaching 1 when these measures were taken. The Dutch prime minister was probably inspired by the fact that a ship's captain can only see whether the ship went in a straight line by observing the wake behind the ship when he said: "we are driving while looking in the rearview mirror", meaning that the only remaining option is trial and error. This is nothing less than using the well-known tools of safety and risk science also known as Deming cycles, risk management cycles, or OODA loops, to support finding a path through this mess. Each measure taken, or lifted, has systemic consequences and/or consequences for life and death. Now that the measures are being slowly lifted, it may be possible to evaluate their effects. However, the measure which is the most discussed, is the minimum distance between people. That measure has not been lifted. On the other hand, the measure is increasingly ignored. Unfortunately, the effect will probably only be seen after months.

The fact is, that these measures came at an enormous financial cost. Currently for the Netherlands the costs are estimated to be 6% of the GDP; while for the UK it is estimated to be close to 12% of GDP, which raises the question whether better preparation would have been wiser: and again the lesson is, as Trevor Kletz put it many years ago: "If you think safety is expensive, try an accident". Several countries have now decided to establish production facilities for medical equipment and PPE in their own territory and to establish stock-piles which, in the future, will last for a few weeks.

Whether the costs were worth it, is also being increasingly discussed. A significant factor driving the discussion is that COVID-19 hits, almost exclusively, the older people. The – almost explicit – question raised is whether restricting the young and the economic damage is still proportionate to saving the lives of the old; which have substantially shorter remaining life expectancy than the young. A cautious calculation according to the methods practiced by the more hard-lined cost benefit analysts, which for both scientific and ethical reasons, we do not recommend,[17, 18] shows

that the benefits still outweigh the costs by a large margin (Appendix 1).

7 Discussion

The question that can be asked, is whether risk and safety science failed. This does not seem the case. The risks were identified and preventive measures, such as preventing the consumption of wild animals to avoid zoonosis were identified. Also, a likely probability was expressed, as in the next decade. The consequences were also characterized as catastrophic. As it is impossible to know the details of a future pathogen, this is the maximum that can be expected. Moreover, the COVID-19 outbreak proved the risk analysts right.

In the policy domain nothing significant seems to have been done to reduce this risk, or to be prepared for reducing the consequences. The risk was taken and the consequences materialized (the die was cast and the 6 came up). Risk handling includes making decisions about what is an acceptable risk. The potential consequences were known. It can be observed that, as usual, the risk is much less acceptable after the consequences have materialized, than before, but that is not a science issue any more: it is a well-known fact of life.

Decisions are not driven by reports of risk experts, whether single minded or not. They are much more driven by interests and by power. It is no surprise that in the third month of lock down, the young are raising the question about whether it would not be better, if society was not so risk averse. The young in this case do not run any significant risk and have an interest in opening up business, restaurants and beaches, while the risk lands largely on the old, who may pay for the release of the young with their life.

8 Conclusion

Whether the risk governance guidance given by science will be accepted by society and whether the world will learn lessons, remains to be seen[19]. It may well be, that in retrospect, the world will decide next time to let a virus have its way, have nature cull the old and the weak and the remaining population will be better off. Science cannot prescribe political decisions. People are often inclined not to spend money on precaution, or prevention, and inclined to complain after a risk materialized in a disaster or crisis[16]. These are always value judgments at best and power wielding at worst. Judgments are essentially subjective and power wielding is the ultimate political game[20].

The statement by Harry Otway, which for some in the risk profession may be hard to swallow, after 40 years of attempts to make sense of the relationship between risk, uncertainty and decisions sums it up[21]:

"And in this sense we, who claim to work in the area, should accept that we are dealing with a topic that in itself is no simpler, nor more complex than that of any other aspect of how people experience and model their worlds and then act on these representations. But it is a topic that is, nevertheless, essentially a political matter".

9 **Postscript**

The corona situation changes rapidly. It may well be that the status quo will have changed considerably by the time this paper reaches publication. However, this paper reflects on what has passed and sets out lessons to be learned from the first phase of this pandemic for the future, and as such can be expected to be more resilient.

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APPENDIX

In this appendix we calculate some key numbers to illustrate points made in the paper. The numbers are derived from statistics about deaths and hospitalizations in the Netherlands as per 13 June 2020[1]
At that moment in time there were 6057 death by COVID-19 confirmed by test. However, this number does not include people who died of COVID-19 in care-homes and in other locations because these people were not tested for corona pre- or post-mortem. The total number of people killed by corona can be derived using the "overkill", i.e. the number of people that have died in excess of the number expected in the time of the year from long term statistics. The number of people killed is estimated to be 9900[2]. The number of people hospitalized is known to be 11822.
These deaths are not equally distributed of the age groups. The death rate is higher among the elderly. For each age group there is a statistical number of life years lost with respect to the average expectation for the age group[3]. These data can be used to calculate the average number of years lost per COVID-19 death as in Table A1. These numbers depend on the demographics of a country and therefore only apply to the Netherlands

Table A1: Calculation of average life-years lost

age groups	distribution of death over the age groups (fractions)	life years lost for the age group	average life-years lost for one death
0	0.00000	82.0	0.000
10	0.00017	72.6	0.012
20	0.00050	62.7	0.031
30	0.00182	52.9	0.096
40	0.00463	43.1	0.199
50	0.02412	33.6	0.810
60	0.08145	24.5	1.995
70	0.26797	16.4	4.395
80	0.61936	9.3	5.760
Total	1		**13.3**

At this time it was estimated that 5.5% of the population was infected[4]. It is also assumed that any epidemic infection is halted when 60% of the population has been infected. Although there are doubts about whether or not people who have been infected, but never have symptoms, are indeed protected, we assume that this is the case. This means that the number of people that would be killed and the number of people that would need hospitalization, can be estimated, as in table A2.
As can be seen the number of patients needing hospitalization over and above the number of deaths, would be 129 thousand, if 60% of the population would be infected. Without any additional intervention measures this would occur in about 4 months.
In the period between March and June 2020, 11822 people were hospitalized. This was also the maximum number that could be treated, as the hospital system was stretched to the maximum possible. This means that of the people ill, it would only be possible to treat 12 thousand. The other 117 thousand would perish. This would amount to 1.6 Million life years lost.

If a value of a life year were set at 80,000 euro, a practice that we do not recommend[5, 6], but is used by the Dutch Health Council this additional cost of lives lost when no measures were taken would be 125 Billion Euro.
It is estimated that the Dutch economy will shrink by 7%, which amounts to 53 Billion Euro. This leads a positive effect of the measures, including the two and a half months lock down, of 72 Billion Euro.
It is argued that there will be additional collateral damage such as postponed treatment of regular cases, death resulting from decreased financial position of parts of the population and death caused by socio-psychological trauma. A possibly pessimistic estimate is given by Gupta[7], who calculates that the collateral damage of the measures including the lock down may amount to 400,000 life years. These would be worth 32 Billion, reducing the benefit to 40 Billion. Therefore, even then, the costs are less than the benefits.
It can also be argued that at this stage the pandemic is far from over so the costs could rise. Nevertheless,

Table A2: Estimation of death, hospitalized and costs without measures including lock down.

people killed:	9900	
percentage infected	6	
numbers killed at 60% infection	108000	
Years lost	1436313	
People in hospital	11822	
People ill at 60% infection	128967	
People that could not be treated	117145	
Years lost	1557937	
costs at 80,000 Euro/year	125	Billion Euro
GDP Netherlands	750	Billion Euro
Economic loss 7% GDP	53	Billion Euro
Economic profit lock down	72	Billion Euro

and contrary to the arguments by the same proponents of hardline cost benefit calculations, in which a human life is treated as just an economic commodity, the lock-down as practiced in the Netherlands does not seem a contra-economic policy.
Similar evaluations could be made for other countries such as the United Kingdom, leading to similar results, but currently for most countries the necessary data are not -yet- available.
As the situation is volatile, the estimates may evolve and so may the conclusions.

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