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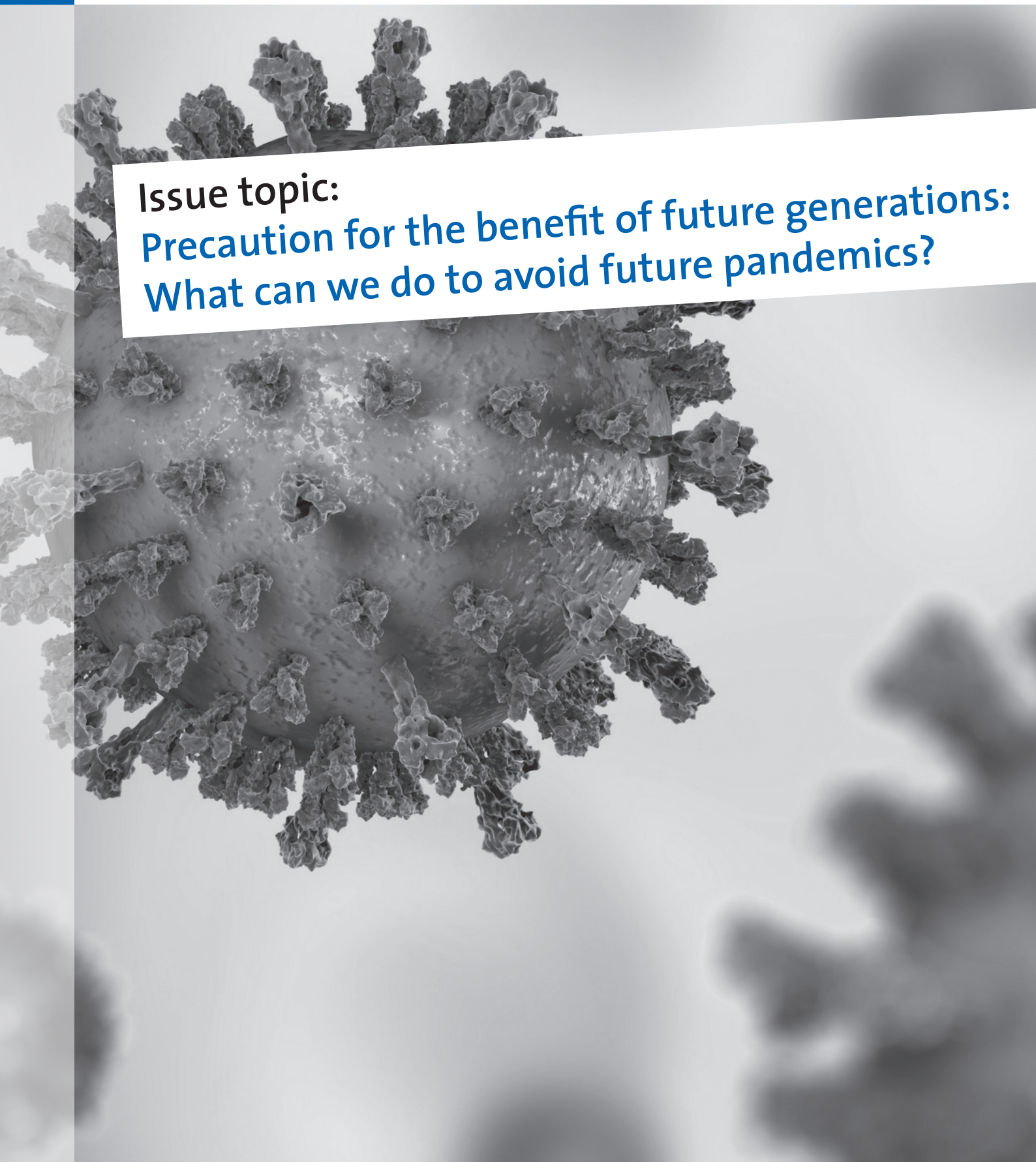

Issue topic:
Precaution for the benefit of future generations: What can we do to avoid future pandemics?

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Editors of the IGJR

The peer-reviewed journal Intergenerational Justice Review (IGJR) aims to improve our understanding of intergenerational justice and sustainable development through pure and applied research. The IGJR (ISSN 2190-6335) is an open-access journal that is published on a professional level with an extensive international readership. The editorial board comprises over 50 international experts from ten countries, representing eight disciplines.
Published contributions do not reflect the opinions of the Foundation for the Rights of Future Generations (FRFG) or the Intergenerational Foundation (IF).

Editorial

While the unprecedented lockdown measures were at the heart of the debate in the first year of the pandemic, the focus since then has shifted to vaccination issues. The reason, of course, is that vaccines and vaccinations have become available by now. All experts agree: If mankind had failed to develop vaccines against SARS-CoV-2, the death toll would have been much higher. This issue seeks to explore what could be described as a "generational approach to vaccinations". The question "What can we do to avoid future pandemics?" is related to different aspects of the failures and successes of humanity's vaccination strategy against SARS-CoV-2.

Pathogens are among the existential risks to humanity that could potentially kill a large part of it in a very short time. For all the tragedy and horror it has brought upon the world, the Corona virus has not been lethal on such a large, all-encompassing scale. But it could serve as a wake-up call for more and better prevention in the future, put differently: as a call to build a "preventive society". When people look back to the year 2022 from the year 2200, will they think of the absence of mandatory vaccination as a dangerous anachronism? And will the unequal global distribution of vaccines be seen as an unbearable vice of our epoch? And will "human infection studies" still be dismissed as unethical if a dangerous new virus boards human bodies? If intergenerational justice means improving the life chances and living conditions of future generations to the largest possible extent, then its link to (the avoidance) of infectious diseases is obvious. We should protect future generations from foreseeable damage if we have the power to do so. "We" is humankind in its entirety. Politically, humanity is divided into many single nations. But biologically, as members of the same species, we share the same vulnerability regardless of ethnicity.

The regular reader of this journal might wonder why this issue of IGJR has a different structure. An unprecedented pandemic calls for an unprecedented reaction and therefore IGJR 1/2021 and 2/2021 are special issues that deal with this disruptive event. We have invited several health experts, politicians and scholars alike to share their perspectives in short opinion pieces (instead of regular peer-reviewed articles). And we are exploring something new: the publication of a FRFG policy paper.

This policy paper starts off with a historical overview on how pandemics have afflicted humanity in the past. It separates moral from legal duties and formulates "epidemiological imperatives" – the way of thinking of a responsible and solidary individual facing the task of preventing an outbreak of epidemics in a community. With the discovery of vaccines, and their availability, the catalogue of duties is increased by one more: to get the jabs as an act of solidarity with others, including future generations. This would prevent states from being forced to take disease control measures that bring about drastic collateral damage. During the first two years of the Corona pandemic, states have imposed lockdowns. The closure of schools has put a special burden on the youngest members of society. This could have been prevented during the second and the further waves. The policy paper also calls for more government funding for prophylactic vaccine research and for the designation of vaccines as "global public goods".

The issue then moves on to a section dedicated to opinion papers by various different authors. The first paper, written by Agnes Binagwaho and Kedest Mathewos (both from University of Global Health Equity, Rwanda), focuses on the issue of health inequity, a concern which has gained more and more traction during the Covid-19 pandemic. The paper examines how vaccine distribution during the pandemic was mainly focused on the global north and how such actions might affect future generations' perception of what is just, fair and morally correct. The second paper, by Samantha Vanderslott (University of Oxford), focuses on the right and wrongdoings connected to pandemic preparedness and response. The third paper, authored by Rajeev Sadanandan (Health Systems Transformation Platform, India), talks about the lessons that can and should be drawn from child immunisations. The fourth paper, by Adriano Mannino (LMU and Parmenides Foundation, Munich), delves into the question how future generations will assess our actions and our response to the current pandemic. The fifth and final paper, written by Jörg Tremmel (FRFG and University Tübingen), is centered around the question whether human infection studies could have been implemented during the early stages of the pandemic to minimise deaths and severe infections.

The issue concludes with two reviews on recent books by Alberto Giubilini and Katie Wright. In his review of Giubilini's *The Ethics of Vaccination*, Marius Kunte notes that it contains a "thought-provoking plea" for individual, collective and institutional obligations to reach high vaccination rates. Judith Kausch-Zongo concludes her review of Wright's *Gender, Migration and the Intergenerational Transfer of Human Wellbeing* with a special emphasis on the book's empirical findings, and praises it in its entirety as "undoubtedly important". Both books serve as poignant reminders of how sustainable societies can only emerge once the challenges revolving around its most vulnerable members have been properly addressed.

Jörg Tremmel, Chief Editor
Markus Rutsche, Book Review Editor

Pandemics and intergenerational justice. Vaccination and the wellbeing of future societies. FRFG policy paper

by Jörg Tremmel

Summary
Has the world responded to the coronavirus pandemic in an intergenerationally just manner? Three aspects are relevant to intergenerational justice: the number of dead and ill (medical dimension), the economic downturn (economic dimension), and the additional national debt (financial dimension). The goal must be to protect future societies from the cumulative damage that pandemics may cause. Against this background, a new vaccination strategy for humanity – and this includes the individual national states – turns out to be the most important element. Such a strategy would help to ease the diseases we can ease and eradicate the diseases we can eradicate. Herd immunity should not only be the goal for the rich countries but for humanity as a whole. This is not only necessary for social and/or developmental reasons, but also serves the self-protection of the richer countries in an interconnected world.
We need more government funding for prophylactic vaccine research. This would lead to the typical development time of a vaccine – 10-12 years on average – being shortened. The rapid development of vaccines against SARS-CoV-2 shows that a reduction to 1-2 years is possible if the necessary resources are made available. The testing of vaccine candidates for each infectious disease, however, comes with the cost of at least in the high three-digit million euro range. Profit-oriented companies cannot reasonably be expected to produce vaccines in advance that may never be needed at their own expense. In the future, vaccines must therefore be treated as "global public goods", whose development and production are primarily the responsibility of states. The record amounts pledged by governments at the donor conferences for vaccines in 2020/2021 show the beginning of a paradigm shift.
However, this approach will come to nothing if the willingness of individuals to be vaccinated does not increase at the same time, as well. Here, every single member of the current generation has a duty of solidarity towards future generations. This should be made aware of and weighed against self-interest. Responsible epidemiological individual behavior includes regular (repeated) vaccinations for the purpose of prevention. This applies in the context of parental responsibility concerning to child vaccinations, but also for adults, e.g. in the context of an annual influenza vaccination. In doing so, thousands of deaths can be avoided, which for the most part have been tolerated by our society up until now. Two changes of the framework conditions are central to this:

- Vaccinations should be generally free of charge for the entire population.
- Vaccinations should be easily accessible, with only few exceptions. This means that vaccinations should be available not only from doctors but also from pharmacies.

1. Introduction

If intergenerational justice[1] means improving the life chances and living conditions of future generations as far as possible, then its link to epidemics is obvious.[2] After all, epidemics were – and still are, as we are now witnessing in the West – among the apocalyptic horsemen who bring death and suffering to the people (World Economic Forum 2017). We should protect future generations from foreseeable damage if we have the power to do so.
To make this case, we begin by laying out two examples – smallpox and influenza – that are meant to illustrate the significance of epidemics for the fate of mankind. This is followed by a proposal of a new, and broader understanding of the notion of "precaution" which does not only refer to the prevention of future disease or death but also takes into account the effect of the pandemic on other policy dimensions. The ensuing demands with regard to vaccination are addressed to the individual citizen, of whom a change in behaviour is required, and to politicians and lawmakers with regard to better vaccination policies in the future.

2. Pandemics have been a constant companion of mankind

The corona pandemic, which began in China at the end of 2019, has suddenly made people aware of an important aspect of their own existence: micro-organisms are the rulers of our planet with all its ecosystems (Earth Microbiome Project 2020). Microbes (algae, bacteria, parasites, fungi, prions, protists, viruses or viroids) make it into the newspapers especially when they harm us. But there are billions of microbes in every handful of potting soil. They are constantly around us, even inside us. As a biological species, as one species among others, we have had to learn in the course of our own evolutionary history to cope with pathogens well enough so as to not go extinct because of them. But they have always been a threat to our species. "Pathogens, including viruses, are relatively small organisms that eat their prey from within. Infectious diseases may often seem scary and threatening, but under normal conditions they are as natural as lions eating antelope (...)" (Quammen 2013: 8).
For microbes, bodies of animals – or even human bodies[3] – are simply a means to exist and reproduce themselves. To start, we will briefly describe two viruses (or virus families): one that has been completely defeated, and one that is very successful until the present.

2.1 The pox

Smallpox, which is caused by a virus, has been known for thousands of years. The mummy of Pharaoh Ramses V of Egypt shows distinct smallpox scars. Throughout history smallpox has killed hundreds of millions of people, more than any other disease and more than all wars of the 20th century put together (Tucker 2002: 3).

The increasing mobility of mankind has led to the worldwide spread of smallpox since the 15th and 16th centuries. In the 18th century, one in ten children died of smallpox. In 1967, 10-15 million people in 43 countries were still suffering from the disease, and 2 million died of it. Those who survived smallpox were usually disfigured for life by the so-called smallpox scars and one in ten survivors went partially or completely blind.

With the help of vaccinations, mankind has succeeded in eradicating this disease.[4] The world's last case of smallpox was documented in Merka in Somalia in 1977. Since hardly anyone has ever seen a living individual with the deep smallpox scars on their face, the disease, which plagued earlier generations to a degree that seems unimaginable today, has disappeared from public awareness.

2.2 The seasonal influenza

Influenza[5] is a disease that affects approximately 9% of the world's population every year, with up to 3 to 5 million severe cases (Clayville 2011). WHO Europe writes: "During the winter months, seasonal influenza can infect up to 20% of the population, depending on which viruses are circulating, and can cause substantial mortality. A recent study found that worldwide up to 650 000 people die of respiratory diseases linked to seasonal influenza each year, and up to 72 000 of these deaths occur in the WHO European Region."[6] Like the coronavirus (which is not itself an influenza virus), influenza viruses affect the respiratory system and can cause serious respiratory diseases.

Epidemiologists rely on estimated and model values to record the number of deaths directly or indirectly caused by influenza viruses (Buchholz et al. 2016: 523). These estimated values are subject to incomplete and low-quality surveillance. Unlike with SARS-CoV-2, there is no basic obligation to check if a respiratory disease was in fact caused by an influenza virus; and doctors often do not take the influenza diagnosis into account when issuing death certificates. Because of these statistical shortcomings, many experts calculate the deaths attributable to the influenza viruses by relating the monthly data of the Federal Statistical Office on the overall mortality of the population with the data of the influenza working group on the course of the flu epidemic (the so-called excess mortality). The number of deaths due to influenza is calculated as the difference that results when the number of deaths that would have occurred if there had been no influenza wave during that period is subtracted from the number of all deaths occurring during the influenza wave.

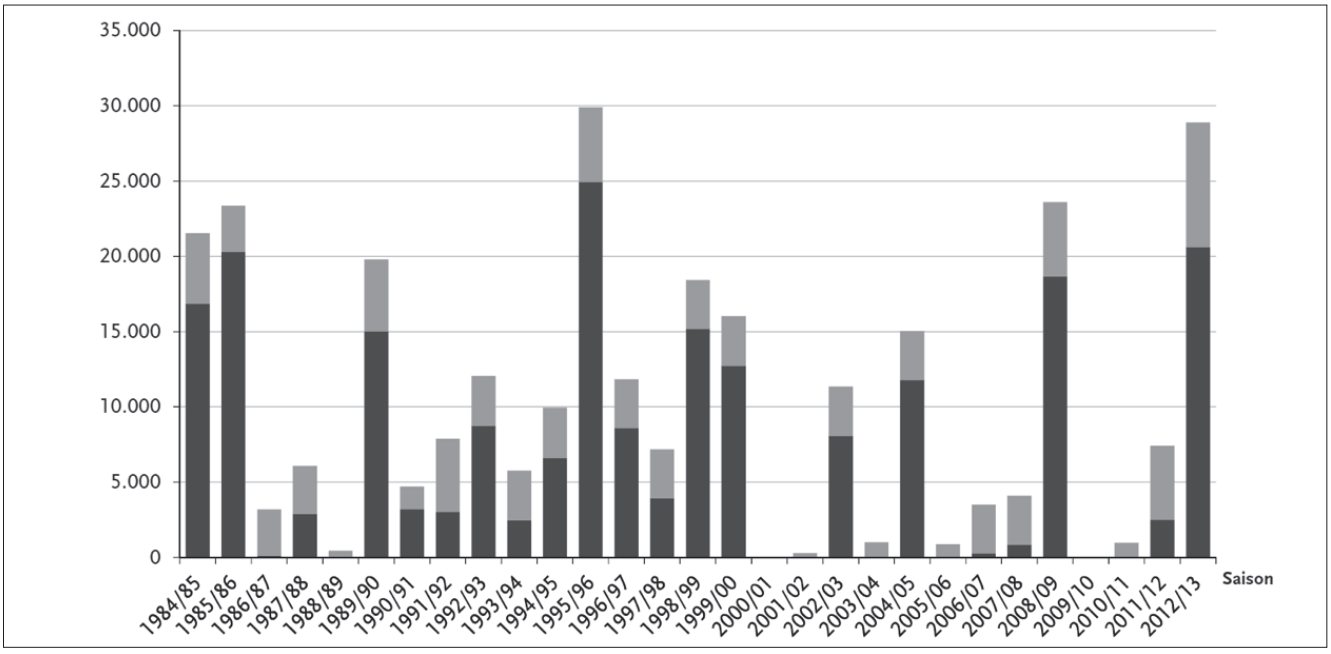
In Germany, for instance, the number of annual flu deaths fluctuates greatly, but has exceeded the 10,000 mark in around half of the years shown in Fig. 1. The highest number of deaths in the past 30 years occurred in 2017/18 – according to estimates by the Robert Koch Institute (2019: 47), this strong flu epidemic cost the lives of around 25,100 people in Germany more than one-quarter of all deaths attributed to COVID-19 until November 2021.

The most deadly variant of an influenza virus was the so-called "Spanish flu" (subtype A/H1N1), which killed around 50 million people worldwide, far more than the First World War (17 million) and around 2 percent of the world population (1.8 billion).

3. What did mankind do differently in 2020/2021 than with earlier pandemics?

It is mainly thanks to the compulsory childhood vaccinations and the spread of penicillin and other antibiotics since the Second World War that we in the West have been able to remove epidemics from the list of life risks we often think about. In Germany, 16.5 times more people now die from the consequences of non-communicable diseases than from infectious diseases (World Health Organization 2014: 175). However, the latter remain a serious threat to the lives and quality of life of the inhab-

Fig. 1: Deaths attributed to influenza in Germany



Source: Robert Koch Institute (2015): Epidemiological Bulletin, No. 3/2015, p. 18. The dark grey bars represent the number of excess deaths attributed to influenza in a conservative calculation, the light grey bar area indicates the probable additional number.

itants of the world's less developed countries. The most serious infectious diseases are tuberculosis (1.2 million deaths per year), AIDS (940,000 deaths per year) and malaria (445,000 deaths per year) (World Health Organization 2019a). Examples of emerging pathogens are the Machupo virus in Bolivia 1962-1964, Lassa in Nigeria (since 1969), Ebola in Zaire and Sudan 1976 and later in West Africa 2014, cholera in Haiti from 2010 and currently in Yemen, Zika 2015 in South America, the avian influenza viruses H5N1 and H7N9 in China/East Asia since 1997, the H1N1 swine flu[7] in Mexico and the US in 2009/2010, and finally SARS (now known as SARS-CoV-1) in Asia in 2002/2003 and MERS in the Middle East in 2012 as earlier variants of the coronavirus that now keeps the world on its toes.[8] In 2019, SARS-CoV-2, which causes the coronavirus disease (COVID-19), was first described. For the first time in decades, a pathogen that was about five to ten times more dangerous[9] than usual seasonal influenza viruses has caused a pandemic in the West, endangering the lives of large numbers of people there.[10]

But how did the response of mankind differ in 2020/2021 when compared to the reaction of our ancestors to earlier pandemics? Earlier generations did not have the knowledge, and therefore also not the words, to bring their precarious relationship with pathogens to the point, but they were much more affected by them than the people of the 21st century. Ironically, the chance that humanity will finally eradicate some of its worst microbial tormentors in the 21st century has not fallen but risen during the corona pandemic.

Until the corona pandemic struck the West, we believed we were invincible. If one had confronted a decision-maker in politics, economics or culture in 2018 with the fact that the global community had set itself the goal of eradicating various infectious diseases, one would have reaped at best a mere shrug of the shoulders. The coronavirus has reminded the Western world of the continuing danger of epidemics and has drawn attention to local and global health management. Never before has the West spent so much money for vaccine development, procurement and distribution. The breakthrough of mRNA vaccines could be a disruptive evolvement of vaccine technology that could have far-reaching consequences for the future. The pandemic has also led to a massive increase in epidemiological knowledge among the population. New hygiene regulations in schools have taught adolescents that microbes are a danger that they must be protected against. Vaccine stockpiling is becoming fashionable again. The risk of not using these prophylactically developed and purchased vaccines is now seen as much smaller than the risk of a lockdown. Podcasts by virologists are echoed throughout society; the opinions of national research institutions/academies of science trigger debates in the mass media. It is a shortcut to say that the corona pandemic has given "experts" more influence. In fact, it has given health experts more influence. There are also experts in the economic, cultural and educational sectors, and they usually speak on talk shows far more often than epidemiologists do. From spring 2020 on, however, epidemiologists and virologists are given more attention. As a result, large sections of the population who had never been interested in epidemiology before now have come to know measures such as "basic reproductive rate", "excess mortality" or "infectivity". We learned that the standard model of disease control states that in the first phase – identifying and extinguishing the source of the fire – infected people must be prevented from infecting others. If this fails, then containment must be achieved. Now one tries to prevent the fire, which no one could extinguish, from becoming too big. Measures include bans on large gatherings, border closures, curfews, general social distancing, and the closure of entertainment, educational and cultural facilities. This can go as far as reducing public life and economic activity to an absolute minimum.[11] Particularly if, as in the case of SARS-CoV-2, a virus can be passed on before the first symptoms of the disease have even appeared, it makes sense to proceed very vigorously at the beginning according to the "hammer and dance" principle (Pueyo 2020a) in order to flatten the first wave as much as possible ("flatten the curve"). Speed is of the utmost importance in disease control. Half of all corona deaths until summer 2020 in the UK could have been avoided if the lockdown had been introduced just one week earlier (Ferguson 2020). In 2021, millions of corona deaths could have been avoided if herd immunity is achieved through vaccination by summer instead of autumn on a worldwide scale.

With regard to the specific virus SARS-CoV-2, the high infectivity was already known shortly after the outbreak in China, but the pathogenicity or lethality was unclear. In such a scenario, it was right to follow the standard model of disease control. Particularly between the first wave and the second wave of infections, when the first shock had faded in summer 2020, ill-conceived slogans such as "hygienism" and "health dictatorship" made the rounds. This polemic was to be expected, as were the far worse conspiracy theories. But still, there are worlds between today and the past. When the plague broke out in Europe in the middle of the 14th century and doctors and authorities of the time had no explanation, the Jews were quickly blamed. They were alleged to have poisoned the wells and thus to have brought the disease into the world. This was followed by the worst pogroms against Jews until the Shoah (Kinet 2020). In many cities, entire Jewish communities were murdered – thousands of men, women and children. There were no comparable corona-related murders in 2020/2021. Unlike in earlier times, people did not follow intuitive thinking that does not recognise complex systemic causes and instead seeks to identify a person (or group of people) as the perpetrator.[12] Or at least less so than before.'[13] The historian Yuval Noah Harari points out another important difference between us today and earlier epochs: "When an epidemic broke out in pre-modern societies like medieval Europe, people naturally feared for their lives and were shocked by the death of their loved ones, but the cultural reaction was resignation. (...) People told themselves it was God's will – or perhaps divine retribution for the sins of mankind: 'God knows best. (...) Those who believe that human beings can overcome this epidemic through their ingenuity only add the sin of vanity to their other crimes. Who are we to thwart God's plans?'" (Harari 2020a).[14] With the scientific revolution, accompanied by a higher standard of education and living, our thinking changed. Whoever calls corona a judgment or a punishment of God is an outsider and today – unlike in the past – will find only a small audience. The increase in knowledge in both science and the wider public since the first quarter of 2020 has been enormous. Science temporarily switched to publishing on preprint servers to share and increase knowledge globally. The public followed (in astonishment) the "trial and error" principle that is the essence of science. Mankind as a whole was able to view the strategies of different countries on the based on, share best practices and estimate,

through simulations, how strongly certain measures would work (and what economic and social side effects they might have).[15] This was swarm intelligence in its purest form. Of course, the methods of data collection were still far from perfect in our present, but if the world's kings had been told 200 years ago that in their future all infections would one day be registered and centrally collected by a World Health Organization, they would have thought it a fairy tale. Never before has humanity's knowledge of epidemics progressed so rapidly, far beyond scientific circles, as with the SARS-CoV2 pandemic.

In sum, an unprecedented pandemic spurred an unprecedented reaction.

4. Vaccination and the standards of living of previous, present and future societies

4.1 The discovery that vaccination can protect against infectious diseases

It is worth remembering that more than any other measure, the development of vaccination methods has helped mankind to escape a number of previously terribly raging infectious diseases. The English physician Edward Jenner had observed that people who had been infected by cowpox could no longer be infected with human-pathogenic (i.e. harmful to humans) pox. Jenner first tested this method in England in 1796 and his scientific publications were published in 1798.[16] The discovery that infections with less dangerous variants of the virus make people immune to the disease led to mass vaccinations in many European countries in the following years and ultimately – 183 years later – to the eradication of smallpox. Jonathan Tucker (2002) sums it up: "The discovery of vaccination marked a turning point in medical history and a fundamental change in humanity's relationship to disease. For the first time, it was possible to take a harmless measure to prevent a deadly infection before it occurred."

As mentioned, smallpox has raged worse than any other infectious disease in human history (Williams 2010), measured by the number of deaths (and disfigured survivors). In theory, people could have effectively protected themselves from the scourge of smallpox much earlier than they did, because cowpox was known and the necessary equipment existed. Many earlier generations could have been spared endless suffering if smallpox had been eradicated earlier than it de facto was. The vaccination procedure is so easy to administer that people could have done it for thousands of years, but the method was only just discovered in the Age of the Enlightenment. It was also crucial that at that time the anti-Enlightenment forces were successfully pushed back. We often take the medical knowledge level of the present for granted, thereby forgetting how difficult it was to overcome false theories. "Every child in the developed world knows that germs cause disease (…) We also know that diseases such as measles, chickenpox and smallpox are infections (…). This understanding has only crystallised during the last hundred years or so. The main opponents were believers in 'miasma theory' (…). Miasmatists were powerful in medicine and society and their stand-off against 'germ theorists' led by Louis Pasteur and the German Robert Koch was bitter and lasted for decades" (Williams 2010: 7).[17]

But gradually, evidence-based approaches became more and more common. In 1966, the World Health Organization (WHO) decided (by a wafer-thin majority of only 2 votes) to launch a 10-year campaign to eradicate smallpox with a budget of $2.4 million. A global campaign to eradicate smallpox was launched – and for the first time, a worldwide compulsory vaccination was introduced, with the well-known result that for the first and so far only time mankind succeeded in getting rid of an infectious disease. As vaccination rates in Europe were sufficient to prevent pandemics, the blessings of Jenner's discovery soon no longer played a role in the public perception of Western societies. Since this milestone in the history of vaccination is no longer in the public awareness, however, only one side of the risk-benefit balance was looked at in the last 30 years: the risks. The formula "In vaccination decisions, the benefits must clearly outweigh the risks" was replaced by "In vaccination decisions, we don't accept any risks at all".

Today, we realise that only mass immunisation against SARS-CoV-2 will restore the life we once led (Gates 2020). We need to regain awareness of where humanity would be today without the discovery of vaccinations and that a lack of commitment in this area threatens the well-being of future generations. But before we can draw any specific conclusions from this change in awareness, let us first say a few words about what humanity can do about infectious diseases.

4.2 Which diseases can be eradicated by vaccination and which not

From an ethical point of view, we would be doing future generations a great service by preparing for coming pandemics. But this implies ability. We humans will never be able to eliminate all pathogens because we can only eliminate those microbes that only occur in humans, i.e. not in wild animals (Wildermuth 2020). Since about 60 percent of viruses alone are also found in animals, and two-thirds of these live in wild animals (Shah 2020), we cannot completely identify the virus carriers and then vaccinate them.

Certain microbes have been circulating in all animal organisms for millions of years without causing any damage. For example, around 3,200 coronaviruses live in bats (Shah 2017). Their immune system is adapted to this. Our human immune system is not. Zoonosis is the technical term for the process when a pathogen passes from an animal to a human being and establishes itself there (i.e. is not immediately eliminated by the human immune system).[18] To infect a new host, a virus must overcome several barriers: (a) it must be able to physically enter the cells of the new host and (b) it must bypass the host's immune system to the extent that cell infection and replication is possible. Since a virus cannot adapt in a targeted manner, the new characteristics that the virus needs are created by random changes in its genome (Thal 2020).

All influenza virus types, all coronavirus types, the pathogens causing AIDS, Ebola, hepatitis E and most other infectious diseases are viral zoonoses. Bacterial zoonoses, on the other hand, are, for example, the causative agents of plague, borreliosis, anthrax or tuberculosis. According to the *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services* (IPBES), infectious diseases that are transmitted from infected animals to humans by vectors[19] such as mosquitoes, ticks or fleas cause hundreds of thousands of deaths worldwide every year (IPBES 2019: 22).

A further increase in zoonoses is expected in the future (Shah 2017; Renn / Kuhlmann 2020). The reasons for an increased spread of zoonotic agents stem from humans themselves. Changed conditions in food production (think of "mass animal farming") and nutrition

promote the spread of the pathogens (Alpers et al. 2004: 624). For example, the falling costs of long-distance travel have made business trips and holidays to remote (tropical) regions increasingly popular. If a highly infectious pathogen appears in a city in the world, one can be fairly certain that it will soon appear in all cities that are connected to this city by direct flights. Another source for zoonoses are wet markets in which animals that normally do not come together in nature are brought together by humans. At these markets, living animals are offered for sale, slaughtered on site and then sold in portions. It is striking that several pandemics have had their origin in wet markets in China. After the first SARS pandemic, experts warned that the large number of coronaviruses in bats together with the consumption of "exotic mammals in southern China is a time bomb" (Cheng et al. 2007: 683). The current corona crisis also began at such a wildlife market, the Wuhan South China Seafood Market. Apart from the fact that it is difficult to distinguish illegally hunted animals from those from legal farms, stacked cages with different species generally pose an excessively high risk of disease. In all countries where such wildlife markets exist, they should therefore be banned by the authorities as soon as possible.[20]

Of course, climatic conditions and the availability of cold storage also play a role, but much more could be done to eliminate these markets. Trade of wild animals, both legal and illegal, also contributes to the increase in zoonoses. The turnover of the illegal wildlife trade is estimated at 24 billion euros per year (Tröster 2020) and plays a major role, especially in Asia. In order to prevent the spread of microbes or pathogens from wild animals to humans in the future, trade in wild animals should be regulated much more strictly than at present in the interest of global health. The Western countries should generally prohibit the import of exotic animal species, even if they are not threatened with extinction. Exotic animals can be admired as part of eco-tourism, at the zoo or on television, but no one has to have them in one's living room. The desire to have exotic pets increases the likelihood of contact with infected animals and vectors.

Designating nature reserves would also be an effective contribution to disease control. As a result of population growth and intensive land use, humans are increasingly invading areas where other species have lived undisturbed until now. Habitat encroachment, biodiversity loss and ecosystem disruption make viruses from animals much more likely to spread to humans (Shield 2020).

5. Epidemiological imperatives – a different perspective on human rights and duties

Sonia Shah, a disease researcher, explains: "What makes it really frustrating to write about these diseases for so many years is that things never change enough afterwards" (Shah 2013). Mankind must act differently after the coronavirus. It must take precautions to ensure that epidemics are less likely to develop into pandemics in the future.

To do this, it is first of all necessary to learn the epidemiological perspective – the way of thinking of a responsible and solidary individual facing the task of preventing an outbreak of epidemics in a community. This view is at odds with our thinking as self-centred individuals, as whom we legitimately see ourselves first and foremost as bearers of rights (civil rights, liberties, etc.). However, with a contagious infectious disease, we ourselves can unintentionally become a deadly risk to our fellow human beings from one day to the next.

It is as if John or Jane Smith suddenly (unintentionally, of course) hold an arm chest with poisonous arrows in their hands, which fires at other people here and there without any action on their part. Based on this logic, one probably arrives at different conclusions than if one bases one's considerations exclusively on the premise of unrestricted personal liberty rights. If all individuals were to behave in solidarity and refrain from contact with pathogens that could infect their fellow human beings, with or without symptoms of their own, then state measures restricting freedom would be unnecessary. In accordance with Kant's Categorical Imperative, individuals can set up epidemic policy imperatives: this would include, for example, immediately informing the public health department if one detects symptoms of a readily transmissible infectious disease in oneself,[21] compiling a list of all contact persons and going into quarantine, or not giving false information on the forms in restaurants or cinemas etc..[22] However, the call for self-responsibility requires clear recommendations from public authorities. Recommendations are not binding regulations. The extent to which the state is entitled or obliged to take even harsh coercive measures to combat very dangerous pathogens is a difficult topic currently being debated (in governments, in courts, in the public). In any case, the most ethically unproblematic measure is prevention.

6. A more comprehensive understanding of prevention

During the lockdown the phrase could often be heard: "There is no glory in prevention!" The phrase served as a justification for drastic lockdowns. However, the concept of prevention has been interpreted rather one-sidedly by epidemiologists in connection with SARS-CoV-2. The notion of prevention must not only refer to the avoidance of illness or death, but must also take into account other policy dimensions. A balance sheet of how well or badly states have coped with the epidemic in terms of intergenerational justice must include collateral damage. If a state produces immense economic damage (including a shrinking of the wage bill) through a drastic lockdown and robs a substantial part of the population of its livelihood, it may have prevented pandemic-related illness or death, but it has not "taken precautions". The same is true for states that have gone into massive debt in order to avoid the other two losses – medical and economic. They unload the costs of avoiding health-related harm in the present on future generations, who will have to pay back these financial debts.

A (fictitious) world society that has taken preventive action in this comprehensive sense against SARS-CoV-2 would perform well in all three dimensions: the disease does not break out in the first place, so there is no economic slump and no increase in public debt to artificially buy short term economic growth. If we eradicate an infectious disease (or the pathogen that causes it), future generations will have to suffer neither death nor illness as a result of this pathogen, nor economic downturns due to a lockdown as needed in 2020/21 to avoid deaths or illnesses, nor the massive new debt needed in the following years to cushion the economic downturn. This is precisely how things have played out, up until now, with smallpox. Thanks to the actions of previous generations, today's generation of people has neither smallpox deaths nor collateral damage. This lack of collateral damage is not visible and therefore not conscious.

When the threat of SARS-CoV-2 was not yet well understood, the disease control measures imposed by many governments at the beginning of the pandemic were justifiable. The imposed lockdowns (including the suspension of civil rights, closures of busi-

nesses and schools) were effective but they brought about drastic collateral damage. The majority of the world's states are not democracies. Many governments have transposed the contact ban and the suspension of civil rights such as freedom of assembly and the right to demonstrate into laws of unlimited duration, thereby exacerbating authoritarian structures.

In democracies and non-democracies alike, the state-ordered closure of the economy is likely to have driven thousands of people, mainly the self-employed and small businesses, into economic ruin.[23] All pupils had to put up with deficits in comparison to face-to-face teaching due to months of homeschooling. The switch to digital teaching, which did not go well in many households, widened the gap between rich and poor pupils, as the digital infrastructure in the parental homes is often worse for the latter.

In almost every country of the world, supplementary budgets or economic stimulus packages were adopted in the first half of 2020 to cushion the economic slump. As a result, the national debt, in principle a burden shifted from today's to future generations, reached astronomical levels, especially in the USA, where presidential elections were due in November 2020. In the Eurozone, the hard-won debt rules were unceremoniously repealed. In Germany, the grand-coalition government repeatedly suspended the debt brake under Article 115 (2) of the German Constitution (Grundgesetz) in order to put together aid packages.

Before SARS-CoV-2, mankind was already aware of six other coronaviruses. The seventh human-pathogenic coronavirus will certainly not be the last. And it is almost certain that there will be new influenza viruses, including some that will be harmful for us. How can we avoid pandemics in the future without choking off the economy and accumulating a mountain of debt? This is where new vaccination strategies and imperatives come in. Both vaccine preparedness (i.e. the individual) and the availability of good and free vaccines (i.e. policy) play a role in this issue.

7. Vaccination strategies under the aspect of intergenerational justice

7.1 Informed vaccination ethics – some medical facts

Vaccination[24] aims to create immunity in a population in a preventive way (without people going through the disease) in order to bring epidemics to a halt and, ideally, to completely eliminate the diseases in the long term. Eliminated diseases or those that are kept in check do not cause illness, so no economic lockdown is necessary and consequently, no new debt is needed to reduce the economic damage by setting up stimulus packages. Once a virus has been eradicated, which has so far only been possible with the strains of the smallpox virus that are harmful to humans (Variola major and Variola minor), mankind can now save the costs for the corresponding vaccinations. The eradication of vaccine-preventable diseases would be a blessing for future generations – just as the eradication of smallpox by our predecessors is a blessing for us.

The WHO recommends a series of childhood vaccinations (e.g. polio, pneumococcal and hepatitis B). The actual vaccination calendar shows that the majority of the vaccinations are given to children aged around 2 months, i.e. children who do not have any

Tab. 4: WHO vaccination calendar

(updated September 2020)

Table 2: Summary of WHO Position Papers - Recommended Routine Immunizations for Children

Antigen		Age of 1st Dose	Doses in Primary Series	Interval Between Doses			Booster Dose	Considerations (see footnotes for details)
				1st to 2nd	2nd to 3rd	3rd to 4th		
Recommendations for all children								
BCG [1]		As soon as possible after birth	1					Birth dose and HIV; Universal vs selective vaccination; Co-administration; Vaccination of older age groups; Pregnancy
Hepatitis B [2]	**Option 1**	As soon as possible after birth (<24h)	3	4 weeks (min) with DTPCV1	4 weeks (min) with DTPCV2			Premature and low birth weight Co-administration and combination vaccine High risk groups
	Option 2	As soon as possible after birth (<24h)	4	4 weeks (min) with DTPCV1	4 weeks (min) with DTPCV2	4 weeks (min),with DTPCV3		
Polio [3]	**bOPV + IPV**	6 weeks (see footnote for birth dose)	4 (IPV dose to be given with bOPV dose from 14 weeks)	4 weeks (min) with DTPCV2	4 weeks (min) with DTPCV3			bOPV birth dose Transmission and importation risk criteria
	IPV / bOPV Sequential	8 weeks (IPV 1st)	1-2 IPV 2 bOPV	4-8 weeks	4-8 weeks	4-8 weeks		
	IPV	8 weeks	3	4-8 weeks	4-8 weeks		(see footnote)	IPV booster needed for early schedule (i.e. first dose given <8 weeks)
DTP-containing vaccine [4]		6 weeks (min)	3	4 weeks (min) - 8 weeks	4 weeks (min) - 8 weeks		3 Boosters 12-23 months (DTP-containing vaccine); 4-7 years (Td/DT containing vaccine), see footnotes; and 9-15 yrs (Td)	Delayed/ interrupted schedule Combination vaccine; Maternal immunization
***Haemophilus influenzae* type b** [5]	**Option 1**	6 weeks (min) 59 months (max)	3	4 weeks (min) with DTPCV2	4 weeks (min) with DTPCV3		(see footnote)	Single dose if >12 months of age Not recommended for children > 5 yrs Delayed/ interrupted schedule Co-administration and combination vaccine
	Option 2		2-3	8 weeks (min) if only 2 doses 4 weeks (min) if 3 doses	4 weeks (min) if 3 doses		At least 6 months (min) after last dose	
Pneumococcal (Conjugate) [6]	**Option 1 3p+0**	6 weeks (min)	3	4 weeks (min)	4 weeks			Schedule options Vaccine options HIV+ and preterm neonate booster
	Option 2 2p+1	6 weeks (min)	2	8 weeks (min)			9-18 months	
Rotavirus [7]		6 weeks (min) with DTP1	2 or 3 depending on product	4 weeks (min) with DTPCV2	For three dose series – 4 week (min) with DTPCV3			Vaccine Options Not recommended if >24 months old
Measles [8]		9 or 12 months (6 months min, see footnote)	2	4 weeks (min) (see footnote)				Combination vaccine; HIV early vaccination; Pregnancy
Rubella [9]		9 or 12 months with measles containing vaccine	1					Achieve and sustain 80% coverage Co-administration and combination vaccine; Pregnancy
HPV [10]		As soon as possible from 9 years of age (females only)	2	6 months (min 5 months)				Target 9-14 year old girls; Multi-age cohort vaccination; Pregnancy Older age ≥ 15 years 3 doses HIV and immunocompromised

Refer to http://www.who.int/immunization/documents/positionpapers/ for table & position paper updates.

This table summarizes the WHO vaccination recommendations for children.The ages/intervals cited are for the development of country specific schedules and are not for health workers.

National schedules should be based on local epidemiologic, programmatic, resource & policy considerations. While vaccines are universally recommended, some children may have contraindications to particular vaccines.

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Source: https://www.who.int/immunization/policy/Immunization_routine_table1.pdf

decision-making autonomy of their own. This is important, because vaccination ethics too often focuses on autonomous *adults* only.

Without this being a compulsory vaccination scheme in the strict sense, the circumstances are such that most parents have their children vaccinated in (paediatric) medical practices. This enables the WHO to set the targets as ambitious as needed, often aiming for at least 95 percent population immunity. The member states of the WHO have committed themselves to eliminating measles, polio and rubella, among others. While some countries achieve the high WHO vaccination rates, most others fail to do so. For poliomyelitis in particular, something needs to be done urgently: As part of its activities to eradicate poliomyelitis globally, the WHO was able to certify the European Region as polio-free in June 2002. The Member States of the WHO European Region have committed themselves to take measures to monitor the polio-free status achieved in their respective territories and to maintain it until a global eradication of polio is confirmed. To avoid the risk of further spread of an imported poliovirus, a vaccination rate of at least 95% is considered necessary by WHO, otherwise the disease could be reimported. But in the examined birth cohorts from 2008-2017, this rate was around 90% nationwide without any significant variation and is therefore too low to prevent the risk of further spread.

Delayed vaccination, be it against polio or something else, exposes young children to the risk of infection for an unnecessarily long time or, as in the case of HPV vaccination, can lead to the vaccination not reaching its full potential. In the case of rotavirus vaccination, untimely vaccination even carries an increased risk of vaccination complications. However, late or inadequate vaccination also unnecessarily increases the risk of the pathogen spreading and makes it more difficult to achieve national and international public health goals (RKI 2020: 23).

In vaccination ethics, and indeed in the entire public health debate, the principle of "population health maximisation" – which is obviously compatible with the health of future generations as well – is considered a core value (WHO 2008; Kompetenznetz Public Health COVID-19 2020). The morbidity and mortality caused by infectious diseases should be as low as possible. Vaccination strategies should be evaluated according to this principle. One of the main reasons why parents have their children vaccinated is to protect them – and thus indirectly to protect themselves. This is a self-interested motive. For (vaccination) ethicists it is more relevant that vaccinations contribute to the protection of others. According to Giubilini (2019: 1), the "choice whether to vaccinate oneself (…) is by its own nature an ethical choice: it requires individuals to act not only or even not primarily to promote their self-interest but also or even primarily to contribute to an important public good like herd immunity." Getting vaccinated is also a matter of protecting people who cannot be vaccinated, e.g. due to age-related ineffectiveness of vaccines, vaccine intolerances due to illness or immunosuppression (e.g. during chemotherapy). "For example, the measles, mumps and rubella (MMR) vaccine is also used to vaccinate against rubella, which is intended to protect the unborn child, not the person being vaccinated" (Schröder-Bäck/ Martakis 2019: 472).

But it should be noted that a vaccination is always a challenge for one's own immune system and an itchy prick, a headache or a one-day mild fever is an expected reaction. In fact, these reactions of the body are desired because they show that the immune system is boosted. In that sense, it is impossible by principle that vaccines are "absolutely safe" (as is sometimes demanded by journalists or the public).[25] What one does not want to see are life-threatening effects directly after the jab (such as anaphylatic shocks) or unusual effects in the weeks or months after. The following case study gives an example of an unexpected side effect.

Case study: AstraZeneca and the blood clots

COVID-19 Vaccine AZD1222 is a vector vaccine developed by the University of Oxford and the British-Swedish company AstraZeneca. It is made up of a virus of the adenovirus family that has been modified to contain the gene for making a protein from SARS-CoV-2. By mid-March 2021, more than 7 mio. doses in the EU (11 mio. in the UK) had been administered. On 15 March 2021, the majority of EU countries, including France and Germany, temporarily paused vaccination when a total of 18 cases of a rare blood clot in brain vessels were counted in several EU countries. Vaccination resumed after EMA issued a statement three days later that

- the benefits of the vaccine in combating the still widespread threat of COVID-19 (which itself results in clotting problems and may be fatal) continue to outweigh the risk of side effects;
- however, the vaccine may be associated with very rare cases of blood clots associated with thrombocytopenia, i.e. low levels of blood platelets (elements in the blood that help it to clot) with or without bleeding, including rare cases of clots in the vessels draining blood from the brain.

Blood clots in the brain are certainly an unwanted side effect. For the ethical analysis, let us assume that there would be a causal link (and not just a correlation) between the AstraZeneca jabs and these blood clots, then the risk would be 1:1.000.000 (as 18 such effects happened when 18 million people were vaccinated in the EU and the UK). If 160.000 people were not vaccinated against Covid-19 between mid-March and end-March 2021, statistically between 750 and 1,500 would die.[26] Those blood clots were not rare, they were not very rare, they were super-rare. Apart from that, some people, e.g. young women, are more exposed to the risk of blood clots than others. The personal benefit-cost analysis would thus have to weigh my risk of such a thromboembolic event against the risk of getting the disease COVID-19, with its associated risk of hospitalisation and death. All reactions of the immune systems to the jab ("side effects") – wanted and unwanted – are to a certain extent different for each human organism and therefore there is always a *personal* risk-benefit balance.

7.2 Vaccination ethics with regard to children

As mentioned, most vaccination decisions (unlike in the case study above) relate to children.

With regard to children, the argument of parental will is added, i.e. the right to make the final decision on whether one's own children will or will not be vaccinated. But this parental right is a "serving right" – it must serve the welfare of the child. This is generally the case with vaccinations because they are especially beneficial for children. With regard to many viruses, children's immune systems have no experience with them and therefore no (partial) immunity, which could lead to easier disease progression. That childhood vaccinations serve to protect children is perhaps best illustrated by the example of smallpox, which for centuries

killed and disfigured children (more than any other age group).
It is therefore possible to draw the interim conclusion that there is a moral parental obligation to have one's children vaccinated.[27] Since child welfare in particular and herd immunity in general are important public goods, ethical questions arise also at the level of state action with regard to the obligations to implement vaccination policies, if necessary coercive ones (Giubilini 2019: 1). This leads on to the controversially discussed state duty to vaccinate children. It goes beyond a strategy limited to appeals, but must also be distinguished from compulsory vaccination (see the scale of the *Nuffield Council on Bioethics*, with which the intensity of state vaccination strategies can be depicted).[28] The step from the postulation of a moral duty to the positivisation of this duty in a legislative or regulatory text seems logical. Fines for parents who neglect their moral duties towards their children are sensible consequences. Moreover, unvaccinated children cannot be admitted to schools or to day care centres for reasons of third-party protection.[29]

7.3 Arguments by vaccination deniers

As an argument against vaccination, vaccination opponents cite the naturalness of fatal diseases (Gamlund et al. 2020). However, this argument is based on a Darwinian world view and seems generally untenable for ethical reasons. Another argument is a general distrust in the health care system (European Commission 2018). It is difficult to argue against this because a deep-seated mistrust cannot be removed by arguments. While some mistrust arguments against vaccination do deserve ethical consideration, others do not as they are just "false facts". The WHO Guide Best *practice guidance. How to respond to vocal vaccine deniers in public* mentions for instance the "argument" that diseases preventable by vaccines are either eradicated or have proven harmless.[30]
The rich countries of the Global North, whose inhabitants suffer from infectious diseases much less frequently than inhabitants of the Global South, are usually much more suspicious of vaccines than the inhabitants of poorer countries. Due to the already mentioned fact that infectious diseases no longer play a major role in the life planning of people in the West, vaccines have also become "a victim of their own success" (IVaccinate 2019).
Then there is the judgement of vaccination opponents that they themselves (or their own children) could belong to the 5 % unvaccinated (because a herd immunity of 95 % instead of 100 % is sufficient). This behaviour is simply "free-riding" (cf. Marckmann 2008: 213; Kompetenznetz Public Health 2020: 4). This mentality is an egoistic lack of solidarity.
The introduction of further compulsory childhood vaccination measures should be accompanied by a strengthening of low-threshold measures (lower levels of the Nuffield scale). All vaccinations from the WHO vaccination calendar must be free of charge and easily accessible. This includes compulsory information sessions[31] at various levels (family doctor, school, association, etc.) as well as the creation of the necessary capacities for this. Creative educational measures should be developed so that the population can understand the benefit of their herd immunity for future generations. Through telephone calls and letters, the authorities could ensure that parents do not miss their children's refresher appointments.[32] However, the effects of appeals are always limited (lack of time by parents, procrastination, etc.), and an increase in vaccination rates would be uncertain. By contrast, almost all studies that compared vaccination rates in different countries before and after the introduction of compulsory vaccination have shown a clear increase in participation.[33] In France, parliament has increased the number of compulsory vaccinations from three to 11 in 2017. The immunisation rate for children born in 2018 has increased accordingly (Bruhl et al. 2019: 1). To enable studies and scientific research it is urgently necessary for all countries to keep an electronic vaccination register to identify the vaccinations carried out.
If an infectious disease is not eradicated worldwide, then it is not eradicated. In the words of WHO Director Tedros Ghebreyesus: „No one is safe until everyone is safe."[34] Therefore, young children all over the world (including the developed countries) should be vaccinated against tuberculosis. Around 2 million people die of this disease worldwide every year – no infectious disease claims more victims. The pathogens are becoming increasingly resistant to the antibiotics used so that in an interconnected world each country must contribute to ensuring that as many people as possible gain immunity. In this context, the medical phenomenon of "silent release" is particularly interesting. In immunology, this is understood to mean that a (human) organism becomes completely immune to the pathogens of an infectious disease after vaccination or infection, as is the case with the oral tuberculosis vaccine. There are also indications that live vaccines against tuberculosis, but also against polio and measles, provide a non-specific antiviral effect against SARS-CoV-2 (Chumakov et al. 2020; Benn et al. 2013; Cumakov et al. 1992). In other words: Those who were vaccinated with live vaccines as children have a lower risk of contracting COVID-19 today.

7.4 Further vaccination ethical arguments

Might these considerations also lead to an obligation to vaccinate adults? This is where the argument of autonomy comes in. "Various preventive measures, such as compulsory seat belts for drivers or smoking bans in public buildings, restrict the freedom of action of citizens under state sanctions. Are these interventions in the autonomy of the individual ethically justifiable?" asks Marckmann (2008: 2010). Well, general considerations of negative freedom (rights of defence against the state) speak against state sanctions for vaccination refusers who have reached the age of majority. Adults should not be vaccinated forcibly against their declared will.[35] However, the opponents of mandatory vaccination for *adults*, for instance against SARS-CoV-2, often rely on dubious arguments. Their argument is that people want to decide for themselves which risks they want to protect themselves against and how. In our liberal society, it should remain permissible to endanger oneself. Anyone who likes off-piste skiing or other high-risk sports should not be prevented from doing so by others. In the context of epidemics, however, it is also a question of external danger. The argument of one's own unrestricted freedom must take a back seat to the need to protect others – a prerequisite for others to be able to live freely. To stay in the picture: If a ski mountaineer constantly triggers avalanches that endanger other people, then one may (and should) prevent him from doing so. If a vaccination opponent voluntarily stays away from all fellow human beings, his refusal to be vaccinated can still be justified by reference to his autonomy, but as soon as this unvaccinated person makes contact with others, he accepts their harm. While children cannot become permanently self-isolated in everyday life (they

must go to school, as not going would lead to serious damage as a result), this self-selected self-isolation does not seem completely impossible for adults. But the community can take measures to ensure that unvaccinated people really do not endanger the health of others: a lockdown for vaccination refusers is justified if vaccines are readily available.

Ultimately, the question of the right vaccination strategy can only be discussed in context, i.e. in relation to a specific infectious disease or its pathogen. For instance, vaccines against influenza do not have any dangerous rare side effects, not even with a probability of 1: 1 million. And many experts assume that the next major pandemic will be an influenza pandemic (Schlag/Wenz 2020). "No vaccination can save more lives in this country," said the Robert Koch Institute after the flu pandemic in Germany in 2017/18.[36] The vaccination rate for over sixty year olds was just 34.8% in 2017/2018.[37] The risk of dying of influenza is many times higher in this age group than the risk of dying in road traffic. Careless handling of influenza viruses should be a thing of the past after the current corona pandemic. However, the effectiveness of the influenza vaccines developed varies greatly from season to season because the pathogen mutates.[38] But the latter means nothing other than that the extremely dangerous influenza variant H1N1 (which was responsible for both the Spanish flu of 1918-19 and the swine flu of 2009) mentioned above can occur again at any time. Each of the new influenza vaccines that are launched each year have cross-protection (i.e. protection against virus types that are not included in the vaccine). It should not be forgotten that both influenza and coronaviruses affect the airways. Those who were vaccinated against the flu in autumn 2019 could feel safer in spring 2020 than if they had not been vaccinated against it. They could then get COVID-19, but not an additional respiratory infection. These interactions are also important for the future waves of the corona pandemic. A team of 37 scientists, led by Stephan Holgate, modelled the "second wave" for Great Britain in early July 2020 and determined that the maximum possible number of 120,000 additional deaths could be significantly reduced if there were more flu vaccinations (Mills 2020). The British Minister of Health, Matt Hancock, announced that the "largest flu vaccination programme in history" would be in place in winter 2020/2021. British opposition leader Keir Starmer has already called for free vaccinations for all over-50s in pharmacies to avoid a "perfect storm" (seasonal wave of flu with a pathogen of unknown aggressiveness and second wave of SARS-CoV-2) in autumn (Lintern 2020).[39]

If the current pandemic had been triggered by an influenza family virus instead of a corona family virus, we would have had a debate long ago on the extent to which we could create more background immunity in the future by increasing vaccination coverage, thus avoiding high rates of infection or death (and consequently a lock-down of companies and schools). For too long, the fight against influenza viruses has only been an issue for special working groups, which have received little attention from politicians and the media. The Spanish flu of 1918-19, the Asian flu of 1957-58, the Hong Kong flu of 1968 and the various avian and swine flu epidemics, mostly named after their host species, should prompt us to treat the annual flu vaccination differently than we have done in the past. The population should be informed every autumn on posters, radio and TV spots as soon as flu vaccination is possible in September. This vaccination should be available free of charge in pharmacies, which should significantly increase the willingness to be vaccinated. All successful vaccination campaigns in the history of medicine show: Vaccinations must come to people, not people to vaccinations. Shifting flu vaccinations to pharmacies or vaccination centres, in addition to doctors' offices, would make a significant contribution to increasing the flu immunity in the population to a sufficient level. While it is legal in many EU countries, the UK and the USA that pharmacists give jabs, Germany this has only been possible in a few pilot trials so far.[40] In Switzerland, people have been able to get vaccinated against influenza in pharmacies for five years now – the vaccination rate has risen by 15% as a result (Eger 2020). A high vaccination coverage rate throughout the population (especially the younger generation) can provide collective protection against influenza for the elderly, whose immune systems are weaker than those of younger people.

7.5 Being able to get vaccinated – prophylactic vaccine research and stockpiling

This leads to the demands on politicians – for a vaccination policy. Humanity has done too little to prevent epidemics, which is why we were very ill-prepared for "the next big one" among the pathogens, namely SARS-CoV-2 (Gates 2018). SARS-CoV-2 is – like SARS-CoV-1 and MERS – a beta coronavirus. Both SARS viruses belong to the same line and are therefore genetically very closely related. When SARS-CoV-1 broke out in Asia in 2002, some good vaccine candidates were developed, but hardly any of them made it into clinical trials (i.e. tests with human subjects) before the disease was contained by public health measures. After that, funding ceased and further research was no longer worthwhile for companies and universities. The fact that research on a vaccine against the SARS-CoV-1 virus was abandoned too early took its toll during the SARS-CoV-2 pandemic.[41] But we should be aware that the development of a vaccine costs a high triple-digit million amount, often one to two billion euros.

The history of vaccine development for Ebola is another case of premature interruption. Ebola was feared for a time by the Americans as a biological warfare agent, so a lot of money went into research and development of a vaccine. The genome of the pathogen has been sequenced at a rapid pace. But in the end, the outbreaks were limited to a few poor African states, with the result that the rich countries stopped funding too early (Berkley 2020; Hanrieder 2015). Thus, from 2014 to 2016 Ebola could ravage in West Africa and infect 28,600 people, of whom 11,300 died.[42] Even for influenza vaccines, for which there is actually an excellent production infrastructure, production capacity would be insufficient in the event of a dangerous variant. In the case of the H1N1 Influenza 2009 (swine flu), vaccine manufacturers quickly switched their production lines to produce a new vaccine to protect against a single pathogen (monovalent vaccine) instead of the seasonal vaccine. Nevertheless, the vaccine was not launched until six months later – much too late (Kekulé 2009).

7.6 Collateral benefits of the corona pandemic

The SARS-CoV-2 pandemic has led to an unprecedented effort by the global community to develop and distribute a vaccine against this virus in 2020. It led to a breakthrough of the mRNA technology – this is an important collateral benefit for vaccine research in general. These novel vaccines no longer contain at-

tenuated whole viruses, but instead, for example, the "blueprint" for a viral protein in the form of a messenger ribonucleic acid (messenger RNA or mRNA for short).[43] Some experts believe that even a universal vaccine against influenza is not an unattainable goal (Schlag/Wenz 2020), if more support were given to research into influenza vaccines in general.

The course of the development of vaccines against SARS-CoV-2 also showed that regulatory procedures could be accelerated by so-called rolling reviews, without compromising safety in an unduly way. Normally, all data on a medicine's effectiveness, safety and quality and all required documents must be submitted at the start of the evaluation in a formal application for marketing authorisation. In the case of a rolling review, regulatory bodies like the European Medicines Agency (EMA), the U.S. Food and Drug Administration (FDA) or the Medicines and Healthcare products Regulatory Agency (MHRA) of the UK review data as they become available from ongoing studies before a formal application is submitted. Once the agencies decide that sufficient data are available, the formal application can be submitted by the pharmaceutical company. By reviewing the data as soon as they become available, the regulatory agencies can reach their opinion sooner on whether or not the medicine or vaccine should be authorised. This application of the "just-in-time" processing of data shows that approval procedures lasting years (or even decades) are not (or were not) inevitably necessary to ensure adequate vaccine safety.

7.7 The global dimension

Before the corona pandemic, the following applied: "Global disease control suffers from a notorious shortage of resources, especially in view of weak health systems in developing countries, and is characterised by distribution conflicts between poor and rich countries" (Hanrieder 2015). In the face of the current global corona pandemic – and the prospect of more zoonoses in the future – we should recognise: The prevention strategy has a territorial dimension that goes beyond the national framework. We know with certainty that the next outbreak will come, we just do not know when and where. We must think globally today if we want to prevent local outbreaks (epidemics) from becoming global (pandemics) in the future (Harari 2020b/Harari 2020c). Vaccine production factories must be distributed worldwide. After all, if a laboratory in Oxford or Tübingen has produced a vaccine, it is not yet "in people". The latter can only happen quickly – and speed is of the utmost importance – if the vaccine can be produced in large quantities on all continents. This, however, may sound like a bigger challenge than it actually is. Till Koch, a physician and infection researcher, explains: "It makes sense to research exactly those viruses that also have the potential to spread globally in a pandemic. There are not many types of viruses that are capable of doing this. To spread globally so quickly, a virus must be able to trigger a respiratory disease. And there are not that many. Coronaviruses are some of them, influenza viruses and para-influenza viruses and certainly a few others – but it is not true that all families of viruses have the potential for a pandemic". As stated above, it is very likely that new pathogens will be created by zoonoses. Koch continues: "One would have to specifically examine animals for viruses, characterise these viruses and find those that are on the verge of spreading to humans. Vaccine candidates could then be developed against precisely these types of viruses, and tested for safety and tolerability in preclinical and phase 1 studies. It is then rather unlikely that these viruses will trigger the pandemic. But there is a high chance that the viruses that will actually trigger the pandemic are relatively close to those that have already been tested. In that case, only a few sequences might have to be exchanged, and one could then start the clinical trial right at the top. Moreover, it is quite possible that cross-protection exists, i.e. that an already existing stockpile of vaccine candidates can be used to contain an outbreak as early as possible" (Koch 2020).

The international community has the resources to a) eradicate those pathogens that are genetically stable and only occur in humans; and b) to locally limit outbreaks of all the others. But the international community needs the will to do so. The challenge for policy-makers is therefore to ensure that the capacity is created to develop and produce a vaccine in a few months *before* the next really dangerous pathogen breaks out. According to all experts, this is possible if budgets, and especially the WHO budget, are significantly increased. Today, we all are in the same boat, given the degree of our global connectedness. A pathogen does not care whether its prey has a light or dark skin colour.[44] Vaccines should therefore not only be defined as "public good" within Western countries (see above) but as "global public good". Through a global fund administered by the WHO, humanity should ensure that future generations are plagued by fewer scourges than humanity is today. In the case of global public goods, basic funding is provided by states. To immunise the entire world population against the most serious infectious diseases, it would take a total of tens of billions of dollars, as Seth Barkley, head of GAVI (an alliance for vaccines), points out (Berkley 2020). This is a fraction of the billions of dollars in losses the global economy is currently suffering.

There are some signs, luckily, that mankind has recognised the signs of the times. The record amounts of money that governments have pledged for vaccines at donor conferences during the corona pandemic show the beginning of a paradigm shift. Some years ago (2016), with the Global Virome Project, humanity recognised the need to identify the viruses (families) that could be extremely dangerous for humanity.[45] This project aims to determine the genetic codes of the viruses discovered and published them so that researchers can identify viruses and combinations of genes in viruses that are particularly relevant to humanity. A specific objective of the programme is to identify the genetic similarities of dangerous viruses. This has immediate benefits, as shown by the example of SARS-CoV-1 and SARS-CoV-2. What is new since 2020 is that state funding alliances are finally providing the funds to proactively develop vaccines. Before the corona pandemic, payments had fallen short of commitments. CEPI, an initiative of the World Economic Forum in Davos, had received only 5 % of the funds needed until the start of the corona pandemic (BBC 2020). Because the prophylactic development of vaccines is a loss-making business for companies (World Health Organization 2020b), significantly higher sums of state and private money for vaccines will be needed in the long term. In addition to prophylactic vaccine research ("approval sleeves") and improved approval procedures, the stockpiling of vaccines also plays an important role in prevention in the sense defined above. In any case, it is cheaper to destroy unnecessarily acquired vaccine reserves if they cannot be used by the expiry date than to subject the economy to a lockdown.

The first doses of reliable and health authority certified vaccines against SARS-CoV-2 were delivered in the EU at the turn of the years 2020/21. Once the vaccination campaign is working properly, our lives will return to normal. The danger is that once the current pandemic is over, the West may once again leave the rest of the world alone, instead of seeing the fight against infectious diseases – first SARS-CoV-2, then other ones – as a task for our generation as a whole, as our service to future generations. During a pandemic, states and companies commit themselves to do everything necessary to "defeat" the pathogen. But once the pandemic is over and the dead are buried, the survivors forget these promises. An important lesson from the smallpox eradication campaign is that really long breath is needed and that it is important to track even the last case of smallpox (in the case of smallpox, this was the Somali cook Ali Maow Maalin).

8. Conclusion

There are about known 1,500 pathogens that can make people ill. Many of them are genetically stable. Mankind could completely eradicate some of them, as we have done in the past with the smallpox virus. And it could establish immunity against other diseases through vaccination and thereby eliminate them. Terrible scourges of humanity like polio, measles, malaria, dracontiasis or typhoid could disappear from our planet. And we can ensure that infectious diseases do not become global pandemics on the scale of the lung disease COVID-19.

In the 20th century, mankind succeeded in eradicating smallpox in a targeted manner. What is our generation doing today, in the 21st century? If we want to eradicate the above mentioned diseases,[46] we must radically change our consciousness. Books about the milestones in the history of vaccination will then belong in every household,[47] and the epidemic policy goal of humanity will be part of every school curriculum. Not only our governments, every one of us can make an important contribution to this global human task.

Vaccination does not come without risks, but it is the only sustainable way to permanently remove many highly infectious pathogens from the list of problems that future generations will have to deal with. We, all people worldwide, should remember and celebrate December 9th every year. On this day in 1979, WHO experts had unanimously declared that smallpox had been eradicated.[48] If we all realize the significance of this day, if every child knows it by heart, then we will be in the right frame of mind to protect future generations from terrible epidemics.

The corona pandemic has been a wake-up call. If we look back from 2100 to 2020, our present time could be seen as the time in which humanity mentally got ready to eradicate some of the most deadly infectious diseases worldwide, following the successful model of the eradication of smallpox.

Notes

1 Here understood as intertemporal generational justice (justice between present and future generations), not as justice between young and old within the group of those living today.

2 According to Werner/von Lengerke (2003: 311), health policy is "intergenerationally just" if the chances of all succeeding generations to satisfy their own health needs are at least as great as those of the generations that preceded them.

3 Often the pathogens that are dangerous for humans are also dangerous for our closest relatives in the animal kingdom. The Ebola virus probably killed more gorillas than humans (Quammen 2013: ch. 21).

4 Except for some small residual stocks in high security laboratories.

5 For more details see Witte 2008; Spinney 2018; Lange 2020.

6 https://www.euro.who.int/en/health-topics/communicable-diseases/influenza/seasonal-influenza/burden-of-influenza.

7 Since the influenza virus of the so-called swine flu is the same subtype, A(H1N1), as the devastating Spanish flu, the disease authorities at the time understandably reacted with great concern.

8 The virus family of human-pathogenic coronaviruses comprises two subgroups: Alpha-Coronaviruses and Beta-Coronaviruses. Including SARS-CoV-2, there are a total of seven coronaviruses that have so far become established in humans. Four of them cause mild infections of the upper respiratory tract, which are usually mild and do not cause any problems. The remaining three coronaviruses, SARS Cov-1, MERS and SARS Cov-2, are significantly more harmful to humans (Ziebuhr 2016; Koch 2020).

9 Pathogens can be classified according to their "dangerousness" on the basis of various variables. The DOTS formula models the risk of a disease outbreak on the basis of four variables (time of infection, pathogen contact, number of social contacts, existing herd immunity), see Kucharski 2020. In a meta-study by Levin et al (2020), the infectious mortality of SARS-CoV-2 is given as just under 1%. This makes SARS-CoV-2 one of the very dangerous viruses. In a model study, a team of researchers from the UK calculated that people in Italy who died from COVID-19 had lost more than a decade of life years on average (Hanlon et al. 2020).

10 For many Asian countries, SARS 2002 was already the first disease of the 21st century to "shake the world" (World Health Organization 2006: VII). This is probably one reason why Taiwan, Singapore or South Korea reacted so successfully to SARS-CoV-2. "We have been preparing intensively for this since 2003," says Audrey Tang, Taiwan's Minister of Digital Affairs (Tang 2019). The West has had to learn some lessons, such as that wearing masks in public is an important contribution to disease control.

11 This is what the term "lockdown" has come to stand for. It should not be overlooked, however, that even in the EU, lockdowns differ considerably from country to country. Curfews are a much more drastic measure than contact restrictions, to name just one example.

12 The philosopher Philipp Hübl (2020) refers to this as bullshit resistance.

13 Even in 2020/2021 this thinking has not been eliminated, and unfortunately there are still too many conspiracy theorists for whom either Bill Gates, Angela Merkel, Donald Trump or the Chinese government deliberately brought the virus into the world.

14 A telling example of the view that a pandemic is god-sent is the sermon of the Jesuit priest Paneloux in The Plague by Albert Camus. In some African societies and in India, smallpox even had the honor of its own smallpox deities (cf. Tucker 2002). According to the believers, these gods and goddesses made the decision as to who was ill and who was not. During the worldwide vaccination campaign to eradicate smallpox, this became a cultural problem, as believers feared the wrath of these deities if they were vaccinated.

15 An estimate of how costly various individual disease control

measures are can be found in Thomas Pueyo's (2020b: chart 16) highly regarded article.

16 Jenner had several children, including his own son, undergo the procedure (Williams 2010: 190). His approach would no longer be compatible with current medical ethical standards.

17 The statutory smallpox vaccination had to be enforced often against the resistance of the church (in 1824, Pope Leo XII even banned the vaccination).

18 Zoonoses can be further subdivided into infectious diseases transmitted from animals to humans (zooanthroponoses), those transmitted from humans to animals (anthropozoonoses) and those that can be both (amphiexenoses).

19 In biology and medicine in general, a disease vector (from the Latin word for 'traveler') is a carrier of pathogens that cause infectious diseases without becoming ill itself.

20 In January, the Chinese authorities provisionally banned all wildlife markets.

21 Self-testing at home for the SARS-CoV-2 virus became available during winter 2020/2021 and provided a cheap and easily accessible way for everyone to find out whether one carried the virus. Immediately, a debate started if people are moral enough to behave responsibly towards others if their tests were positive.

22 It should be considered whether the state – i.e. the community of all citizens – should pay state compensation to its quarantined fellow citizens, regardless of actual loss of earnings. However, this cannot and must not be a prerequisite for (self-)quarantine.

23 In democracies, curfews and contact bans were interventions that many people would have considered unthinkable before the outbreak of this pandemic.

24 The following refers to vaccines authorised by health authorities. By definition, all these vaccines have gone through a complex, multi-stage approval process.

25 It is a big problem that one mantra of journalists is that “we cannot communicate probabilities to the public, it is too complicated”. This leads to a press coverage in which 1:1000 and 1:1000000 side effects are equally labelled as “rare cases”.

26 Calculation by the former head of the World Medical Association, Frank U. Montgomery, in the talk show Maybritt Illner on 18 March 2021.

27 It varies from pathogen to pathogen which groups have a particular risk of disease. With SARS-CoV-2, older people are at risk of serious illness and death, while younger people usually have only mild symptoms or no symptoms at all (Begley 2020; Davis et al 2020). In the case of the Spanish flu it was exactly the opposite: at that time it was mainly younger people who died because the bodies of older people had already become acquainted with earlier flu viruses and as a result some antibodies had formed which also offered partial protection (background immunity) against the very aggressive influenza virus of 1918. From the viewpoint of vaccination ethics, those age groups with the highest risk should be vaccinated before those age groups with a lower risk if the vaccine is scarce.

28 Here is the (slightly modified list) of the Nuffield Council on Bioethics (2007):

1. do not actively offer vaccinations, but only on demand, and do not finance them publicly.
2. provide general information about vaccinations and finance recommended vaccinations through the statutory health insurance funds
3. compulsory vaccination advice for doctors or the public health service
4. "kick-starting", by carrying out recommended vaccinations as standard during the doctor's visit (with "opt out")
5. providing incentives for vaccinations (e.g. discounts on the cost of day-care facilities, awarding vouchers for benefits in kind).
6. implement deterrent measures (e.g. contribution to treatment costs for diseases for which one could have been vaccinated).
7. limit options for action, e.g. by making certain treatments or access to public facilities only available to those who are vaccinated (e.g. no access to childcare or school).
8. compulsory vaccination, with physical violence if necessary.

29 This was also confirmed by the German Federal Constitutional Court when, on 1 May 2020, it rejected emergency applications against the Measles Protection Act: "Vaccination against measles in certain community centres should not only protect the individual against the disease, but at the same time prevent the further spread of the disease in the population, if the measures are such that the vaccination rate in the population is high enough. This would also make it possible to protect people who, for medical reasons, cannot be vaccinated themselves but who are at risk of serious clinical consequences if they become infected. The aim of the Measles Protection Act is to protect life and physical integrity, which the state is obliged to do in principle also by virtue of its fundamental duty to protect under Article 2 (2) sentence 1 of the Basic Law". (Federal Constitutional Court 2020).

30 https://www.euro.who.int/__data/assets/pdf_file/0005/315761/Vocal-vaccine-deniers-guidance-document.pdf

31 The smallpox eradication was meanwhile threatened not by the quality of the vaccine, but by a lack of education and courage. Jenner's procedure, infecting a healthy person with a substance from a sick cow, was immediately rejected by some contemporaries as illogical, unnatural and repugnant (Tucker 2002). To this day these immediate impulses against vaccination still exist.

32 “The reasons why people choose not to vaccinate are complex; a vaccines advisory group to WHO identified complacency, inconvenience in accessing vaccines, and lack of confidence are key reasons underlying hesitancy.” (World Health Organization 2019b).

33 This is the conclusion of a literature report of 11 before and after studies (Lee / Robinson 2016). Rezza (2019: 293) notes an increase of the vaccination rate in Italy by 4.4% since the introduction of compulsory vaccination in 2017.

34 https://www.euronews.com/2020/08/18/coronavirus-19-european-countries-record-high-incidence-rates-as-surge-continues

35 The term refers to a violation of physical integrity, i.e. the physical administration of the vaccine against the declared will of the vaccinated person.

36 https://www.rki.de/DE/Content/Service/Presse/Pressemitteilungen/2018/09_2018.html

37 https://www.rki.de/DE/Content/Service/Presse/Pressemitteilungen/2018/09_2018.html

38 Unlike smallpox or measles, for example, which are genetically very stable viruses.

39 In the winter of 2019/2020, around 8,000 Britons died of influenza.

40 German pharmacists had offered to provide COVID-19 vaccinations at their annual meeting on 21 September 2021. But the doctors' guild, which competes with them, immediately spoke out against it.

41 Frank Snowden, author of a major work about pandemics in history (2019), says: "Our problem is that we do not promote science in the right place, that we do not use it wisely. We could have had a coronavirus vaccination long ago. But after SARS disappeared and MERS proved to be less easily transmissible, the development was no longer worthwhile. In the end, the pharmaceutical industry is all about profit" (Hackenbrock 2020: 106).
42 Epidemiologist Kekulé draws three conclusions:
(a) Disease prevention must become an integral part of development aid, (b) we need an early warning system for new pathogens, and (c) a medical response unit must be able to be deployed quickly to control epidemics in a crisis (Kekulé 2015).
43 For a constantly updated status of vaccine research against SARS-CoV-2, please consult https://covidvax.org/; see also the WHO overview of all approved vaccines and all vaccine candidates https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines.
44 However, sometimes genetic differences between people mean that a virus can cope better with one human host than with others, and that there are different courses of disease. People with blood group A positive are more at risk for a severe COVID-19 progression.
45 So far, 111 viral families have been identified. 25 of them are suspected of being able to infect humans. Within these 25 families, there are about 1.67 million hitherto unknown viruses in mammals or birds; both species account for 99 percent of virus hosts. Of the 1.67 million viruses, between 613,000 and 827,000 are human pathogenic, i.e. can jump to humans and potentially damage them (Comforter 2020: W7).
46 The vaccination trick how the CIA managed to chase down al Qaeda leader Bin-Laden was a major coup in the U.S.-led war on terrorism, but it also was also a setback the war on polio (McGirk 2015).
47 On the history of the eradication of smallpox, see Henderson 2013; Williams 2010; Koplow 2003; Hopkins 2002; Tucker 2002; Fenner et al 1988.
48 On 8 May of the following year, the 33rd World Health Assembly ratified an official multilingual document that declared smallpox eradicated.

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The policy paper is avaible at
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Setting an example for future generations

by Agnes Binagwaho and Kedest Mathewos

Throughout the past 15 months, our world has dealt with the immeasurable toll of COVID-19. Not only have we lost nearly 3.5 million lives globally,[1] we have seen economies crumble, individuals lose their livelihood, and education and health services get disrupted. We have grappled with whether or not these severe impacts of the pandemic could have been prevented with more honest communication and a better uptake of scientific information. While we have a response to these questions, we rarely ask ourselves how the example leaders have set will impact the coming generations.

During this pandemic, inequity has emerged as the most recurring theme and has manifested in three different ways. Firstly, the pandemic exacerbated existing inequities globally. The socioeconomic impacts of public health measures have disproportionately impacted the vulnerable, with the World Bank estimating that global extreme poverty will rise for the first time in 20 years.[2] Moreover, inequities in health outcomes have also increased with, for example, black people in the US being more likely to get infected and die from the virus.[3] Secondly, countries that failed to support their vulnerable during lockdowns through the provision of social safety nets have endangered their citizens' livelihood. This inequitable response has reduced adherence to COVID-19 guidelines, further exacerbating the health and safety of the vulnerable as well as entire nations.[4] Thirdly, COVID-19 preparedness and response efforts across the globe have been marred with inequitable policies and programs. A prime example is the distribution of COVID-19 vaccines that has prioritized the global North. 87% of the vaccines have been distributed to rich countries while only 0.2% has been distributed to low-income countries.[5]

These manifestations of inequity during the COVID-19 pandemic are not novel. However, given that this is the first health crisis that has affected the globe at this scale, children, adolescents and young adults have witnessed this inequity across the world to a greater degree. We need to examine the impact of such global exposure to lies and the denial of science on the next generation.

Let us focus on the example of COVID-19 vaccine distribution. High-income countries (HICs) such as Canada hoarded enough vaccines to inoculate their populations multiple times.[6] Some states in the US have started vaccinating children 12–15 years old.[7] For months, these actions have generated a lot of debate and controversy. This is because countries across the globe had, at the beginning of the pandemic, committed to first vaccinating the most at-risk worldwide i.e., healthcare workers, through the COVAX initiative. However, for months, HICs are refusing to share vaccines with low- and mid-income countries (LMICs), who are still yet to vaccinate their populations at high risk. The next generation is listening to these debates, face to face or through e-meetings at all levels (regional, national and at community level), and to the comments on radio and social media. The lesson they may learn from this is that lack of solidarity and sacrificing the lives of people in danger is normal when they are poorer than you.

They will grow up with the idea that lives of people in HICs are worth more than the lives of people in LMICs, and believe that an individual's human rights are tied to the wealth of their country of origin.

Witnessing inequity and the lack of solidarity can have long-lasting implications for the functioning of our future societies as ideas and convictions are built, strengthened, or changed by observing the actions of leaders around us and the norms created by what is accepted and tolerated in the society we live in. These examples of shameful, open lack of solidarity in response to inequities may set

the idea in the mind of children and young adults that inequity is the norm or the correct world order. They will grow to accept ideas that the vulnerable are deserving of their unfortunate state of being – globally, nationally, and in their communities.

We have to stand and act quickly to denounce the current situation and to teach the next generation the values of trust, solidarity and equity and that all lives have equal value. However, we must do this not through mere declarations of commitment but through actions to educate the next generation. If we do not respond to this challenge by focusing on equitable policies and building a culture of solidarity and equity, then it is not a stretch to guess that future generations will respond to the next health threat even in a way even worse than what has happened during this pandemic.

Notes

1 Ritchie / Mathieu / Rodés-Guirao et al. 2020.
2 World Bank Group (ed.) 2020.
3 Rashawn 2020.
4 Rutayisire / Nkundimana / Mitonga et al. 2020.
5 UN News 2021.
6 Cohen 2021.
7 BBC News 2021.

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Vaccination strategies and policies: What can be done by whom, when and where?

by Samantha Vanderslott

Future generations will think we were completely unprepared for a predictable pandemic. We had numerous warnings from AIDS, Avian flu, SARS, MERS, Ebola, Zika[1] that should have acted as a catalyst for better preparedness. In the end, complacency and overconfidence, among other failures, led to disastrous handling. According to Sydney's Lowy Institute Europe, five South American countries (Peru, Mexico, Colombia, Argentina, Ecuador), Iran – which was hit badly in the first wave, and the US – which had the highest number of deaths, fared the worst on six criteria.[2] The criteria included confirmed cases, confirmed deaths and testing metrics (note Brazil and China were not included in the ranking due to lack of available data).

However, what did go well and was an exceptional health achievement, was the development of safe and effective vaccines against SARS-CoV-2, which happened much quicker than for previous vaccines, and will set standards for vaccines in the future.[3,4]

COVID-19 vaccines against SARS-CoV-2 were developed quickly because they built on existing research that has sought to understand coronaviruses.[5] For example, the Oxford-AstraZeneca

vaccine used learning from developing a vaccine for MERs, which was already in early-stage clinical trials. Also, the mRNA vaccines have come of age at the right time. While these technologies are new, they have been researched over the past decade in other trials and have offered the opportunity for fast development. Having Chinese scientists find and publish the SARS-CoV-2 virus genetic sequence sped up the initial phase of determining how to produce an immune response.[6]

The resources, funding, and focus that a global pandemic has brought meant that time was not wasted waiting for funds or making the case for research attention.[7] Arranging for industry partners and organisation of international testing sites has happened much more easily because of the concentration of efforts. There has not been an issue with the recruitment of trial volunteers either, as people have been very willing to take part. The number of people these vaccines have been tested on in fact constitute a higher number and from a broader range of countries than is usual for vaccine testing. Such an emphasis on fast working has also meant that stages of the trial overlapped, and the vaccines were manufactured at risk, so the quantities needed for each stage and for the anticipated rollout have already been produced. The advance purchase agreements and pre-orders are additionally bolstering the funding for the vaccine developers.

Regulatory agencies have also been working very closely with vaccine developers. Regulatory agencies in the United States, Europe, and Japan, in particular, have a historically developed capacity in regulating pharmaceuticals.[8] As vaccines are normally given to healthy people, they are among the most closely evaluated medical products. Even before trials begin, they have to pass ethical review boards to be allowed to begin – and data and safety monitoring boards independently assess the trial throughout.[9] Regulators are able to set out what requirements of efficacy and safety data they will be expecting for approval.

In addition, regulators have been conducting in-time assessments as a 'rolling review', so instead of waiting for data to be sent at one time, they have been receiving this incrementally as they become available. Rolling reviews are a tool that regulators use to speed up the assessment of a promising medicine or vaccine during a public health emergency.[10] The process happens before a formal application for authorisation is submitted.

The development of vaccines cannot be a success in itself. Next comes producing enough vaccines at scale, making sure the rollout happens efficiently and people are willing to be vaccinated. Countries who negotiated the best supply deals with pharmaceutical companies have fared better,[11] but the lasting failing will be in vaccine nationalism and the vast vaccine inequity globally. The COVAX initiative (by GAVI, the Vaccine Alliance, the Coalition for Epidemic Preparedness Innovations, and the World Health Organization) to support research and development, raise funding, and negotiate the purchase and distribution of COVID-19 vaccines, was an attempt at avoiding such a situation.[12] However, it has not achieved the cooperation needed. Future pandemics will need better arrangements to ensure protection via vaccines throughout the whole world.

Notes

1 Reperant / Osterhaus 2017: 4470–4474.
2 Lowy Institute, Sydney n.d.
3 Almond / Hacker / Harwood et al. 2020.
4 Bloom / Cadarette / Ferranna et al. 2021: 410-418.
5 Vanderslott / Pollard / Thomas et al. 2020.
6 Amodio / Vitale / Cimino et al. 2020: 51.
7 Hanney / Wooding / Sussex et al. 2020: 61.
8 Fonseca / Jarman / King et al. 2021.
9 Yao / Zhu / Jiang et al. 2013: 94–106.
10 Mahase 2021.
11 Wouters / Shadlen / Salcher-Konrad et al. 2021: 1023–1034.
12 The Lancet 2021: 941.

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Equity in vaccination against COVID-19: Lessons from child immunization

by Rajeev Sadanandan

Vaccination is an effective pharmacological measure against epidemics, including COVID-19. Therefore, universal vaccination is a necessary condition to return to normalcy. However, for a pandemic in a globalised world, this is possible only if a certain threshold of vaccination among the global population is reached. Child immunisation is much easier as only newly eligible cohorts need to be covered and vaccines have proven their efficacy. But since all health systems are familiar with child immunisation, lessons from it are useful to understand and address the issues connected with COVID-19 vaccination.

Vaccines come with significant biological risks and face behavioural resistance, due to a human tendency to discount an uncertain future event at a higher rate than current inconvenience. A systematic review showed that, even in child vaccines, beliefs about the potential harms from vaccines was the most common barrier to accepting vaccination (Munõz et al. 2015). This has been accentuated by the novel and untested technologies and the unprecedented speed with which COVID-19 vaccines were developed and approved. The social and political factors that determine access to health care and trust in government also impact vaccination.

The international development community, treating child immunisation as a global public good, had mobilised resources to procure vaccines for low-income countries. Similar support is not evident for COVID-19 vaccines. High and upper middle-income countries, with 13% of the world's population, have procured 60% of vaccines, while low-income countries have purchased 2% and COVAX, mainly serving low- and middle-income countries, 22% (Duke Innovation Centre 2021). If the population in low-income countries is not vaccinated, the probability of mutations that can evade vaccines will increase, threatening the foundation of current prevention strategies. The cost of vaccination would be far lower than the economic impact of a continuing pandemic in high-income countries, as shrinking world demand will affect them more (Çakmaklı et al. 2021). Support is also needed for adequate human resources, maintenance of cold chain, syringes, IT systems to register and manage vaccination, and surveillance systems to track adverse events from vaccination. Therefore, it is in the interest of high-income countries to ensure that all countries have access to vaccines, in the same manner as they have supported child immunisation.

Inequity in access due to social and economic reasons, familiar in child immunisation, is seen in COVID-19 vaccination too (Grumbach et al. 2021). An important barrier for a disempowered population, as in child immunisation, is the lack of trust in persons of authority due to one's past experience. Marginalised groups such as ethnic minorities, immigrants and poor people traditionally tend to distrust governments. While governments may be eager to ensure universal vaccination, they may not have conduits for communication and bridges for creating trust. The reluctance of poor and marginalised populations needs to be accepted as a legitimate response to years of neglect or even victimisation. Such acknowledgement shows respect for the communities and makes them partners in the process, enabling them to air their concerns and have them cleared by experts. Communities given the right to choose the vaccination sites and timing will choose locations they are comfortable with, say a site of worship instead of a government dispensary or after working hours instead of opening hours of a health institution. Community leaders can be co-opted to get vaccinated in public, to vouch for its safety and efficacy and to address the concerns of the community. Non-government groups who work with marginalised populations and are trusted by them have been acting as ambassadors and facilitators. But the temptation to use coercive methods, such as denying employment, will only worsen the problem.

Distrust of governments is a fertile soil for conspiracy theories

such as those that vaccines were created to harm certain communities or religious groups (Wouters et al. 2021). Since none of these allegations are founded on any evidence, but rather appeal to emotion and faith, they are difficult to counter. But every religion has respected leaders and professionals from the community who are capable of exposing such claims citing religious texts and testify for vaccination. Such campaigns have succeeded in weaning communities away from rumours against vaccination as in the Pulse Polio Campaign in India.

Unlike in child immunisation, where the same vaccine or vaccines of comparable efficacy are provided to all children, COVID vaccines that have been licenced differ in their efficacy and dosing schedules. It is possible that groups who are socially, economically and politically less powerful would get vaccines with lower efficacy, augmenting inequity. As finances for vaccines run low in many countries, they will be tempted to offload part of the cost by allowing private payment. The private sector may also be allowed to import high-cost vaccines from abroad. This may be an acceptable option if adequate public funding is available to ensure access of the poor to vaccines and the system for targeting is effective. Since the duration of protection provided by vaccines is unclear, booster shots may be needed, which are unlikely to be publicly funded. Given the current visibility of COVID-19 vaccination, resource-constrained countries may divert funds from child immunisation programmes or other crucial public health programmes, which will also adversely affect the poor.

Child immunisation is best delivered close to the home of the beneficiary. However, since COVID-19 vaccines are relatively new and untried and a case of severe adverse reaction could set back vaccination efforts, most countries carry out vaccination at locations where medical support is available, mostly in urban centres. This makes access difficult for persons who do not have transportation, the elderly who do not have anyone to accompany them, and care givers who cannot leave home for long periods. Since most registration systems use apps that run only on smart phones or laptops, access by the elderly is further reduced as IT savvy persons are able to reserve vaccination slots as soon as they open up.

Child immunisation provides the template to manage this. A registry of the eligible population, prepared using existing data sets and validated in the field by community workers or representatives, will ensure that no one is missed. Persons in the registry who are not likely to access vaccination on their own can be identified by field officials and managed individually. Counselling to dispel vaccine hesitancy, IT support to book vaccination slots, arranging transport to the vaccination site and back and mobilising social support will improve uptake of vaccination. But, as in child immunisation, some persons would still be left out. Intense mop-up operations and investing additional time and energy on them would be required to cover the persons who remain resistant. Managers would have the temptation to leave out the most difficult to reach or convince when the threshold needed for effective prevention of the epidemic is reached. But persons who are left out are at risk of personal vulnerability. Since they are also likely to be among the poorest and most marginalised, considerations of equity demand that government and communities go the extra mile to cover them too. Unlike child immunisation, the COVID-19 vaccination process risks spreading infection. Careful management of the process based on a registry will enable allotting dedicated slots to individuals to prevent overcrowding.

As in child immunisation, the persons who need COVID vaccination the most are least likely to get them. The factors that reduce their access to the vaccine are the same that make them vulnerable to infection. If a pool of infection remains in any country or section of the population in the country, it will re-emerge to haunt the world again. Universal vaccination against COVID-19 is as much a global public good as child immunisation against vaccine-preventable diseases, and international agencies and national health managers need to use the lessons learnt from child immunisation to implement COVID vaccination effectively.

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How will future generations look back on the pandemic?

by Adriano Mannino

The question of how future generations will look back on our actions is an interesting heuristic on at least two accounts. Ethically, future generations may be of overwhelming importance, given that they will vastly outnumber the present generation; and epistemically, future generations are likely to possess a clearer picture of our present situation than we do today, due to the benefit of hindsight and the historical bird's eye perspective.

If we try and survey – from our present, limited perspective – the macrostrategic situation we are facing during the Covid-19 pandemic, it is hard to overlook the immense significance of vaccines. Without the expectation of safe and effective vaccines becoming available sufficiently quickly, our containment measures might have made little sense: After being caught on the wrong foot and (very irresponsibly) hesitating to act in early 2020,[1] we got our act together and attempted to contain the spread of the virus. We did not aim to merely "flatten the curve" of infections but (correctly) tried to avert the virus spreading through the whole population until effective vaccines would be available. This entire strategy was premised on vaccine development progressing sufficiently fast.
Looking back, future society will probably realise just how lucky we were that mRNA vaccine technology had come to fruition by 2020 – just in time. (We were also lucky, of course, that the virus did not hit us with its most aggressive variants right away.) At the same time, future generations may be shocked that we thoroughly failed to take advantage of our luck: The blueprint for Moderna's mRNA vaccine was available by mid-January 2020, right after SARS-CoV-2's genome had been sequenced. This may come to be viewed as the single most striking fact about our pandemic management: The vaccine was available the whole time.[2]

The reason the vaccine was not known to be effective until many months later, of course, is that the standard trials take a lot of time. But there is a way to shorten the process drastically: We could have conducted human challenge studies (HCS), in which test subjects are directly exposed to a pathogen after receiving a potentially effective vaccine. The subjects are screened for good health, receive the best medical supervision possible, and are fully informed.

Space constraints do not allow me to do justice to the ethics of HCS here,[3] but I do wish to note that prohibitions of *monetarily uncompensated HCS*[4] seem to violate at least two basic rights: well-informed participants' right to take personal health risks for humanitarian ends, and scientists' right to offer and conduct such research. If, say, a ban on monetarily uncompensated kidney donations[5] would constitute a serious rights violation, then the same arguably goes for bans on uncompensated HCS. (Consider also the right to volunteer to provide emergency medical services in epidemic outbreaks, which greatly increases one's risk of being infected, or the right to pursue extreme sports for purely personal, non-humanitarian reasons.) Future generations may thus come to see our current legal ethics of HCS as tragically flawed: Not only did current regulations have disastrous consequences by delaying vaccines – perhaps by up to half a year[6] –, they also violate multiple basic rights and thus constitute a serious injustice.

Just like we failed to prepare for the clear possibility of a pandemic *practically* (masks, tracing apps, or emergency governance protocols were not ready), we also failed to prepare *epistemically*: e.g., we failed to think through and debate the ethics of scientific studies that would help us save millions of lives in times of crisis.

One might wonder whether, if monetary non-compensation is an essential ethical desideratum, sufficiently many people would volunteer for HCS. The answer, most likely, is yes: Very few participants are needed for HCS to be reasonably statistically powered (which is one of their advantages over experimentally vaccinating people and counting on some of them getting infected while they go about their daily lives); the history of the biomedical sciences has known many scientists, science enthusiasts, and humanitarians who volunteered to test risky treatments; and the potential benefit of receiving an effective vaccine early on may provide some non-monetary incentive.

Unfortunately, the tragedy of our vaccine policies does not end here. Additional months were lost because most states failed to order the candidate vaccines in adequate quantities. Relative to the enormous public health and socioeconomic cost of a prolonged pandemic, ordering every plausible candidate vaccine in sufficient quantity would have been very cheap. Surplus vaccines should then have been shipped to poorer countries for free. Sadly, neither humanitarian nor prudential reasons have been sufficient to make us realise that we should have made it a priority to supply the whole world with vaccines.

From the beginning of 2020, we should have gone into "war economy" mode as far as vaccine production and distribution were concerned. Even before 2020, the risk of global pandemics was obvious and should have been countered with a "Manhattan Project" of vaccine research and development. (As mentioned, we were very lucky that mRNA vaccine technology had emerged just in time. We should not be relying on luck.) Unfortunately, we still have not learned these lessons and are greatly underestimating future pandemic risks. These include zoonotic outbreaks, whose causes the international community is not addressing (e.g.: factory farming, wild animal and wet markets). They also

include lab accidents and bioterrorism, which society is largely unaware of. The fact that there is a non-negligible chance that virological research itself caused the Covid-19 pandemic does not seem to move us. But dangerous accidents or criminal acts are statistically certain to happen over the coming decades. Natural and especially artificial pathogens could kill hundreds of millions of people.[8] This should cause us to immediately regulate risky biotechnological research, and to embark on the aforesaid "Manhattan Project" of vaccine development and deployment. We should aim to be able to develop and deploy vaccines against a large range of novel pathogens within just a few months.

We should – and we probably would if the present were as wise or crisis-ridden as the future likely will be. Alas, I fear future generations will look back on the Covid-19 pandemic and see a small-scale catastrophe that failed to teach us the lessons we should have learned.

Notes

1 Mukerji / Mannino 2020.
2 Wallace-Wells 2020.
3 For some elaboration, see chapter 5.3 in Mannino 2021.
4 Leading objections to monetary incentives in such contexts include that they exploit economic inequality and wrong the poor, that they render truly free choice impossible, and that they disvalue and change practices of self-sacrifice for scientific and humanitarian ends (cf. Sandel 2012). Counterarguments include that prohibiting monetary compensation is paternalistic, violates autonomy and liberty rights, and has net negative consequences. The United Kingdom has allowed a monetarily compensated HCS to start in March 2021: https://ukcovidchallenge.com/.
5 In the early days of transplantation medicine, kidney donations were very dangerous, and the risks associated with them continue to be significant. Regardless, there plausibly is an individual right to engage in kidney donation, even if the risk to oneself is very high.
6 Eyal / Lipsitch / Smith 2020. Subtracting several months from the vaccine licensure process would have averted on the order of one million deaths, ten million severe and long-haul Covid cases, billions of liberty rights restrictions (due to lockdown measures), and trillions of dollars of economic damage.
7 Lipsitch 2018.

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Human infection studies and the SARS-CoV-2 pandemic

by Jörg Tremmel [1]

What could humanity have done better in fighting the SARS-CoV-2 pandemic? From a financial and scientific point of view, it has done many things right, but a crucial ethical question has remained rather unexamined. In this paper, I argue that controlled human infection studies (HIS)[2] would have been ethically justifiable and the right way forward in developing a vaccine against Covid-19. The phase 2/3 trials of the vaccines from AstraZeneca, Pfizer/Biontech and Moderna took between 75 and 196 days. Human challenge trials would have taken much less time, about 30 days. In retrospect, these three vaccines could have been launched 45 to 166 days earlier than they actually were. If this had happened, hundreds of thousands of deaths and millions of hospitalisations worldwide could have been avoided due to the cumulative effect. In terms of preparatory measures for the next pandemic, the ethical discussion on HIS is of utmost relevance for the well-being of future generations.

First use of vaccines on humans (phase 1 before approval)

In order to understand the ethical issues surrounding HIS, it is necessary to understand how vaccines are tested on humans in the first place, before the HIS. Once vaccine developers have tested a certain agent against an infectious disease in animals ("preclinical studies") and these creatures have been successfully immunised, the next step is the first application in humans. The immune system of humans is so fundamentally different from that of even the animals most similar to us, that the approval of an investigational vaccine solely on the basis of animal experiments is not an option. Depending on the number of test persons and the exact question, a distinction is usually made between three phases (and occasionally a phase 4 after approval) in human application. For human volunteers, phase 1 ("first in human"), is the riskiest. The author of this text participated in the phase 1 trial of CureVac[3] as a subject and received 8µg of the investigational vaccine (CVnCoV) twice.

How would one have proceeded in a "human infection study"? Regulatory authorities need data on the efficacy of vaccine candidates beyond the results of the phase 1 trial for their decisions. The sequence of studies until submission for licensure is described in chart 1.

How approved vaccines against Covid-19 were actually tested "in the field"?

Time is the decisive factor in protecting future generations from new pandemics.[4] As HIS studies can replace phase 2/3 studies (but not phase 1 studies), it is important to know exactly how long the phase 2/3 studies lasted.[5] Chart 2 shows the relevant data for the first vaccines approved in the EU and the USA, i.e. those from PfizerBiontech, Moderna and AstraZeneca,[6] as well as for the CureVac vaccine CVnCoV.[7]

Chart 1: Process to SARS-CoV2 vaccine licensure, including a human infection study

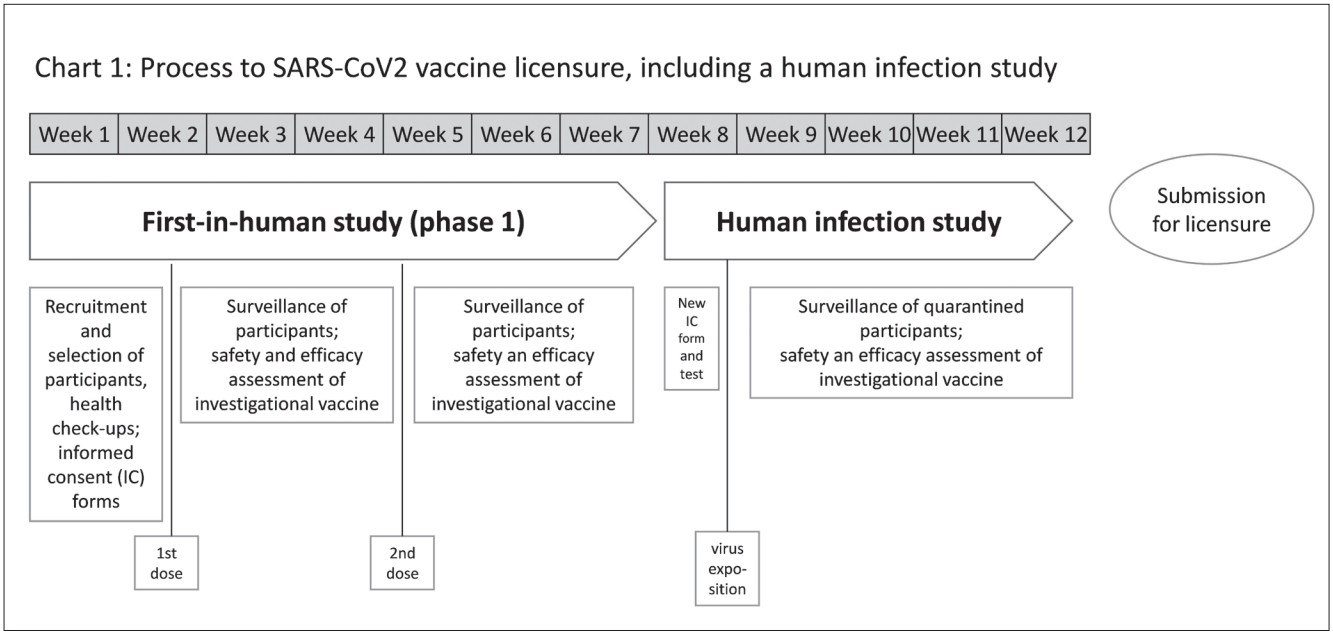

Chart 2:

	Duration of the phase 2/3 study	Participants	Infected persons in the active agent group	Infected persons in the placebo group	Effectiveness of the vaccine
BNT162b2 (Pfizer/ BioNTech)	***75 days*** *27.07.2020 - 09.10.2020*	43.448	8	162	95%
mRNA-1273 (Moderna)	***112 days*** *27.07.2020 - 15.11.2020*	30.420	11	185	94,1%
ChAdOx (AstraZeneca)	***196 days*** *23.04.2020 - 4.11.2020*	23.848	The values of these columns are not comparable, as the phase 3 study was divided into two sub-studies, and the summation of the values was strongly criticised within the scientific community.		
CVnCOV[8] (CureVac)	***123 days*** *11.12.2020 - 12.04.2021*	39.680	83	145	48,2%

The phase 3 trials of the first vaccines approved in the EU and the USA took between 75 and 196 days, depending on the vaccine. Human infection studies would have taken significantly less time, about 30 days. In retrospect, therefore, the vaccines that were gradually approved could have been on the market 45 to 166 days earlier than they actually were. Indeed, a large number of deaths and hospitalisations could have been avoided if HIS had been used instead of the usual phase 2/3 trials.

Without HIS, the following adversities occur. The stronger the protective measures ("lockdown"), the more months are lost. How many infected people there must be before the regulatory authorities are satisfied is an opaque process. This is where vaccine manufacturers and regulatory authorities have to come to an agreement. Ultimately, these are negotiation processes that are hidden from the public. Different actors – the government, the regulatory authorities, the public – have different ideas, which can lead to tensions. An example from Turkey: "The Turkish researchers, speaking alongside Health Minister Fahrettin Koca, said 26 of the 29 people who were infected during the trial were given placebos, adding the trial would continue until 40 people become infected. (...)" Health Minister Koca said Ankara would now – this was on 24.12.2020 – use this data to approve the vaccine. He added that "researchers initially planned to announce the results after 40 people were infected, but that the findings showed the volunteers had minimal adverse effects after the shot and that it was therefore deemed safe."[9] Incidentally, the vaccine in question was China's Sinovac vaccine, and the vaccine effectiveness of 91.25% calculated on the basis of the small number of cases, which the Turkish health minister communicated to the public, is doubtful. However, this is also true for the decimal places in the vaccine efficacy calculated by e.g. PfizerBiontech or Moderna from the low infection cases of their respective studies. Waiting to see when 10, 20, 30, 40, 60, 80 or 100 vaccinated people will "accidentally" be infected is gruelling when the whole world is waiting for a vaccine. And the small numbers lead to unsatisfying data about vaccine effectiveness.

Existential risks for future generations – ethical requirements for HIS in general

In addition to anthropogenic climate change, a possible nuclear war and other factors, epidemics are among the existential risks for future generations. The potential of HIS is undisputed and was once again highlighted by the WHO in 2020 during the first wave of the Corona pandemic: "Well designed human challenge studies provide one of the most efficient and scientifically powerful means for testing vaccines, especially because animal models are not adequately generalisable to humans. Challenge studies could thus be associated with substantial public health benefit in so far as they (a) accelerate vaccine development, (b) increase the likelihood that the most effective (candidate) vaccines will ultimately become available, (c) validate tests of immunity, and (d) improve knowledge regarding SARS-CoV-2 infection and transmission."[10]

Can the worst effects of pandemics be avoided in *general, i.e. also in the future,* if humanity relies on HIS? That depends on many virological-medical factors. From an ethical point of view, one cannot come to a simple yes or no conclusion in respect to HIS. The following factors and framework conditions play a role in determining the answer:

Benefit of a vaccine – disadvantages for society as a whole without HIS

HIS have helped in the early research with smallpox, yellow fever and malaria that eventually changed the course of global public health. And HIS have recently helped, for example, to accelerate the development of vaccines against typhoid and cholera.[11] Whether vaccines help in the long term depends also on the ability of a virus to generate immune escape variants. The ability to mutate varies from the genetically stable smallpox virus at one end of the scale to the very rapidly mutating influenza viruses at the other. SARS-CoV-2 is somewhat in the middle. This means vaccination is a useful but not a perfect remedy. This is the case for most infectious diseases. All experts agree: If mankind had failed to develop vaccines against SARS-CoV-2, the death toll would have been much higher. Georg Schmidt, chairman of the Working Group of Medical Ethics Committees in Germany, is of the opinion that one can consider conducting a HIS only if the risk is manageable and a social catastrophe is imminent. With regard to Covid-19, according to Schmidt, this is not the case in the current situation.[12] Not a catastrophe? Peer-reviewed global estimates of excess deaths indicate 18.2 million people may have died because of the COVID-19 pandemic by December 31, 2021.[13] The global Corona pandemic was very much a catastrophe, especially for the most vulnerable members of society. Next to the millions of deaths and long-haul Covid cases we should not forget all the liberty rights restrictions due to lockdown measures, and the lost livelihoods due to economic depression. What is correct is that the sheer size of the catastrophe is an important factor in the ethical assessment of HIS. The more a pathogen poses an existential risk to humanity, the more HIS are justified.

Benefits of HIS for vaccine research

The best possible design of vaccine trials, including how many sequential trials there should be, varies from pandemic to pandemic. However, the tendency is that HIS can generate extremely important data for vaccine development. In the case of the SARS-CoV-2 pandemic, the objection to HIS was that the data obtained in young, healthy volunteers could not be transferred to the vulnerable group of people over 70. The WHO disagrees: "Prioritizing the safety of participants is standard in modern challenge studies and acceptable in so far as studies with low-risk participants nevertheless produce useful results"[14]

Health risks for the test persons

The lower the health risks associated with HIS, the more likely they are to be ethically permissible. A specific assessment is always required. In the case of SARS-CoV-2, there were still many uncertainties in the initial phase regarding the pathogenicity or lethality of the virus. There were also no effective drugs or therapies against SARS-CoV-2 in 2020-2021. Unlike, for example, malaria, influenza, typhoid and cholera – diseases for which controlled infection studies have been and are being conducted. The risks to the subjects are reduced when there is excellent diagnostics so that action can be taken within a sufficiently long incubation period before the disease becomes life-threatening. This was not the case with SARS-CoV-2. And as there was no effective therapy, the health risks for HIS test persons in early 2020 were high.

Ethical Assessment

All in all, human autonomy should be the deciding argument. In many contexts, our society allows adults to help others at the risk of their own lives.

Examples of ethical analogies to participation in HIS:

– members of volunteer fire brigades are allowed to run into burning buildings to save lives at the risk of their lives and without financial compensation (unlike professional firefighters).

– doctors or nurses are allowed to travel to war zones at their own risk to alleviate suffering.

– In particular, it is incomprehensible why our society legally allows phase 1 trials in vaccine development, but not subsequent human infection trials. As made clear in the first part of this text, the phase 1 trial subjects also took a risk.

As long as someone can assess the risk to themselves, they should be allowed to act altruistically, even at the risk of their health or even their life.

By the way, it is young people who have joined forces to enable controlled infection studies in which they themselves want to participate as test persons.[15]

Notes

1 This is an abridged version of an open letter to the German Ethics Council, available at: generationengerechtigkeit.info

2 Synonyms are Human Challenge Studies (HCS) or Human Challenge Trials (HCT).

3 Kremsner / Mann / Kroindl et al. 2021a.

4 FRFG 2021

5 This refers to the large trial study with thousands of participants. In practice, this is not always referred to as Phase 3, but also as Phase 2/3, Phase 2a/3 or Phase 2b/3, depending on the circumstances.

6 Johnson&Johnson is not included here because only one dose was administered here. This automatically reduces the time for the clinical trials. As it turned out, however, the immune protection also suffered.

7 Baden / El Sahly / Essink et al 2021; Polack / Thomas / Kitchin et al 2020; Voysey / Clemens / Madhi et al 2021; Kremsner / Guerrero / Arana-Arri et al 2021b.

8 It is obvious that CureVac came along later than the competing companies. The Paul Ehrlich Institute had already approved the first "first in human" study of a vaccine against Covid-19 in Germany on 22 April 2020, namely for four mRNA-based vaccine candidates from the company BioNTech. CureVac ultimately had to refrain from further seeking market approval from the regulatory authorities due to the lower efficacy of its vaccine compared to the vaccines approved until the end of 2020.

9 https://www.reuters.com/article/health-coronavirus-turkey-china-int/turkey-says-chinas-sinovac-covid-vaccine-9125-effective-in-late-trials-idUSKBN28Y1R3. Viewed 24 December 2020.

10 WHO 2020: 2.

11 WHO 2020: 2

12 Reich 2021.

13 Wang 2022.

14 WHO 2020, 14.

15 See: www.1daysooner.org

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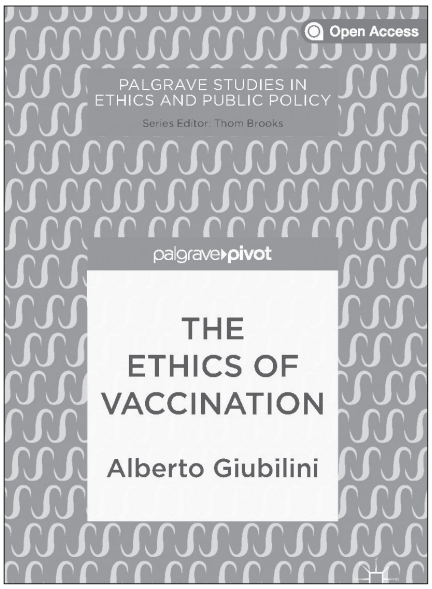
Alberto Giubilini: The ethics of vaccination

Reviewed by Marius Kunte



Little did Alberto Giubilini know that one year after his book *The Ethics of Vaccination* was published, Western societies would start engaging in debates about vaccination policies. However, the senior research fellow at the University of Oxford offers an alternative to the path that most governments have chosen to fight the pandemic. Instead of trying to increase vaccination rates through symbolic public appeals, Giubilini advocates for compulsory vaccination against relevant diseases. His bioethical perspective can be classified as a contribution to the 'demandingness debate' in moral philosophy (van den Hoven 2007). Giubilini argues that compulsory vaccination is an acceptable, reasonable demand which we can put to individuals without over-burdening them. He wants to offer a reasonable claim for why states have an obligation to require all those without medical contra-indications to get vaccinated against common transmissible diseases. Unwarranted refusal to vaccinate oneself or one's children should be illegal and punished by a significant fine. Because many scientific aspects in this complex debate are morally relevant, the need for an empirically informed, interdisciplinary 'ethics of vaccination' is apparent from the outset. Giubilini follows this trajectory in four interconnected chapters. Although reading the first two chapters separately offers interesting insights, the book is best understood when viewed as a coherent whole. While Giubilini appeals to informed academic peers and the general public alike, familiarity with basic ethical concepts and philosophical parlance will enhance the reader's understanding of the book's nuanced yet assertive argument.

The first chapter serves as an introduction into key concepts and explains their moral relevance. Giubilini lays out the fundamental assumption that vaccinating oneself or one's children is an ethical choice: It goes beyond self-interest as it contributes to protecting others from harm. This leads to a key pillar in Giubilini's framework, which is to treat herd immunity, i.e. the indirect protection from infections that requires a certain level of common immunity to stop transmission, as an important public good. Herd immunity does not hold mechanisms of exclusion, does not diminish when individuals benefit from it, and can only be attained through cooperation. Under this premise, getting vaccinated is a contribution to the public good. By definition, it requires collective action and creates the adjacent collective action problem ('free-riding'; a premise that is disputed by Bradley/Navin 2021). Ultimately, this makes herd immunity a matter of collective responsibility. But as some evidence suggests, not enough people feel individually obliged to get vaccinated. For Giubilini, this observation calls for state regulation and an ethical debate about compulsion.

Having established the basic assumptions of herd immunity as a public good and vaccinations as a moral problem, Giubilini delves into a detailed philosophical discussion of responsibilities and objections to his argument in the second chapter. Linking an ethical review of the harm principle, claim rights or best interest with an examination of vaccine science, he elaborates why individuals are unconditionally the bearers of a moral obligation to accomplish herd immunity. In essence, the individual contribution to this shared collective responsibility should be a moral duty when undertaking it is sufficiently easy. Subsequently, because a single vaccination is insufficient in realising herd immunity, an obligation that applies individually to each member of a collective has to be justified. As the missing piece of the puzzle and his original contribution to the debate, Giubilini argues for a basic principle of fairness: Since realising a shared collective responsibility comes with burdens, they should be distributed fairly.

Fairness as the bridging factor between collective responsibility and individual obligations requires what Giubilini labels a *political* understanding of moral responsibility. Besides getting vaccinated, supporting or at least not hindering state policies that aim for herd immunity becomes part of the individual moral obligation. From this ethical interplay of collective and individual responsibilities, Giubilini derives an institutional obligation for the state to implement such vaccination policies and to ensure the realisation of herd immunity. Although Giubilini makes sure to highlight that democratic states are in a strong moral position to enact such policies (but not any policy imaginable), this part of his argument seems to be prone to substantial criticism. It would have been necessary to thoroughly discuss the possible implications of his proposed individual obligations under non-democratic circumstances (e.g. to not even protest coercive vaccination policies).

The third chapter elaborates on the idea of an institutional obligation. It provides a careful and context-sensitive analysis of its implications for vaccination policies. Assuming herd immunity as the only aim, Giubilini discusses policies with varying intrusive character against the backdrop of the principle of least restrictive alternative (PLRA). This widely accepted public health principle states

that authorities should choose those available, effective policies that are the least infringing upon individuals' rights. The alternatives are presented in the form of an intervention ladder that includes – from zero restrictiveness to coercion – persuasion, nudging, financial incentives, disincentives (i.e. penalising a legal choice; like mandatory vaccination as a prerequisite for school or day care enrolment), and, not only as a measure of last resort, compulsion (making non-vaccination illegal). Giubilini deals with the sometimes open question of each method's effectiveness by referencing scientific literature and discussing their ethical indications in light of various social circumstances and other relevant variables. Following our intuition, those interventions seem ethically preferable that are least restrictive for those who are most heavily burdened by them (so Giubilini invokes a version of Rawls' *maximin* rule). Meanwhile, coercion is understood as the psychological influence of a certain vaccination policy; people feel coerced when they see no acceptable or reasonable alternative. Since this violation of free will is *prima facie* morally wrong, coercion is in need of a moral justification. Thus, the realisation of a public good like herd immunity would have to outweigh the violation of autonomous decision-making. On the PLRA's terms, moving towards the coercive end of the spectrum would presuppose proof that those policy options further down the intervention ladder are ineffective in attaining herd immunity.

Contrary to this position, Giubilini makes an ethical case for compulsory vaccination that does not rely on the ineffectiveness of less restrictive policies in the final chapter. In short, his provocative and certainly debatable argument depends on slightly leaving behind the first major pillar of his book – herd immunity (which, for no clear reason, reappears at the end of the chapter) – to advocate for more recognition of his own addition to the ethical debate about vaccination policies: Giubilini suggests fairness as an ethical value that should not be outweighed by the PLRA or compromised by liberty and expected utility. In his view, in a 'proper' understanding of those concepts, there is no conflict to be balanced. What is more, fairness is not only an ethical value informing policymaking (and instrumental in ensuring cooperation) but also one of the goals of policies that aim at providing public goods. Broadening the scope of vaccination policies' objectives allows him to question the ethical assumptions that seem to rule out compulsory programs (as discussed in the previous chapter). As for Giubilini fairness trumps the restrictions on liberty and autonomy, he also rejects granting non-medical exemptions to those who oppose vaccinations ('conscientious objection').

When there is an individual obligation, the state is morally justified in implementing unqualified compulsory vaccination. Thus, when the aim is not simply herd immunity but universal vaccination coverage and a fair (equitable) distribution of hardship, Giubilini presents compulsory vaccination as the most successful policy. In his understanding, compulsory vaccination does align with the maximisation of expected utility, with a fair distribution of burdens of reaching a collective, public good, and with the requirement not to infringe on any relevant liberal right. However, outright *forced* vaccination is not defended by Giubilini's logic because he is concerned with ethical in-principle examinations.

All things considered, *The Ethics of Vaccination* is a carefully researched and convincing project. It is validated by scientific literature from various relevant disciplines (medical science, psychology or economics) but not blind towards the inherent uncertainty of scientific insight. Giubilini is generally successful in providing an accessible knowledge base. He is aware of the book's limited perspective, proactively highlighting a Western bias for most of its content ("a book about an ethics for the privileged", 10) and points to global injustices. Especially because there is a global dimension to the problem of infectious diseases, this frame seems debatable. A similar challenge concerns the incorporation of relevant scientific details, e.g. how much specific vaccines prevent transmission or how much of an influence different levels of infectiousness should have on our assessment of a compulsory policy's restrictiveness. Giubilini does cover these questions and calls them relevant. He pre-emptively meets the underlying objections by saying that he is making a non-pragmatic case. However, they seem to (significantly) weaken the power of his position when it comes to policy implementation (Navin/Attwell 2019). Despite those challenges, Giubilini lives up to his stated aim: He presents a reasonable argument for why there is an ethical obligation for the collective to realise herd immunity and for the individual to get vaccinated against certain infectious diseases.

However, we should move beyond Giubilini's perspective on time: Not only are parts of current populations potentially harmed by those who do not contribute to herd immunity, but also all members of future generations. Diseases are also a risk for those who cannot protect themselves because they just have been or are not yet born, so they deserve to be considered in public health ethics. They should be seen just as worthy of protection as those present members of society who cannot (sufficiently) protect themselves against infections and their side effects. In Giubilini's framework, this would call for a philosophical examination of whether yet unborn people have the same claim right to be protected from preventable harm as present individuals do. Such a position could also reference Rawls' veil of ignorance to justify compulsory vaccination: Why should we accept the possibility of being born into a world full of harmful, easily preventable diseases as fair?

Treating systematic vaccination as a tool for transgenerational prevention of disease outbreaks and their socio-economic side effect (which tend to disproportionately affect young generations) has been stipulated by Atzinger and Henn (2020). It appears to be in line with Giubilini's thinking, who calls attention to the apparent legitimacy of mandatory child vaccinations. Demanding that adults get vaccinated in order to avert harm from unborn children could just as well be justified by a principle of fairness. If children are obliged to do their share in providing herd immunity even without consenting, it is especially hard to justify vaccine refusal for adults when the objective is to provide for transgenerational justice. This broadened perspective would reinforce Giubilini's narrative: His empirically backed appraisal of the freedom and safety that the elimination of some diseases has afforded to present generations (Chapter 1) and his extensive effort to derive forward-looking moral responsibilities (Chapter 2) logically make herd immunity a crucial condition for the wellbeing of future generations. But then, we again have to rethink Giubilini's focus on the privileged nations. As the pandemic has shown, no one is safe (from infectious diseases) until everyone is safe. So although compulsory vaccination regimes do not have to be global, treating vaccines as a global public good seems imperative.

Under these premises, the policy implications Giubilini presents appear to be even understated. A fortified collective and institutional responsibility for promoting herd immunity provides a strong moral mandate for expanding state aid in the development, production, and distribution of safe and effective vaccines. The state community is primarily capable of incentivizing and funding preventive research that might not generate profit even if it succeeds (Ritvo et al. 2005). As Atzinger and Henn (2020) have argued, aiming for transgenerational justice will imply the global eradication of transmissible diseases and hence much more action and cooperation from the wealthy states. And it is not far-fetched to demand state action that makes vaccines free of charge and as easily accessible as possible. Once states have laid this foundation, individuals should indeed feel morally obliged to protect themselves, others and those who will be born from most infectious diseases as an expression of basic solidarity. By way of such an extension, Giubilini's thought-provoking plea for collective, institutional, and individual obligations to reach high vaccination rates serves as a powerful and timely voice of support for intergenerational justice.

Giubilini, Alberto (2019): The Ethics of Vaccination. Cham, Switzerland: Palgrave Macmillan. XV, 126 pages. ISBN 978-3-030-02067-5 (hardback). Price €29,12. (Free e-book available through open access at https://doi.org/10.1007/978-3-030-02068-2).

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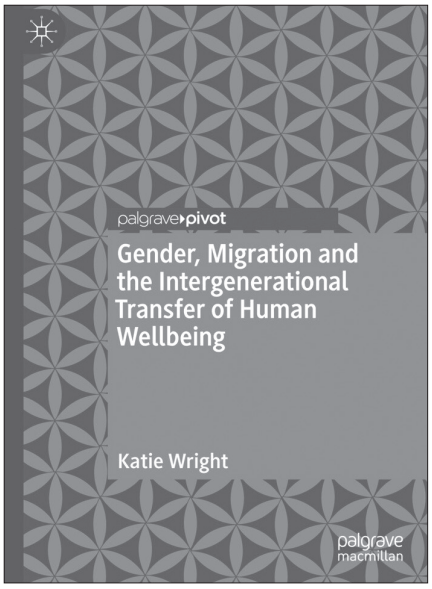
Katie Wright: Gender, migration and the intergenerational transfer of human wellbeing

Reviewed by Judith Kausch-Zongo

In her book *Gender, Migration and the Intergenerational Transfer of Human Wellbeing* Katie Wright touches on one of the most important factors for achieving sustainable societies: how can the most vulnerable members of society who are affected by multiple discriminations overcome their vulnerability and thereafter participate in social mobility? More precisely, this study examines the processes of psychosocial transfers from mothers to daughters who migrated from Latin America to London by looking at how these transfers can be converted into human wellbeing outcomes (via educational and occupational advancement). In so doing, the research looks at a social group often left behind and with little political voice.



Until recently, research on migrants from Latin America has mostly focused on their situation in the US and Spain. However, research on Latin American migration to the UK is growing. Katie Wright's investigation contributes goes beyond migration research (33): the book also broadens the concept of IGT (intergenerational transmission) by examining not only the transfer of material goods but also what she refers to as psychosocial transfers, thereby integrating the concept of human wellbeing into a holistic approach. Consequently, the book is just as persuasive and enriching for researchers (social sciences, psychology) as it is for practitioners (public sector, social workers) interested in questions of gender and migration with a special focus on Latin America, intersectionality and social mobility, intergenerational transmission of human wellbeing, and resilience. Presenting important results of narrative interviews, Wright's study offers implications for both theory and public policy.

By looking into the functioning of transfer processes, Wright's main

objective is to understand how psychosocial intergenerational transfers impact social mobility and how these transfers are marked by

- intersectionality – in this case including gender, race, migrant status, age
- relationality – mainly intergenerational between mother and daughter, but also the greater family constellations) and
- temporality – transfers impact differently in special life periods (18, 19)

As mentioned, IGT literature to date has mainly focused on material transfer and less on psychosocial transfer. To gain a more holistic view, Wright proposes a theory of Human Wellbeing that integrates both of these features. The concept of Human Wellbeing considers relatedness as an elementary psychological need for 'living well' and encompasses intergenerationality. This perspective might broaden the work of Portes et al. (2016) and Brannen (2015) through a "consideration of how transfers may be negotiated, mediated or resisted" (43), including how transfer processes are shaped by racial, ethnic, age, class, life-course periods, as well as gender differences (23).

Gendered inequalities can restrict possibilities of occupational advancement and human wellbeing outcomes. Human wellbeing transfers can vary over the span of a lifetime. The empirical findings in the investigation show that the transfer process is heavily influenced by gender role attitudes. For example, in some cases, mothers transfer to their daughters the gendered role in which women are responsible for keeping "marriage intact (no matter the personal cost)" (84). Contrary to studies that focus on the intergenerational transmission of material deprivation, Wright shows that on the psychosocial side, mothers tend to transfer their daughters to focus on education in order to leave behind low-paid work (such as cleaning) and to achieve independence from men, and to reduce their vulnerability. "[D]aughters were encouraged to better withstand or to exit relationships typified by machismo" (133).

Furthermore, the study analyses how the IGT of psychosocial assets is constructed by intersubjectivity. More specifically, it asks how the interaction between individuals as well as their relations affect intergenerational transfer from mothers to daughters. Interrelationality between the first generation of migrants (mothers) and the second generation (daughters) are conceptualised based on the work of Portes et al. (2016). The latter pioneered a longitudinal study on immigrants' children in the United States and developed a theoretical approach to identify factors – both material and psychosocial – affecting upward (and downward) mobility amongst second-generation migrants.

Identification with the host society becomes an important factor for the second generation to succeed in education systems. However, discrimination based on gender and race can decelerate psychosocial adaption. Referring to Kasinitz et al. (2008), Wright notes that material transfers such as legal documents allow the second generation to gain host country nationality.

A crucial kind of psychosocial transfer is represented by the attachment to a cohesive community based on ethnic affiliation. To identify salient psychosocial transfers by means of narrative interviews, Wright grounds her argumentation in Brannen (2015) and suggests that discourses that shaped a whole generation in a particular historical context, for example attitudes linked to patriarchy and dictatorship in Latin America, need to be identified in the narratives and to be dissociated from respondents' own narratives of how individuals perceive what was passed on to them as material and non-material transfers and what they wish to transmit to their children. Only then, she suggests, can subtle transfer processes in intergenerational life courses be appropriately analysed.

Interestingly, the empirical insights show that values, especially prioritising education, were often not transferred successfully. One of the main findings of the book is that daughters' ability to adopt these psychosocial transfers depended partially on the bonding between the mothers and daughters. The maternal relationship often suffered during the life course as a lot of interviewed mothers migrated first to Europe before their daughters could join them. These periods of separation influenced the success with which values could be passed on to the next generation. In some cases, it became very difficult to re-bond with the mothers in the host country. Furthermore, due to multiple and onward migration, mothers and daughters lived in complex household structures in which the women, especially the mothers, often found themselves in series of relationships including dissolutions and repartnering. This also affects the relationship between mothers and daughters and, by the same token, psychosocial transfer processes as well as human wellbeing outcomes.

In contrast to concepts of chronic poverty, the concepts of human wellbeing and IGT allow for more temporal complexity. The life course is marked by different life events or transitions. During these periods, poverty might well increase. For women in particular, events such as divorce or the birth of a child can have strong effects on material situations; IGT theories mostly assume that "material deficits resulting in childhood poverty have negative impacts that extend throughout the life course" (16). Nevertheless, the level of negative IGT can differ over the life course and poverty reversals are possible.

The empirical insights presented in Wright's study are based on 50 narrative interviews, 25 mother-daughter couples. Mothers (Cohort A) have single nationalities (Colombian, Ecuadorian, Peruvian, and Dominican), and "[r]espondents were predominantly middle-aged and well educated. As regards marital status, the majority were not in relationships at the time of interview" (59). In cohort B, "[o]f the 25 daughters, the majority were aged 11–20 and had dual nationality (11 had both Spanish and Latin American nationality whilst 5 had dual Latin American and British nationality)." The majority of daughters (20) were single and six of them had children of their own. In terms of education, two had been to university, even though none had graduated – in one case migration from Spain to the UK had prevented this (65).

Deterministic research studies of poverty cycles and the intergenerational reproduction of material deprivation do not take the complexity of psychosocial assets and their impact on social mobility during life courses into account. Nor can they map approaches to overcome inequalities. Wright's book stands against this deterministic perspective and shows us how an optimistic perspective can be adopted when studying the IGT of inequalities. Even if not explicitly mentioned, I would like to suggest that Wright's underlying starting point is that mechanisms exist which can lead to exit "inherited" poverty despite intersectional discrimination and social mobility barriers (34). Therefore, the temporal aspect is very important: "refocusing attention on social constructions of age might encourage a move away from more linear and deterministic ways of thinking about how poverty and inequality is 'transmitted' to broader understandings of how it may be 'mediated' or resisted and how poverty reversals can occur" (20).

By studying very different cases of mothers and daughters, Wright examines IGT mechanisms on which policy interventions might

be based. In my view, this underlying starting-point is crucial and needs to be especially highlighted, seeing that research on how to interrupt poverty reproduction – by psychosocial assets – is a far more complex matter than merely concentrating on the IGT of material goods. The complexity is embraced not only by integrating the concept of human wellbeing to the IGT of psychosocial assets, but also by differentiating very precisely important intervening social aspects (gender, migration), relational aspects (mother-daughter bonding), and temporal aspects (life events that cause financial penalties). By considering the complexity of the analysis and this nuanced approach, Katie Wright is doing justice to the holistic view that she has made use of. Nevertheless, while reading the study, I couldn't help the impression that satisfying the very high standard the author has set for herself is particularly challenging. I shall illustrate this with two points.

In contrast to the two examples presented at the very beginning of the book, empirical insights gathered from the interviewed mother-daughter couples show that only a minority of the presented daughters can overcome their mothers' precarity during the interviews themselves. In my view, this leads to an important shift in the study when comparing the theoretical argumentation at the beginning with the conclusions drawn from its empirical insights: Whereas the theoretical approach stresses issues of temporality, reversals of poverty and upward mobility, the empirical conclusion no longer focuses on psychosocial aspects that might interrupt the intergenerational transfer of poverty. Empirical findings show, for example, that mothers whose daughters were separated from them for several years due to migration have more difficulties passing values on to their offspring. Of course, identifying (psychosocial) obstacles to exiting poverty is an important result. Nonetheless, it could have been interesting to add mother-daughter cases in which psychosocial factors of social upward mobility can be studied as resilient attitudes. This could also lead to contributions to resilience theory which is closely linked to the concept of human wellbeing. Empirical answers show that changing family constellations, new partners, new stepfathers, new social environments or membership in cohesive communities play an important role in transfer processes. The impact can be negative or positive, but it would be interesting to know how families' closer social networks affect the IGT and human wellbeing of the second-generation of female migrants.

The second important aspect of Gender, Migration and the Intergenerational Transfer of Human Wellbeing that I wish to highlight here is the distinction between psychosocial and material assets. "[Dolores and Miriam] had become homeless in London when Dolores separated from her partner, and though she later secured council housing she was still unable to supply her daughter with regular access to the internet which prevented Miriam from securing good grades" (88). "Marta suggested that she (as her mother) had children early, later repartnering in Spain due to gendered vulnerabilities linked to her migrant status" (115). The majority of the interviewed women are engaged in cleaning; nine of the daughters did not have a European nationality. All these examples suggest a strong link between material and non-material goods. The book does ask (25) about the intersection of material and non-material transfers. But it concentrates much more on the offset of material deprivation by non-material transfers and leaves the impact of material deprivation on psychosocial transfers in the background. Furthermore, with regard to material deprivation, the study mostly focuses on educational and occupational advancement including language knowledge and, in my opinion, does not give enough attention to legal status and income (including access to social benefits).

Reading the empirical part, I asked myself the following questions and was left without answers: What legal status did the interviewed persons have and how does it determine IGT processes? Are some of the persons forced to work in informal (cleaning) jobs due to their legal status and have no exit option? How does this affect psychosocial assets? How did material status (for example not having access to the internet) affect psychosocial aspects such as motivation and self-esteem?

The theorisation of the future of second-generation migrants is an interesting starting point (40). At the end of the book, Wright suggests a number of implications for public policy. It is important to factor in the existential formal barriers to social mobility with a direct impact on material process (legal status reducing access to legal help and social benefits) and psychosocial assets (informal administrative barriers including humiliating chicanery) in order to get the whole picture. These aspects may have an important effect on the construction of IGT processes as they might hinder social mobility despite positive and resilient attitudes and thereby lower self-esteem and motivation.

In sum, Katie Wright's study is undoubtedly important, but its empirical findings, in my view, are even more interesting and richer than the conclusions drawn from them in the book.

Wright, Katie (2018): Gender, Migration and the Intergenerational Transfer of Human Wellbeing. Cham: Palgrave Pivot. 150 pages. ISBN 978-3-030-02525-0 (hardback), ISBN 978-3030025267 (e-book). Price: €57.19.

Recommendations of new books on the pandemic

Karl Heinz Roth, a medical doctor and historian, shows how deeply the global pandemic is affecting our societies and people's everyday lives – a fundamental work for critically coming to terms with this crisis, and for avoiding future ones. For the past two years, the pandemic triggered by the SARS-CoV-2 virus has dominated the world. It has permeated people's everyday lives, changed social relationships, dominated the media, challenged the political establishment and put numerous scientific disciplines to the test. Roth presents the event from a global perspective, recounts the prehistory dating back to the 2000s, analyses the spread and dy-

namics of Covid-19, and discusses the pandemic's characteristics and impact on humans. It addresses the countermeasures, the failures revealed in the process, and the mental, political, social, and economic consequences of the lockdowns. For the first time, this book considers, relates, and contextualizes the individual aspects of a global pandemic across disciplines, allowing for discussion and resolution of contentious issues such as the virus as a laboratory escapee, the role of major international foundations, and the effects and collateral damage.

Roth, Karl H. (2022): Blinde Passagiere. Die Corona-Krise und ihre Folgen. München: Antje Kunstmann Verlag (engl. translation: Stowaways. The Corona crises and its consequences). 480 pages. ISBN 978-3-95614-497-4. Price: €30.00.

For all its horror, the history of epidemics is a story of success and progress, and not only in medical terms. We owe our current life expectancy not least to the experience gained with pandemics.
Many epidemics even made great history – for better or worse. While measles made an inglorious name for itself as an invisible supporter in the conquest of the New World, vaccinations were used against smallpox for the first time, and repeated cholera outbreaks led to improved hygiene concepts taking hold in cities. In the Spanish flu of 1918, on the other hand, most countries largely failed to protect people.
Many individual aspects of the epidemic story are all too familiar to us today: from conspiracy theories and rapid protective measures to lockdown and vaccination opponents, to courageous and self-sacrificing efforts on behalf of the sick and others who suffered, and the ability to stand together as a society and defy the challenge.

Gutberlet, Bernd I. (2021): Heimsuchung. Seuchen und Pandemien: Vom Schrecken zum Fortschritt. (engl. translation: Visitation. Epidemics and pandemics: From horror to progress). München: Europa Verlag. 432 pages. ISBN 978-3958904262. Price: €24.00.

In this Very Short Introduction, eminent biologist and popular science writer Dorothy Crawford offers a fascinating portrait of viruses even before Corona came around. Crawford first relates how viruses are being discovered and she unravels the intricate structures of tiny parasites that are by far the most abundant life forms on the planet. Analysing the threat of viral infections, Crawford recounts stories of renowned killer viruses such as Ebola and rabies as well as the less known bat-borne Nipah and Hendra viruses. She identifies wild animals as the source of the most recent pandemics, detailing the reasons behind the present increase in potentially fatal infections, and evaluating the evidence that suggests that long term viruses can eventually lead to cancer.

Crawford, Dorothy H. (2018): Viruses: A Very Short Introduction. Oxford: Oxford University Press. 176 pages. ISBN 978-0198811718. Price: €16.97.

The Covid-19 pandemic has left a trail of loss, misery, and economic ruin in its wake. With such destruction, can there be any silver lining? As veteran science journalist Debora MacKenzie illuminates in this captivating, acclaimed book, there is one: with the lessons learned from this disaster, we can stop it from happening again. She lays out the full picture; of the previous viruses that should have prepared us, the shocking public health failures that led to this catastrophe, the wrong decisions made at every turn. And employing what we have learned about viruses, vaccines, inequality, global cooperation, and more, she charts a bold, optimistic path forward for protecting humanity from threats to come. There is no question that more viruses are on the way, and we are still unprepared. But if we learn from our mistakes and heed the vision MacKenzie lays out in this book, we might avoid going through a nightmare like this ever again.

MacKenzie, Debora (2021): Stopping the Next Pandemic: How Covid-19 Can Help Us Save Humanity. New York: Hachette Books. 384 pages. ISBN 978-0306924224. Price: €24.07.

This sweeping exploration of the impact of epidemic diseases looks at how mass infectious outbreaks have shaped society, from the Black Death to today, and in a new preface addresses the global threat of COVID-19. In a clear and accessible style, Frank M. Snowden reveals the ways that diseases have not only influenced medical science and public health but also transformed the arts, religion, intellectual history, and warfare.
A multidisciplinary and comparative investigation of the medical and social history of the major epidemics, this volume touches on themes such as the evolution of medical therapy, plague literature, poverty, the environment, and mass hysteria. In addition to providing a historical perspective on diseases such as smallpox, cholera, and tuberculosis, Snowden examines the fallout from recent epidemics such as HIV/AIDS, SARS, and Ebola and the question of the world's preparedness for the next generation of diseases.

Snowden, Frank M. (2019): Epidemics and Society: From the Black Death to the Present. New Haven: Yale University Press. 582 pages. ISBN 978-0300256390. Price: €21.22.

The Corona pandemic and the federal government's response to it in terms of infection control policy have spawned a new movement: the "Querdenker". Little is known about the social composition, media use behaviour, and knowledge practices of this group. For the first time, an interdisciplinary group of social scientists has comprehensively studied these protests to understand why the movement emerged, what moves it, and how it operates. The book comprehensively covers the various protest groups, from the economically affected to vaccination opponents and esotericists to conspiracy theorists and radical right-wing protesters.

Lindenberger, Thomas / Reichardt, Sven (2021): Die Misstrauensgesellschaft der "Querdenker". Die Corona-Proteste aus kultur- und sozialwissenschaftlicher Perspektive. (engl. translation: The distrust society of the "contrarians". The Corona protests from a cultural and social science perspective). Frankfurt : Campus Publisher. 323 pages. ISBN 9783593514581. Price: €29.95.

Second only to the human brain in its complexity, it is one of the oldest and most critical facets of life on Earth. Without it, you would die within days. In Immune, Philipp Dettmer, the brains behind the most popular science channel on YouTube, takes readers on a journey through the fortress of the human body and its defences. There is a constant battle of staggering scale raging within us, full of stories of invasion, strategy, defeat, and noble self-sacrifice. In fact, in the time you've been reading this, your immune system has probably identified and eradicated a cancer cell that started to grow in your body.

Dettmer, Phillip (2021): Immune – a journey into the mysterious system that keeps you alive. New York: Random House. 368 pages. ISBN 978-0593241318 (hardback). Price: €22.99.

Quarantine is our most powerful response to uncertainty: it means waiting to see if something hidden inside us will be revealed. It is also one of our most dangerous, operating through an assumption of guilt. In quarantine, we are considered infectious until proven safe. *Until Proven Safe* tracks the history and future of quarantine around the globe, chasing the story of emergency isolation through time and space – from the crumbling lazarettos of the Mediterranean, built to contain the Black Death, to an experimental Ebola unit in London, and from the hallways of the Centre of Disease Control (USA) to closed-door simulations where pharmaceutical execs and epidemiologists prepare for the outbreak of a novel coronavirus. But the story of quarantine ranges far beyond the history of medical isolation. In Until Proven Safe, the authors tour a nuclear-waste isolation facility beneath the New Mexican desert, see plants stricken with a disease that threatens the world's wheat supply, and meet NASA's Planetary Protection Officer, tasked with saving Earth from extra-terrestrial infections. They also introduce us to the corporate tech giants hoping to revolutionize quarantine through surveillance and algorithmic prediction.

Manaugh, Geoff and Twilley, Nicola (2021): Until Proven Safe. The History and Future of Quarantine. New York: MCD. 396 pages. ISBN-13978-0374126582 (hardback). Price: €23.60.

With lessons learned from COVID-19, a world-leading expert on pandemic preparedness proposes a pragmatic plan urgently needed for the future of global health security. The COVID-19 pandemic revealed how unprepared the world was for such an event, as even the most sophisticated public health systems failed to cope. We must have far more investment and preparation, along with better detection, warning, and coordination within and across national boundaries. In an age of global pandemics, no country can achieve public health on its own. Health security planning is paramount. Lawrence O. Gostin has spent three decades designing resilient health systems and governance that take account of our interconnected world, as a close advisor to the Centers for Disease Control and Prevention (CDC), the World Health Organization (WHO), and many public health agencies globally. Global Health Security addresses the borderless dangers societies now face, including infectious diseases and bioterrorism, and examines the political, environmental, and socioeconomic factors exacerbating these threats. Weak governance, ineffective health systems, and lack of preparedness are key sources of risk, and all of them came to the fore during the COVID-19 crisis, even – sometimes especially – in wealthy countries like the United States.

Gostin, Lawrence O. (2021): Global Health Security. A Blueprint for the Future. Cambridge, Massachusetts: Harvard University Press. 331 pages. ISBN 978-0674976610 (hardback). Price: €40.94.

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