



Metis

Study

Global health

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**Institute for
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Summary

Health is a guarantee for personal well-being and social, economic and political development and stability. Serious threats to it can destabilize societies, states and regions and jeopardize peace, so global health risks have long been a subject of security-related thought. The present study takes a

prescient look at two developments. The first is that of the risk of pandemics, with a focus on the increasing resistance of pathogens; the second is that of the chances for improving global health care. The study's final section briefly looks at three health-related matters to think about for the Bundeswehr.

Global health: tendencies, actors, risks

The health of the world population is similar to other topics that do not seem to be of direct relevance to security at first glance, such as water and food supply. However, it has become firmly embedded in security-related thought within the context of the so-called broader concept of security.¹ The United States, for example, already addressed the issue in its national security strategy back in 1998.

Health is a fundamental element of quality of life, and although there is no uniform definition of this multifaceted concept, it is obvious that mental or physical health confinements not only affect a person's sense of well-being, but also restrict their ability to participate actively and productively in social life. Health is therefore a guarantee for social, economic and political development and stability. Threats to it can destabilize societies, states and regions and jeopardize peace. The focus of the present study is on this macro level.

The primary indicator for measuring the health development of a population – the world population, in this case – is the average life expectancy. Despite the enormous improvements that were made altogether over the course of the 20th century, in particular due to the reduction of child and maternal mortality, the global

comparison shows that there are still major differences between the OECD world and the least developed countries. A life expectancy of more than 80 years in Germany contrasts with one of less than 60 years in Sub-Saharan Africa (see Figure 1).

The World Health Organization (WHO) has assumed a unique importance in the global promotion of health since the end of the Second World War. The Geneva-based United Nations directing and coordinating authority on health acts as an international standard setter. Besides this, the achievements of the organization, which was established in 1948, range from the eradication of smallpox and the promotion of breastfeeding and vaccination to the control of tobacco.

The WHO has, however, also faced sharp criticism recently. It has been accused of having prematurely categorized the H1N1 influenza as a pandemic in 2009 and having failed to respond resolutely enough to the hitherto largest Ebola outbreak in Congo in 2014. The WHO has since been working with the Health Emergencies Programme on one of the most far-reaching reforms in its history. The programme's purpose is to provide new response forces to support countries around the world in dealing with health crises. There is undoubtedly an urgent need for this as, according to a WHO report from May 2016 written in response to the Ebola outbreak in 2014, only 65 of 193 states at that time had the "minimum core capacities" required to detect, report and respond to the risks of pandemics to international standards.

¹ For more on the broader concept of security, see "Food and water scarcity – a key factor in future conflicts?", Metis Study No. 06 (June 2018).

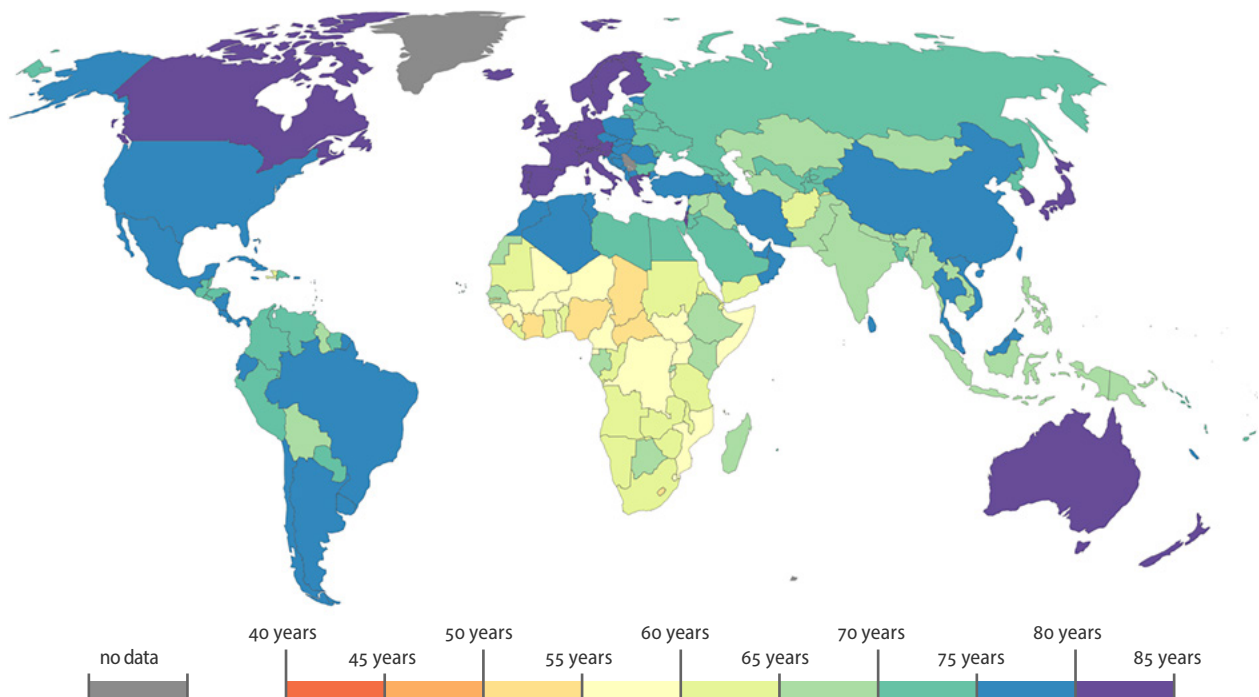


Figure 1 Global average life expectancy – status: 2015. (Source: Our World in Data)

Germany has made its mark over the last decade in the context of the WHO as an actor in the field of global health due to its commitment in the Ebola crisis in 2014 and during its G7 and G20 presidencies. While the United States is still the largest WHO donor country, it has been scaling back its support under President Trump. Europe and Germany will therefore have to keep taking on growing responsibilities in the area of global health in the future.

The risks that global health faces are meanwhile numerous, ranging from malnutrition in developing countries to the spread of obesity in the OECD world, from an increase in air pollution and climate change to underdeveloped health care systems in fragile states and contagious diseases.

The present study takes a prescient look at two topic areas that could both have a significant impact on global health in the future – in a positive as well as in a negative sense. Pandemics and the increasing resistance of pathogens will be addressed first, the chances for improving health care second. The study's final section briefly looks at three health-related matters to think about for the Bundeswehr.

Pandemics and resistance

A pandemic is an (infectious) disease that in contrast to an epidemic is not confined to a local geographic area, but spreads across countries and continents. The risk of pandemics has rarely been as high as it is today. The

reasons for this are the continuous increase in the world population combined with urbanization and the boom in tourism and trade. A pandemic can have a number of origins.

People are increasingly weary of getting vaccinated, for example. The WHO has classified this as one of the top ten threats to global health in 2019. Vaccination for measles is one of the vaccinations whose need is most questioned.² From 2016 to 2017, the number of measles cases reported went up by 30% worldwide. The largest increases were observed in the United States, the eastern Mediterranean and Europe. Despite the increasing circulation of misinformation and conspiracy theories, however, vaccines remain the best weapon against pathogens such as measles, Ebola or Influenza.

Synthetic biology, a comparatively new field at the intersection of molecular biology, organic chemistry, engineering, nano-biotechnology and information technology, is making it possible to manipulate or even produce pathogens. Such a targeted procedure could also become the cause of a pandemic. A prominent role in

² The scepticism towards the inexpensive, highly effective measles vaccine is unfounded. The article published in the *Lancet* in 1998, which is quoted in this respect to this day, was retracted in 2010, as it was based on falsified data. The authors (Andrew Wakefield et al.) are regarded as discredited.



this is played by CRISPR³, a molecular biological method developed in 2015 that can be used to cut and modify DNA with previously unknown precision. It has drastically accelerated and improved genetic engineering procedures. The international community has already addressed these new biosecurity risks in contexts such as that of the Biological Weapons Convention. The development of capabilities in synthetic biology is still a complex, costly endeavour and thus largely confined to government laboratories, so the risk of a disastrous act of bioterrorism being committed, for example, using synthesized viruses, remains limited. With a view to the possibility of the smallpox virus being synthesized, however, an independent expert group commissioned by the WHO already warned back in 2015 that the risk of such a bioterrorist act being committed by a variety of actors was increasing due to both the rising commercial availability of genetic material and the corresponding hardware as well as the diffusion of knowledge.

Laboratories can also inadvertently become a starting point for pandemics due to human error. In fact, there are regularly cases of infected laboratory assistants potentially carrying pathogens into the outside world – interestingly, irrespective of both the types of pathogens concerned and the security levels of the laboratories (i.e., even of those at which the highest biological protection levels, 3 and 4, apply). Such an incident would be particularly dangerous if a highly pathogenic virus were released that was able to spread from mammals to humans through the air. Controversial trials with air-transmissible H5N1 influenza viruses carried out in the Netherlands (Ron Fouchier) and the United States (Yoshihiro Kawaoka) recently expressly underlined this risk.

Finally, climate change does not only have direct adverse effects on global health due to the increase in extreme temperatures (according to the Robert Koch Institute, almost 500 people died in Berlin alone from the extreme heat in Germany during the record summer of 2018). It is also conducive to the outbreak of pandemics, as it both encourages bacterial growth and causes permafrost to melt, which in turn could “wake up” pathogens trapped there.⁴

Ignorance, lax hygiene and the disproportionate use of anti-infectives in humans and animals additionally advance the emergence of resistant pathogens. One example is *Candida auris*, a tenacious fungus that is resistant to common antimycotics and in a short time has spread to hospitals around the world. *Candida auris*

is dangerous only for patients with a weakened immune system, but nearly half of those who contract the infection die within 90 days. Bacteria resistant to antibiotics have long been a subject of debate. In fact, the WHO says that antibiotics are becoming increasingly ineffective against pneumonia, tuberculosis, gonorrhoea and salmonellosis.

According to a study commissioned by the government of Great Britain, infections caused by resistant pathogens worldwide are estimated to claim the lives of about 700,000 people each year, and this figure could rise to up to 10 million in 2050.

71 countries (status: December 2018) have meanwhile enrolled in the WHO's Global Antimicrobial Resistance Surveillance System (GLASS) to support global monitoring. Besides this, the World Health Assembly (WHA), the highest decision-making body of the WHO, already adopted a global action plan back in 2015. Germany is implementing it in the country under the German Antibiotics Resistance Strategy (Deutsche Antibiotika-Resistenzstrategie – DART 2020).

Looking ahead, an effective way to develop new antibiotics could be to use bacteriophages, i.e., viruses that infect bacteria. Bacteriophages have been rediscovered as a research subject, having been used for medical purposes at the beginning of the 20th century, but then ousted by broad-acting antibiotics such as penicillin. Phages could again play an important complementary role in the future, especially in the fight against multi-resistant bacteria that do not respond to several conventional antibiotics. One advantage of phages is that particular types target and destroy specific strains of bacteria, which means that a therapy for a specific bacterium spares other, useful bacteria in a human body. Phages have not yet been authorized as medicinal products in the EU. In Germany, however, the first clinical study is currently being conducted under the umbrella of the German research project “Phage4Cure” with the aim of establishing phages as approved medicinal products in the fight against the bacterium *Pseudomonas aeruginosa*, which frequently becomes multi-resistant and causes lung infections.

Health care

The OECD world has great hopes of two technologies and their medical application: artificial intelligence (AI)⁵ and predictive genetic diagnostics. The chances and risks of both are examined closely in this section. The remainder

³ CRISPR is short for *Clustered Regularly Interspaced Short Palindromic Repeats*. It is also commonly referred to as “gene scissors”.

⁴ See “The impact of climate change on the Arctic”, Metis Study No. 2 (March 2018).

⁵ The term artificial intelligence is rather broad and not coherently defined. It covers multiple software-based technologies and methods for the automation of tasks that so far have required the use of human intelligence. Use of the term AI is largely avoided here and concrete technologies – such as automatic image recognition – are used instead.



of the section is devoted to discussing the potential for progress in developing and emerging countries.

Experience with the use of AI technologies in the medical sector has been mixed. Hitherto to use methods based on machine learning to provide guidance for therapies have been sobering. Systems capable of evaluating large amounts of medical literature were used in trials to assist with diagnoses and the selection of therapies. Clinical trials conducted in the United States in the area of oncology are considered to largely have failed. One reason for this is that the technology used for the processing of unstructured data material such as articles in medical journals is not (yet) suitable. Difficulties were also experienced with the integration of these new computer systems in existing hospital infrastructures and with data protection issues.

Nevertheless, when it comes to dealing with other types of data, AI-enhanced technologies such as machine image recognition continue to present enormous chances and could significantly improve diagnostic procedures in the near future. Potential for this is above all seen in the field of radiology. There is broad consensus that automatic image recognition by means of Convolutional Neural Networks (CNN) can and will indeed play a key role in the process, though this does not mean that it will replace human radiologists in the foreseeable future. However, legal and ethical questions remain to be resolved in this field of application as well.

Health care currently comes primarily in the form of curative health care, not preventive health care. At the same time, societies in the OECD world are increasing the pressure to make health care systems more effective, cost-efficient, transparent and universal. A key to this lies in the systematic, blanket collection and analysis of patient data. Predictive genetics offers a particular chance here – provided that sustained progress in the field of molecular biology is made and an even better understanding of the human genome is gained – and could turn the current paradigm upside down by actually enabling health care to become primarily preventive rather than reactive. The reason for this is that molecular genetics allows predictive diagnostics to be carried out for the purpose of determining the future course of a disease. If medicine becomes data-driven to such an extent, however, fundamental questions concerning medical ethics and society will arise. In addition, there are considerable forces of persistence in the traditional, reactive insurance companies and health care institutions in the OECD world; as a consequence, the legal foundations and insurance models required for such a revolutionary step to be taken are just two examples of prerequisites that do not yet exist. Nevertheless, a profound change in medicine, with sustainable cuts in costs and positive effects for global health, is conceivable in the longer term.

The advances in the area of human genetics are equally creating chances and ethical problems. In 2018, the case of the “CRISPR babies” from China attracted attention. He Jiankui, a scientist who was educated in the United States and works in China, publicly announced that two children – Nana and Lulu – had been born whose genes he had modified using CRISPR gene scissors during in vitro fertilization. The intention behind this intervention was to immunize the children, whose father was said by Jiankui to be HIV-positive, to the immunodeficiency disease. In July 2019, reports emerged that in addition to the twin girls Nana and Lulu, a third baby had been born whose genes he had likewise edited. There is still doubt as to whether the intervention (the targeted modification of the CCR5 gene to the variant CCR5-delta32, which as a form of natural mutation prevents certain types of HIV from entering cells) has actually achieved the desired result, i.e., the children’s immunity to HIV. It is also unclear what undesirable side effects the manipulation in the children could have. More than anything, however, the intervention is ethically highly controversial because interventions in the germ line of human beings are considered taboo. The WHO responded to the case by setting up a working group to develop proposals for global standards.

Government investments in the course of the 20th century have proven to be an extremely effective instrument for raising health levels, as measured by the average life expectancy (see Figure 2). Notwithstanding, a billion people around the world still have no access to adequate and affordable health care. Every year, more than 100 million people fall below the poverty line because they have to pay for medical treatment out of their own pockets.

There are still no established health care systems in developing and emerging countries comparable to those in the OECD world, but the advances in technology could enable huge strides to be made. Against this backdrop, private sector actors are expanding their activities. However, the case of the United States shows that non-universal health care systems provide perverse incentives and generate higher costs per capita, only marginally lower government spending and unequal access to health care. Ethical and economic considerations therefore equally argue against private, commodified and instead for public, universal health care. Another interesting option lies in the establishment of hybrid systems in developing countries, especially since a large part of innovation today is the result of privately funded research and development activities.

Concluding remarks and matters to think about

With a view to developing countries, global health is to a great extent an issue of good governance. The greater the fragility of statehood, the harder the impact of health threats on a population. A crucial component is therefore

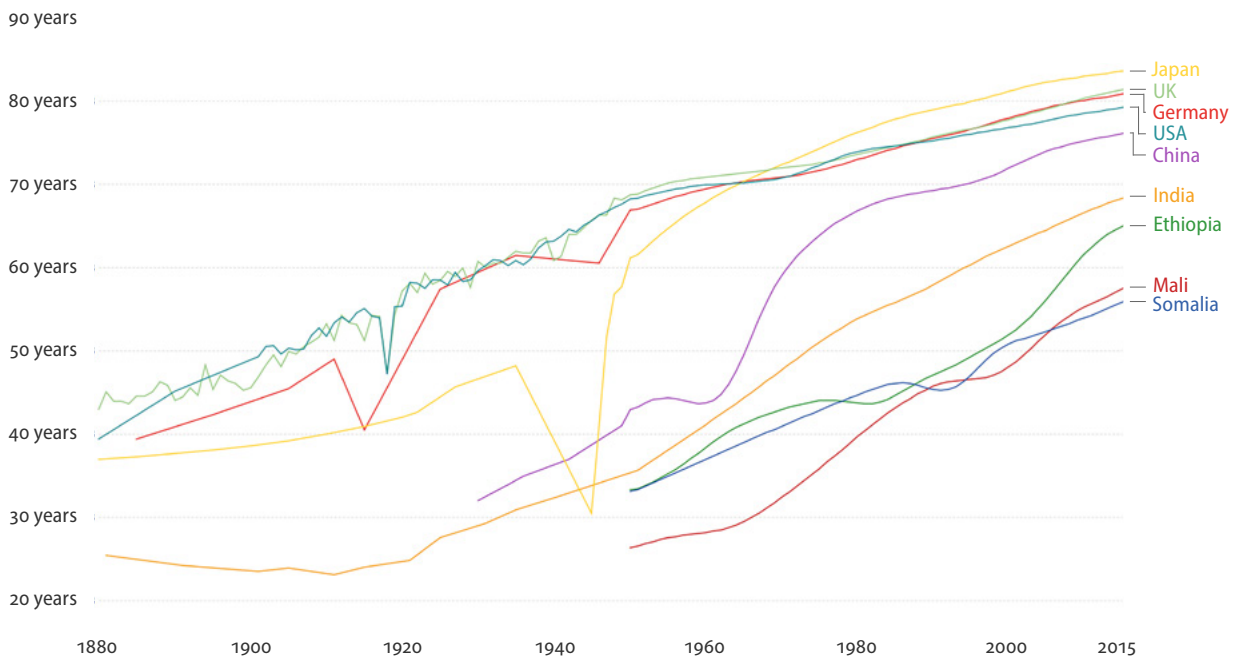


Figure 2 Development in average life expectancy from 1880 to 2015 as measured in a comparison between China, Germany, Ethiopia, United Kingdom, India, Japan, Mali, Somalia, USA (Source: Our World in Data)

the establishment of trustworthy public health care institutions. The last Ebola outbreak in Congo, for example, became so disastrous despite new diagnostic procedures, experimental treatments and the availability of a vaccine because the people had no trust in the medical institutions – to the point of attacking Red Cross staff.

In the OECD world, the leading causes of death continue to be cardiovascular diseases and cancer, both of which are encouraged by factors such as obesity and diabetes. According to OECD figures, average health care spending as a share of the GDP has remained relatively stable in the OECD since 2009, at around 8.8%. Only the United States spent more, 17.1% (in 2017). Yet the average life expectancy in the United States has declined for the last three years. It becomes clear from this that increased spending (on technology) cannot be the only key to better health in the OECD world in the 21st century due to the changes in living conditions. Instead, the dramatic rise in the rate of mental illnesses in the OECD world⁶ suggests that changes in lifestyles – less and healthier food, more sleep, deceleration, reductions in loneliness and stress

(see Figure 3) – are expected to have positive health effects in the developed, urbanized world.

It naturally makes sense to use technology in health care in the OECD world, too, but neither as a substitute for a healthier lifestyle nor as a replacement for medical personnel. Technology should rather be used to ease the workload of medical personnel and enable them to have more time for the patients on a personal level again. A metaphor that can be found for this in the literature devoted to looking ahead is the “multi-door health centre” where general practitioners function as confidants and counsellors and have enough time to collect the patients at the entrance and guide them along, to talk to them as equals and to determine with them the further consultations and diagnostic and therapeutic paths – from yoga to gene therapy.

Three matters to think about can be derived for the Bundeswehr from the issues addressed in this study:

- Obesity has become the main reason for the rejection of applicants to the US Armed Forces. Nearly one in three applicants is considered unfit for service for this reason. The Bundeswehr is confronted with this trend, too. The problem of widespread obesity in the OECD world has long since also become a problem for recruitment and operational readiness in armed forces.
- The results of a meta-study conducted in the United States in 2017 and published in the Clinical Psychology

⁶ The WHO estimates that depression will replace cardiovascular diseases in 2020 in the developed world as the main limitation on a normal life free of health complaints (as measured by *disability-adjusted life years*).

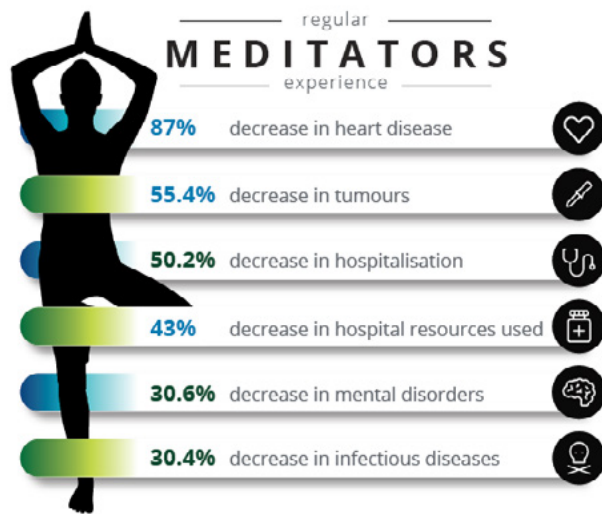



Figure 3 Positive health effects of regular meditation (Source: Janson Yap, Ng Zhi Hui 2016: Health Care Foresight: Identifying megatrends. Deloitte, p. 8)

Review suggest that meditation and yoga are promising complementary approaches in the treatment of post-traumatic stress disorders – a problem that Bundeswehr soldiers returning from deployments are also increasingly confronted with.

- A study conducted by the Bundeswehr Office for Defence Planning in 2013 concluded that apart from being ethically dubious, an improvement in the performance of a healthy organism cannot be achieved responsibly by applying existing genetic methods. The progress made in the field so far, above all the development of the CRISPR method, calls for a reconsideration of the current state of affairs and global activities and reflection on both the ethical and legal frameworks and regulations regarding “human enhancement”. 

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