The Digital Pill: How Technology is Transforming Healthcare

Interview — Angel Gonzalo *Photos* — Noor Staring

Healthcare is at a turning point: digitalization offers enormous opportunities to increase efficiency, promote preventive measures and democratize access to medical services. New technologies and data analysis not only improve the quality of medical services, but also establish a new way of thinking about health and illness. Digitalization is on the verge of revolutionizing healthcare and opening up new possibilities, from prevention to treatment. Dr. Fleisch, a professor at ETH Zurich and the University of St. Gallen, explains in an exclusive interview for The Essence how digital technologies will increase efficiency, reduce costs and transform the healthcare system in the long term.

Dr. Fleisch, you are a professor at ETH Zurich and also at the University of St. Gallen. Your area of expertise is information technology. How is it that you are writing a book about digitalization in healthcare and reflecting on the future of our healthcare system?

The so-called "Internet of Things", in which the computer becomes omnipresent and at the same time disappears into everyday things, was the original field of research that my team and I started over 20 years ago. The fields of application for this technological vision have literally exploded, and we have focused on a few areas of application: retail, manufacturing and healthcare. Here, together with colleagues from the medical faculty, we are building new applications and investigating how new technologies are changing healthcare.

Thanks in part to medical advances, we have doubled our life expectancy in the last 100 years. So we are living longer, but are we paying more and more for the treatment of illnesses?

Yes, it's incredible what medicine has achieved in this period of time. We are living longer, but more and more often we are also ill for longer – chronically ill. We have soon realized that digitalization in healthcare is particularly important, also and especially because of chronic illnesses. These are the big issue in medicine in the future and also the big cost drivers.

Non-communicable chronic diseases – cancer, diabetes, cardiovascular and respiratory diseases, as well as mental illnesses – are the big challenge. Will it remain that way for future generations?

As we age, we become more susceptible to chronic illnesses. It is somewhat of a paradox that our healthcare system is on the verge of collapsing in terms of costs precisely because it is so effective. Our healthcare system was established about 100 years ago, and at that time acute illnesses were the most common cause of death. Today, chronic illnesses are. Our healthcare system was not built for this. However, there is a promising aspect: from twin studies, we now know that about 70 to 80% of

Prof. Dr. Elgar Fleisch

Elgar Fleisch is Professor of Information and Technology Management at ETH Zurich and the University of St.Gallen (HSG). His currently largest laboratory, the Center for Digital Health Interventions, investigates how digital technologies are changing our healthcare system. It combines the disciplines medicine, informatics & economics.

Elgar Fleisch and team have published their findings in over 600 papers, including the book The Digital Pill. He is co-founder of several spin-off and start-up companies and member of various supervisory boards as well as academic steering committees.

Elgar Fleisch did his doctorate in Vienna, in the field of artificial intelligence, and his habilitation in St.Gallen on the topic of network companies. He spent his sabbaticals at MIT and Dartmouth College.

chronic diseases can be prevented. So it is not primarily the luck of the genes that keeps us healthier, but the behavior of each individual. Through my behavior, I can decisively influence the risk factors and thus prevent chronic diseases. That is the big opportunity.

You raise an important point: precaution and prevention are given a low priority in our healthcare system. Less than 3 percent of healthcare costs are spent on prevention. What are the reasons for this?

That's a very important question. Well, the most apt answer is: "There is no glory in prevention". I don't know of any sensible doctor, researcher, insurance or pharmaceutical manager who says that prevention is nonsense. Even if the long-term effect of preventive interventions is much more difficult to prove, I hear from my esteemed medical colleagues that prevention is less a medical issue than a business case issue. The fact is that the incentives are set for repair and not for prevention. Whether or not prevention is widely adopted is ultimately a question of the business model. Hospitals need to fill their beds, and doctors' offices need to pay back the loans for their expensive equipment. And today they only get reimbursed for repairs, not for prevention. Even if you are the best and most idealistic doctor in the world, the incentive system will eventually catch up with you. To put it figuratively: a patient who is healthy does not generate any income for you. Only a visible illness is the ticket to today's healthcare system.

In Singapore, the Health Promotion Board was founded over 20 years ago with the aim of enabling people to take control of their own health. How does that work exactly? Is this model also applicable in Switzerland?

Yes, absolutely. There are several initiatives in this direction worldwide. They start by creating the necessary awareness that health is important and can be influenced. We learn a lot of things at school, but we actually learn just as little about "health literacy" as we do about "financial literacy". What do I need to do to feel good physically and mentally? This includes nutrition, exercise, sleep, stress, how to deal with addictive substances and basic knowledge about health. A person who knows more about health stays healthier. Health literacy has a decisive influence on our health.

> "Our healthcare system is a disease system, because only visible disease is the entry ticket into today's healthcare system."

In your book "The Digital Pill", you, as co-author, describe five levers that show how digitalization can be a central key to the healthcare world of tomorrow. The first lever you describe is the promotion of behavioral change through digitalization. How does that work exactly?

Everyone knows how difficult it is to break old habits. In my view, bringing about and anchoring behavioral change is the biggest challenge in prevention. The power of small nudges is emphasized everywhere, but their effect is often very limited. Changes are easier to bring about when it is not a major burden for the patient and when they can clearly see or even feel the necessity for it. The further in the future the positive effect lies and the greater the effort involved in the changeover, the more difficult it becomes. Digital technologies can help here in a big way. They extend the doctor or therapist from the few minutes in the practice to 24/7 care around the clock. If they are well designed, they are fun, motivating and informative. They are the personal trainer for everyone. They can be very effective, especially in combination with the doctor, and at the same time extremely cost-effective.

The digitalization of healthcare is about technology, apps, algorithms, data and sensors. Does this mean we are moving away from a humane medicine?

No, if we do it right, the opposite will happen. Technology supports and extends the doctor, it does not replace him or her. And it supports the patient. Technology helps us to be much closer to the individual and to involve the doctor when support is really needed.

In the area of prevention, it works a bit like with a car. There, dozens of parameters such as oil temperature and tire pressure are constantly measured without saying. If a parameter leaves its normal range, an orange or red light comes on. With digitalization, this can be more and more the case with people. Our digital helpers are constantly measuring our blood pressure, blood sugar levels and heartbeat in the background and report before the disease becomes visible. We cannot feel blood pressure and triglyceride levels ourselves, and the same applies in healthcare: what I cannot measure, I cannot manage.

Are we Europeans generally less open-minded about new technologies?

Unfortunately, it is a European perspective to emphasize the risks. Digitalization fuels many fears in us. The Chinese are more open in this regard, as are North Americans. Let me explain: in our part of the world, the first question is always about regulation and security. Innovation then takes place elsewhere, not here in Switzerland or in Europe. We may have the most comprehensive data protection laws, but we have hardly any digital business. We are beginning to regulate AI before we understand it. I have the uncomfortable feeling that our biggest export is the raised index finger. And yet innovation is becoming faster and faster, more agile. We have to have a certain basic trust in the legality and solidity of innovative people and companies that produce new things. Innovative companies are where you can try out new things, and that is often no longer the case here.

In many countries, health systems are controlled by the way they are financed. This is often primarily about business with a wide range of vested interests. Can digitalization help to untangle this?

I am convinced it can. But we have to remember that information technology acts as an amplifier. If I digitize a poorly organized system without changing it, without an overarching concept, then it will become much worse. So, let's say I have a hospital and I require all departments and doctors to manually enter all medical data into a computer. That's not a good idea.

Has the Covid-19 pandemic helped us in terms of digitalization?

Yes, massively. Necessity has become a virtue. Good telemedical services have been developed quickly. In Sweden, 45% of appointments with general practitioners are handled by telemedicine. This relieves the pressure on the healthcare system there enormously. In terms of digitalization, Scandinavian countries have developed faster than the rest of Europe. We can learn from that.

> "There is no glory in prevention."

Does digitalization also increase efficiency? Where do you see inefficiency and where can costs be saved without a loss of quality?

Many cost drivers are due to inefficiencies, that is, to "waste" in the system. Digitalization helps here to create transparency and avoid redundancies by giving every treating physician easy access to all previous examination results and health data concerning his or her patient. Digitally supported triage systems can also help to relieve the pressure on expensive and notoriously overburdened hospital emergency rooms. From a medical point of view, up to 55% of emergency room visits are unnecessary or avoidable.

You mention that digitalization is democratizing medicine. Can you explain that?

Medical services that can be provided digitally are many times cheaper and are not tied to time or location. They are accessible and affordable for almost everyone. They are also easy to measure and thus transparent and comparable. And they enable every citizen, whether sick or healthy, to easily access their health data and secure health knowledge. This strengthens a patient's autonomy and changes the relationship between patients and doctors.

Can digitalization significantly improve the quality of medical services? Is it already doing so?

In a lecture at the University of Zurich on the occasion of a medical congress, I asked the question to a full lecture hall: Do you think that digital therapies in 2030 will be better than the poorer half of conventional therapies? The doctors voted anonymously via an

app. Even I was surprised by the result: the vast majority voted yes. The reason is simple: medical knowledge is exploding. It expands with every new scientific publication. A single researcher can hardly keep up in his or her field, and a practicing physician has no chance at all. A good AI, whether in the field of diagnosis or intervention, will soon be consistently better than the average doctor. In some areas, such as imaging techniques, this is already the case.

Thanks to digitalization, medical knowledge can be created from data, which basically benefits everyone. However, the handling of health data as a public good is the subject of heated and controversial discussion. How do you assess this development?

Medicine is an empirical science. Its core, clinical studies, are conducted to collect and analyze data in order to test hypotheses and make evidence-based decisions. Not only data from clinical studies helps, but increasingly also health data that patients themselves generate and collect digitally. From a medical point of view, this is an infinite treasure trove that is becoming massively more important with digitalization. Countries in which this data is not available due to ideological data protection will be at a disadvantage in medical research in the medium term. The latest developments will then take place elsewhere. Unfortunately, I speak from experience here.

When you see what people post on Facebook and Instagram, you get the impression that it's not the general public that has a problem with data protection, but just a small, loud and, above all, healthy elite. Anyone who is ill and looking for help is very willing to share their data – anonymized and secure, of course – for research purposes. In my view, donating data is the new blood donation.

"Donating data is the new blood donation."

You are talking here about so-called "citizen scientists". These could provide a sound knowledge base. What does that mean and how great is the real potential?

Every single person can contribute to medical progress by collecting their health data and making it available to research in anonymized form. Firstly, my data helps me for prevention purposes and in the event of illness. Secondly, they contribute a tiny bit to my children and grandchildren being able to benefit from better medicine. Some people are already going a step further in specially organized programs by participating in voluntary studies, for example on the effects of different eating habits. They are then called citizen scientists.

Do you advocate making health data widely available for medical research?

Yes, definitely. If the data is anonymized and secure, then the vast majority have no problem with it, but see it as a contribution to the future health of society. Therefore, I am a big fan of the opt-out variant, in which citizens who do not want to donate data must actively decide against donating data and are otherwise included by default. Incidentally, this is one of the few small nudges with a big impact.

According to the WHO, integrated health systems should play an important role in the future. This will increase efficiency and the quality of services because coordination will improve. How do you assess this development?

Today, the reality is often that patients run from one doctor to another, from one specialist to another, examinations are carried out multiple times, redundancies arise and different data sets are created. The individual players are not coordinated with each other and certainly not integrated. Integrated would mean that the patient is truly the focus, and all parties have an interest in the patient recovering as quickly as possible. This would mean that at least a good portion of the compensation would be based on results. The medical service providers would be judged by the success of the healing process and not by the input, i.e. the examinations carried out and medications prescribed. This requires that they all pursue the same goal, are incentivized in parallel and work together. Everyone accesses the same data and works together for the good of the patient. A good example of this is an integrated type I diabetes clinic in the Netherlands that has just been analyzed in the renowned New England Journal of Medicine Catalyst.

You say that prevention today fails mainly because of the lack of a business model. Are there any examples that point to a possible way forward?

I am particularly fascinated by models that take a personalized and evidence-based approach. The first company we noticed that does this is called **insidetracker.com** and is based in Cambridge near Boston, USA. I can upload my blood count as a PDF and an AI will use it to derive personalized nutrition recommendations. Each of these recommendations is backed up with the scientific publications on the clinical studies. A few months later, I can upload my new values and see if anything has changed for the better or worse. The logic of measuring and managing is implemented. **Function Health**, also based in the US, offers a similar service, as does the company **Aware** in Germany and **Care.me** in Switzerland. These are used by people who want to age healthily and cannot find the appropriate support in the traditional healthcare system.

Are these new players in the healthcare sector in competition with traditional medicine?

No, I don't see it that way. Rather, they complement it; each has its own focus and is optimally aligned with its core task in terms of costs. Healthy customers who, as part of prevention, are diagnosed with conditions such as prediabetes, switch to the traditional healthcare system and then come back again. This can already be seen today at Care.me, for example.

What role does technology play in prevention?

Prevention must be accessible to everyone and as straightforward and cost-effective as possible. Digital technologies play a key role here because their marginal costs are almost negligible. An evidence-based, personalized, patient-centered, always up-to-date, easily accessible and affordable prevention service is hardly conceivable without massive digitalization. That is why we at the Center for Digital Health Interventions at ETH Zurich, UZH and HSG are working with partners in North America and Singapore on digital biomarkers, digital health interventions and the corresponding platforms.

In your book "The Digital Pill", you ask the rhetorical question "Why isn't health a compulsory school subject?" Yes, why not?

We all went to school and didn't really learn anything about how to maintain and promote our health, except maybe a few physical exercises (laughs). Perhaps the time has come for us to integrate health as a comprehensive topic into a school subject. Basically, it's about an essential life topic, such as social studies or financial literacy. It could be based on the four pillars of health prevention in an appealing way: exercise, nutrition, sleep and stress management. In such a subject, you would not primarily learn for school, but for life.

Centre for Digital Health Interventions

The Center for Digital Health Interventions (www.c4dhi.org) is a joint initiative of ETH Zurich, the University of Zurich and the University of St. Gallen (HSG). For over 10 years, interdisciplinary teams from computer science, medicine and social sciences have been working there on evidence-based and cost-effective personalized digital therapies for the treatment and prevention of chronic diseases. They develop and evaluate digital biomarkers, digital and hybrid interventions, and new business models. The center is financed by projects of the Swiss National Science Foundation (SNSF), the US NIH, the Singapore NRF, the Swiss Health Promotion Foundation and companies such as CSS. It publishes its results in leading scientific journals, in books, teaching materials and in the form of open source software. Elgar Fleisch is co-founder and co-chair of the center.

"The Digital Pill", the book

Our healthcare system is under great pressure to change: groundbreaking medical advances are allowing us to live longer, but our increasingly unhealthy lifestyles mean that we suffer from chronic illnesses more and more often. This is driving up healthcare costs and undermining our successful system. Accelerating digitization in healthcare is one way to counter rising costs while providing better care for the sick. "The Digital Pill – A Journey into the Future of Our Healthcare System" (Campus Verlag) provides a global overview of today's healthcare system, its considerable successes and the challenges posed by medical progress and an aging population, and shows how digitalization can help solve these problems. Using the example of five chronic illnesses, this publication shows what digital innovations can already achieve today and takes us on an exciting journey into the digital future of our healthcare system.