

eHealth

Trends & Talks



Digital Health Literacy | Innovative Ecosystems | Mobile Health | Telemedicine | Gamification | Wearables | Health Apps | Data-Driven Healthcare | Startups | Big Data | Integrated Health | Cloud Technology | Digital Patient | Democratization Of Healthcare | Fitness Trackers | Electronic Health Records



WE DISCUSS AND INFORM.

The Polish Healthcare Journal is among the leading scientific magazines in Poland, focusing on issues that fall within the scope of management, ICT innovation, eHealth, mHealth, wearables, Internet of Things/Health, digital health start-ups and their innovative ideas. We publish monthly interviews with international experts and practical advice for managers, promoting the development of information and communication technologies.

It is the only magazine publishing analyses and prognoses for the pharmaceutical and medical market on a regular basis, based on data collected from more than 30 000 pharmacies and medical centres. The health maps, reflecting the development of the epidemiological situation and health threats, are a source of knowledge for the creators of health policy at the regional and national scale. Among regular issues we present special reports. The previous issue reported "Best Health Apps" as a guide in a world of thousands of mobile apps for patients and professionals.

The magazine is a media partner of the most important events in the Polish and European healthcare market, as well as the organizer of conferences and an annual European congress attracting more than 900 guests from Poland and abroad. Join us and discover great investment opportunities, share your ideas and knowledge with our readers, present innovative solutions, promote your event. Become our expert or let's find out what we can do together regarding eHealth topics. The magazine reaches more than 17 000 subscribers per month. We are available in print and on-line.

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Understanding eHealth



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The digitization of the healthcare sector is in a phase of dynamic development. More and more countries are already implementing—or in coming years they are going to implement—eHealth strategies, healthcare providers are investing boldly in IT infrastructure and companies and start-ups are introducing increasingly modern mobile solutions to the market. The expectations of patients, doctors and nurses are rising along with their digital awareness. We are witnessing the crystallization of the new healthcare reality, where information serves as a pill with the power to solve many of today's problems.

eHealth has quickly become a symbol of the democratization of healthcare, as well as an opportunity to meet the challenges caused by an ageing society, the epidemic of non-communicable and chronic diseases and the dramatically rising costs of healthcare. It gives us the hope that we can restore the patient to a central role in the system, and guarantee coordinated and personalized care and more efficient preventive treatment, all thanks to a cross-sectional knowledge of the patient, available everywhere as part of their secure electronic health record. Information is becoming as vital as medicine, allowing medical conditions to be continuously monitored and health threats to be detected in advance, replacing curative treatment with preventive treatment and contributing to the process of clinical decision-making.

However, innovative technologies alone are insufficient to make revolutionary changes. What is needed is cultural transformation—a new healthcare providers' cooperation model that does away with existing information silos. The interoperability of systems, and the novel solutions necessary to guarantee the free exchange of information and its compatibility, is becoming a huge challenge. Legal solutions are not keeping up with market development: many countries are still awaiting legal regulations concerning telemedicine and the exchange of electronic information. Health insurers are sceptical towards reimbursement for teleconsultations and mobile health apps. But this is slowly changing.

We are watching the development of eHealth with fascination, where young start-ups, with their fresh ideas, are those shaping the trends. Mobile health apps have gained rapidly in popularity, resulting in healthcare being at our fingertips instead of behind the door of a consulting room. There are new issues that are heating up experts' debates: the internet of things, clinical decision support systems, wearables, medical data analysis, big data and small data, cyber-crime and digital literacy.

To thoroughly understand eHealth—to learn why so many hopes are pinned on it, and what challenges have to be overcome to achieve the benefits of digitalization—we talk with market experts, in search of multiple points of view. In our first special edition of the Polish Healthcare Journal "eHealth Trends & Talks", we present a condensed knowledge of the subject in the form of interviews, articles and infographics. In this way, we can join in the discussion on healthcare in the era of information and communication technologies (ICT).

We wish you a pleasant read.

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POLISH HEALTHCARE JOURNAL

We deliver knowledge and present
the newest trends and innovations
on the healthcare market.

digital health
ehealth & mhealth
telemedicine
wearables
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health apps
start-ups
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Comprehensive health protection



The OSOZ Open Health Care System is a comprehensive and long-term information project that is unique in Europe, created to support health and designed to suit the majority of European citizens. The system is intended to coordinate the treatment processes of individual patients and of the entire society.

In the cybernetic and slightly philosophical perspective, every human being lives in a multidimensional life space in which they move along a specific route, called a health trajectory. An optimal human health trajectory is always singular and will never repeat. Therefore, the aim of the project is to extend the health trajectory, which translates into the longest and the best in human health. How can this be achieved?

The implementation of a task whose aim is to optimise life and health has remained a theory for decades due to the lack of an opportunity to create vast health databases as well as to process information quickly and cheaply.

Nowadays, in the age of the information revolution, all these obstacles have been overcome and, in practice, we can collect health information without restrictions, process it and use it for the good of man. The target of health optimisation can be achieved easier by medical cybernetics, supported by technical and economic cybernetics.

The health processes currently implemented increasingly face such issues as: information collection, treatment process modelling, development of modern health supporting technologies, prediction of diseases, development of early-warning systems, as well as the design of health programmes and treatment processes supporting health. The elements necessary to achieve the above mentioned targets include information technology and computerisation of healthcare facilities, understood as places where health information is created. This process has been in a state of constant progress since the beginning of the 1990s.

It is not difficult to observe that health protection has a multiannual dimension, with an increasing number of patients reaching the age of 100. Consequently, IT systems that support health protection also have to be timeless in order to support healthcare processes over long periods of time, comparable with our lifespans.

In the light of the foregoing, more than 30 years ago the KAMSOF Group set itself a very ambitious and innovative task - to build an overall system of health protection based on the achievements of medical, technical and economic cybernetics.

These multiannual and consequent actions resulted in the development of the National Health Care System and its successor, the Open Health Care System, which is currently the company's flagship product promoting a unique approach to health with the use of the opportunities created by e-health technologies.

Open Health Care System (OHCS)

The OSOZ National Health Care System used the Polish health model as its basis. However, with the course of time this strategy proved to be so innovative that other countries have become interested in it, considering the OSOZ solutions as an opportunity to improve their own healthcare systems. This was the birth of the idea on how to develop national OSOZ solutions, similar to the Polish solution, but differing in their details. These small changes are caused by national differences at the level of the healthcare system, health policy, diets, demographic structure, etc. In short, each country is characterised by its own health model.

The creation of national OSOZ systems should entail the creation of a global OSOZ system combining the individual national solutions into a single, coherent health management support system. It has also become evident that another multilingual layer of management support in the healthcare system needs to be developed with the capacity for coordinating and co-organising the individual national systems. The global OSOZ system, based on the foundations of economic, medical and mathematical sciences, as well as expertise in biomedical engineering, is an important step forward in the creation of the European information society in the area of health.

SELECTED WEB SERVICES FOR PATIENTS



Online registration

This service for patients allows them to remotely register an appointment with a doctor. With the doctor's schedule available on the OSOZ platform, the patient can make their own choice of suitable date for the appointment, and then the health centre where the doctor works sends a confirmation of the appointment.



Online availability of drugs – “KtoMaLek”

The patient, after receiving their prescription, can check online in which pharmacy the prescribed drugs are available. An additional and very convenient feature of the service is the possibility to book drugs at the pharmacy online. Due to its practical values, this service quickly becomes popular with patients.



Verification of Drug-Drug interactions

Drug interactions constitute one of the most serious problems for patients who take several drugs concurrently. This concurrent drug intake without consulting a doctor may have an adverse effect on the patients' health, and be hazardous to their lives. The service gives the patient the possibility to check for themselves whether their drugs are safe.



Verification of the Drug-Food interaction

Drug-food interactions are an issue that have been neglected for many years, and even underestimated despite the fact that many interactions can have a highly negative impact on human health. This service can, within a few seconds of the drugs being prescribed by the doctor and hence before they are purchased at the pharmacy, remotely inform the patient about what foods they should avoid while taking specific drugs.



Information on drugs

This service provides comprehensive information about the drugs available on the Polish pharmaceutical market. It functions on the basis of the BLOZ Database of Medicines and Healthcare Measures and is used every day by thousands of patients, doctors and pharmacists. The service allows them to check the current prices of drugs and the repayments available for reimbursed drugs, as well as allowing searches for the cheapest drug substitutes.



Find a pharmacy

This search engine allows patients to find easily any pharmacy in their area. The results include the exact address, the opening hours, and an online check of the availability of drugs in the pharmacies.



Find healthcare

Due to the “Find healthcare” search engine the patient has the possibility to check the current addresses of different healthcare facilities, learn which specialists admit patients in a given healthcare facility, check the doctors' surgery hours, and even book an appointment online.

Preventive health programmes

The interactive health programmes available in the OSOZ system allow the continuous monitoring of the patient's health. This means that it is possible to detect potential threats early and to undertake appropriate preventive actions. The health programmes contain information on recommended health services, tests that the patient should undergo, specialist doctors they should see, and preventive measures they should apply to suit their health needs as they change over time, taking into account the current entries on their

Health Account.

The programmes are intended for users of all ages, starting with the pre-conception programme through the prenatal, pre-school and school programmes, as well as programmes for adults which cover the subsequent decades of their lives.



OSOZ portal

Services supporting the patient's health are available through the OSOZ portal under the following address: www.osoz.pl.



SELECTED WEB SERVICES FOR DOCTORS

“Online” history of the patient's health

For the doctor, the information about the patient's health recorded on their Health Card constitutes a comprehensive and well-organised set of data describing the patient's state of health. This information comes directly from those healthcare facilities and pharmacies which cooperate with the OSOZ system and together document the patient's health history. On each occasion the doctor can view information about the origin of the entry. Upon the patient giving their consent, the doctor can access the patient's history directly through the medical software they use at their surgery every day.



Managing interactions and allergies

In making a safe drug prescription the doctor is assisted by the system of interaction and allergy checks, which automatically examines whether the prescribed drugs interact or cause allergies with the other drugs and chemical substances recorded on the Patient's Health Account. In the case of an interaction or allergy, an appropriate warning message is displayed immediately on the doctor's monitor to prevent them from prescribing a drug which could be dangerous or which would not contribute to the patient's health improvement.



Messages about the withdrawal of drugs from the market

Messages from the Main Pharmaceutical Inspector are designed to eliminate from the market those drugs which, after testing, have been shown to be harmful. The Main Pharmaceutical Inspector service gives doctors access to current messages within a few moments of them being published. An additional feature of the service is the possibility to have a withdrawn medicine blocked automatically in the doctors' IT systems, hence also ensuring they cannot prescribe it.



The innovativeness of the OSOZ system involves the coordination of the most important parts of the national healthcare systems under one model for the collection, processing and electronic exchange of information.

The global OSOZ system gives the opportunity to analyse medical, pharmaceutical and economic data globally. The complexity of the information collected creates the opportunity to plan key treatment processes on the European medical and pharmaceutical market.

The functionality of the OSOZ system is developed in two basic areas:

- a platform for the collection and automatic exchange of information,
- a global platform for the development and implementation of standards in healthcare systems.

In the national systems, the personalised support for the individual patient's health and the anticipation of potential future threats to their health are each based on historical information on health collected as Anonymous Individual Health Accounts (IKZ).

A special feature of the Health Account is the emphasis placed on the complete anonymity of the collected information. Despite the complete anonymity of health information, it has an excess of security algorithms for use in the case of sensitive information systems. Access to the content of a Health Account is additionally secured by the Patient Health Card and access keys similar to protection systems used for highly sensitive information systems.

Another essential feature of the national OSOZ systems, increasingly appreciated for safety reasons, is the possibility to work using “cloud computing”. The use of the “OSOZ cloud” gives healthcare facilities unprecedented opportunities to achieve organisational and financial savings, and in particular the chance to manage the company through the use of time management systems.

“The essence of the OSOZ system is to build a model of health protection that is able to detect and eliminate health problems at the initial health layers.”



“The global OSOZ system, based on the foundations of economic, medical and mathematical sciences, as well as expertise in biomedical engineering, is an important step forward in the creation of the European information society in the area of health.”

Essence of the national OSOZ system

The OSOZ National Health Care System is one of the largest information projects in the Polish healthcare system, covering thousands of health market entities, millions of citizens and billions of health services conducted each year.

Health management in a system as large as the OSOZ one is not an easy task. Therefore, it was found necessary to divide the entire system into smaller functional subsystems. The OSOZ system was split into nine smaller subsystems, known as layers of health protection. Each of these nine layers carries out different tasks and is responsible for a different element of human life and health.

Health layers are like barrage balloons, protecting society against diseases. The first and foremost layer is the Early Warning Layer, responsible for the identifying and detecting health problems at the earliest stage of disease development. It is obvious that the earlier a health problem is detected and eliminated, the less harmful it will be for the human organism. A consequence of this is better health results.

The last and ninth layer of the OSOZ system is for remedial treatment, used to support treatment processes at the peak of disease development, where the treatment is not always effective, and its costs are disproportionately high.



Availability of medicines online

The BLOZ Database of Medicines and Healthcare Measures ensures rapid access to information on medicines available on the Polish pharmaceutical market. The database modules, in addition to supplying basic information about the medicine, also contain current data on the types of patient co-payments, medicine substitutes with the same active substance, as well as clinical indications recorded in the medicinal product's characteristics.

SELECTED WEB SERVICES FOR HEALTHCARE FACILITIES



Business support for healthcare facilities

The economic services intended for managers of healthcare facilities includes the possibility to compare the outcomes of the facility's operations in its environment, in particular to analyse the comparison of individual economic indicators with similar average indicators for the region, province or the entire country.

Due to the epidemiological service, the healthcare facility has the possibility to prepare for forthcoming changes and to adjust the scope of its health services to meet the future needs of society.



Insurance

The OSOZ platform allows entities which provide health services in cooperation with insurance agencies to gain the possibility of managing health insurances online.

The OSOZ platform creates the possibility to initiate cooperation with a chosen insurer, to manage insurances online as well as to manage the financial settlements.



Online test results

The option to check test results online ensures convenient access to the information required by the patient. A message about the availability of test results can be passed to the patient via e-mail or text message. The information necessary to check the test results online (referral code, website address) are submitted when the material for tests is accepted.



Online showcase of healthcare facilities

Each healthcare facility in the OSOZ system has its own online showcase, including basic information about the facility. The showcase can be seen in the OSOZ system under the "Find healthcare" section or by entering the name and address of the facility into the search engine. There is also the possibility to add a short description and the opening hours, as well as to insert photos presenting the facility.

SELECTED WEB SERVICES FOR PHARMACISTS



Managing interactions and allergies

At the early step of selling a drug at a pharmacy, the OSOZ system allows monitoring of whether the drug is safe for the patient. The pharmacy programme interacts directly with the OSOZ system while the patient is still being served. An automatic comparison is made between the current drug and those purchased over the last 30 days, as recorded on the Patient's Health Account. The analysis of the drugs includes checking interactions and allergic reactions. In the case of an interaction or allergy, an appropriate warning message is displayed immediately on the pharmacy's monitor and prevents them from selling a drug which could be dangerous to the patient's health.

Drug-food interactions

The use of drugs and the intake of food can have an adverse effect on the processes used to treat the patient. There are many rules on how to take drugs in a safe manner, and the role of a pharmacist in the patient's education is invaluable. Therefore, during the sale of a particular drug the pharmacist has the opportunity to receive information about potential drug-food interactions. They can then provide the patient with recommendations in the form of a printout, or send them quickly and simply via e-mail or text message.



The essence of the OSOZ system is to build a model of health protection that is able to detect and eliminate health problems at the initial health layers, which are connected with preventive medicine, and to prevent the development of the disease process, in particular that stage of the disease which requires the application of serious, much more expensive and less effective remedial treatment.

Messages about drug withdrawal

Participation in the OSOZ project gives pharmacists access to current messages from the Main Pharmaceutical Inspector (GIF) within a few moments of them being published. The moment a drug questioned by the GIF is recorded as to be given to the patient, an appropriate warning message is posted in the pharmacy system.



Text messages

Automatic text messages sent directly from the pharmacy system can inform patients that a drug is ready to be collected. All the pharmacist needs to do while ordering a drug or entering it into the "list of drugs to be ordered" is to add the patient's mobile phone number.



Pharmacists can also use text messages to inform patients about the availability of prescription drugs.

Partnership programmes

The numerous Partnership Programmes help to strengthen relationships. They can be easily entered using the OSOZ platform by different organisations, such as drug producers, pharmaceutical wholesalers, pharmacies, healthcare centres or networks of healthcare facilities. The programmes are available to pharmacies as well as their employees.



Pharmacy business support

This gives unique access to analyses of the pharmaceutical market in Poland. As part of the economic services aimed at owners of pharmacies, there is the possibility to compare the outcomes of pharmacy operations in their environment, in particular to compare individual indicators with the average values for the region where the activities take place.



Prescription Management System

The Prescription Management System [SKR] allows the real-time verification of prescription correctness while it is being processed in the presence of the patient. The system checks the prescriptions in terms of whether they have been stolen, lost or falsified. This part of the service strengthens pharmacy safety in terms of the reimbursements made by the National Health Fund (NFZ).



Online showcase of pharmacies

Each pharmacy in the OSOZ system has its own online showcase, including basic information about the pharmacy and information on the possibility to check the availability of drugs and to reserve them online.



Data collection

The feature that distinguishes the OSOZ system is the online exchange of information in "real time". Working in real time means utilising a scheme in which information about the health services provided for patients at healthcare facilities is exchanged between the interested parties within a fraction of a second. Currently, information flows at the speed of 150 incidents per second, regardless of the location of the healthcare facility or pharmacy. The amount of data collected on a single day exceeds 3.5 million records, and the system has not even reached half of its target capacity.

Currently, the OSOZ system cooperates with several healthcare facilities and pharmacies across the country, and the databases of the OSOZ system collect information on the health of hundreds of thousands of patients. In the basis of such a large accumulation of data, it is possible to create reliable health models.

The OSOZ Open Health Care System collects health information on Anonymous Health Accounts assigned to individual citizens. Due to such a methodology, it has become possible to accumulate health information in a single location, to which only the anonymous owner of the Health Account has access. Doctors, pharmacists or other authorised people can only gain access to this information by seeking the personal permission of the Health Account owner.

The Health Account contains health data which are automatically retrieved from all the entities that cooperate with the OSOZ system, including hospitals, healthcare facilities, pharmacies, laboratories and other places where health information can be generated. In particular, the patient can enter their own health records independently. Each entry is marked with the source of the data, which increases the reliability of all the data collected.

Over time, the health information saved automatically on the Health Account becomes increasingly comprehensive and reliable. With access to this comprehensive and well-organised information about the patient's condition, any subsequent medical diagnosis becomes much more accurate, the applied treatment methodology more effective, and, in consequence, cheaper.

The automatic collection of information and the authorised access to the Health Account is ensured by



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the Patient Health Card. The Health Card is a secure key to the Health Account. Through the Health Card and unique passwords, the patient has the possibility of granting the doctor authority to access the health history recorded on the Health Account.

In addition to the above mentioned characteristics, the Health Card gives many other opportunities, which allow:

- online registration for an appointment with a doctor registered with the OSOZ system,
- online reservation of drugs at pharmacies registered with the OSOZ system,
- quick and efficient search for a patient in the clinic's files, authorisation of health services, etc.

Modelling of the patient's health

Mathematical health models, in particular the Patient's Health Model, the National Health Model and a model describing disease patterns allow the anticipation of future threats, hence enabling the design of appropriate and effective preventive actions, and the develop-



Reimbursement analyser

The reimbursement analyser is a pharmacy programme module using OSOZ analyses to forecast prices for reimbursed drugs and patient repayments following the publication of a new reimbursement notice by the Minister of Health. On this basis, it presents analyses related to the sale or purchase of a given drug, allowing pharmacies to check in advance whether it would be profitable to buy a larger amount of a given drug or whether stocks of that drug should be sold as quickly as possible.

HEALTH POLICY



OSOZ education

The OSOZ system also allows modern training of the personnel necessary on the health market. This project addresses higher education establishments and medical schools interested in the education of students in the scope of e-health. The concept of the educational process is based on the possibility of current (online) cooperation and information exchange between different universities.

The OSOZ-EDUCATION platform is equipped with modern, efficient and scalable computer systems capable of handling thousands of students and scientific employees at the same time.



National Health Maps

The collection of such a large amount of information on health incidents allows the creation of unusual and extremely necessary solutions, like the National Health Maps.

The OSOZ system records health incidents in 'real time', that is precisely a fraction of a second after they are saved in the IT systems of the medical and pharmaceutical units cooperating with the system throughout the country.

Health Maps show the geographical and demographic distribution of the occurrence of specific groups of diseases. It is an excellent tool to monitor on an ongoing basis the occurrence and spread of diseases and the events connected with them.



List of drugs

The national BLOZ Database of Medicines and Healthcare Measures functions on the basis of which drug services are created and are used in different branches of the National Health Fund and the majority of the economic entities operating within the Polish medical and pharmaceutical market.

ment of modern and effective preventive medicine as well as general prevention methodologies.

The key issue for the OSOZ system within prevention and health design is the Patient's Health Trajectory. The Health Trajectory is determined on the basis of the Patient's Health Model, which is the specific route along which the patient has been moving since their birth and on which they will continue until the end of their life.

The determination of the patient's future health trajectory, through the optimisation of health processes, is a solution which gives the potential to redesign the patient's health. Modelling and automation of the processes taking place in health protection allow the development of more effective medical technologies and contribute to the improvement of health, as well as the reduction of healthcare costs.

Strategies, processes and health programmes

Effective health management and the design of society's health require the standardisation of health services and automation of medical processes. The health services in the OSOZ system are divided into: healthcare services, technologies, programmes, processes, strategies and health policies.

One of the more significant tasks in the OSOZ system is the design of health services in such a way as to adjust them to suit the market expectations. They should also achieve the highest therapeutic effectiveness, constitute standards for the treatment process, be well-tailored, well-estimated and simple enough to be recorded and settled with the patient.

The effectiveness of support for healthcare depends on how early the patient is covered by the healthcare system and how long they remain within it. One example

of comprehensive and long-term involves health strategies. A health strategy is a set of health programmes and processes adjusted to suit the patient's age and health condition. In the OSOZ system there are health programmes created for and addressed to the whole of society, with patients belonging to any age group, starting from the pre-conception, healthy lifestyle programme. Subsequent programmes support the prenatal, neonatal, pre-school and school periods, all the decades of adulthood, until the end of life. ■

“The OSOZ Open Health Care System collects health information on Anonymous Health Accounts assigned to individual citizens.”

Integrating healthcare Caring for Patients



KAMSOFT
Next generation
healthcare IT solutions

4th Industrial Revolution

1784 – mechanization and the first steam engine.
 1870 – electricity and mass production. 1969 – electronics, IT, and production automation. 2015 – cybernetics, Internet of Things, virtual reality, information and communication technologies. We are living through a grand technological revolution which may turn out to be one of the most important stages in the history of humanity. How will it impact healthcare and ourselves?



Innovation and digitalization are rapidly changing the way we live, work, and communicate. The very idea of a human as a natural concept is coming to an end: our bodies will become so permeated with technologies that it will be hard to draw a thick line between what is natural and what is artificial, physical or digital. Klaus Schwab, Founder of the World Economic Forum, aptly summed this up: “One of the features of this Fourth Industrial Revolution is that it doesn't change what we're doing but it changes us”.

Over just a few, maybe a dozen or so years, billions of people all over the world have gained access to unrestricted communication and sources of knowledge. All of this is due to mobile devices and the increasingly easier access to the Internet, which is becoming a basic necessity in the digital reality. It is merely an introduction to the technology of tomorrow: artificial intel-

ligence, robotics, the Internet of Things, autonomous cars, 3D printing, nanotechnology, biotechnology, quantum computerization, and virtual reality. Previously unattainable due to its huge data sets and complexity, knowledge and information is becoming the key to discovering medical correlations, breakthroughs in drug research, and victories over certain diseases due to early prophylaxis.

Every revolution brings the opportunity to change the lives of people all over the world for the better. In healthcare, the primary change is the integration and analysis of big data, as well as real-time monitoring of bodily functions and the detection of any disorders at a very early stage. This will be possible due to implantable sensors that replace mHealth in the form of smart watches and bands. However, we must remember that even though industrial development has improved the

prosperity of people all over the world, we are paying the price in the form of the largest ever devastation of the natural environment in history. All of this results in global warming – a phenomenon endangering human kind. The digital revolution will not be free from mistakes either. Economists Erik Brynjolfsson and Andrew McAfee note that the negative aspects will include unprecedented social

inequality. Machines and robots will gradually take over simple manufacturing activities, which will reduce the chances of the poorly educated on the labour market. The “low qualifications – low pay, high qualifications – high pay” model may lead to social unrest. This can be observed even today – the demand for highly specialized staff in such areas as IT, bioengineering or nanotechnologies is growing, while the demand for lower-ranked positions is decreasing. Sharan Burrows from the International Trade Union Confederation believes that the threat of job loses in favour of robotics is realistic but what is more important is the question of how we will define work and the division of wealth in society. Freedom of communication may be yet another threat, with over 30% of people all over the globe currently using social media to communicate with one another, gain knowledge, and share information. By entering into international interactions, have we become more open as societies, more

tolerant and understanding of cross-cultural interrelationships? Or perhaps on the contrary, the Internet has become a medium to spread radical views, a tool in the hands of those interested in global terrorism.

There is an aspect of the Fourth Industrial Revolution which involves the approach to privacy, personal freedom and intimacy. In a world where our health becomes monitored by a number of sensors, and doctors gain access to complete information about our lifestyle, we will have to accept a life under constant surveillance. We will no longer be able to hide the information about smoking, alcohol abuse or regular fast-food consumption from our physician (and insurer). We will lose control over information about us; yesterday this information was kept in a medical file closed in a doctor's cabinet, tomorrow it will be analyzed by artificial intelligence systems, processed for

the benefit of global science in international data centres. Jon Kabat-Zinn of the University of Massachusetts speaks about a renaissance of science, which we owe to the discovery and understanding of the human genome and the insight into the human mind and body. We will better understand our connections with nature, the surrounding world, and other people.

Life in a system of technology will become normalized, oriented in advance towards specific effects, especially in the area of health. Everything we do will be optimized by a physician or a virtual advisor, although this will not happen against our will. We will be compensated for partially losing our freedom and privacy with the promise of a better and longer life – values we cherish above all. Old age will no longer be a time of loneliness, limited possibilities and social marginalization. We will also benefit from inventions helping us to overcome current restraints: intelligent prostheses for the disabled with functions similar to those of natural body parts, printed organs, DNA editing in the treatment of complicated genetic diseases, nanotechnologies for the precise delivery of drug doses to specific tissues.

“We need a new model of economics, something between Keynesian Economics focused on health and education, on cooperation between public administration and businesses, and neoliberalism oriented towards the free market”, says Stewart Wallis from the New Economics Foundation (UK). The system of the future will have to make an effort to satisfy the needs of each and every individual in the world, to become a fair mechanism maximizing the value of prosperity. Cities will become more efficient, focused on harmonious interactions between man and nature, between man and man, and energy-savings, with plenty of resources available locally due to mini-production based on easily accessible 3D printers. William McDonough from the Stanford University (USA) speaks about a vision based on a paradigm change to a healthy, safe, fair world with access to clean water, clean air, soil and energy.

The technology underlying the Fourth Digital Revolution is just round the corner. Another challenge will be to implement this on a wide scale and to make it available at a price affordable to all. ■

Based on “The Fourth Industrial Revolution”,
World Economic Forum.



HEALTH APPS

for better healthcare



Doctor's Visit

A mobile tool extending the functionalities of standard medical IT systems which help doctors in their work. Its key functions include: home visits, integration with registration via the Internet, drug search, prescription printing, and e-medical documentation. To use the app, you must have a doctor's account in the KAMSOFIT IT systems (or another system – after resolving compatibility issues). Integration with the OSOZ system.

FOR DOCTORS AND NURSES
Polish / English | Free | iOS and Android



VisiMed

A mobile app providing the user with access to his Personal Health Account in the OSOZ system. A great variety of functions: doctor search, appointment review and scheduling, booking medicines in pharmacies and their collection without queuing, checking the availability and prices of medicines, treatment assistant (dosage, control of interactions, for example with food), treatment history outline (prescriptions, visits, health services), calendar notifications.

FOR PATIENTS
Polish / English | Free | iOS and Android

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Photo: eHealth Week 2016

Exit the waiting room

Grand visions, inspirational discussions, start-up ideas and political declarations: eHealth Week 2016 was an opportunity to take a closer look at the digitization of the health sector in Europe and across the world. The market keeps surprising patients with new solutions addressing their needs, and the only aspects which are needed to ensure full satisfaction and realize the promised potential of eHealth are data integration and a cultural change. We present the ten most important conclusions from the conference.

Practical application and usability value rather than technology

One thing that was particularly noticeable when comparing this year's eHealth Week with the previous editions was the strong focus on the patient and patient needs, in contrast to the previously hermetic and technologically inaccessible world of eHealth. I hope that this is not just the perspective of the Dutch health care system, which, by the way, is known for its excellence. Rather than presenting the functional side of systems, the focus was on the user's point of view. One of the most memorable moments of the event was the emotional speech delivered by Anne-Miek Vroom, the director of the IKONE Foundation, who spoke from her wheelchair. She questioned the validity of losing valuable time getting to a doctor or waiting for a visit at a time when there are technologies available to enable remote medical consultations. It is difficult to disagree with this: health care needs technologies. But technologies keep bumping up against legal obstacles (or in other words, delayed legislative processes relative to the pace of market development) and distrust of new

solutions on the part of the payers. Dutch Health Minister, Edith Schippers, presented a similar approach. “Patients with a chronic illness can receive help at home, and digital solutions allow them to live an active life, have a job and be a part of society,” stressed Minister Schippers. In turn, Stephen Lieber, President of the HIMSS (Healthcare Information and Management Society), said that we are now in the middle of reorientation from technology to usability. The next step will be to learn from best practices.

Working with and engaging patients rather than forcing solutions

Nothing about us without us—this could be the theme of eHealth Week 2016. It is rare to see so many patients at conferences intended for experts, especially in such a complicated field as eHealth. “In less than a decade, health apps and digital solutions have found their way into our daily lives—including in the area of health care. The focus of the health care system is clearly shifting from the doctor to the patient,” said Vytenis Andriukaitis, EU Commissioner for Health and Food Safety.

The patient was a theme discussed in almost all the presentations. Start-up solutions are particularly relevant to the specific needs of everyday life. These include applications designed to support people suffering from mental illness and facilitate chronic illness man-

agement, and robots providing assistance to seniors. End users take an active part in the working groups of young companies. Start-ups know that market success is not a matter of distinctive technology but orientation towards solving small and big problems, and making life easier. These are the “to be or not to be” factors for start-ups, which, unlike companies with a large capital base and a stable position, cannot afford experiments in the area of eHealth.

The acceptance of eHealth solutions will largely depend on user-friendly interfaces, much like the case with the game-changing mobile solutions from Apple. From a physician’s perspective, it is about simple systems for collecting data in electronic medical records, while patients need simple telemedicine applications and solutions. Yet even this problem may soon become a thing of the past: the growing number of sensors and integration with health accounts will largely automate data collection, eliminating the need for the physician to maintain medical histories. It has to be noted that a large proportion of medical facilities still use solutions

Anne Miek-Vroom, a patient and ambassador of dialogue between patients and health care organizations, pointed out how eHealth could make a patients’ life easier by eliminating the days of waiting, travelling to clinics and feeling uncertain after leaving the hospital or doctor’s office, when the patient is left alone with their condition. Unfortunately, new solutions are limited due to administrative barriers and fail to reach the people who need them most.



“Health care will be delocalized; we will substitute hospitals for smartphone-based health care.”

deployed several years ago, when functionality had a much higher priority than “ergonomics”.

Representatives of companies taking part in the AAL (Active and Assisted Living) Programme presented components involved in a model process of eHealth solution design. They stressed the importance of precise target group definition, expectation studies, interaction between designers, technicians and users, solution conceptualization and thorough testing.

Paradoxically, patients’ organizations are not prepared for new eHealth challenges, either. There is a lack of awareness of the application and potential of digital solutions, and a lack of knowledge about and experience with communication and information technologies. IT companies do not know how to engage patients in the design process.

The cloud rather than silos

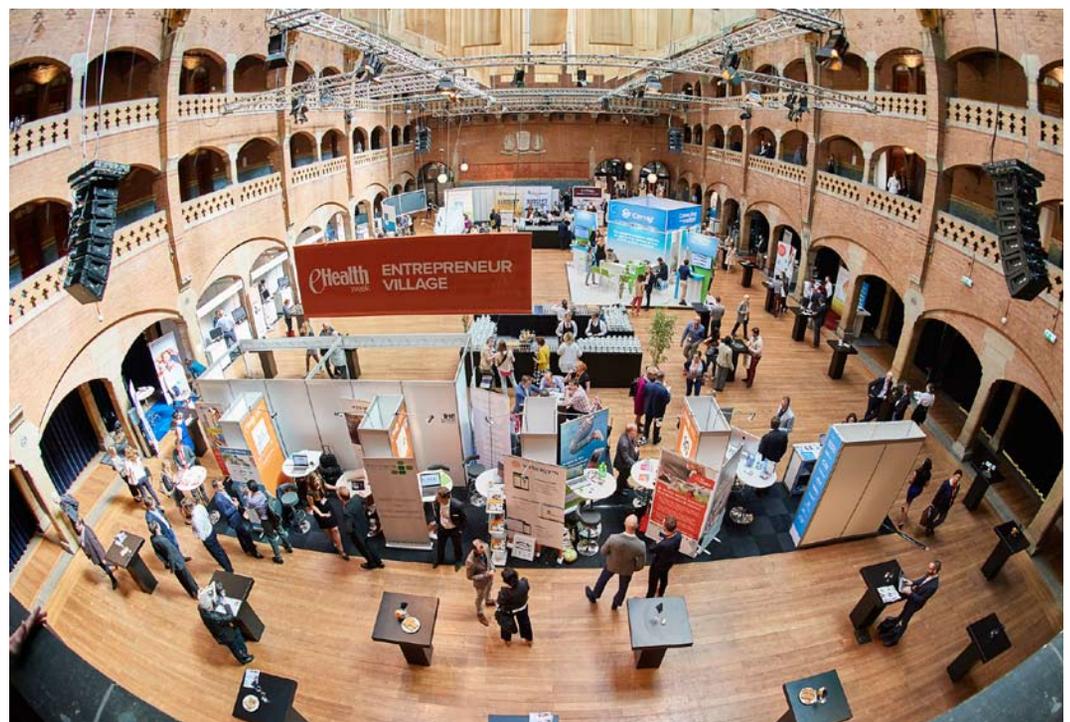
Neil Jordan from Microsoft leaves no doubt: collecting data in the cloud is the future of health care. The advantages of this technology include unrestricted access to information from any location, integration, control, easy communication and huge possibilities

for data analysis. Local databases created by medical facilities are much like closed cabinets with paper documentation, and as such they reinforce the culture of information silos. The resulting digital isolation from the external world significantly reduces the benefits of informatization, and attempts at system integration – deployed without a long-term strategy in place – often fail due to divergent standards and incompatible databases. Patients, physicians and other health care employees are becoming increasingly mobile. With the cloud, every participant in the health care chain can be linked together. “The cloud is the key to a transformation that will make health care smart, personalized and effective. It will allow us to understand medical information better”, Neil Jordan says. He forecasts that the cloud will become the norm for data collection within several years. Dr Maritta Perälä-Heape (Oulu Health) is of a similar opinion: in the future, data will be continuously collected in the cloud, and analyzed by artificial intelligence systems and a physician, who will take action when health parameters fall outside of the normal range.

Cooperation within an ecosystem rather than isolation

Horizon 2020, a programme promoting clusters and public-private partnership, has demonstrated how the funding method can translate into positive changes. The term “ecosystem”, while often overused, has become an integral part of the development of regional and national eHealth systems. In the context of the natural environment, an ecosystem means an ecological community of inter-related organisms. The analogy

As many as 54 companies presented innovative eHealth, mHealth and telemedicine solutions. The winners of the EU SME eHealth Competition, which recognizes the best solutions produced by small and medium enterprises from the European Union, were iHealth with its intuitive health management solutions and Symptoma, a diagnostic search engine tool that suggests possible diseases in a patient based on the symptoms entered by the physician.



in health care would be a system of entities linked to each other by specific relationships. Only by cooperating within an ecosystem is it possible to achieve economies of scale for eHealth projects. In health care, an ecosystem involves market stakeholders, such as public administration, non-profit organizations, private businesses, patients' associations, the social welfare system, health care providers, physicians and other health care employees, and insurers. An example of an eHealth ecosystem is OuluHealth (Finland), a cluster which aims to create innovative solutions addressing the challenges of health care systems. It includes the Oulu University Hospital, the BusinessOulu organization and the Centre for Health and Technology. OuluHealth promotes cooperation between experts to achieve ambitious goals, such as the Future Hospital project, which has been initiated by the University Hospital and which will have a budget of 500 million euros over 20 years. The aim is to build the world's smartest hospital that will be based on digitization and cutting-edge design solutions. Such an ambitious idea requires the transfer of knowledge, cooperation between experts from different fields and adopting an innovative approach to health care. Working in the ecosystem model guarantees its success. Alternatively, the term "ecosystem" can indicate an open eHealth platform accessible to eHealth app developers, diagnostic equipment developers, etc. One example is the HealthSuite platform from Philips.

Integration rather than information chaos

With its big data analytics performance, IBM Watson has proven the potential of medical intelligence. Years ago, when data collection was limited to an electronic health record, the interoperability of systems and devices seemed just a matter of time and simple standards. Yet we are now moving further away from that vision and not closer to it. This is due to the dynamic growth of mobile technologies: health apps, measuring devices and wearables. The need for standardization was a recurring topic at eHealth Week 2016. Nonetheless, there were no ideas put forward for overcoming the current deadlock of medical data chaos. Technology-driven health care is becoming chaotic. Initiatives such as the Personal Connected Health Alliance attempt to change this by certifying compatible mHealth devices, but the decisive step must be taken by individual countries or the European Union. Without greater standardization, we will be unable to break the vicious circle where the value of information is being wasted due to the growing number of non-integrated devices. Every day, there are new apps

Virtual reality can be applied to the treatment of mental health-related conditions, rehabilitation and physician training. In the photo: Psious, a platform supporting phobia treatment for patients (including claustrophobia, fear of heights, etc.). The patient is exposed to anxiety-inducing scenarios while the therapist monitors the vital functions to track the reactions of the patient's body and control the session accordingly.



“The cloud is the key to making health care smart, effective and personalized. It will allow us to better understand and use the medical information we collect.”

and miniature sensors for tracking lifestyle, physical activity, sleep length and health parameters. The results are seldom used by physicians. Let us start with the basics: by creating standardized health accounts for storing information from various sources while working on international standards, so that in future years a standard health information summary is available, one which can be used, for instance, by a physician in another country.

Chronic illness management and telemedicine rather than treatment and visits

Chronic illnesses generate up to 80% of health care costs. And it is chronic illnesses that teams developing new mobile apps focus on. If you analyze all the presentations delivered at eHealth Week, most of the time was devoted to mental health. This comes as no surprise: according to the WHO, mental illnesses will form the number one disease burden by 2020, and the related costs in Europe are estimated at 92 billion euros a year. The features of eHealth, such as mobility, ano-

nymity, confidentiality, progress tracking and customization, perfectly support the prevention and treatment of mental health problems, especially depression and anxiety disorders.

Telemedicine, which enables remote patient monitoring instead of in-hospital treatment, offers important benefits as well. Leonard Witkamp, director of Ksyos Telemedicine Centre, outlined the efficiency of teledermatology: a 74% decline in the number of face-to-face visits, a time-to-result reduction from 6-8 to less than 5 weeks, and a 20-40% cost reduction.

Easy communication and mobility rather than stationary health care

The smartphone is becoming a health management centre. In the future, health apps (by then considered medical equipment) will be supported by measuring devices and beacons located around the home, part of the Internet of Things. Always at hand, the mobile phone will become the physician's favourite tool for distributing health information and a communication platform. We are still waiting for the payer to reimburse mobile apps, which seems like a perfectly logical idea given their current stage of development and growing popularity.

Multidimensional data utilization rather than pointless collection

In my view, it was one of the most important presentations at this year's eHealth Week. Dr Jeremy Theal from the North York General Hospital cited the results of the eCare project to argue that “the pen is the most expen-

Dr Daan Dohmen (healthcare futurist): health care is about making those who need help feel that there is someone out there who cares, someone who can be trusted. This can be ensured by technologies that look after the patient 24 hours a day and virtually connect the patient and the doctor, but also by robots that take care of the elderly. We cannot judge what is best for patients: they need to experience a given technology for themselves and decide what it is worth.



sive tool used by doctors". The adaptation of the eCare system has brought savings of 76% by sealing the clinical decision-making process, reduced the pneumonia mortality rate by 21% and reduced the incidence of medical errors by 40%, which saves 31 pneumonia or COPD patients a year. The costs of the project, which amounted to USD 24 million, were paid off within less than 6 years. This is just a sample of the possibilities offered by big data analytics and a well-designed clinical decision support system; it is also another trend that should put to use when data is stored chaotically in electronic health records. Patients' data should be, in the first place, made available to patients themselves to increase their engagement and responsibility for the prevention and treatment process. A recurring comment was that access to information alone changes nothing: patients are not interested in viewing records they do not understand and cannot use in practice. Patients' information must be converted to practical tips, reminders, guidelines and health management tools.

Technologies as a background rather than technologies as an objective

This year's award for the best eHealth solution developed in the EU by small and medium enterprises went to iHealth for its iHealth Discovery, a simple device with a health management system that is easy to use for people from any age group. Patients, just like doctors, are not IT experts. Even the most complex and feature-rich solution must convince the user with its intuitive interface, just like today's smartphones and operating systems installed on computers. In some of the presented eHealth solutions, the old 1990s design habits were still apparent.

As virtual reality shows, technology has the power to amaze. As I was putting on 3D glasses to test a system for the treatment of anxiety disorders (Psious), I was rather sceptical and wondered if virtual reality could match the real world. And yet when I was soaring to the top of a skyscraper in a virtual lift, the knowledge that this was just a video could not suppress the emotions I felt.

Innovative action rather than theoretical discussion

"In the transformation process, specific solutions and products are more important than politics", said Lucien Engelen, director of REshape Center Radboudumc, to summarize the current reorientation of health care

towards information-based processes. "For the first time ever in history, we will be present when a person gets sick. Professionals will subscribe to patient's data." added Engelen. The waiting rooms at medical facilities and doctors at their desks will be replaced by a group of specialists in a telemedicine centre monitoring a wall of displays and analyzing data sets collected in real time. A "transformation from hospitals to smartphones" is underway that will lead to health care delocalization. On the other hand, discussing, analyzing and looking into how eHealth can affect the health care system is not enough. "Stop talking, don't be afraid to make mistakes, start acting," said Lucien Engelen to summarize the conference. We are in the middle of the fourth industrial revolution, known as the Internet of Things, or Internet of Information. Small innovations over the years will accumulate, resulting in a technological tsunami. The challenge, however, will be to change habits and the culture. ■

eHealth Week – Europe's leading eHealth conference, held by HIMSS Europe (an independent organisation of eHealth leaders and independent businesses) and the European Commission.



WATCH ONLINE

Keynote by
Lucien Engelen
at eHealth Week 2016
(20 min 25 s)
www.goo.gl/ouzq5F

Digital patient. Our health in the future



Dipak Kalra is the Clinical Professor of Health Informatics at University College London, President of the European Institute for Health Records (EuroRec) and a Director of the openEHR Foundation.

He plays a leading international role in research and development of electronic health record architectures and systems, including the requirements and models needed to ensure the robust long-term preservation of clinical meaning and protection of privacy. We talk about the “digital patient” and how new technologies can change the future of healthcare.

What exactly is the “digital patient” and how can ICT (Information and Communications Technology) change the way we deliver healthcare, undertake prevention and organize healthcare systems?

The digital patient is a metaphor for the set of information known about a patient's health, healthcare and state of wellness, and which may at times serve as a useful digital proxy for the patient. In recent years it has acquired a special meaning into which mathematical models and computer generated simulations have been incorporated. The digital patient is then no longer a record of the past, it is a tool that helps us to anticipate the future. This can help us with planning treatment decisions, and providing preventive health advice that is more specific and well tailored to each individual. Our health advice to a particular patient may therefore become very precise and feel highly relevant

to that patient, because it is not just based on population averages.

Other kinds of ICT solutions, especially new generation wearable devices, will help the patient to capture data near to real-time, almost without effort, and provide high-quality data feeds to computational models and give patients rapid feedback on their health situation. This will be especially valuable for chronic disease self-management.

What do we need in order to make the “digital patient” real?

On one level, realizing the potential of the digital patient requires us to be able to technically integrate and semantically integrate the many diverse data sources that accumulate data on a single patient during his

“We must not forget, when presenting novel visualizations of health information to patients and health professionals, that we will need to provide education about how best to make use of this additional knowledge.”

or her lifetime. This may include multiple GP practice systems, multiple hospital systems, health centres, schools and occupational health systems and sometimes health clubs. This will require a much wider adoption of standards than we have today, and a greater alignment of clinical documentation practice so that health information is consistently organized and can meaningfully be combined to present a coherent and holistic picture of the patient’s health.

On another level, the forward-looking vision of the digital patient which combines mathematical modeling, simulations and probabilistic predictions, needs more research. Many of the existing models that have been developed need large-scale validation to confirm their accuracy.

We all know that individuals are co-producers of health and there is a need to engage everybody in the process of “health production”. In one of your presentations you mention that we need a shift in focus from patient centered care to citizen directed care. What should “citizen directed care” look like?

Patients are already co-producers of their health, or non-health, through lifestyle choices and through how they manage themselves when ill. (Of course there are many factors influencing health that are not directly controllable by the patient, including genetic predispositions, accidents etc.). However, healthcare systems are not good at involving the patient actively, and proactively, in contributing to the prevention and management of illness. We still have a rather paternalistic model of healthcare.

Many patients already learn a lot about their illnesses and good lifestyle advice from the Internet, and will do so more often through mobile applications. These applications can potentially be filled with data from their health records, enabling them to take better informed and more significant decisions, more powerfully co-creating their health. Social networking tools already enable patients to find each other, support each other, learn from each other and help each other to take decisions. The predictive modeling dimension added by the digital patient will clearly enhance the opportunities for patients to take more informed control of their own health agenda, hopefully working in a close and mutual relationship with their health care providers.

Citizen directed care occurs when the individual is the primary decision-maker in all health and healthcare choices, informed and guided by their healthcare professionals and by trusted digital sources of information. However, not every patient wishes to be in full control of every decision, and at times of stress or severe illness they may prefer a trusted healthcare professional or team to “take” care planning decisions on their behalf until they are stronger again. We must, of course, respect such patient wishes.

Nowadays almost every country in Europe is developing EHRs (Electronic Health Record) solutions. What guidelines should they take into consideration to make EHRs projects successful? What is lacking in most of the EHRs projects, what can we do better?

There is a vast literature on the electronic health record, and many important standards that should be adopted when implementing it. In particular there are very good international standards, many published by ISO, that should be used within procurements, by vendors and then when EHR systems are deployed: requirements for the EHR, interoperability models, access policy models, information security standards etc. There is a growing

“The digital patient is then, no longer a record of the past, it is a tool that helps us to anticipate the future.”

number of semantic interoperability standards, such as clinical modelling specifications and vocabulary term lists, that should be used provided that they meet locally agreed needs.

However it must be remembered that health data are complex because of the inherent complexity of medicine, especially when patients have multiple conditions that interact, and our knowledge is constantly advancing, changing the way that we interpret illnesses and the evidence for best clinical practice. Health data are also inherently diverse, because medicine is an art as well as a science: patients are individuals and cannot be described entirely through standardized data sets and vocabularies. In areas where best practice is not yet established, clinical practice may vary, and so might the corresponding documentation. There are many semantic interoperability standards that are needed but have not yet been developed.

An EHR has the potential to encourage better quality and more consistent documentation practice that can help with the adoption of evidence based practice, on the other hand it has the potential to introduce a resented data entry burden. EHRs may generate more data per patient that can either prove helpful to clinical decision making or prove overwhelming. Forms and templates presented to clinicians to complete can be highly relevant to patient care or can be useful to managers but not to the clinicians. The local configurations and adoption of the electronic health record system has to be undertaken as a multi stakeholder engagement and collaboration process, in which the local configurations of the systems to be deployed align as much as possible with the needs of all of the stakeholders. I have very rarely observed patients or patient representatives being included in large scale or small scale (local) EHR adoption programmes – but it is vital to include them!

The biggest limitation of some of the major electronic health record programs we have seen internationally, usually implemented and deployed on a national scale, is that they have been conceived and driven as a technology adoption process. It must be remembered that EHR adoption is not technology adoption. It is a complex socio-technical adaptation that needs to be holistic when we consider the organizational change processes that must accompany the introduction of an electronic health record in order to ensure that it is successfully used and delivers real benefits.

Many studies show that patients are surprised and disappointed at the lack of cohesion within their health care system, about their data and about the coordination of their care. First and foremost patients expect our new investments in health ICT to enable their care to be better integrated and more patient centered.

How can EHRs help us to care about the health of individuals and society in the future?

Electronic health records, especially if linked to knowledge such as guidelines and education, if they incorporate advanced mathematical models, and are accompanied by applications and devices, will assist patients, their families, and their healthcare professionals to make the best possible decisions in relation to preventing as well as managing illnesses. However, this is only one set of tools. There are many other influences on the quality of health care services, relating to staff training, sufficient workforce capacity, equipment and other resources, systems for care coordination, organizational workflow processes and reimbursement models. There are many influences on patients and their lifestyles, including the affordability of healthy choices, advertising, peer behavior and the state of mental well-being of each individual, which will influence their motivation to become healthy and to stay healthy.

It is important that we invest in well-designed and thoughtfully deployed electronic health records and personal health records, and that we equip patients with technical tools, but we must not overlook other very important factors that will influence the health of our society. ■

“An EHR has the potential to encourage better quality and more consistent documentation practice.”



The danish example of innovative healthcare

An interview with Morten Elbæk Petersen, CEO of the Danish public health portal sundhed.dk.

In the last 14 years you have created a successful online patient platform. Could you please tell us about the project and the portal, how it works and what its mission is?

Sundhed.dk is the official portal of the public Danish Healthcare Services, aiding patients and healthcare professionals in finding information and communicating.

The purpose of the portal is to:

- Bring together relevant information from all parts of the health service
- Offer a shared platform for communication
- Empower patients by offering maximum insight and transparency within the healthcare sector by providing access to their health data
- Supply healthcare providers with easy access to clinical information about their patients' medical history
- Support the national strategies of the Danish Healthcare Service

Fourteen years ago, an online patient portal was something difficult to imagine. How did the idea come to fruition? Especially in an age when eHealth was still an unknown topic...

Denmark was a pioneer in digitalization for other areas, including banking, public information and so on,

ensuring that we already had the right platform and some maturity among the users. At the same time, health data already existed, as we have an extant tradition of collecting data to improve quality and research. All stakeholders agreed upon a health portal that could unite these existing data sources.

More than twenty five percent (1.5 million out of 5.6 million) of the Danish population use the portal every month. What advantages and incentives does this solution offer, why do patients find it useful and want to log in?

The portal offers transparency and information to patients, allowing them to actively respond over the course of their illness. It simply enables patient empowerment.

Which aspects and details of the project made it successful?

Our portal is the result of a joint public digitalization strategy, meaning that all stakeholders are behind it. The tradition of joint public digitalization strategies in the healthcare sector goes back many years in Denmark.

The key to our success involves sharing values and visions across various sectors, political standpoints and individual professional agendas. In Denmark, we have learned that it is essential that a group of innovative decision makers lead the way; people that have the will and the courage to take the public healthcare system to the next level, following new paths and changing the traditional patient-system relationship.

On the basis of your wealth of experience, could you please describe the most important advantages of the sundhed.dk eHealth platform for the healthcare system, patients and doctors?

The economic idea behind the portal is to help keep citizens out of expensive hospitals, to allow them to be or

become healthy where they are most comfortable: at home or with their local GP. Our focus on the GP-sector is a focus on lifestyle, prevention and chronic disease.

The GP sector in Denmark covers everybody and is free of charge. It is funded by the taxpayer and it costs about 200 euro a year per Dane for full coverage. A total of 90% of the patients remain in the GP Sector, but if that were to change, so that only 89% remained there and 11% received hospital treatment, then hospital waiting lists would increase by between 10-15%. Therefore, this is something very important.

Many European countries are still sceptical about the benefits of eHealth on the quality of healthcare. In their opinion, this is because of a lack of research in this field. Are they right?

We do have survey and research results that indicate and prove the financial benefits of eHealth. However, eHealth is more than just a financial matter; it is about democracy, quality improvement and patient empowerment. So instead of arguing that eHealth by definition saves money I would say that eHealth is a factor that facilitates ongoing development and change in a healthcare sector under a significant economic constraint.

What is the next step in the development of sundhed.dk. What is still to be done?

An important milestone is the ability to easily access this data, not only from a desktop or laptop computer, but from a tablet or smartphone, giving both the patients and health professionals the freedom and flexibility of mobile access. Today you can certainly access our portal from a mobile or tablet, but we want it to be an even better, more user-friendly experience. As many as 50 percent of our users currently access the portal using mobile devices; therefore in June 2016 we launched a new mobile beta version of our portal.

It is not only about HOW the data is accessed, it is much more about by WHOM and WHEN. Thanks to mobile access, a patient can contribute by providing much more data on-the-go, creating a much more coherent, yet complex and dynamic picture of the patient's health situation. There is no doubt that the future will reveal many interesting and even explosive developments that we at sundhed.dk will follow and take an active part in.

How do you see the portal in 5 years' time?

It will continue to help patients to be active co-authors of their treatment plans throughout the course of their illness. ■

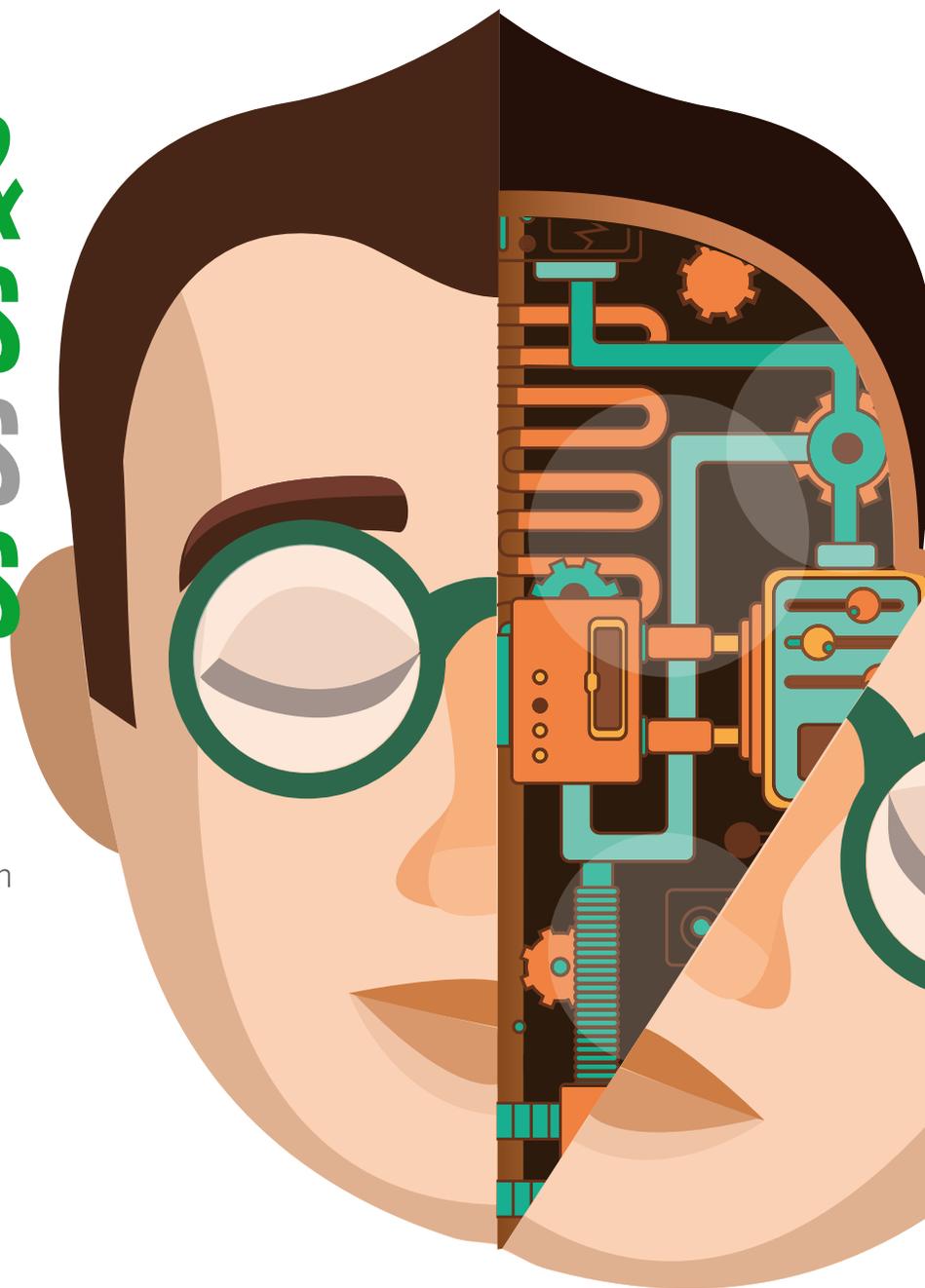
“The key to our success involves sharing values and visions across various sectors, political standpoints and individual professional agendas.”

Robots & computers versus doctors

In the era of healthcare digitalization the question arises: can robots and computers replace doctors and to what extent will they assume their responsibilities in the future?

In 2012, Vinod Khosla, the founder of Sun Microsystems, claimed that 80% of activities performed by doctors can be theoretically replaced by technological solutions. It is worth mentioning that the American billionaire and investor is mainly preoccupied with the topic of human error in medical practice. Clearly there is still a lot to be done but the automation of some processes together with rigorous supervision conducted by IT tools could limit the scale of medical errors which are mainly caused by human inattention, organizational weaknesses or information gaps.

In recent years, several social phenomena and innovations have raised the issue of wider usage of technology in medicine. It is becoming increasingly popular to make a preliminary diagnosis using the Internet and so-called "Dr. Google" or phone apps which allow us to consult our symptoms or to manage some illnesses. The IBM Watson supercomputer can perform an analysis of terabytes of data and millions of clinical cases in just a matter of seconds, while for a doctor medical analysis involves months or years of intensive work. The machine has already been making the first accu-



“80% of activities performed by doctors can be theoretically replaced by technological solutions. True or false?”



rate diagnoses for people suffering from rare forms of cancer.

Due to the popularity of new trends, the newspaper headings suggest that IT and robotics will sooner or later lead to the replacement of medical experts. Luckily, hot media topics have nothing to do with the facts; unfortunately, they often cause unnecessary concerns among patients and strengthen the resistance of medical professionals against technological innovation. We know perfectly well that AI will not compete with doctors but simply provide valuable assistance.

The first change, observable for a number of years now, is the attitude towards knowledge and information management. In the traditional model, the doctors, and before that, the students of medicine were forced to acquire all academic knowledge, to memorize all details concerning symptoms, treatment, medication, therapy, etc. Today, access to properly organized medical resources, stored on the Internet, present in scientific literature or personalized resources, collected on

“AI will not compete with doctors but simply provide valuable assistance.”

health accounts which individually describe each patient's condition, is becoming more important. The era of the Internet has turned everything upside down. The ability to search for particular information has become as valuable as the information itself. Another important aspect to be taken into consideration is the fact that, according to some theories, the knowledge available doubles each year and it is becoming more and more onerous to systematize it. Thus, IT technologies and AI solutions face the great challenge of introducing changes in browsing, ordering and selecting knowledge with respect to the patient's individual history of illnesses, lifestyle and his/her closest environment. Without such support doctors are not able to function in the digital world or implement the idea of personalized care.

Computers will not replace doctors but they will become a permanent part of the diagnosis process, consultation and treatment. Nowadays, it is difficult to require doctors to spend ample time with their patients and, at the same time, update their professional knowledge, follow the current state of scientific research or quickly-changing rules of conduct. This is the kind of profession where the newest information may determine the treatment's success. In this context, the strategic question is how, in the era of information overload, to deliver that specific information pertaining to the patient's individual condition? Adequate and personalized information also means complete information, comprising every element of lifestyle that may help with the diagnosis and treatment, including results collected by wearables and medical history stored at another doctor's office or in another medical centre. Due to the digitalization process and the departure from using paper files, we are slowly beginning to combine all of these elements into a single whole.

Reflecting upon technology in the service of doctors, one more question needs to be answered: how will the personal relationship between the patient and the doctor change, what does the patient expect from the doctor and what will he/she expect in the future? Will it be care and psychological support or the best, according to the current knowledge and practices, possible diagnosis and treatment? Patients have better access to basic information resources that may be found on special social media websites where they can consult each other and exchange advice. This is why they expect doctors to provide expert knowledge that goes beyond the tips that they may find themselves online. The doctor of the future will be a “curator of knowledge”, a manager of medical information. This model, promoting an individual approach to every patient and clinical case, requires deeper immersion not only in the medical file and history of the patient but also in each aspect of everyday life, surroundings, social interactions, etc. Such an in-depth analysis, juxtaposed with the latest medical research study results and best medical practices, will allow for greater precision in handling

each medical case. The patient-doctor relationship will change, as it already has in the course of medical progress. There is nothing wrong with that; after all, the invention of the stethoscope did not destroy the personal relationship that doctors had with their patients.

Portable devices such as smartphones, portable multi-life parameter monitoring equipment (wearables, health trackers) or electronic health records will cause a rapid increase in the volume of data used in clinical practice. When EHRs (Electronic Health Records) will be filled with complete medical history, there will be an opportunity to document people's activities, nutrition, lifestyles, as well as elements of mental health that are still beyond our control. A detailed picture of life will help in setting up optimal models of prophylaxis and those very models will have a decisive role in healthcare, pushing intervention medicine into the background.

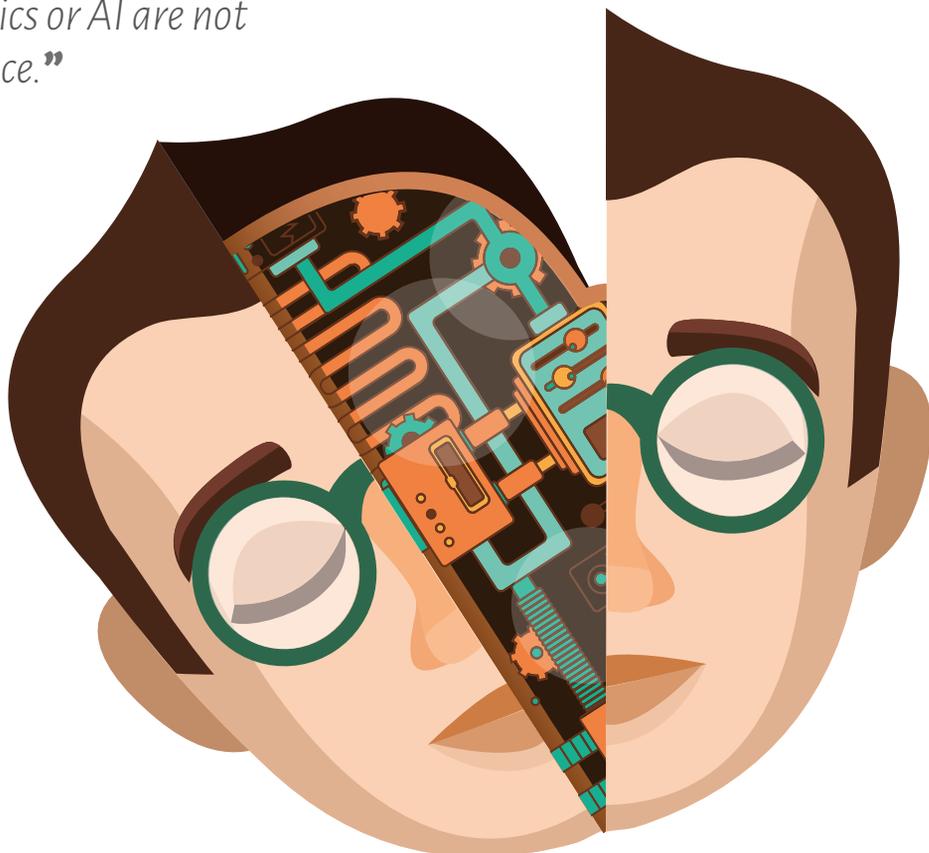
Access to knowledge will bridge the gap in the patient's healthcare, for example, the course of events after pre-

scribing medications and leaving the doctor's office. According to some studies, as many as 50% of patients do not take prescribed medications or take them contrary to the doctor's recommendations. We can only imagine how that affects the treatment's effectiveness. Employment of available technologies is also an ethical obligation of modern healthcare.

A perfect example is the problem of drug interactions which, according to statistics, is one of the ten most common causes of death. Introducing electronic patient records on a wide scale with a full history of pharmacotherapy and an automatic control mechanism in place could prevent many complications and untimely deaths.

An empathic and trust-based dialogue between the doctor and the patient is something which robotics or AI are not able to replace. In the future of medicine robots will take over simple tasks; they are already assisting in nursing care of the elderly. They will also be used in telepresence, monitoring the patient's condition day and night. IT technologies will play a far greater role in organizing the doctor's information space and supplying him/her with precisely selected data. In this context eHealth tools are not a competitor but an urgently needed aid. ■

“An empathic and trust-based dialogue between the doctor and the patient is something which robotics or AI are not able to replace.”





Apps of doubt

They will arrange your fitness plan, remind you to take your medications, measure your heart rate, blood pressure and distance covered. But do health apps really make us healthier?

Almost two billion people all over the world use smartphones. More people have access to high-tech phones than to potable water. If we could travel back 30 years, our smartphone would be the equivalent of a super-computer with capabilities exceeding that of equipment occupying several rooms. Such great progress has a vast influence on how we live, think, communicate and see the world. These significant changes have also entered the arena of healthcare. For those born after 1990 it is difficult to imagine that 20-25 years ago there were only two sources of information on health: a medical encyclopedia or a doctor; mobile phones were practically non-existent. With the growing popularity of the Internet, the doctors' monopoly on information concerning illnesses, diagnoses, symptoms and treatment has been broken.

Today we are witnessing a new trend: 'health apps' and 'health trackers'. Smartphones can take over the role of medical measuring and lab devices, allowing anyone to measure their own sporting achievements, monitor their heart rate and blood pressure, compare their re-

sults with friends or boast about their new records on social media. Special tools remind us to take medications regularly or to check our blood sugar level; they also monitor our mood, help us to fall asleep and collect data on health parameters ready for further detailed analysis. Thanks to these apps our physical and mental condition can be described in points, each activity related to chronic illness treatment can be meticulously planned and implemented, step by step. This fascination with a new field of knowledge known as mHealth is thought by some to be just a fad while others perceive it as a permanent change in our individual approach to health. The market quickly noticed the new trend, which is still expanding at roughly 60% per year: by 2018 the market is estimated to be worth about \$21 billion.

Continuously improving our health, getting into better shape, and achieving an excellent level of well-being... Are medical and fitness apps just a technological promise or a real chance to improve healthcare standards and prophylaxis?

The British Medical Journal has recently published an article in which doctors warn us that health apps may cause anxiety and have a negative influence on one's sense of well-being. Dr Des Spence argues that some apps, mostly those monitoring health parameters, do more harm than good. Moreover, they are often not based on real medical knowledge. We are not able to interpret many health outcomes correctly; thus, all standard deviations can lead to erroneous interpreta-

“mHealth apps measure health parameters and monitor the progress of chronic illnesses. However, they are not always beneficial to the user.”

“We are not able to interpret many health outcomes correctly; thus, all standard deviations can lead to erroneous interpretation.”

tion. According to Dr Spence, especially harmful are the invalid and unreliable tools that are created for one purpose only: to generate profit.

Some psychologists are concerned that obsessively checking efficiency and achievements while continuously comparing ourselves to others may have a negative influence on us, causing frustration, disturbing our sense of equilibrium and lowering our self-esteem. If you failed to implement your 10 000 steps a day routine, the app will inform you of that fact at the end of the day. Feeling like a loser can be triggered by seeing that this month your colleague has run further and burnt more calories than you have. Eating a dessert not included in the schedule of a diet app may be seen as a sign of weakness. The persistent drive to achieve goals previously set by apps do not always bring joy.

Some American dermatologists decided to test the accuracy of apps diagnosing skin cancer on the basis of a photo of the lesions. The tests conducted show that at least 30% of moles and lesions identified on the basis of the app's algorithm as harmless were actually cancerous. Another test was to check whether people suffering from diabetes, lung and heart disease could, with the help of the app, gain more control over their ailments. Out of 41 cases analyzed only 16 showed a positive influence of the technology. Another group of researchers came up with an even more interesting conclusion: over 100 popular apps encourage people to smoke by showing pop-up ads on their screens: two of these were educational apps designed for children. It is also known that constantly using a smartphone can lead to wrist pain, sleep disorders or chronic fatigue. Furthermore they produce their share of Internet addiction and disorders connected with spending a significant part of one's life in virtual reality.



On the other hand, many studies show quite the opposite scenario: health apps increase the feeling of control over one's illness, health and well-being. It depends mainly on the quality of the device itself, its construction and the user's knowledge. Apps that allow direct interaction with a doctor, such as in the form of teleconsultations or giving a specialist access to stored clinical data in order to identify dangerous standard deviations, are believed

to be the most beneficial. They are not limited to specialist telemedicine tools monitoring the heart rate of those who, for instance, have had a heart attack. Another good example is an app that could test our state of mind: if it observes a susceptibility to depression, the doctor would be able to intervene quickly after having identified those individuals at risk. This task is very onerous in the traditional model of healthcare. However, most apps lack such interactive features, and usually the patient is left with all the data without knowing what to do with it. When analyzing the usefulness of an app you need to consider various user groups. The elderly, suffering from memory impairment, will definitely benefit from apps reminding them to take their medications. People with diabetes, by regularly noting their medical outcomes in a smartphone, can learn to understand their condition better and gain additional support. It is a different matter with wellness & fitness apps, whose purpose is to improve our motivation to exercise or eat healthily. If they make it easier for an overweight person to lose a few pounds, it is a success.

It is easy to get carried away with the possibilities of tools designed to aid those with various health problems. The lack of market regulation means that the user is left with a wide range of devices to choose from, all of them have different levels of usefulness and quality. Validation and scientific consultation concerning the content could make a substantial difference and open a new chapter in the history of prophylaxis. There would not be any obstacles to prevent doctors from prescribing attested apps in the same way as they do with medications. App designers need to be more considerate, their responsibility is to guarantee greater transparency of the collected data and ensure safety. The apps themselves also need a makeover: instead of useless monitoring and storage of large amounts of data they should rather focus on providing useful information, tips or advice, in consultation with a doctor, with the collected data monitored by a specialist. Additionally, selected data obtained from the apps should be directly transferred to central health accounts.

According to research2guidance, in 2015 as many as 500 million people all over the world have used health apps. In popular app stores there are over 17,000 such apps available. Due to the fact that we keep our mobiles with us constantly, smartphone apps are becoming everyday objects. There is no denying that the impressive number of downloads and users do not entirely reflect reality. The more apps that there are on the market, the shorter their lifespan is. Some studies suggest that up to 80-90% of apps are removed after their first use. Even if they are not removed, they are quickly forgotten. Without a doubt, mHealth has an important role to play in healthcare, not as major as their enthusiasts would prefer but definitely greater than many sceptics predict. The truth, as always, lies somewhere in between. ■

Wearable technology: move more, pay less!



The greater the involvement in health protection, the lower health insurance premium – thanks to new technologies, patients' involvement can now be rewarded fairly.

Health is a basic human right and every health care system, whether publicly or privately funded, strives to consistently realize this principle. There is no doubt that access to care should be unrestricted and equal for everyone irrespective of economic or social status, origin or personal views. At a time of rapidly rising costs of medical care and the national health care program struggling to guarantee the same benefits to all of the insured, more and more insurers propose a different perspective: health is a universal right, but also a responsibility. This is a starting point for the discussion about introducing differentiated health insurance rates dependent on one's personal involvement in keeping oneself in good physical condition. This so-

lution, though apparently logical, sparks a lot of controversy.

Recently, the media reported that one of the insurers was planning to fit cars with special devices monitoring the drivers' compliance with speed limits. Those obeying traffic regulations would be rewarded with a lower insurance premium. Opponents argued that this practice would encroach on the privacy of drivers, while supporters wondered why those who drive safely must shoulder the costs generated by reckless drivers. It is a compelling argument. After all, this is hardly a revolutionary idea: insurance premium differentiation has been used for a long time. Vehicle insurance policies

“If I take care of my health and minimize the risks, why should I pay the same premium as those who don’t?”

take into account the age of the driver, the accident-free period and place of residence, while home insurers consider the construction materials used and alarm systems installed.

Health is a much more sensitive issue, however. Over the years the system has made us accustomed to the thought that no matter how many risks we take with our health, we can always expect a full refund of the costs of treatment, no matter how high they are. An extreme example is heavy smokers who, even after a complicated surgery for lung cancer, chemotherapy, and several months of hospitalization refuse to quit their habit, resulting in a relapse. It is the classic ethical dilemma: with limited resources available, should we prioritize the needs of people who wilfully compromise their own health or those unquestionably in need (e.g. children requiring complicated surgeries). A fair solution would be to provide treatment in all cases, but – since it is necessary – this would require a larger financial contribution from some patients. The first step is to determine what affects our health and to what extent. We already know that for the most part, 60% of our health depends on our own choices (lifestyle, nutrition), 10% on genetic factors, 20-25% on the living environment, and 10-20% on medical treatments. The primary risk factors are quite obvious: smoking, alcohol abuse, sedentary lifestyle and unhealthy diet. We are not sure how exactly they translate into particular problems for any individual person, especially in correlation with genetic and environmental factors, which are outside of anyone’s control. Excessive body weight is not always caused by inappropriate nutrition and is not easily reduced through willpower. The recently published results of a 9-year study of 176,000 obese people showed that 98.3% of men and 97.8% of women never managed to return to a healthy weight. We might conclude that obesity is a disease that is difficult to control. Even if we could establish precise

“Physical activity is fully measurable thanks to the growing popularity of new technologies: wearables.”

correlations between risk factors and health, another question emerges: how to measure the content of one’s diet, alcohol consumption or number of cigarettes smoked per day? That would require extremely exact body monitoring systems which are not available at the moment and which the public would certainly not consent to.

This solution has many similar problems. However, there is one factor which has a direct influence on health, prevents some of the deadliest diseases of civilization (diabetes, cardiovascular disease), and which is now accurately measurable. The factor in question is physical activity. Differentiating health insurance premiums according to this criterion could become a reality in next few years.

With very few exceptions, activity and exercise are a personal, free choice for each of us. Some consider it a natural part of life, a habit established in childhood, while others need to convince themselves to love it, learn to do it, or sometimes force themselves. Another

“It is hard to dispute that becoming more active is a simple change that anyone can make.”

study involving large groups of subjects showed that practically any kind of physical activity has a positive effect on physical and mental health. There is no doubt about that. Genetic factors play no role in deciding whether to skip an evening session in front of the TV in favour of a walk or a bike ride. Physical activity is not a luxury commodity only available to those with a higher social status (which is less obvious for other factors such as healthy nutrition). It is hard to dispute that becoming more active is a simple change that anyone can make.

Physical activity is also fully measurable thanks to the growing popularity of new technologies: from the simplest of free apps requiring no special equipment other than a smartphone to more advanced devices known as wearables (health trackers, smart watches). The revolution started with the popularity of smartphones. Simple mobile fitness applications can moni-

tor the distance covered or the number of steps taken. The market quickly responded to the enthusiasm and needs of consumers by introducing a new generation of devices: fitness trackers. A small band collects accurate data on the user's activity levels and transfers the results wirelessly to a smartphone, where they can be analyzed, compared, and new goals can be set. Smart watches with built-in sensors have taken the idea a step further, the next stage of smartphone development. This year alone, consumer interest translated to tens of millions of units sold.

The prices of health trackers have fallen considerably in the last few years. Today, a simple device of this kind can be purchased for \$20. It is no wonder that medical insurers are increasingly interested in using them to promote physical activity and reward it with lower premiums. The principle is simple: the more you exercise, the less you pay. These devices are so affordable that private companies may even provide them for free as part of special insurance packages. Those who already practice an active lifestyle with no external encouragement

ance premiums could become a strong argument and motivator. That is the right way to view this change: as a reward for healthy behaviour, not as a punishment for those who prefer a sedentary lifestyle.

The time has come to get used to the changing rules of the health care system. Although some may consider it controversial to introduce health insurance rates dependent on the level of physical activity, it is only a matter of time before this solution becomes widespread. It will gradually evolve towards monitoring additional factors, such as diet and unhealthy habits. This is hardly an unnecessary complication of the insurance system or a step towards a grim totalitarian surveillance state, but a response to the rising costs of health care and the current injustice of the system. ■



are in favour of the idea. To them, it means savings and fair insurance rates. "Since I'm careful about my health, I'm less likely to need medical services, which means lower costs for the insurer. Do I not deserve a lower premium?" Among the opponents are those who consider it dangerous to introduce control measures into the private sphere. Many are worried about data security, undoubtedly a serious problem. It is imperative not to bring the topic of discrimination into this heated argument: health will always remain a matter of private life and the availability of medical services must be equal for everyone regardless of their level of physical activity. Those adopting healthy lifestyle choices in fact take over part of the insurer's obligations and should be rewarded. As a positive side effect, this controversial solution may change the traditional approach to health and increase patient awareness and engagement. Under the current model, the patient's personal involvement is not rewarded, but differentiated health insur-

"This controversial solution may change the traditional approach to health and increase patient awareness and engagement."



165,000

The number of health apps for mobile phones.

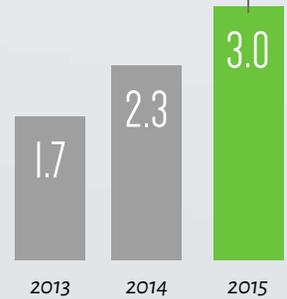


45,000

The number of developers of mHealth apps.

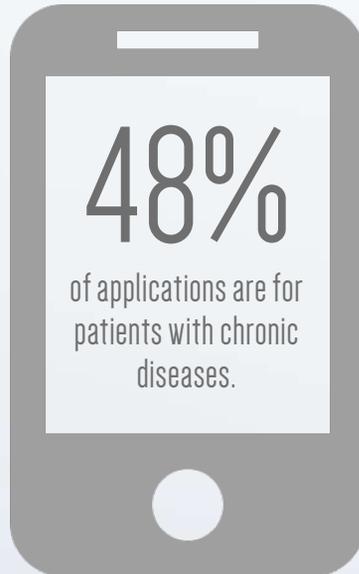
The predicted number of downloads of health apps in 2015.

3 BLN



Number of apps (in thous.) 10 20 30 40 50 60 70

The greatest number of applications are available in Google Play and Apple App Store. Both stores have nearly 70,000 apps.



One of the greatest promises of mHealth apps is the ability to change adverse health behaviours.



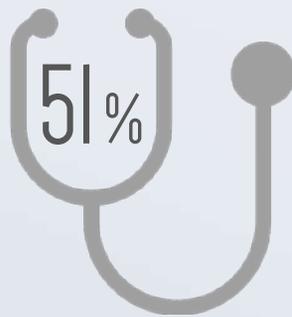
60%

The percentage of entities dissatisfied with releasing a healthcare application (having failed to achieve their expected goals).



62%

Only 11% of companies achieved 100,000 downloads of their applications. For 62% of developers this number did not exceed 5,000 downloads. Around 2% of companies managed to reach the magic number of 1 million downloads.



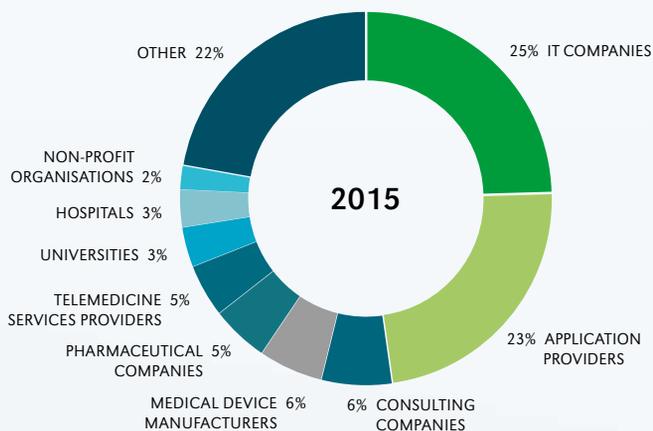
51%

51% of companies / application developers employ healthcare professionals and 45% cooperate closely with them.

MOBILE



HEALTH APP DEVELOPERS



54%

of providers have 2-10 apps in their portfolio, 30% have developed only 1 app, with 16% having more than 11.



Monitoring health status using mobile devices is going to be the fastest-growing branch of mHealth. On-line medical consultation tools will enjoy a similar boost in popularity.



29%

of applications are fitness applications, 32% of which are marketed to hospitals.

HEALTH THE TREND IN NUMBERS



53%

The percentage of companies declaring that their main motivation behind the development of health apps was to improve public health.



PATIENTS



HEALTHCARE PROVIDERS



PAYERS



PHARMACIES

THE BIGGEST BENEFICIARIES OF MHEALTH APPLICATIONS

“To ensure the rapid development of health apps, they must be reimbursed by payers, and the collected data must be included in each patient’s electronic account.”

Source: Research2Guidance – mHealth App Developer Economics study 2015, n=5,009





Injectable sensors may revolutionize healthcare

Forget about health trackers, smart jewellery and wearables, now is the time for sensors and electronics implanted into the human body.

In recent years there has been a market boom in compact devices measuring fitness and health parameters, such as blood pressure, pulse, burned calories, and covered distance. Some of these are now used as mobile EKG or EEG systems. However, wearables are just the first step in the development of solutions integrated into the human body. Despite their growing popularity, the future is with injected electronics. Only full synchronization of technology with the muscles, nerve cells and integral organs can open new doors in the treatment of presently untreatable conditions or particularly complex diseases. While just imagin-

“Microelectronics in medicine hold a lot of promise, yet before it all goes mainstream there are significant challenges we still need to overcome.”

ing biotechnological solutions might give you goose bumps, they are already helping millions of patients worldwide. The simplest example, and a pioneering one at that, is the popular pacemaker.

Implanted chips will serve two functions: to control vital functions and the health condition, and, most interestingly, to stimulate the function of individual organs if any disorder occurs. This is where neuromodulation comes into play. An internal sensor will help to detect the first symptoms of a heart attack before the actual onset of the attack, saving precious hours. One of the main killers will thus become a minor incident that is treatable at a very early stage. With accurate identification of the type of disorders that cause depression, it will be possible to correct and stabilize certain chemical substances in the brain by sending electrical signals. In patients with diabetes, special processors could regulate the insulin levels, while in patients with obesity they could block the signals responsible for feeling hunger. Mini-electronic implants could dose the required levels of medication and send an alert if the body has a deficiency of certain microelements. Prosthesis users will regain control over their artificial feet and hands along with their sense of touch, allowing them to move them with precision. Pioneering solutions in this area are already being developed in laboratories. There is a great deal of hope in optogenetics, a field of science that focuses on controlling the activity of particular neuron groups using light.

Microelectronics in medicine hold a lot of promise, yet before it all goes mainstream there are significant challenges we still need to overcome. One of these is how the e-implant should communicate with the external device. While most wireless devices, such as health trackers, interface with a smartphone via Bluetooth, with implanted sensors this is not so simple because the human body absorbs a large portion of the 2.4 GHz signal used by Bluetooth. Another potential problem is how to power these internal sensors. Neurostimulation requires artificial electrodes to be connected to the nerve endings, which are extremely fragile receptors of miniature size and complex structure. It will take years of research before micro-neurosurgery can deal with this, and it is one of the reasons why bionic prosthetics have yet to make the leap from the laboratories of innovative companies. They pose a risk to the patient and may cause infections as a result of connecting the electrodes.

The first application for injected electronics will be to monitor the body and health much more effectively than with the health trackers available today. Subcutaneous chips will monitor the level of adrenaline, nutrients and hormones. Not even the most advanced armband synchronized with a smartphone or the cleverest smartwatch can do that. The need to monitor and measure one's health parameters is becoming increasingly obvious, as is evident from the sales of health trackers. At this point, we just measure how many steps we take, but soon we will want to know more, know it quickly and know it precisely. As measuring capabilities grow, how we provide knowledge must change. It is unreasonable to expect an average patient to know what a change in the level of a particular hormone or the lack of a particular microelement indicates. It is the same with laboratory results, which cannot be interpreted without assistance. The data will be converted into practical tips, warnings and recommendations. If there are any alarming changes, then the microchip will automatically alert the rescue services. ■

“In the future, the role of a doctor might be limited to monitoring data supplied in real-time by implanted sensors, identifying the first worrying symptoms and instigating suitable preventive procedures.”

The democratization of healthcare



An interview with John Nosta – innovator, philosopher and futurist who specializes in healthcare and technology. John is the founder of NOSTALAB – an amorphous, self-organizing neural network dedicated to the advancement of digital health. He is also the author of Health Critical in Forbes. We talk about the Internet of Things, big data, democratization of health and the future of healthcare.

If you look at healthcare today, what would you point out as the biggest problem?

I don't think that it's smart to point the finger at one issue as a leading issue or concern. The problem is multifactorial ranging from a system that is entrenched in old habits to economic drivers that fail to support innovation. And again, it's a complex picture that is best examined by region or country. So, I'll go out on a limb here and suggest that "passivity" is one of the biggest problems in healthcare. What I mean here is that patients and caregivers fail to take a more active role in both wellness and care – leaving the healthcare provider to make decisions. As we shift to a more "patient-empowered" dynamic, as in traditional consumer marketing, we will see new and powerful drivers address everything from costs to the allocation of services.

What does "innovative healthcare" mean to you? What steps do we have to take to get closer to this idea?

For me, innovation is about seeking new solutions to an existing system. This is accomplished by a host of initiatives from questioning fundamental assumptions to looking for new perspectives from other industries and thinkers. For example, medicine can learn a lot from finance and the leisure industry. Part of the magic of the digital health movement is the multiple and varied voices that converge around a problem. The solutions are often unexpected and solve problems in unconventional ways.

Health start-ups, health apps, wearables, etc. Do you think that these trends will influence the healthcare market or is it just short term hype?

“Health is becoming a more personal and self-directed endeavor where control is being replaced by collaboration.”

I certainly don't think that it is hype! But some of the products and innovations will certainly fail. However, we are at the early part of an exponential curve that offers tremendous innovations in medicine. But let's back up a bit. For many people, health is a destination – a place to go for an appointment or test. In a funny way, it's almost disconnected from the object under observation. And that's you! Health is becoming a more personal and self-directed endeavour where control (usually left to the clinician) is being replaced by collaboration. And it's this collaborative care (the clinician, the mom, the caregiver, the individual working together) that will come to change the very nature of wellness and medical care.

One of the first touch points of this is the emerging ability to establish “the quantified self” and step up to a higher sense of “observation and ownership” around your body. The role of the sensor – as in motion trackers and sleep evaluation – is only the beginning. Soon, wearable technology will expand to amazing abilities to sense the very earliest stages of life-threatening conditions (cancer, heart attack, stroke) and shift this detection earlier and earlier and earlier. What results is disease detection that actually shares a border with prevention. It's not unrealistic to have nanotechnology “robots” constantly flowing through your body searching for the very first cancer cell and destroying it long before there is any substantial growth or physical manifestation.

Sensors will no longer be an optional part of our lives that we commonly observe in the gym or with the weekend warrior. They will evolve to become “essential partners” that act as a “check engine light” for your body and become a ubiquitous tool for adding both life to your years and years to your life.

But here's a word of warning. Those sensors that are commonly on our wrists will evolve to become something we consume, wear as a patch or become embedded under our skin. The notion of a wristband sensor will be nothing more than a quaint reflection of the early days of digital health. And that shift will happen much sooner than you think.

It might also be better to define a “tracker” as less a tool to measure steps and more as one to detect cancer when coupled with advances in nanotechnology. When we move from athletic options (where we are

now) to clinical imperatives, and it's this shift that will catalyze the changes in digital health, things will start to get interesting. Simply put, a major trend will not be the acceleration of existing devices but the development of new and innovative clinical tools – not digital toys – that fundamentally change the practice of medicine.

So, is it just hype? Absolutely not!

Which of the new innovations will be “the next big thing” and why?

First off, I would never try to predict the next 20 to 50 years. As we are in an exponential curve, going out that far is almost impossible. But I believe that we will see a few key changes. The role of AI in all aspects of our lives will be commonplace. And it might be better to shift from “artificial intelligence” to IA – Intelligence augmented. From cooking at home to complex surgery we will become intertwined with technology as an essential tool to process information and decide the best paths forward. And this cognitive connection will be further empowered by aspects of new interfaces from new complex visualizations to augmented and enhanced reality. I would also suggest that big data may emerge as a powerful window into humanity that will reveal new and important connections. And these connections will help power and drive everything from simple manufacturing to aspects of human evolution!

What will the relationship between patient and doctor be like in the future?

Today, care is almost always defined by one word: Control. It's the physician and the payer that frequently control the type and quality of care a patient receives. The future will see a shift from control to collaboration. A new and more informed patient (and caregiver) population will know more about their condition, know more about care options and place a higher value on clinical data. And the resulting dynamic will shift care to a different “equilibrium” that will do a few interesting things. The first is disruption. Physicians and patients will have to find new ground where collaboration can fit into the complex clinical equation that is already burdened with many issues. However, over time, the emergence of a “new normal” will result in situation where healthcare providers and patients will both win.

“Sensors will evolve to become ‘essential partners’ that act as a ‘check engine light’ for our bodies.”

What exactly does “democratization of health” mean and how will it impact healthcare?

As I have said many times in the past, control will be changed from control to collaboration. You only need to look at various consumer companies to see this. From Uber to Amazon, the power of the consumer is THE defining trend that defines and destroys entire industries. I think that the same will apply to medicine as patients play a more active role. But it's also fair to suggest that this change might be less a pure democracy and more a two or three party system. The unique aspects of medicine will always require specific domain knowledge and this may (yes, I do say may) still remain under that “control” of the physician. But even that might be up for change!

Why is the confluence of health and technology so important to you?

Why health and tech? It's a simple reason. It gives me an “unfair” advantage in life. We live in interesting times. Both health and technology are topics that are resonant to our individual lives and society as a whole. For me, and certainly for many others, the ability to enjoy good health and the rich benefits associated with wellness are a “life imperative” that always remains a top priority. We remain vigilant to diet, exercise and knowledge to help nurture and protect this vital asset.

And to help accomplish this, we have now become technologically empowered with tools like the smartphone, nanotechnology, genomic analysis and many other “tools of technology” to make smarter decisions, battle disease and injury with less fight and more finesse and even, dare I say it, cheat mother nature.

My interest – no obsession – with the confluence of health and technology is simply a smart longevity strategy that is brought to life by the wonder and magic of science.

The Internet of Things is a common topic. How big do you see it becoming?

The Internet of Things will become huge. It will be amazingly large and form a network of connectivity

that will define and drive much of our lives. Yet this looming monster of technology will become invisible and be a passive system that is incorporated into the very fabric of our lives. Interestingly, one of the places that the IoT will thrive is in our homes. The rooms in our homes will become passive laboratories that will collect data, track our motion, keep an eye on the refrigerator and collect biological samples for real-time analysis. Our actions—from heating a room in the winter to choosing more healthy food choices—will be informed and optimized by technologies that speak to each other and form a collaborative network.

What is your favorite social networking site and why?

I'm a Twitter fan. And while I make very good use of other social networking sites such as Facebook and LinkedIn, I find that Twitter is an outstanding tool to listen, learn and engage. From lists to hash tags, I find that Twitter helps me to “take the temperature” of a concept or issue. I've often compared it to the Heisenberg Uncertainty Principle in physics where you can measure the exact momentum or position of a particle—but not both. With Twitter, you can find exacting information as to “what's happening now.” But as with the Uncertainty Principle, you sacrifice depth of content. And that's where search engines like Google come in to add depth and context beyond a timely collection of 140 character tweets.

We often talk about the democratization of health and the empowerment of the individual. For many, Twitter acts in a similar way. We all get 140 characters to tell our story and then we shoot that little arrow into cyberspace. It really doesn't matter who you are, what you're saying is the important thing. The ability to have your voice retweeted or even to go viral is right there at the intersection of your fingertips and the keys. So please follow me@JohnNosta. I promise to provide real value and engagement!

Why are you optimistic about the future?

I'm an optimist by nature. But I think that an optimistic outlook has a bit of magic built into it. I believe that a positive outlook takes us down a decision tree path that builds a path to success. If I take the “no road” I'll often end up at a dead end or follow options that are defined by negativity or pessimism. And this applies to all aspects of life from business to relationships.

But there's another equally important aspect of my optimism and that's the factual reality of science. It's my business to stay close to innovations in digital health and I often have first-hand looks at ideas, prototypes, data and results that aren't in the public domain. And what I see puts a smile on my face and drives a jubilant sense of optimism that is not only irresistible—it's infectious! ■

“The rooms in our homes will become passive laboratories that will collect data, track our motion, keep an eye on the refrigerator and collect biological samples for real-time analysis.”



How to use EHRs to improve the quality of care?

Radboud University Medical Center is one out of the three hospitals in Europe with the highest EMR adoption level (EMRAM Stage 7). How does IT influence daily work and quality of care? An interview with Ronald Petru, Chief Medical Information Officer.

Why has the hospital focused so much on ICT and digitalization? What was the reason for investing so steadfastly in new technologies?

ICT has never been a primary goal in itself. Our hospital has a mission: a radical transformation into a unit providing innovative, sustainable and affordable healthcare – to make a significant impact on healthcare.

It is all about the individual and his or her quality of life. We want to deliver excellent clinical care to our patients. With our scientific research, in addition to our education and training, we also fulfil an important public role.

These four aspects of our vision will enable us to live up to our mission:

- The patient is seen as a partner in his or her own treatment team. We strive to match the diagnosis, treatment and research to the patient's specific characteristics. We call this *participatory and personalized healthcare*.
- Providing *excellent quality* in our endeavours, regardless of the domain, department or position.
- *Operational excellence*: effective use of our resources.
- Collaborating with partners in *sustainable networks* in which we can share, increase and disseminate knowledge and expertise.

To achieve this goal, we need a single hospital-wide health archive from which data and information can

“ICT is not the goal, it is a necessary tool to achieve our strategic targets which drive all further developments in ICT.”

be shared between all healthcare providers, depending on their needs and security authorization, but also shared with patients. This archive could provide data used for benchmarking, reports, etc., and this data could be combined with other information from outside of the health archive. The only way to achieve this is to have all the data available within a versatile electronic database.

Ideally, we would like a single input of data performed in a discrete way and then reuse the data for all necessary purposes. These can range from real-time clinical decision support to quality benchmarking with other centres dealing with scientific research, education, billing and other purposes. Last but not least, we share information with the patients through our patient portal. This explains our focus on ICT and digitalization since this would never have been made possible without it. ICT is no longer an administrative side-process but part of our core business to improve healthcare in a sustainably affordable manner.

The hospital has gained the EMRAM Stage 7 – this in turn means the full development of EHR. Looking back, what was the most challenging part of the digitalization process? Which issue was the most complicated, and the most difficult to overcome?

The most challenging part was to analyze the primary processes, to have thorough knowledge of them and to reach a consensus regarding the functional description of how the system should work for all of these different healthcare professionals. Configuring an ICT solution to match this description is in most cases manageable, however, gaining an exact knowledge of all of the primary processes is much more difficult and abstract. The process of automation of the medical and nursing workflow is partly about bridging the gap between the art of medicine and technology.

Therefore, the in-depth involvement of the representatives of each medical speciality and all types of care providers: physicians, nurses, paramedics, administrative personnel and others, are crucial to the whole process. It starts as early as when the requirements for a system are set, and carries on throughout the phase of configuration and continues even after the go-live.

Could you please describe the IT infrastructure in the hospital?

Basically, the entire hospital uses IT solutions. Patient care is fully automated and so is the logistic process. This includes critical departments like the ICU's, the emergency department, operating theatre, laboratories and the whole medication process within the pharmacy. In the critical departments, bedside devices like infusion pumps, ventilators and bedside monitors are fully integrated in the EHR. The medication process is fully monitored from the prescription, then preparation, and up to the actual administration to the patient, and the whole process is close-loop secured with the

use of barcodes on every single dose as well as on the patient's wristband.

The number of applications is limited and any new requirements for ICT support are judged against the enterprise's architectural principles. If there is a need for multiple ICT solutions, they need to be fully interfaced in a stable and redundant manner. Data are always entered in a single instance and never copied.

All of the primary processes are paperless and if an individual care provider ever chooses to use a piece of paper, it's for their personal convenience only, it is never a part of the care process, that takes place fully within the EHR system. All orders are placed by the authorized care provider also using the electronic method.

How did you manage to convince the staff to actively use the IT systems? How did you motivate them?

I would rather not talk in the past but rather in the present and future tense. It is a continuous process. The care providers were closely involved in the whole process starting with the requirements for the European tender until the go-live and thereafter. The biggest motivation for care providers is, of course, better quality and safety of care but also increased efficiency and the availability of data to monitor their work processes. These requirements and wishes differ widely between an internist and a dermatologist, nurse, psychologist or chaplain. All of them have to be motivated. One of the most motivating aspects is the completeness of the information the care provider receives. The limitation is not related to technology but to legal and privacy aspects as to which information an individual provider has access to. If all data are accessible through a single system, it is much easier to have a complete picture of all of the information about the patient. The challenge is to provide the right balance between a lack of information and overwhelming the professional with too much data.

It is very feasible to gather data within the primary process in such a way that a discharge letter is almost completely automatically created, charges are automatically dropped and the reports and graphs about the process are readily available. This is rewarding for the professional and stimulates safe and standardized operating procedures.

From today's perspective – what are the biggest advantages of EHR adoption? Please focus on three perspectives: management, staff, and patients.

Management: there are a growing number of reports that reflect all aspects of the primary processes like finance, use of resources, bed capacity. The EHR also provides the data for the data warehouse from which these reports are generated, they serve purposes like quality benchmarking and efficiency, and reporting to external organizations. Excellent quality and operational excellence are also important issues for purposes

“The biggest motivation for care providers is, of course, better quality and safety of care but also increased efficiency and the availability of data to monitor their work processes.”

es such as negotiations with insurance companies and dealing with public opinion.

Staff: the growing efficiency of the staff going through their primary processes. Administrative nuisances are progressively avoided by the re-use of the data that are already available in the system to partially create progress notes, discharge letters and home prescriptions. The system also provides continuously growing decision support which makes the decision making process safer. But probably the biggest advantage is that all of the information about the patient in real-time is readily available everywhere throughout the hospital, concise and complete. As the possibilities of the system are expanded, the staff will increasingly profit from the exchange of data between the centres, so that they will have access to even more information, provided that the patient has given his or her consent to share this data. In addition, scientific research will get a boost from the availability of data in a traceable way.

Patients: the patients are probably the group which profits the most from the EHR, although they may not always be aware of it, especially of the improved safety aspects. The fact that their care provider always has the latest, complete information is confirmed by the fact that the patient does not have to inform the personnel twice. The biggest noticeable advantage is the online patient portal where patients can view their own medical files from home in order to see laboratory results, correspondence and their scheduled appointments. It is already possible for patients to reschedule or cancel appointments or to schedule new ones online. In the very near future, patients will also have the ability to enter details of their home medication and any deviations in their use from the original prescription, allergies, history and answer questionnaires through their online portal. This will increasingly make the patient a real partner and member of his or her treatment team. As a result of the possibility to reschedule appointments, we have already reduced the number of no-shows by half in ambulatory patients who use the portal. This is a good example of better patient partnership and efficiency going hand in hand. The data is monitored in real-time within the system, and available to the department manager.

Do you measure the improvements in the quality of health services, patients' satisfaction, medical errors, etc.?

It is too soon for an improvement in quality to be measured also the hospital had already been widely automated, although not as integrated as in the current system. Patient satisfaction is measured continuously and has shown some improvement over the last year, although the numbers were very high already. Medical errors are, for example, prevented by warnings during all stages of the medication process and are shown both to the care provider and to the pharmacist in real time. But there are also warnings generated, for example, to identify patients that are at risk of deteriorating

in the general ward, who may develop septic conditions or who may have multiresistant or rare tropical infectious diseases that require specific early treatment. However, these conditions are rare and it will take time to prove in a statistically significant manner that these algorithms show a benefit.

What was – in your opinion – a success factor that determined the positive results of EHR adaptation?

The organization-wide acceptance of the system and the support of the board of the hospital. ICT should not be a goal on its own but should serve the needs of the primary care process.

How do you want to develop the IT infrastructure in the near future? Which IT investments will be a priority?

Numerous efforts are being aimed at creating even better infrastructure regarding hardware, network, speed and even better redundancy of systems and their monitoring. We would like to recognize technical issues by continuous monitoring of our systems before any problems are reported by the users. This includes technical issues like network speed, server capacity and running out of storage space. We are also investing heavily in the patient's portal, exchange of medical data and images with other care providers outside our hospital, reuse of data for external reporting and benchmarking and more efficient work processes for the professionals. Last but not least, we are investing in a state of the art research environment that enables researchers to use anonymous clinical data in a traceable and secure manner according the best practices in the field.

Which eHealth trends will influence how the hospital is developing its IT tools?

The patients will act as full members of their treatment teams, this will give them access to their health information and enable them to not only view their data, but also to add to them and integrate the information in the EHR with a patient-maintained personal health record of their choice. In addition, in a different way we are also providing insight into the hospital's medical records to other care providers like general practitioners. We are in a continuous dialogue with patient organizations to better accommodate their wishes and expectations regarding their participation in modern healthcare.

A summary of your advice to hospital managers who decide to implement EHRs...

Do not look at EHRs as a side-process or administrative tool. As in many other industries, ICT will progressively become an inseparable part of the primary care process. If we want to continue to provide state of the art medical and nursing care now and in the future with all of the contemporary requirements at limited costs, using ICT is the only solution which enables us to do so. ■

“ICT will progressively become an inseparable part of the primary care process.”

Data-driven healthcare

“In our times data are as important as oil was in the ages of industrialization” – says Tobias D. Gantner, founder and CEO of the HealthCare Futurists GmbH, an international network and think tank of experts from diverse disciplines with a focus on medicine, healthcare and life sciences. We talk about the future of healthcare.



How would you describe the idea of data-driven healthcare, its advantages and the challenges it faces in the future?

The idea of big data driven healthcare in general is the ability to recognize patterns in previously collected data, patterns that have remained invisible to the eye of the individual physician or care-taker. For this we will be using self-learning algorithms that will also eventually be able to emulate what we call “experience”. We will see clinical decision support systems that access broad data bases and will be able to view multiple perspectives of the patient’s history to predict what is now

called patient pathway or patient journey. This is probably more than a normal physician would have been able to grasp. Being a physician by training myself I understand that this might not be a very popular concept amongst my peers. Physicians worry that they might become redundant and they feel that their position in society and their relationship with their patients may be in jeopardy. The idea of being supported, let alone replaced by a machine is a narcissistic slap in the face. In Germany, the physician is often times still referred to as the “demi-god” in white. Those days are over; starting in big cities, non-specialist physicians will become a commodity just like hair-dressers. They will face the

“We are again living in times of reformation. People now gain medical literacy through Dr. Google and others.”

informed patient and instead of talking through a preliminary diagnosis, they will have to convince the patient that the results of the internet search should be ignored and give a convincing reason as to why this is so. And, as a matter of fact, big data has already done a lot from that perspective. It all started with the internet, a logical successor to the book printing technology that was developed by Gutenberg in the 15th century. Eventually the printing machine made the reformation possible with Martin Luther translating the bible. People started to make up their own minds about what they would believe. In my opinion, we are once again living in times of reformation. People now gain medical literacy through Dr. Google and others. That might not always be to their direct medical benefit, yet the industry is working on making the search quality more reliable. And this is, nota bene, the non-medical industry. As the reformation in the 16th century brought some democratization to religion, we are now looking at even more democratization in the realm of technology: Apple first democratized computers and eventually music, Google is democratizing information and ebay has done the same thing with commerce. It is still unclear as yet who will bear the name that will be connected with democratization in healthcare. I am pretty sure that it will not be one of the big players that we deal with today. As is the case with all evolution, democratization in healthcare carries some down sides as well. We might look into data protection and the abuse of information in terms of getting access to classified insurance data and thus raising premiums accordingly. But whether we as medical professionals like it or not, patients and con-

“Consumers will engage with healthcare much earlier to lead a preventive life-style.”

sumers of health-services will get their way and in doing so they will change healthcare as we know it quite a bit in the near future.

The future patient: how—in your opinion—will the future of medicine look in the age of big data? How will the role of patients, the healthcare system and doctors change?

Patients will be better informed when they see their doctor. The doctor will need to engage in lengthy conversations about the patient's internet research. Patients will demand more transparency in their treatment and in billing. Prospective consumers of healthcare services will use third party agencies to support their decision making and this will most likely also be sponsored by the health funds. Furthermore, more and more patients will expect e-consultations from their physicians rather than house calls or as a supplement to them. This is quite a problem in terms of data security standards and in reimbursement. Patients will also be more informed about their genetic makeup. Services that offer genome sequencing for a self-pay market will be on the rise and these new genomicists will adapt their life-styles according to their genetic makeup. This will be a movement much more powerful than any arbitrary form of diet. Last but not least, consumers will engage with healthcare much sooner in order to lead a preventive life-style. They will tap into their personal data with wearables to measure vital parameters and have their training or work-out plans adjusted accordingly. There are already examples out there where companies endorsed the usage of wrist bands to activate their staff, employing a peer-competition program. Another effect of the genomic sequencers is already that for rare diseases they flock together to put pressure on big pharma to produce a product on their behalf and with their aggregated payment. This is another form of democratization through research on demand. A little farfetched from the perspective of the time we live in, but then again quite realistic is the aspect of data donation. Soon prospective patients will be able to anonymously share their medical data with an independent data trustee, most likely on a club basis. These data derive from personal input and from wearables and will always allow you to survey your current alert status in acquiring or activating certain medical conditions. It will be a little bit similar to consumer recommendations as we know them today: “people who bought this book, also bought that book”, in medical terms: “people who had this condition also have an increased likelihood of being prone to acquire that disease. So please pay attention to the following symptoms...”

Is data the new oil then? Why?

Oil is a raw material that comes from rigs and wells, crude and unprocessed from the earth and when it is not used properly it can cause a lot of harm such as environmental disasters. If you want to get your money's worth from oil, it needs to be refined. In this process products from light oil to diesel and kerosene appear when energy is applied to the crude oil. Oil is separated out into these substances in a process that produces fire.

In a way this could be an allegory, in the sense that what happens to oil also needs to happen to data: We gather data unprocessed directly from the patient employing

“Data-driven healthcare is still healthcare after all.”

primary or secondary data sources. When this data are not treated with care they can lead to either misinterpretation or can be misused in data fraud. For the individual this can lead to disaster. These data have to be put in order and thus undergo a refinement process. Once this has occurred, we can call them “information” (data have been formed anew and brought into order). Eventually in such a manner, refined data becomes information and this becomes knowledge. This only happens though, when energy is applied and what we gain is the light of enlightenment. Nonetheless I suppose that the analogy of oil and big data points to the fact that both of them harbor great potential. Oil kept in-

“We need much more physicians right now who can cope with the wind of change rather than investors to whom a sustainable solution is not of the utmost importance.”

dustry going for the last 150 years and obviously data are estimated to do pretty much the same by generating new technologies, new ways of gathering insights and thus new jobs.

In one of your articles you wrote that “data-driven healthcare needs more physicians than investors”...

Data-driven healthcare is still healthcare after all. Investors make a good preliminary predictor when things are really about to go well. To my recollection and experience in the field, investors are usually quite reluctant to invest in healthcare. This is true for a number of reasons: Turnover is more rapid and yet market access is way more difficult than in common markets. ROIs in some areas – in healthcare as well as in other markets – have a reputation of soaring where

other investments lag behind. Because of this there are a lot of myths around about how to properly invest in healthcare, but looking at the current changes, everyone seems to fall for them. The mantra of demographic change producing a mass market is still heard very loudly out there. I would always reply: Who is going to pay for the non out of pocket services if we consider every scenario as it has been predicted? These growing demand markets are highly underfunded because the contribution payers have just not been born or immigrated into our country. The prevailing state of confusion is a reason to consider that the serious investors may be a predictive factor in thinking that big data in healthcare has finally arrived in the mainstream and yet it will always be the physician who is the missing link between data scientists and molecular researchers. So we need many more physicians right now who can cope with the winds of change rather than investors to whom a sustainable solution is not of the utmost importance.

You are predicting that therapy of existing conditions and prevention will change. How?

Prediction is always difficult. I am not a fortune teller nor am I a sage. Being a mere mortal I am trying to piece things together and trying to derive opportunities, strictly based on gambling therapy. My extrapolations as of today are that we will be looking very closely at preventive medicine. This will help you to be more engaged in the prevention of diseases rather than fighting them, when they occur. We will, in the future, talk a lot more about preventive or even preemptive medicine and some studies will be carried out to provide proper medical screening to everyone seeking shelter or a new home in Europe. The methodological point of innovation has hardly ever been to bring homogeneous groups together. We will see a number of vaccines coming to the market and we will run a high risk for them not to be reimbursed as the patient might wish. Some of these vaccines will probably be taken off the market as a result.

Big data requires first of all standardization and second of all – the will to share information. There are still a lot of challenges in both areas...

This is true. When we look back at the way that the computer world developed, we find a number of competing systems that were hardly compatible. This trend came to a halt when IBM compatible computers and Apple computers were the last ones on the consumer market (I am well aware of other disk operating systems but these ones didn't really matter from a consumer point of view). And now with the common medium, the internet, these differences are hardly fought over. People have found themselves at ease with the system that they get along with. As for the topic of data collection, I see a more methodological challenge: Which data do we want to collect from where? Where do we store these data and who has the right

“We will be looking very much into preventive medicine.”

“The old days of proprietary knowledge might have gone.”

to interpret them? There is no such thing, especially in healthcare, as an independent data trustee that insurance companies, physicians and industry all trust and can get along with.

The good thing about data though, to answer the second part of your question: When I share them, they double. This means that the old days of proprietary knowledge might have gone forever. The first question that we will need to tackle, who actually owns the data. In healthcare it is becoming more and more clear that the physician is not the one who owns the data but the patient. Patient empowerment also needs to happen in this area. This will then lead to patient charts or data vaults that are the property of the individual patient and s/he will feed this database with any other data provided by wearables or life-style agents. Once these data have been cumulated and anonymized, big-data-driven healthcare will provide pattern recognition algorithms which will then calculate the individual risk for certain diseases and will most probably also suggest ways to evade what used to be referred to as fate. This is why, through big data we will steer towards preventive and even more preemptive medicine.

Are you not afraid that the great idea of big data might be ruined by some cyber-attacks on a huge scale or even those small ones? How can we assure society about the safety of shared medical information?

I agree that this is a challenge and I would tend to call it the “German Question”. In this, I am referring to Germany’s notoriously picky attitude to data safety and data security which is rooted in German pre WWII history. I subscribe to the idea that we need to think about solutions, but stopping the discussion, is definitely not the right idea. Cyber-attacks might happen, but did we discard the idea of cars because we have traffic casualties?

How would you describe a day in the life of a future citizen, in relation to healthcare?

To spend a complete day contemplating healthcare can be a pretty daunting thing. This will most likely not change in the future. Furthermore, it depends which future we are talking about: We will eventually find physician support systems whose usefulness will become non-negotiable (perhaps less due to quality constraints and more due to financial challenges?) We will go from prescriptive medicine which is highly eminence based to participative medicine, which could be described as engagement based? Will we progress to preventive medicine based on evidence and

yet every year face new challenges? Will we then enter the realm of predictive medicine which I would like to refer to as emergence based medicine? It is not clear where we are headed. One thing seems to be quite obvious. The government will withdraw stepwise from being the omnipotent care-giver. We will most likely see a basic coverage of insurance and that will apply all across the board, on a global scale. People – and this depends very much on individual education, socioeconomic background and on the view of the body as a machine or a living being – will most likely give preference to quality of life over longevity and in that they will start with prevention early on. This will, together with the rise of information technology lead to more medical literacy which will eventually translate into the improvement of the physician patient interaction. The future citizen will need to be more self-aware of his health, thus healthcare will play a bigger part in his life. This will ultimately translate into the democratization of healthcare and will make the health provision system much more effective. Empowered people know why they do things and why they do not do other things. This will put power into the hands of the patients; power to decide about themselves by way of informed consent based on data and information availability. People then tend to make wiser decisions when it comes to their choice of therapy and physician. We still have a long way to go to before we achieve patient empowerment, but if we don't follow this road with our patients, they will travel without us. ■

“The future citizen will need to be more self-aware of his health, thus healthcare will play a bigger part in his life.”



Doctor in the smart refrigerator

Can a conscientious monitoring of what we eat and the lifestyle that we choose lead to better health? Let's talk about everyday choices and technologies in the service of prophylaxis.

As the World Health Organization's research shows, about 40–50% of people in Europe have insufficient knowledge concerning health-related topics. In order to change this, the education system would have to be reformed, putting more emphasis on instilling healthy habits from an early age. Politicians deciding on labeling and imposing a tax on junk food, architects designing healthier buildings and municipal infrastructure, and the representatives of polluting industries – they all must play a part so that we can face health problems together. In addition, technologies which can provide more detailed information on what we are doing wrong and what needs to be improved should also be employed for our mutual benefit.

The most significant change will be the result of the so-called the Internet of Things (IoT). To put it simply, this means that the devices which surround us, are connected to the net and are able to collect, process and exchange data. Firstly, the way we do our shopping and handle our food will definitely change. Smart trolleys and baskets will not only calculate the total price of items but also their energy value, and then record and send information on the products and chemical preservatives. People suffering from allergies will be warned about hazardous food additives and devices will suggest what to buy in order to balance the nutritional value of the food. Electronic health accounts,

“The word “smart” is used to describe an increasing number of items, like a smart knife, a smart chair, smart glasses, smart shoes and a smart watch.”



supplemented with information on diet, will help to select products suitable for particular illnesses and risk groups. A similar role will also be fulfilled by high-tech fridges controlling the expiry dates of food, freshness of products, bacteriological norms, rates of consumption, etc. Smart devices will work in the background, providing help and advice to all family members on an individual basis. Checking eating habits via new technologies is already possible today thanks to meal planning apps, for those counting calories or controlling food allergies. Their disadvantage is having to input all the data manually. Everyday objects, integrated in a coherent network, can operate day and night. The same change will also encompass physical activity, but in this case the progress seems to be faster than anyone could have imagined. Special bands or watches measuring the number of steps taken, calories burned or the distance covered are a reality; the m-health market is expected to develop rapidly and increase several dozen or even several hundred percent annually.

“The way that we do our shopping and handle our food will definitely change.”

The more precise that control over life gets, the better the conditions to implement the so-called principles of individualized prophylaxis. General recommendations will be replaced by detailed guidelines available to an individual. Systems analyzing medical and social data will check interactions between medications and food, which in turn shall increase the safety level of drug therapy.

Our homes will turn into small labs. During our morning routine a urine sample will be tested, assessing the most important parameters. Of course, all information will be automatically entered into our medical files. Other measurements – on the basis of the condition of skin, eyes, breath – will be made by a smart mirror, displaying the most important results for the user. Scientists from Europe are already working on such a solution. Data will also be collected via clothes and everyday objects, such as furniture and comput-

ers. Nowadays, designers outdo one another, combining traditional items with electronics. A great example is, among others, a mug which controls the number of calories consumed, the level of hydration of the body and the kind of beverage. The word “smart” is used to describe an increasing number of items, like a smart knife, a smart chair, smart glasses, smart shoes and a smart watch. And now a bed has also joined this group of e-solutions. Packed with electronics, it will check the quality of sleep and try to improve it by, for example, adjusting the temperature, lighting in the room, humidity or initiating an appropriate relaxation program.

Why do we require these control mechanisms for better prophylaxis? There exist several arguments. Firstly, the volume of data points, not only concerning health, is rapidly growing and we are no longer able to digest all of them on our own nor update them on an ongoing basis and therefore, apply them. The same goes for doctors who frequently use expert portals analyzing and selecting scientific contributions. Secondly, prophylaxis will never be a priority in itself. Even extensive knowledge on health-related topics does not mean that it will be used in practice. Technologies will enable the type of information to be adjusted to a particular person, their lifestyle, illnesses, potential risks. Individualized dietary programs will take into consideration lifestyle and culinary preferences, while, at the same time, trying not to drastically change them. Thirdly, information on meals and lifestyle will be correlated with data contained in the health account. In this way awareness of being in an at risk group, having allergies and suffering from particular illnesses will be available which may be used for developing personalized guidelines or specific schedules encompassing dietary recommendations and exercise routines.

The promise of better health compels us to agree to more extensive control. Ultimately, we will still have freedom of choice, that also applies to health-related matters. We are not threatened by, at least not in the near future, a totalitarian prophylaxis. Nobody can prevent us from buying a packet of crisps or a bottle of Coca-Cola. Taking into account modern trends it can be said that we ourselves will be primarily interested in enjoying a long and healthy life. Consumers will be willing to try out any novelties to help them to achieve this goal. ■

“Technologies will enable the type of information to be adjusted to a particular person, their lifestyle, illnesses, potential risks.”



THE INTERNET OF THINGS

The number of connected stand-alone devices that communicate with each other, such as smartphones, doubles every five years. In 2010, there were 12.5 billion such devices. According to forecasts this number will reach 25 billion in 2016 and 50 billion in 2020.



AN AVALANCHE OF DATA

In 2015, the amount of medical data available throughout the world exceeded 153 exabytes. 1 exabyte = 1,000,000,000,000,000 bytes. Experts predict that this number will reach 2,314 exabytes by 2020.



WEARABLES

These include trackers that monitor health parameters, physical activity, sleep quality etc. In 2014, the global number of wearables was estimated at 29 million. In 2018, this number will reach about 172 million.

BIG DATA

If the full potential of the available medical data collections were leveraged, the savings for the healthcare system would reach USD 300-450 bn in the United States alone.



70%

eHEALTH STRATEGIES

In the WHO European region, 70% of countries have already launched national eHealth strategies or policies. 69% of these have dedicated financial resources to fund their eHealth plans.

The patients' eHealth related needs are reflected in the growing demand for mobile apps. Those that allow remote monitoring of the health condition and tools for medical e-consultations show the greatest potential.

THE REVOLUTION IN DIGITAL HEALTH

Information technologies in healthcare are developing at an increasingly rapid pace, and this is happening not only in highly-developed and developing countries. Smartphones, universal Internet access and the growing number of mobile apps designed to meet the expectations of patients are revolutionizing the healthcare sector. Telemedicine is making its way into clinical practice, medical universities are incorporating eHealth into their curricula and more and more countries are introducing regulations to support digital health.

Research has shown that sending text message notifications to patients prevents 1 in 6 cases of failure to follow pharmacotherapy recommendations (forgetting or deciding not to take the medicine).



eHEALTH ACCOUNTS

59% of the countries in the WHO European Region have national systems for electronic health accounts in place. 49% implement state-funded mobile health programmes (mHealth).



THE GLOBAL eHEALTH MARKET
In 2013 the value of the global market for eHealth was USD 60.8 bn.



The October 2015 regulatory changes allowed telemedicine solutions to be used in Poland. The National Health Fund currently offers contracts for two procedures: teleconferences in cardiology and geriatrics. PLN 1.3 million has been earmarked for the achievement of this objective this year.

Source: International Data Corporation (IDC) – Digital Universe (2014), World Health Summit Yearbook (2015), eHealth in the WHO European Region (WHO, 2016).

mHealth: the power of mobile technology

“Telemedicine and mHealth are an opportunity for citizens and a driver of great economic impact” – says Terje Peetso, Policy officer at European Commission (Unit Health and Wellbeing in DG Communications Networks).



I would call you “an EU ambassador of eHealth and mHealth solutions”. Why do new technologies fascinate you so much?

Digital solutions are part of our everyday life in many areas – we use them for banking, booking hotels and buying tickets for our trips, parking a car – it makes many procedures certainly faster, easily accessible (24/7) and sometimes cheaper. We are used to it and cannot imagine life without these tools. I believe digital tools can produce similar effects in healthcare – booking an appointment to visit a doctor over the Internet, accessing my health record in the same way as I access my bank account, putting questions to healthcare professionals – from anywhere and at any time.

There are not so many things in digital healthcare that are completely new and have never been done before. Data collection has been, is and will be a fundamental part of every aspect of healthcare – prevention, diagnosis, treatment, monitoring and rehabilitation. Doctors and nurses collect data all the time – from subjective descriptions of feelings and complaints to the objective description of the status of a patient. Thus, there is nothing new in data collection per se – it is only that instead of writing on paper we now introduce this information into a PC. Thanks to this small, rather technical change in the procedure we can actually make a big difference in the healthcare service in general – it is not only that having my electronic health record containing a full description of my health history saves me from having to go through it all again every time

“Big Data will allow faster and more precise diagnosis and the selection of more effective treatment methods.”

I see a different doctor (the question is also whether we actually remember everything?). It may also become useful when selecting a treatment method as the system may automatically highlight allergic reactions that have occurred in the past and contraindications because of some diseases in my medical history. Furthermore, if my medical record was part of a bigger database, it would allow my doctor to seek a treatment method that has been most effective for patients in the same age group, with similar underlying diseases, with the same phenotype and genotype. Such a database and effective data analytics can lead to a new quality of treatment and significantly improve health outcomes. In fact, it would help personalized medicine to become a reality. Indeed, it fascinates me!

What about security issues?

Health data is indeed sensitive data and should be handled with care while fully applying data protection rules. It is very important to have in place systems for identification and authentication, rules for data access and rules for anonymization or pseudonymization of data for research and data analysis purposes. It is not easy to find a good balance between the two objectives – firstly, to guarantee data privacy and secondly, to allow for the use of health data for health research and for public health policy creation. However, I believe that with a good explanation people would easily understand how their individual health data could contribute to better health outcomes both at a personal level as well as at the level of the population as a whole and provide consent when needed. There would be far fewer worries if people could understand how their personal health data could help themselves and their family to get a faster diagnosis and more effective treatment and how data privacy requirements are met.

How will healthcare be transformed in the digital age?

I do not think that diseases and suffering will change – we will have colds and flu, headache and gallstones, bone fractures and depression as we had in previous eras. We will continuously need doctors and nurses; we need personal contact and physical support. But thanks to much easier access to information and an increased role of citizens/patients in managing their own health and disease the center of the healthcare universe will shift towards citizens/patients and healthcare providers could change the emphasis of their health care i.e. to prevention. As I have already stressed in my answer to your first question – access to large amounts of data

(often called Big Data) will allow faster and more precise diagnosis and the selection of more effective treatment methods. We will choose the option to monitor the health status of people with chronic diseases from their homes more often and this will make it possible to note the worsening of their conditions hours or even days before the patients themselves will feel that their physical condition has got worse. It may be stated at this point that the fact that data sharing would avoid duplication of analysis and that unnecessary hospitalizations would be avoided by tele-monitoring, would not only deliver more effective healthcare, could actually create more efficient healthcare.

Who – in your opinion – can benefit most from mHealth?

Everybody can. Children can learn about health through games, young healthy people can find in mHealth support for adopting healthy lifestyle, people with chronic diseases can use apps reminding them to take their medications or register important data e.g. blood sugar or blood pressure, informal carers can have real-time contact with their ward from a distance. Citizens can have access to their health records and data that was recorded using health and wellbeing or medical apps can be linked to their health records. There are many ways in which mHealth can contribute to better health outcomes – you name it and mHealth has it. And if it does not yet have it, it is just a matter of time before it will be there. This is why the involvement of end-users – citizens, patients, healthcare professionals, informal carers – in the process of developing new tools is crucial. It is the involvement of end-users that makes new tools user-friendly, thus, they will be used.

“The center of the healthcare universe will shift towards citizens/patient.”

You keep an eye on the development of the European ICT market. Which countries are the leaders now? What are the success factors of the efficient adaptation of ICTs?

There are good developments taking place in every Member State. Some are more advanced at a national level, in some Member States good progress is made in regions, in some regions excellent results have been achieved at a municipality level – there is a lot of good practice to share and learn from everywhere in the EU. I would like to stress that some good lessons have actually been learned from failure as well. Thus, the most important point is to share experience.

Another success criterion is good coordination. I think that in the healthcare sector it is important that we do not forget about the main goal – better health for all

citizens. Whether we are creating an electronic health record, introducing the implementation of tele-consultation for mental health, launching ePrescription or developing an app for the elderly reminding them to take blood pressure medication twice a day – all of these activities are part of the same system and results will only get better if there is good interoperability between these tools.

Could you please give some examples of mHealth solutions that you have discovered recently?

I try to follow the developments as part of my everyday work, but it is almost impossible to be aware of everything that is happening in this field. Again, most of these tools are not introducing something completely new, but replacing the procedures with faster, more easily accessible and more efficient ones. For example, considering the increasing prevalence of Type 2 Diabetes, apps that help in the monitoring of blood glucose levels and regulate physical exercise combined with food intake are valuable tools for diabetes management. Or a tool that helps health care professionals analyzing electrocardiograms seems to help on many occasions, as the analysis of EKG is one of the most common diagnostic tests, but the results are often misinterpreted. These are tools useful for healthcare professionals, healthy citizens, patients and informal carers as they contribute to better health and care outcomes.

Are health apps present in your daily life?

I have one health app in my telephone and it is measuring my steps. I wanted to know how many steps I take a day and was rather surprised to find that without making any special effort I never reached more than 8,000! To meet the suggested level of 10,000 steps I have to leave the metro three stops earlier. Lesson learned!

How is the European Commission supporting the development of mHealth tools?

The Commission's public consultation about the Green Paper on mobile health (April 2014) collected stakeholder views on how to tackle the challenges to the mHealth market in Europe. The results of the public consultation were published in January 2015.

“Analytics suggest that the app categories that have the highest expected market potential in the near future are remote monitoring (53%) and consultation apps (38%).”

As a follow-up to the Green Paper on mHealth and the public consultation we have organized two stakeholder meetings to further discuss possible policy actions, in particular as regards data protection and the quality and reliability of mHealth apps – on 12 May 2015 in Riga and on 6 July in Brussels.

The Commission is facilitating the development of an industry-led code of conduct for mobile health apps, covering privacy and security issues. A drafting team, consisting of industry members, was set up in March 2015. The Code of Conduct is targeted at app developers and its purpose is to provide easily understandable guidance on how to respect EU data protection rules in relation to mHealth apps.

A first draft of the code was presented to all other interested stakeholders at a meeting on 7 December 2015. Once finalized, the aim is to submit the code of conduct to the Article 29 Working Party established under the Data Protection Directive (EU Member States Data Protection Authorities) for approval.

Secondly, we are working on enhancing the reliability of health and wellness apps and are currently setting up a working group representing different stakeholders to develop guidelines for assessing data validity and the reliability of mHealth apps, in particular in the context of linking data to the electronic health records.

Activities in the Horizon 2020 Work Programme 2016-2017 related to mHealth include the funding of research and innovation in the field of big data, digital security for healthcare, empowering patients/citizens and improving digital health literacy. A grant to the WHO and ITU has been anticipated in the Work Programme for establishing an EU mHealth hub. The mHealth hub is expected to become the focal point for expertise on mHealth in the EU. The hub should act as a convening platform to bring together experts and innovators for institutionalizing best practices in mHealth whilst avoiding the creation of silos and fragmentation in mHealth knowledge across the EU. One of the objectives will be to support the development and implementation of mHealth strategies in selected pilot countries/regions.

Do you think that in the future health apps, wearables and telemedicine will become a part of healthcare so that doctors will prescribe them and that health insurance companies will reimburse these new tools?

I do. Today, the majority of mHealth apps address health or wellbeing, but analytics suggest that the app categories that have the highest expected market potential in the near future are remote monitoring (53%) and consultation apps (38%). Of course, such apps should meet the requirements for medical devices and are be proven to be safe, reliable and to preserve privacy. ■



Empowering innovations in healthcare

On the one hand – great and innovative eHealth solutions, on the other – traditional healthcare structures and ways of thinking about hospitals. How can we overcome the barriers that block the implementation of eHealth solutions? An interview with Thomas O. Holm, Senior Executive Advisor – Health Care Procurement (Denmark, Region Sjælland).

It is clear that there is a contrast between innovative eHealth solutions and the traditional health care structure. The health care sector is about human lives, and any failure in diagnosis or treatment is expensive – because at the end of the day, failure may cost lives. For the same reasons clinicians are conservative about changing well-functioning procedures or equipment, and therefore have a conservative attitude towards new treatments or equipment. Often the clinicians would like to see evidence showing the benefit of innovative equipment and associated treatment procedures before changing something. As you know, innovative eHealth solutions seldom come together with evidence for outcomes. Another important reason for these conservative attitudes towards innovative eHealth solutions is that the market for such solutions in many cases is more often driven by technology or

suppliers than by the needs of clinicians and patients. This, of course, adds to the low acceptance rate for innovation as seen from the point of view of hospitals.

Why do hospitals so rarely decide to implement innovations? What are the main reasons? How can we overcome the barriers mentioned earlier?

With regard to the first barrier, one should appreciate that clinicians are also somewhat conservative for the sake of the patients' well-being. At the same time, the barrier has something to do with the clinicians' perceptions and culture. Something might change when increasing numbers of younger doctors and nurses enter the system, as they will presumably have less well-established working procedures and therefore find it easier to change in comparison to older doctors and

nurses. With regard to the second barrier, hospitals have to be clearer about their unmet needs, and learn how to better express and present these needs to the industry. This is the only way that hospitals can change the supplier-driven market to a demand-driven market that produces eHealth solutions that better meet the needs of hospitals.

“Innovative eHealth solutions seldom come together with evidence for outcomes.”

Public procurement policy is one of the reasons. But what do we need to change: the policy or the way we think about innovation? Is a wider dialogue among stakeholders needed?

We need to change both the public procurement policy and our thinking about innovation as mentioned earlier. One of the main principles in the European Procurement Policy is equal treatment of suppliers/bidders and the subsequent ban on negotiations. The enforcement of the principle has in the perception of many procurers prohibited almost all dialogue between the procurers and suppliers to the disadvantage of innovation. This behaviour might be caused by the national legislators' or procurers' overly strict interpretation of the former European Public Procurement Directive. The new Public Procurement Directive, while still upholding the principle of equal treatment, offers access to procedures that are more flexible than before. Unless you are buying an off-the-shelf product, the new directive allows for more dialogue both before instigating a procurement procedure and during the procedure. Hospitals should seize this opportunity to make use of the new flexibility and engage in increasingly substantial dialogue with the market while procuring innovations.

“Hospitals have to be clearer about their unmet needs, and learn how to better express and present these needs to the industry.”

Could you please give some examples about how innovation could change the way hospitals work, and some positive outcomes once the traditional attitude to procurement has been broken?

In Denmark we have an outstanding project known as the Sundhedsplatformen – an innovative eHealth solution. The procurement of Sundhedsplatformen (estimated value: 150 million €) is an example of what can be achieved when dialogue based procurement procedures are applied. It is a joint procurement project for two neighbouring regions: Zealand and Capital. Sundhedsplatformen is a new way of meeting the patient, and organizing patient centred clinical workflows. Due to the demand for innovation, the two regions applied the procurement procedure for competitive dialogue. This means that a selected number of potential bidders were chosen for a dialogue based on a preliminary requirement specification. During the several rounds of negotiations with the bidders, the regions tested what the suppliers were actually capable of delivering when it came to innovation. The required specification was met during the negotiation process, step by step, as the regions ascertained what the market could deliver. The regions' required innovative solutions for which, had the regions insisted, only one or two bidders could have submitted a final bid. By applying the competitive dialogue process the regions were successful in identifying the solution which suited their needs best. Sundhedsplatformen is presently under implementation.

The EPP-eHealth* project was developed to transform the public procurement process and to make it more innovative. What are the project outcomes so far?

The EPP-eHealth project is presently at an intermittent stage where there is still a need to verify the data collected so far. The verification is taking place through an e-survey distributed to the eHealth procurers and suppliers in Poland, Spain and Denmark. From the data collected so far it is apparent that the term “eHealth” has a very different meaning in the three countries. A similar confusion holds for the terms “efficient procurement” and “innovation procurement”. Attitudes are not supportive for a more widespread use of eHealth: managers often lack the necessary motivation to use eHealth solutions, doctors can form an opposing lobby, and pensioners suffer from digital exclusion. There seems to be a general lack of integration between different eHealth solutions. Too many pilot projects are stand-alone systems that fail to integrate with other eHealth solutions. Data security is an issue and finally the lack of resources for procuring eHealth solutions are seen as a problem in Poland.

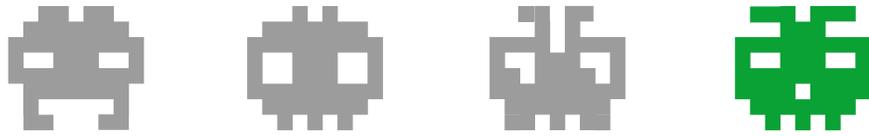
Let's talk about the differences between countries. Where is the process of public procurement more open to innovation, and how does this work in Denmark? What is typical for countries where innovations are implemented more rapidly and hospitals become more innovative in terms of eHealth?

“Health care managers often lack the motivation for using eHealth solutions.”

The European Public Procurement Directive regulates public procurement in the EU. Each Member State has transposed the directive into national law. This means that even while the principles of public procurement are the same in all Member States the practical application of the rules may differ between Member States. This means that until now in Denmark the opportunity for using the procurement procedure called the competitive dialogue – which is a procedure designed for the procurement of innovations – was more or less ruled out by the Danish Complaints Board due to a strict interpretation of the law. If you look at the data collected in the EPP-eHealth project it seems that Danish hospitals are quite innovative within eHealth, despite it being very difficult to apply competitive dialogue. Therefore, from this small analysis it appears

that there is no direct connection between the national public procurement regime and hospital's procurement of innovative eHealth solutions. This hypothesis needs to be tested further. The reasons for Denmark being rather successful in telehealth are, according to the Danish Government: availability of governance and funding mechanisms, a willingness to re-organize patient care, availability of incentives and finally a high level of eHealth deployment. ■

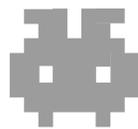
The aim of the EPP-eHealth project is to transform the market for eHealth solutions through dialogue and innovation procurement. The project will make progress towards this aim by creating a network of procuring organizations that understand the opportunities that eHealth can offer and have competence in innovation procurement and the capacity to pioneer new approaches to collaborative procurement. As well as stimulating demand for eHealth goods and services and creating a robust framework for practical procurement (public procurement of innovation – PPI and pre-commercial procurement – PCP) outcomes within the period of the project, it will also serve as a leading procurers group for the wider population of some 15,000 hospitals in Europe. Website: innovationhospitals.com



Gamification: let's play for health



Gamification is the use of games or, more precisely, the mechanisms of engagement, entertainment and relaxation present in them for other purposes, such as to change behaviour, educate or even treat some diseases. What role can it play in healthcare?



In the beginning, the child chooses his favorite character from Disney films, Marvel comics or Star Wars. The character becomes his everyday companion while brushing his teeth. For every 2 minutes of brushing, the child receives digital stickers, while for regularity and systematicity there are also stars and special plaques. This is how the Disney Magic Timer app motivates children to brush their teeth. By stimulating the "reward center" in the brain, it changes a disliked activity into entertainment. Gamification uses elements of play to provide education in healthcare, teach, change routine tasks into pleasure, motivate one to engage in physical exercises and treats mild mental disorders (behavioral cognitive therapy). In this way, games help us to use the strength of our minds to modify our lives.

For many years, games were seen only as a source of entertainment, as a time waster, harmful especially to children, competing with time spent outdoors with

their peers. However, a properly designed game can bring benefits. There is increasing evidence confirming this statement, from research conducted in various centers around the world. In one of these studies, a game helping diabetic children led to a 77% drop in emergency visits. It has also been observed that children playing Super Mario Bros games feel less stressed before surgical procedures. The experts claim that the popular Angry Birds game, which absorbs the player's attention, may alleviate anxiety states. The efficacy of gamification has also been verified by the Accenture consulting agency. In a pilot program with 5,000 participants, it was proved that 70% of the people who participated in a rivalry related to taking 10,000 steps everyday continued the healthy habit after the program finished. On the market, there are ever greater numbers of applications available to motivate people to do sports, eat healthy food, lose weight and pursue healthier habits. Everything is based on rivalry with friends, in the form of light entertainment.

“Games may play a therapeutic role, change behaviors and motivate.”

“Games may form a good motivation-reinforcing factor, especially for chronically ill people” – comments Bonnie Henry, who directs GameMetrix Solutions. We must remember that these people have to fight with their disease every day and it is extremely difficult to maintain their engagement after some time passes following a visit to a doctor or when the disease is not accompanied by troublesome symptoms, as in the case of diabetes. It is estimated that in cardiology the adherence level may be even lower than 50%, meaning that over half of the patients do not observe the doctor’s recommendations. Secondly, as much as 70% of all healthcare-related costs result directly from human behaviour, especially inadequate lifestyles and the lack of adherence to the set therapeutic path.

Gamification is all around us, even if we don’t realize it. We like rivalry, we like to compare ourselves with others and aspire to membership of certain groups or a certain status. However, it was only thanks to the development of mobile technologies that the concept could be developed and used in a more directed way – to control chosen aspects of life. A good example is the use of apps that build communities of people doing a particular sports discipline. The app users may share photographs or publish their achievements and running routes. Posting the morning jogging route on Facebook with the use of the popular Endomondo app is also an element of gamification. The trend has additionally been supported by the development of wearable technologies. Health trackers – like Jawbone, Fitbit, Garmin, Misfit, Microsoft Band or Apple Watch – measuring distance travelled, vital signs and calories burnt, enabling everyday life to be made a real part of the game for health and better condition. A game in which everyone can be the hero and the winner.

According to the Markets&Markets report, the gamification industry will grow to 5.5 billion dollars by 2018 (in 2013 it was USD 421 million), with a yearly increase of 67%. Among the stimulating factors, one can list wider research into the efficacy and medical results of gamification and the change of generations (people brought up after the digital revolution, fluent users of computers and tablets). After the boom in mobile technologies, which entailed wider discussion about the use of games in healthcare, the world is on the verge of making a quantum leap into virtual reality (VR). It is enough to put on special 3D goggles – like Oculus Rift or Samsung Gear VR – to enter into a completely different reality, a different place. The psychiatrists from the University of Louisville use

VR technology in “exposure therapy” for patients with various types of phobias, such as claustrophobia. Similar methods could be used for some other mild mental illnesses, such as depression or autism. Interesting conclusions were arrived at by the experts of the University of Washington: patients undergoing minor but painful procedures without anesthesia, such as wound dressing, were allowed to play SnowWorld during the procedure. The strong influence on the patients’ senses was effective in diverting their attention from the pain. Can gamification find more applications in medicine? There is increasing evidence that it can. In *Cyber Psychology and Behavior* we read about the first positive results of the rehabilitation of some brain diseases and injuries. The disabled will be able to enter places otherwise inaccessible to them in the real world, and telemedicine will take on a new meaning.

The Akili game enables the detection of the first symptoms of Alzheimer’s disease. The PlayCare application, while engaging children in interesting tasks, analyzes the occurrence of the first, sometimes hidden, symptoms of autism. Reflexion Health is a video game for senior patients – a virtual trainer and physical therapy specialist in one. There are ever more applications for games in healthcare. Whether the goal is education, creating good healthy habits, helping with mental disorders, or healthcare and prevention, hidden behind the elements of the game and light entertainment is an opportunity to bring out the most important elements of health management: knowledge, engagement and motivation in the patient. However, there are also some disadvantages: the games may be addictive and the educational factor may often be dominated by the entertainment layer. The long-term consequences of remaining within virtual reality are unknown. According to some psychologists, intensive experiences may be as strong as other stimulants and make the virtual world, not limited by the laws of physics (without gravity, geographical and temporal barriers, giving us absolute power), simply win over the real one, tempting us with its freedom and creativity. ■

“After the boom in mobile technologies, which entailed wider discussion about the use of games in healthcare, the world is on the verge of making another quantum leap, that of into virtual reality.”



Dormant digitization

Growing expectations are hindered by the conservative structure of healthcare – digitization of healthcare faces lift-off issues. What exactly is this technology of which some are still distrustful, and which is already enthusiastically used by many others? Are the hopes attached to digitized healthcare too high? An interview with Michael Pitsch, Managing Director Healthcare, Accenture.

Regardless of the region of the world, the healthcare priorities of every country are similar: broad availability of effective medical services. In reality, ministries of health often implement strategies based on the availability of resources. In countries suffering from economic difficulties, such as Spain and Greece, costs are cut and this can impact the quality of services. In developing countries, such as those in South America, making services widely available is prioritised, hence the considerable investment in the sector. In economically developed countries – where there's more consistent availability and service quality – solutions for improving the efficiency of distribution and cost effectiveness of services are frequently sought. The reality is that health expenditures keep increasing; even now

they consume at least one-tenth of the national budget. All entities listed will sooner or later face the challenge of rapidly rising expenditures that fail to meet society's needs. One of the obvious causes is the ageing of society. Analyses indicate that if current tendencies and the organisational status quo are maintained, some European health systems could lose their stability and financial solvency in 10-20 years. Knowing this, we start to wonder what could be done to avoid such a crisis. Healthcare may well be the only industry which still does not make use of the potential of IT, and in which competitive advantage is not based on information. Benefits resulting from the use of IT solutions are evident in other branches of the economy. In my opinion, information technology could play an

essential part in maintaining the efficient operation of healthcare systems. I am not suggesting the implementation of IT solutions simply because there are more and more of them available, but rather using information which can be obtained thanks to data collections.

Let's take a look at the structure of expenditure on healthcare. On average, 5–10% is spent on administrative costs while the remaining 90–95% is the direct cost of medical services. Out of this, more than three-fourths is spent on patients suffering from chronic conditions. There is a lot of room for applying IT here. First of all, data gathering makes it possible to identify threats to health and send patients to see a doctor for consultation earlier than this is currently done. Secondly, mobile technologies increase the involvement of the patient in – and their cooperation as part of – a given therapy, by means of ensuring compliance with prophylactic principles or by ensuring that the patient regularly takes the medicines prescribed to them. Thirdly, the treatment and care could continue uninterrupted thanks to access to the full medical records of a given patient. Services based on such principles are already rendered in some regions of Spain, where telemedicine devices monitor health-related parameters, special e-surveys make it possible to track the progress of therapy and patients can contact doctors or nurses to talk with them about symptoms they are concerned about. This may seem like a minor change, but it results in vast time savings for the healthcare system and in direct benefits for patients. This is more than just a convenience. This is why there is so much hope placed in e-services. In addition to economic considerations, the quality and results of treatment and prophylaxis would also improve.

Unfortunately, in Europe, the market conditions do not favour eHealth development. The system is payer-based and hospitals are not really interested in reducing the number of services. On the contrary, they strive to increase the number. If they accept more patients for treatment, they can count on more funds. They are not interested in introducing in-home care, which is more cost effective than hospital care, since the payer does not reimburse for such services. Thus, the vicious cycle continues. To change that situation, the principles of the system would have to be re-defined and additional measures, such as incentives, would have to be introduced. Under the current circumstances, digitization thrives in isolated spots. Particular medical institutions create their own collections of data containing files of their patients because they are obliged to do so or because they have to in order to comply with reporting requirements. IT is not considered an investment, and many managers see information systems merely as cost centres. This is a mistake on their part – software can serve as a source of important information, facilitating work at every organizational level and helping doctors and nurses in taking decisions. Healthcare employees should not fear – eHealth will

“There are no data archiving methods guaranteeing 100% security. This applies to both electronic solutions and conventional ones.”

“Digitization is not about systems but about effects and benefits. It is about what can be achieved for patients.”

never take over their work and will not compete with them. Instead, they would have access to information about the treatment process and to data boosting their ability to take correct decisions regarding therapy and prophylaxis.

What we need to do is to merge information repositories created at particular locations where data is generated. Let us take Finland as an example – it is developing the system of a single unified patient record. Every doctor and nurse and all hospital employees will have access to the same data and will be able to coordinate medical activity with one another. This creates an uninterrupted process of patient care. And what is the present situation? Every time we go to a different doctor, we have to answer the same questions over and over again and no one knows what procedures the previous doctor performed and what medicines he or she prescribed. We waste resources and run the risk of mistakes.

As I have emphasized many times, eHealth is not about IT, tools, systems or new applications. What matters is the purpose: improving quality, increasing patient involvement, increasing the patient's satisfaction level and making services available to more people. As far as the latter is concerned, let us not forget that telemedicine saves lives for people inhabiting less densely populated areas, where access to doctors is quite limited. Equal health-related opportunities should be one of the most important objectives for the public health sector in every country.

Many object to gathering data in electronic form and making it available, arguing that this may not be safe. As far as I am concerned, that debate is already over. We know that there are no data archiving methods guaranteeing 100% security. This applies to both electronic solutions and conventional ones. A patient file on paper, which is stored in a drawer, is just as likely to vanish as digital data. The difference between them is that such a disappearance is far less likely in the case of modern IT systems. Let us listen to what patients have to say. The majority believe that the benefits of sharing medical information electronically outweigh the risks, according to Accenture's 2016 Consumer survey on patient engagement. To them, effective treatment is the top priority. They are willing to make their data available, knowing that this is the way to achieve effective diagnosis and treatment. There are, as you know, websites where patients openly share information about their condition in the hope of receiving advice from some specialist that has dealt with a similar case previously. When we are concerned about our health due to a symptom, our first reaction is to look for information on the Internet. This was not possible in the past and it was the spread of information technology that satisfied our hunger for knowledge. All this happens outside of the healthcare system at a national level. From the perspective of patients, it is evident that such solutions are needed.

Let me use another example: in Denmark, between 1,200 and 3,000 people die every year due to preventable medical errors that occur during hospitalization, according to the Danish Society for Patient Safety estimates. For example, if a patient's medical history is not known during an emergency, they could be given an incorrect medicine, resulting in an acute allergic reaction or death. Platforms for gathering patient medical data and making it available to doctors, were created only when specific numbers were mentioned and the exact nature of the problem was pointed out. Other governments should realise that digitization is not only a matter of technological solutions, implementing IT solutions and replacing paper with computers, but also a way to make healthcare systems function more effectively and to help patients. The level of awareness is high in Nordic countries, and other countries, such as Brazil in South America, Great Britain in Europe, Singapore in Asia, and Saudi Arabia in the Middle East, where they are also creating eHealth platforms. No market, not even the most modern one, will spontaneously create an eHealth strategy and interoperability. Decisions need to be made at the strategic and governmental level. If they are not made, more and more cutting-edge technologies will not interact with one another and, consequently, there will be no eHealth benefits. Another example: roughly 95% of prescriptions in Estonia are digital. Patients suffering from chronic conditions do not have to go to their doctor just to receive a printed prescription – this is possible via the Internet, from their own home. What is more, they can also find the nearest drug store where their medicine is available and order it online. When I say "digitization," this is what I have in mind, and this is why I prefer to say "digital health" rather than "eHealth." The "e" prefix is often mistakenly associated with making some services available online. However, it could be more accurately

defined as the integration of processes and combining information that was previously dispersed, resulting in more personalized healthcare.

Technology is an everyday thing for our children. Expectations will continue to increase. This will also be the case in relation to healthcare and medical benefits. As far as the challenges ahead are concerned, I would point to the integration of services, and the focus on uninterrupted care in the form of a continuous process instead of separate, uncoordinated services. Big data and the analysis of medical data collections and population data seem very promising. We will soon be able to understand how to best treat illnesses in an optimum way and in line with best practices and experience. Measurement of health-related parameters and data gathering will enhance prophylaxis and disease prevention before the first actual symptoms manifest themselves, and will help ensure good health. Smart systems will find crucial information, not by accident, but thanks to meticulously sifting through vast data collections. This is a real breakthrough, made possible by applying artificial intelligence solutions, with the ability to find connections where we were not even looking. It's discovery by means of data analysis. Integrated healthcare is the future. ■

“In 10-20 years, healthcare will lose its stability and financial solvency.”

Socially valuable technologies

Health applications have long been perceived as merely fashionable gimmicks and not actual medical tools. That attitude is now changing rapidly. New, innovative solutions are based on the knowledge and experience of medical science and artificial intelligence elements, constituting substantial assistance in the diagnosis and treatment of illness. We discuss the medical and technological revolution with Paweł Jarmońkiewicz, the founder and management board member of Harimata, a Polish start-up, and the author of an application for detecting developmental irregularities in children which has received numerous awards worldwide.



How did you become interested in healthcare and health applications?

I have been occupying myself with developing innovative technologies for a long time and I could see how information technology solutions have revolutionised our world over the last decade or two. Artificial intelligence, big data, widely available smartphones and

“Mobile solutions will revolutionise our approach to health and healthcare.”

staying online 24/7 – this opens up new possibilities for healthcare. I believe that business should not only generate income, but also help to solve actual problems. Using cutting-edge technology for protecting health – in diagnostics, therapy and prophylaxis – could do a lot of good and really help some people. Developing such solutions is quite challenging, not only in technological, but also in business terms, which makes such work even more appealing and exciting.

How did you come up with the idea for an application to facilitate the detection of autism in children?

The road leading to that idea was not a straight one. When starting its business activity, Harimata’s objective was to create a technology for assessing the emotional condition of a person on the basis of the way in which they used a computer, smartphone or tablet. Over the course of several months, we conducted research whose results indicated that we were able to infer the emotional condition of a person with high accuracy solely on the basis of the way in which they used their device. We quickly developed a prototype of the solution, and were pretty sure that there would soon be customers for it, wanting to use such technology to make the life of users easier in some way. We

were greatly surprised to learn that there were indeed many prospective customers and that they were mostly online casinos and companies wishing to better target people with their advertisements. Ever since the beginning of its business activity, one of the main principles of Harimata was to create solutions beneficial to their users and not to advertisers or casino owners. We decided to change our approach and to use our knowledge to develop a technological solution which would be of real value for society. We asked ourselves how we could, using what we had created thus far, make the world a little bit better. This may sound like a cliché but we did actually ask ourselves that. During a brainstorming session, in which the entire team took part, we concluded that since we were able to detect emotions then maybe we would also be able to detect psychological disorders. We decided to check whether or not this was possible. That was the beginning.

The mental health of children is a very sensitive subject with parents and doctors – weren’t you afraid of the vastness of this challenge and the responsibility connected with it?

I was not afraid but I did feel great responsibility. It was clear to me that the challenge was worth it. I knew that if we managed to achieve our goals, the life of many children would change for the better. It became crucial for us to make a solid scientific basis the core of our solution and to ensure its top quality. The basic elements of the technology were developed as a result of research in which several hundred children from right across Poland took part. We are still scheduling and conducting further scientific research aimed at de-

Play and test

During a 15–20 minute play session, the application gathers detailed data regarding the child’s movements, dynamics and behaviour.



veloping and verifying our technology. This is one of our top priorities, and an element which makes us very different from other companies active on the eHealth market. We focus on scientific and factual cooperation, working together with therapeutic centres, nursery schools and universities in Poland and the United Kingdom. In order to ensure that quality management is consistent with the highest standards, we implement the ISO 13485 standard pertaining to medical devices. I hope that the certification process, which has taken up almost a year already, will be completed in December, and that we will receive a CE certificate for medical devices.

What was the factual preparation process like? What is the area of knowledge on which the application is based?

My business partner, and Vice-President of Harimata, Anna Anzulewicz, has been in charge of the factual aspects of our activity from the very start. She is a psychologist, specializing in psychometrics, and a PhD student at the Jagiellonian University in Cracow. Soon enough, we established cooperation with an expert from the University of Strathclyde in Glasgow who has been conducting research into the motor skills of children with disorders which can be classified as autism, and with scientists from the Gdańsk University of Technology working with affective information technologies. Together, we are now making use of a subsidy co-funded by the National Research and Development Centre as part of the "Social Innovation" programme. We also collaborate with foundations helping people suffering from psychological disorders, and consult child psychologists in relation to all of the solutions we develop. We also carry out our research at child centres and nursery schools, where we are assisted by therapists, educators and parents. I believe that the key to success is an inter-disciplinary team and extensive cooperation with others.

Did the market react well to such an innovative solution; one which had never been seen anywhere else before?

We were very curious about the market's reaction to our idea, and we expected to encounter a lot of scepticism. However, the reaction turned out to be very positive. We met with great enthusiasm at every turn and doctors, therapists and parents alike all expressed interest in our solution. It is innovative and connected with a new approach to diagnosing motor-skill disorders in children, making use of elements of games and playing with a tablet. We have received numerous awards and distinctions in recognition of our research, and approach to business, in Poland and abroad. Among the most important ones are: the Minister of Science and Higher Education Award in Poland, the gold medal with distinction awarded as part of the Eureka contest during international innovation fairs Brussels Innova, Digital Health Award Winner (XLHealth) and best

Polish company using innovation and technology to improve quality of life (Euro Innovation and Technology for Social Good Forum).

We are currently implementing a solution for parents called Play.Care for Autism in several test markets. Parents who would like to check if their child is developing properly can download our application for tablets from the Apple App Store and test their child at home. The results of such a test should not, obviously, be considered a diagnosis, but they may be the first steps towards having one made. The results of the test can be used during a visit to a paediatrician who will recommend further steps to be taken to the parents. We hope that the solution will make it possible for children with disorders to take advantage of early-intervention programmes thanks to earlier detection with the use of the described solution.

As far as our solution for professionals, Play.Care for Professionals, is concerned, we have implemented it as a test in several children's hospitals and therapeutic centres in Poland and Western Europe. We would like to release the final product onto the market at the beginning of next year.

How does the application work?

It should be emphasized here that Play.Care for Autism does not make a diagnosis – it is a tool for detecting symptoms of autism early on. In other words, it facilitates diagnostics and is the first step in the process. The accuracy of our test is very high – around 90% (this has been confirmed with research).

The whole test takes 15–20 minutes, during which the child plays three specially prepared games, each lasting 5 minutes. During the play, data from the touch screen and motion sensors (accelerometer, gyroscope) are collected, as well as data about the progress of the test and the child's behaviour. An important thing to note is that the test is 100% anonymous.

The data collected are sent to the cloud where, during the first stage, we determine a set of 350 parameters pertaining to the behaviour of the child, including motion precision and acceleration of finger movements on the screen. As part of the next stage, algorithms compare data regarding the behaviour of a given child

“The basic elements of the technology were developed as a result of research in which several hundred children from right across Poland took part.”

to data generated by the behaviour of properly developing children, data which we accumulated during research, and to data produced by children who have been diagnosed with developmental disorders. An interactive report is generated on the basis of the test results, which is then available at the level of the Play.Care tablet application.

One of the elements of the report is a measurement of skills crucial for proper child development, such as concentration, understanding and movement stability and precision. As part of the application, we also indicate examples of exercises which parents could do with their child to facilitate the development of the child's particular skills. Quite importantly, you can monitor progress by taking the test at regular intervals.

Do you think that the m-health market will dynamically develop and that health applications will become popular?

I am convinced that mobile solutions will revolutionise our approach to health and healthcare. Due to an ever-increasing human population, the current healthcare system cannot keep up with our expectations and needs, and there are so many elements we could improve by means of facilitating the exchange of information between doctors and patients, or by means of creating specialized systems assisting doctors in making diagnoses. First and foremost, however, I am con-

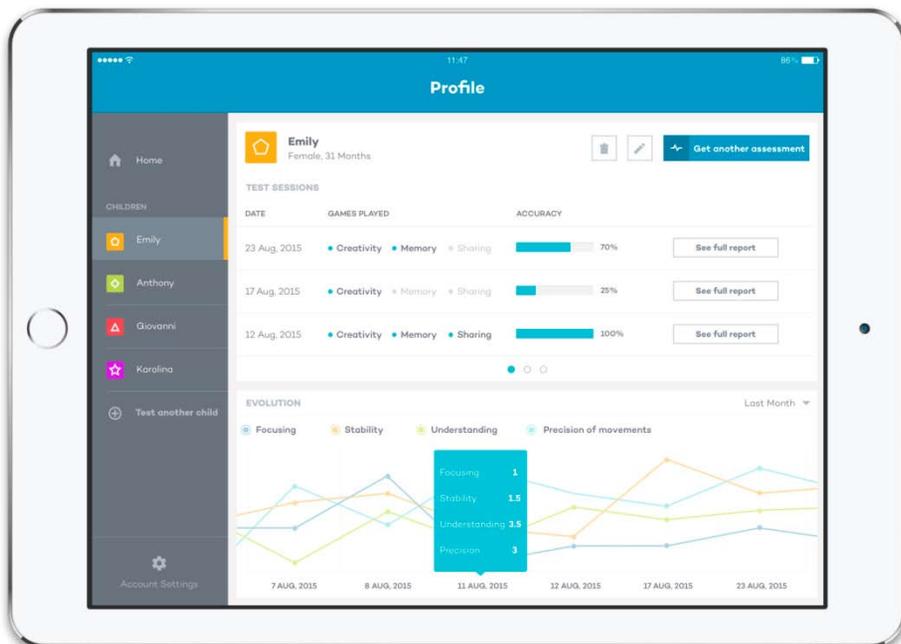
vinced that reliable and well-tested eHealth solutions will be created. There are a great number of applications available on the market, but only a very small portion of them have been scientifically tested and verified. Without this step, they remain mere lifestyle applications and, as such, do not have any major influence on healthcare systems.

Tell us about some healthcare trends which you can see today and which will soon develop.

I believe in the power of data, so I would say that all solutions based on big data, data mining and machine learning will continue to develop. It is incredible just how many connections and patterns invisible to the naked eye a good algorithm can detect. I am also fascinated with our achievements regarding de-coding and understanding human DNA. ■

Conclusions drawn on the basis of behaviour

Data collected as part of the game are sent to the cloud where, as part of the first stage, a set of 350 parameters pertaining to the behaviour of the child is prepared, including motion precision and acceleration of finger movements on the screen. As part of the next stage, algorithms compare data regarding the behaviour of a given child to data generated by the behaviour of properly developing children, data which we accumulated during research, and to data produced by children who have been diagnosed with developmental disorders. An interactive report is generated on the basis of the test results, which is then available at the level of the application.



Record-breaking electronic efficiency

HIMSS is the largest global non-profit organization that focuses on improving healthcare standards by means of advanced information technologies. It represents the skills and knowledge of 52,000 experts on eHealth, 600 companies and 250 organisations. John P. Hoyt, the Vice-President of HIMSS Analytics, tells us about new developmental prospects for the healthcare system, hospitals and patients.



According to HIMSS, what does modern healthcare, based on IT solutions, involve?

HIMSS facilitates the development of IT solutions for healthcare mostly in order to systematically improve its quality, safety and efficiency. Our vision includes the creation of mutually interconnected and harmoniously co-functioning electronic medical records (EMRs) of patients which would connect, in informational terms, particular entities on the market and service providers. We strive to achieve that goal worldwide. We all have the same health-related needs, regardless of where we

live. We would like to make use of technologies in order to involve the patient in the process of managing their own condition and to reduce the number of medical mistakes made at hospitals. Thanks to IT, the patient becomes a more-aware participant of health-related processes. In a digitized environment, the possibilities for improving the position of the patient and raising their awareness are far greater than in a situation where data are stored on paper. Just try to and imagine the healthcare system as a network of communicating vessels and patient care as a process in which all of its participants performing different medical and para-

medical tasks take an active part. If records are kept on paper, access to them is limited in territorial terms. This is a very significant obstacle. A solution to this is to digitize patient data, to remove spatial limitations hindering the flow of medical data, to make use of electronic medical records (EMR) of patients or, like in some European countries, health and social records of patients (EHSR). The objective here is to achieve personalized and uninterrupted care. The entire treatment process – from a diagnosis made during a visit to a doctor, through to treatment, to rehabilitation and the monitoring of results – should be cohesive and coordinated thanks to unrestricted data exchange.

The target model of medical information exchange in the electronic form you described – is it limited to a single country or is it possible to achieve international inter-operability?

This would be possible but on a very small scale. There are international medical standards for laboratory norms, benefits codes and databases of medicines on the level of their ingredients. Basic information regarding diagnosis, identification and medicines prescribed could, theoretically, be exchanged. However, there would be problems as far as transmission of medical records or medical descriptions from, say, Greece to Singapore are concerned. Those problems do not pertain to data transmission and coding because similar data are transmitted in, for example, the banking sector, where institutions and systems communicate between continents, exchanging information with the use of proper patterns. However, using numbers is much simpler than using medical descriptions. We have not managed to find a complete solution to this but we are getting closer year by year. We are aware of the need for it and the expectations connected with it. When we travel, such information should follow us, regardless of whether we are located in New York, London or Paris. In spite of this, we will have to wait until such an ideal solution is developed.

What does the implementation of eHealth systems look like in different regions of the world?

During the 2009 crisis, a programme was developed in the USA aimed at encouraging doctors and hospitals to use EHR. Members of the medical profession and hospitals received financial incentives for implementing more EHR solutions. Did this facilitate the development of the IT market for health solutions? Definitely. Incentive programmes based on financial encouragement bring solid results and more such programmes should be implemented. This is a job for individual countries and governments. Why? Because the main beneficiary of using EHR is the payer, i.e. the state in most healthcare systems (central budget). It is the payer who benefits from, among other things, a greater control over costs and actual savings. Patients, obviously, reap benefits as well, but it is difficult to accurately measure those. The quality of care is too complex

“The development of eHealth requires creating IT infrastructure and incentive programmes. This is up to the government.”

a concept to capture all of its aspects in strictly mathematical terms.

Aside from financial encouragement, what else could be done to speed up the transformation of the conventional model for distributing medical benefits and the refund system?

The greatest mistake that we make is paying using the fee-for-service model – this only helps perpetuate the current system. A broad stream of money flows to hospitals for treating patients. Nobody even stops to think that some costs could be avoided thanks to better patient engagement and health maintenance. The situation is difficult because eHealth is a relatively young line of business, and everyone just looks at what everyone else is doing, wanting to find the best model to follow. We need to limit the consumption of medical services – and this would require changing our approach to healthcare.

From the patient's point of view, what should be done to encourage a more extensive application of eHealth and mHealth tools?

First of all, we need to make sure that society can acquire and develop its IT skills and knowledge. Secondly, people should be made aware that using eHealth tools could improve the quality of prophylaxis. The generation which was raised in a digitized environment is more enthusiastic about technology. On the other hand, we need to ask ourselves, is there any proof that greater involvement of the patient in the treatment process results in an improvement in their health? As of now, we are at an early stage in developing conclusive scientific evidence to make a strong argument in favour of speeding up investments in eHealth. Another issue is the training of medical personnel and preparing healthcare employees to function in a new healthcare environment. Those people could become the best ambassadors of such changes.

What are the tendencies that shape eHealth?

From my point of view, the strongest tendency is to increase the involvement of patients and to include the patient in the healthcare process. In the past, the health of a patient was up to their doctor, whereas now, health is taken into account by the patient on a daily basis. Like I said before, we need research in this area to confirm that increased patient involvement leads to improved

results. Patient involvement could be increased thanks to continuous monitoring with mobile eHealth and there are more and more tools making that possible nowadays. We know well enough that systematic supervision over the health parameters of patients suffering from chronic conditions makes it possible for both the patient and their doctor to exercise greater control over the condition and, in many cases, makes it possible to prevent remission.

Another prominent tendency is a shift from records kept on paper to electronic records this is being implemented by various medical institutions, particularly hospitals. Many institutions still keep their records on paper. As far as implementing IT solutions in hospitals is concerned, the USA is the leader, all thanks to the right choice of programmes aimed at encouraging the use of IT. In Europe, Denmark is the leader and in Asia, Singapore.

HIMSS developed a programme of its own for assessing the level of information technology application in

hospitals (EMRAM – Electronic Medical Record Adoption Model). The highest level (7) means that no paper records are kept.

The programme, based on a system of seven reference levels of “IT maturity,” is a reference point for improving the level of implementation of IT solutions, and for moving away from medical documentation on paper to electronic medical documentation. Similar maturity models have been in place in other sectors for a long time, and we decided to create such a reference standard for electronic medical records in hospitals and clinics. This enables the managers of such establishments to see what level they are on and what steps they would have to take to improve their score. Every level is described in terms of its requirements. Being certified with a score of 6 or 7 can also be used in marketing activities, improving the competitive advantage of the institution. We have been contacted by representatives of ministries of health from different countries who wish to implement national standards based on EMRAM and, by doing so, to measure EMR

European EMR Adoption Model SM	
Stage	Cumulative Capabilities
Stage 7	Complete EMR; CCD transactions to share data; Data warehousing feeding outcomes reports, quality assurance, and business intelligence; Data continuity with ED, ambulatory, OP.
Stage 6	Physician documentation interaction with full CDSS (structured templates related to clinical protocols trigger variance & compliance alerts) and Closed loop medication administration.
Stage 5	Full complement of PACS displaces all film-based images.
Stage 4	CPOE in at least one clinical service area and/or for medication (i.e. e-Prescribing); may have Clinical Decision Support based on clinical protocols.
Stage 3	Nursing/clinical documentation (flow sheets); may have Clinical Decision Support for error checking during order entry and/or PACS available outside Radiology.
Stage 2	Clinical Data Repository (CDR) / Electronic Patient Record; may have Controlled Medical Vocabulary, Clinical Decision Support (CDS) for rudimentary conflict checking, Document Imaging and health information exchange (HIE) capability.
Stage 1	Ancillaries – Lab, Radiology, Pharmacy – All Installed OR processing LIS, RIS, PHIS data output online from external service providers.
Stage 0	All Three Ancillaries (LIS, RIS, PHIS) Not Installed OR Not processing Lab, Radiology, Pharmacy data output online from external service providers.

EMRAM reference system

It determines the level of implementation of Electronic Medical Records in a given medical institution (on a scale from 1 to 7). Level 7 means that all patient records are kept in the electronic form. There are three hospitals in Europe which have achieved that level and 205 such hospitals in the USA. HIMSS is the creator of the system and the certifying authority.

“A patient involved in the treatment process, having the relevant information at their disposal, will play a strategic part in healthcare transformation.”

adoption in institutions, promoting investments in IT. Today, EMRAM is a certification method which has acquired worldwide recognition. It makes assessment of maturity and degree of implementation of EMR possible. There are few developmental stimuli better than occupying a specific position and knowing that your competitors are better than you.

Can the difference – for example in terms of the efficiency and quality of treatment – between hospitals on different levels of the EMRAM scale be demonstrated?

Of course. The results of independent research indicate that hospitals awarded with the highest EMRAM ranks have the following characteristic features: safer pharmacotherapy, higher quality of benefits, higher level of satisfaction of nurses and increased efficiency. We

have begun collecting such data only recently, but the results are promising.

How many hospitals are there with the highest EMRAM rank?

In the USA, there are 235 level 7 hospitals; in Europe, 4; in China, 2; in Korea, 1. Level 6 was achieved by almost 30% of hospitals in the USA (nearly 1,600 out of a total of 5,400 hospitals in the country), more than 40-50 hospitals in Europe, 4-5 hospitals in China, 8 hospitals in India, 1 in Australia, 6 in the United Arab Emirates, 6 in South America and 2-3 in Saudi Arabia. Our observations indicate that the greatest challenge for European institutions is to proceed from level 5 to level 6.

Those are not great numbers. How can we speed up the implementation of EMR?

First of all, external funding is needed – without the right stimulation, hospitals will not be interested in improving their EMR-related competence. When a region or a country wishes to intensify investment, it develops its communication infrastructure. In the case of eHealth, communication routes driving development and resulting in specific benefits for the entire system are necessary. Funding and support are tasks for governments. Secondly, the gap between the training and the expectations of medical personnel developed during their studies and reality – which is sometimes very far removed from what was expected – needs to be bridged. Thirdly, there is the issue of medical data security. ■

Patient based health technology

Less than an hour's flight from Helsinki, Oulu is Finland's technological capital. This Silicon Valley of Finland is blending world-leading technological expertise with breath-taking forests and lakes, cutting-edge university research with perfectly-preserved nineteenth century cottages, the calm Finnish temperament with all the vibrant life of Northern Finland's largest city. No wonder the city is attracting innovative entrepreneurs from all around the world.

As a national leader in the "Future Health program", set up to facilitate research and establish innovation ecosystems in the field of bio-economy, bio-cyber security, bio-smart city, bio-sustainable energy solutions and future health, Oulu is home to hundreds of bio-health and health IT companies.

Like many other cities around the world, Oulu is adopting information technology as a way to access and share information. Connected health requires collaboration among the stakeholders involved in the patient's health. For instance, good communication and effective use of technology by health professionals and patients can make a difference in detecting illnesses, improving the quality of care, and facilitating clinical and consumer decision-making.

Providing the highest level of care requires that people become engaged with the patient, work together and interact in a meaningful way in an environment that supports personalized care. OuluHealth works towards this innovative environment by facilitating cooperation between health providers such as Oulu University Hospital, research institutes such as the Centre for Wireless Communications (CWC), the City of Oulu, scientists, industry partners and technology stakeholders.

We talk with Noora Jansson, Director of OuluHealth responsible for ecosystem strategy.



What is the main idea behind OuluHealth ecosystem, why was OuluHealth created? Who established it etc.?

Oulu is a municipality with approximately 250,000 inhabitants, located on the Gulf of Bothnia in Northern Finland.

An aging population, the shortage of healthcare workers and the skyrocketing costs of medical services are prompting municipalities to achieve more efficient use of communication technologies to provide better health services. Oulu Health was established in 2012 by the municipality to bring partners together, seek enablers for innovation and identify business opportunities.

How does the ecosystem work and why do you believe that it can accelerate innovations in the local healthcare system?

OuluHealth is one of the five innovation ecosystems of the Oulu Innovation Alliance. The OuluHealth ecosystem comprises several stakeholders from academia, the public sector, and the private sector. The principal idea is to facilitate open collaboration and to accelerate innovation by bringing together various partners able to contribute to the needs of the health care sector. The ecosystem approach facilitates the combination of expertise from wireless information technologies and life science to introduce smart ICT (Information and Communications Technology) solutions for delivering advanced, personalized, connected health service solutions.

Additionally, Oulu University Hospital is the chair of OuluHealth board. BusinessOulu is in charge of ecosystem collaboration facilitation and supporting companies in growth and commercialization. The Centre for Health and Technology is responsible for coordinating the research and innovation activities. OuluHealth Labs offer an innovation platform which facilitates the involvement of citizens and professionals.



Ecosystem means bringing together different stakeholders. How can we get the private and public sector, academia and other players to work together? How can we convince them to cooperate instead of competing?

By strategically combining several related sectors, OuluHealth facilitates close cooperation between professionals in health technology, boosts business development and gives citizens greater control over their health.

Top multidisciplinary researchers, access to different health data sources and numerous start-ups create the basis for thriving RDI activities. The Centre for Health and Technology manages OuluHealth's RDI cooperation by associating researchers and companies, facilitating their international collaboration, and promoting new health businesses. The sample collections of Biobank Borealis (of Northern Finland) and the (Northern Finland) Birth Cohort Studies research programme provide excellent possibilities for RDI.

Moreover, OuluHealth organizes an ecosystem day three or four times a year where all the partners can meet and mingle.

Future Hospital is a programme that aims to create "the smartest hospital in the world". What is the image for the "future hospital", what kinds of solutions will be implemented and what concrete steps form the project?

Digitalization is revolutionizing health care. In particular, hospitals will be the venues for digital devices and digitalized services. The hospital environment requires novel solutions in areas such as integration, interop-

erability, data security and machine-to-machine communication.

About the hospital, Oulu University Hospital, or OYS, is at the heart of the campus, oversees services in over 50% of the territory of Finland, with about 7,000 staff treating approximately 123,000 patients, annually. OYS is an innovative, research and development-oriented provider of high quality health care. The area of special responsibility for OYS covers the whole of Northern Finland, accounting for more than half of Finland's territorial area, and is home to 741,000 people. Patient care is based on the latest research, best practises in treatment, and state-of-the-art technology. The hospital employs 6,800 professionals. OYS will play a significant role in the development of OuluHealth. In the next two decades, the hospital will invest EUR 500 million in the modernisation of its functions and premises. The Future Hospital OYS 2030 programme related to this project has already been launched. Local businesses and other campus area experts are participating in the development and renewal of the process.

The hospital has an extensive operational renewal programme, which will secure the position of OYS as a top national and international provider of specialized health care. The programme's objectives are to improve the quality, productivity, efficiency and effectiveness of treatment. The utilisation and development of advanced technology, used to create a smart hospital, is an integral part of the Future Hospital programme.

Moreover, the hospital is surrounded by 100 health organizations and businesses with approximately 8,000 staff, making it a lively and well connected area for collaboration and business opportunities.

Could you please describe other OuluHealth projects?

READi for Health is a European FP7-REGIONS programme funded project. READi for Health (Regional Digital Agendas for Healthcare) will support four European regional clusters to facilitate faster uptake of their eHealth innovations. The project will deliver a Joint Action Plan to promote the eHealth ecosystems in Murcia (ES), Skane (SE), Oulu (FI) and Midi-Pyrenees (FR). Key areas of focus include clinical data exchange, cloud computing and mobile security, while promoting Pre-Commercial Procurement and facilitating the internationalization of eHealth companies.

Bio bank Borealis, located on the Kontinkangas health campus, opened its doors in 2015 and is part of the national Biobank network in Finland. Bio banks collect human samples like tissue, blood or cells that are linked to the health data of donors.

“By strategically combining several related sectors, OuluHealth facilitates close cooperation between professionals in health technology, boosts business development and gives citizens greater control over their health.”

How do you manage to finance all the projects?

Most projects are EU funded, including the Oulu University Hospital living lab environment to facilitate and support the development of health and medical technology products and services in a user-oriented way, this is part of the Oulu Sote Labs project which is partially funded by the European Regional Development Fund (EAKR). The project began on 1 January 2015 and will last for two years.

The development of Thalea is to be partially financed by THALEA project funding, within the 7th framework programme of the European Union.

What are the key conditions to build a successful ecosystem that accelerates the implementation of ICT solutions in healthcare? Could you please select the five most important pieces of advice?

The ecosystem and its partners need to generate, develop and deliver a technology-based or business-model innovation.

It's our role to motivate, inspire, facilitate and promote all of the ICT solutions in health care activities that take place in the region. Moreover, we manage the ecosystem and partner or find links with, for instance, the European Connected Health Alliance and the Nordic Connected Health Star Track.

For the functioning of the ecosystem, it's crucially important that we include researchers from the university, hospital staff, biotech, pharmaceutical and health tech companies, administrative workers from the city of Oulu and, last but not least, the patients in the process. ■

INTEGRATION

Healthcare market entities need access to the complete sets of patient data. It's time to build IT platforms that can integrate the information collected by all the various participants in the medical services chain (including the latest ones, such as mobile apps and devices monitoring physical parameters). To increase the patients' involvement in prevention and strengthen their role in the system, they must also be given access to their own medical data. Smartphones are the best fit for this purpose as they are evolving into virtual medical points (medical e-consultations, health apps etc.).

"Therapies and healthcare will move from hospitals to our homes and integrate with our everyday life."



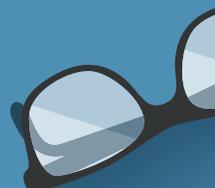
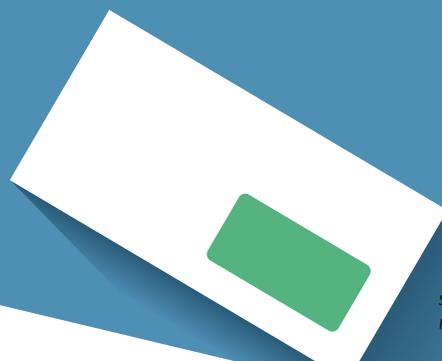
ANALYSIS

The ever-increasing range of data collection brings a number of new challenges for the architects of healthcare solutions. In the future, dedicated analytical and statistical algorithms will aid earlier diagnosis and a greater understanding of the relationship between a person's health status and lifestyle. Currently this potential is almost completely untapped. Access to their eHealth account is not enough and the patient should be given specific indications and advice instead of raw data. Predictive analytics, in turn, will allow identification of any deterioration in the health status of patients, such as those with cardiac disorders.

"Artificial intelligence systems will analyze medical information while looking for health threats."



eHEALTH CHALLENGES AND OPPORTUNITIES



RESULTS

Digitization of healthcare is not an aim in itself, it must contribute to improved clinical outcomes, quality, management standards and higher patient satisfaction. We are at the beginning of this road. In line with the motto “from quantity to quality”, by 2018 the US plans to implement a new model of healthcare services in 50% of healthcare points – providers will be granted funds in return for achieving specific goals. This accelerates IT consolidation of physicians, outpatient clinics and hospitals. Future medical interventions will be based on the big data analyses of similar clinical cases.

“The times of informatization for the sake of digitization alone are passing. Investments in IT must yield measurable benefits.”



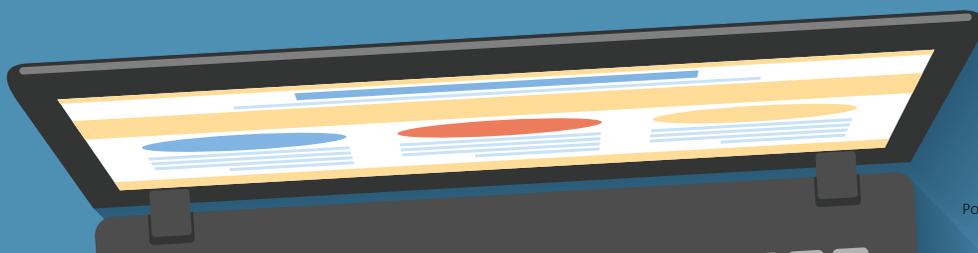
SECURITY

Without a strong security basis underlying the collection and exchange of information, it's difficult to consider the dynamic growth of eHealth, the benefits for healthcare and trust of patients in relation to digitization. This is a task for the IT solution providers and medical institutions responsible for creating appropriate security procedures. An even greater challenge is the need to protect medical information in mobile apps on smartphones. Insurance companies and healthcare providers are an increasingly frequent target of organized cyberattacks. The reason? The rising value of medical records on the black market.

“The security of sensitive medical data must remain the pivotal issue in eHealth development.”



Innovation in information technology is changing the ways in which entities operate in the healthcare market. In the US in 2015 the amount invested in start-ups operating in the digital healthcare market reached USD 4.5 bn. The investors' hopes are not exaggerated, as eHealth is currently one of the fastest developing areas. What awaits us in the coming years? The increasing integration of IT systems, the universal use of collected data for managing and improving efficiency, and greater emphasis on the security of medical information.



The digital democracy



Why are local eHealth initiatives better than central mega-projects? Should the market for health applications be subject to restrictive regulation? From where does the social acceptance of innovations originate? Robert Madelin is the Senior Adviser for Innovation at the European Commission (European Political Strategy Centre, EPSC). During the “Innovative Healthcare Forum” we met to talk about the market for new health care technologies.

A few years ago eHealth meant electronic medical records, whereas today it has an entirely different meaning...

Since the “eHealth” term crystallized, technologies have changed beyond imagination. Currently, eHealth issues are strongly associated with mobility, information flow, and availability. This constant communication began with the intensive computerization of the sector and the spread of the Internet. In the first place there were computers with access to electronic medical records, then smart phones, more common wearable technologies and pervasive sensors, all leading to the acquisition of large databases. What is more, they are going to become even more common. The value of health information has been steadily increasing, creating a scientific basis, sometimes called big data, allowing us to learn more about diseases, disorders and prevention. It gradually makes the approach to the patient more personal, which allows us to understand different processes, such as the process of disease development. So far it has been difficult, as it requires the analysis of thousands and millions of similar cases. This is the essence of eHealth.

However, a shortage of evidence and tests showing the specific benefits of eHealth is like a ball and chain to digitization. Why should we continue investing in IT?

The answer is simple: we cannot separate eHealth from the other elements of health care and explore this issue in isolation. In applying such an approach, we tend to look for firm evidence, preferably calculations showing improvements in effectiveness, quality and cost reductions. We have to look at eHealth as a wide range of technologies, not a solution taken out of context of the entire economy. In a systematic, interdisciplinary approach, it is easier to notice benefits at the most basic, local level of health care, even with its numerous aspects. On the other hand, on the macroeconomic scale we have to wait for appropriate analyses as eHealth is a relatively new field. However, it is only a confirmation of what we already know. When discussing the topic of investments in IT, we must remember the mundane barriers: tight budgets for the health care system, making it difficult to find additional resources for technology investments; the social welfare system, which also cannot afford to allocate substantial funding for IT; and users who are still getting used to the rapidly evolving technological solutions.

“Acceptance results from experience. Only when we use eHealth tools do we appreciate their value.”

Since the available technologies are far ahead of our possibilities to use them, let us talk about the last mentioned obstacle, which is social acceptance. How can we popularise e-health with patients and health care workers?

The best way is to imagine that we need eHealth solutions: patients suffering from chronic diseases are most aware of this. Their experience means that there is a theoretical need for IT solutions, and, as elsewhere, acceptance results from contact with a given matter, and this contact consists of experimentation. Fear and prejudice arise from a lack of knowledge. The research on robots taking care of the elderly comes to mind. A group of respondents was asked if they would like robots to look after their older relatives, and most people gave a negative answer. When they were informed that such a robot would be free of charge, their opinions were more diverse. After 6 weeks, those people who benefited from the help of robots were asked whether they wanted to give them back. Most of them decided

to keep them and even wanted to pay for such a possibility.

The other group consists of health care workers. It is also a simple solution: instead of trying to persuade them, the technology itself should be convincing—intuitive to use and beneficial at work and in other fields. In this way, it will popularize itself.

The European Commission supports many smaller, often pilot initiatives in the field of eHealth. Are they the key to wider adaptation of digital solutions or do we need central mega-projects?

Large projects are not the best way to speed up the development of the health care digital market. We have a lot of examples that suggest that micro-projects, bottom-up initiatives or creative start-up ideas give much more impetus. For instance: eHealth applications. In cases where eHealth architects are very close to patients, need-tailored solutions are developed, as it is competitiveness that constitutes one of the most crucial factors in a real free market situation. On the other hand, we should take care to centrally establish certain rules—interoperability, safety and quality standards in order to ensure the smooth operation of the entire system and the patients' protection.

Shouldn't we increase the number of regulations in the eHealth market? For example: mobile health applications developed beyond any control. Isn't this the last moment to avoid informational chaos in the market?

The key to developing the market is the user. They know best what they need. They will benefit from solutions that are of high quality and recommend them further, rejecting useless solutions and giving them a negative opinion. It is natural selection, one of the best regulators. In the age of the Internet, user reviews become the fundamental criterion for the selection. It reflects a real democratic market regulated by the consumer's opinions, not by imposed technologies. As far as health care workers are concerned, the effectiveness of new solutions is decided by a comparison with the existing clinical methods. Therefore, at the functionality level, the user becomes an instrument of verification. However, these elements have to be controlled by top-down regulations. One of them is safety. Does the application provide reliable information? Are the data collected and processed in compliance with appropriate standards? National control, validation and legal mechanisms play the most crucial role here. Nevertheless, when it comes to other issues, I would rather trust natural market principles instead of developing barriers limiting creativity.

Do we have to prepare for significant changes in the health care system?

Yes, as health care is in transition and it will increasingly change its direction to... health care in the true sense

of this word. The significance of the treatment will decrease, the central point of all processes will be data, their simple analysis and availability. The quality of information management will play the strategic role.

A developing phenomenon is the 'Internet of Health'; constant and free access to medical data, which will mean that patients will become much more involved in issues connected with health. We can expect the development of wearable technologies, smaller sensors measuring health parameters and lifestyle at any time of the day or night. Over the course of time, they will be replaced by implanted chips. Interfaces with IT systems will become easy to operate and they will be controlled by voice commands. Together with technologies our needs will also evolve, which is partially connected with demographic changes and other priorities.

Is the ageing population and the 'silver economy' a threat or rather an opportunity?

There are many pessimistic articles on this topic in the media. Nevertheless, I personally prefer to look at this issue from the point of view of the opportunities available, and on this point I agree with what was said during this year's Economic Forum – we are dealing with the fourth industrial revolution, humanity needs to decide about its future and give thought to the measures and solutions that should be undertaken on its path to prosperity.

During the ageing process we have to face such facts as the limitation of physical mobility, productivity, and higher rates of adverse incidents. Technology can also help in this field. First and foremost, we need to change the orientation of health care towards preventive solutions and health promotion so that we can invest in health and active ageing for the entire course of our lives. Technologies open up new possibilities for the elderly in ways that we haven't been aware of so far. It is worth mentioning, for example, modern communication possibilities, telemedicine, telesupervision, telework, commitment to social projects, etc. The silver economy is not just a challenge, but also a perspective that shows that this part of our lives that has been neglected so far will regain dignity, quality and due attention. ■

“The management of the increasing amount of medical data is a challenge for modern health care systems.”

The unseen hand of technology

What will the role of artificial intelligence in healthcare be? Will supercomputers revolutionize diagnostics, therapy and the way in which clinical research is conducted? John Crawford and Matej Adam, experts in the field of solutions for the healthcare sector at IBM, tell us more about the changes which information technology, as applied to healthcare, will undergo in the future.

IBM has created a new class of computer called Watson which can be trained in medicine, and which is capable of analyzing terabytes of medical data from different sources in order to help doctors make better diagnostic and treatment decisions. However, whenever big data is mentioned, the issue of data fragmentation and lack of standardization emerges. How can we solve this problem?



Photo: eHealth Week 2015

An example of a solution to the problem of data dispersion is the Watson computer in combination with a resource called the Watson Health Cloud. In brief, it is a safe cloud of services where users can gather and exchange information. Let us take a closer look at Watson's environment / ecosystem and the way this works. At first, we created an environment for storing data and algorithms for processing them. Next, working with clinical experts, we trained Watson in specific medical domains, starting with oncology. We then used artificial intelligence approaches to enable the computer to learn on its own and improve itself as far as analysis of data and drawing conclusions are concerned. This way, Watson gradually acquired more and more knowledge, becoming able to answer specific questions with ever-increasing ease and accuracy. The starting point was, for us, the creation of a single platform for different sources of information, sometimes very dispersed; a cloud in which different users could store their data. This was the only way to allow Watson to obtain such vast knowledge – granting it access to rich sources of information.

One of the problems that healthcare faces is the fact that information is dispersed due to the complex structure of the system: data is collected at many levels – in the doctor's office, in hospitals and

clinics, in laboratories and at the patient's own home. The process for ordering particular elements of the system and combining them together has only begun recently, as with the digitization of healthcare. More and more countries, including Poland, are implementing nationwide programmes aimed at systematizing medical records in the form of electronic patient files.

During a break in the interview, John Crawford presented a mobile platform and application for gathering data from different sources, also from electronic medical files and m-health devices [health trackers], and placing them inside the cloud. The tool makes it possible to collect the dispersed data into one place, presenting them in the form of a clear summary of a given patient's medical status.

There is a lot of talk about big data, and this phrase evokes emotions and is widely commented on. However, we should turn our attention to small data as well. That is, data from the lowest level, such as descriptive texts created by doctors, should also be made a part of such analyses. Such individual pieces of the healthcare jigsaw puzzle may be small in size, but the information that they contain may nevertheless prove important for diagnostics and treatment.

Watson's focus is on facilitating the process of making medical decisions. Will it be possible, in the future, to use data collections for prognoses regarding health?

We do not know all of the possible applications of the Watson technologies yet, and our adventure with discovering its capacity has only just begun. We began with checking its powers as applied to oncology where there are vast amounts of data to be processed. Working with clinical experts from Memorial Sloan Kettering, we trained Watson in the field of cancer treatment, and the resulting system is now available as an offering called Watson for Oncology. A thorough analysis by this system could determine the recommended course of treatment, and a number of factors which it was not possible to take into account before can now be considered. We also developed Watson Genomics Advisor, and Watson for Clinical Trials Matching, to provide an even broader set of capabilities and decision support services. Another future application of Watson is explaining medical and clinical knowledge in layman's terms so as to make it comprehensible to people who are not employees of the health-protection sector. For example, we would like to know what impact risk factor Y has on the progress of condition X. Today's medi-

“Mere gathering of electronic data is not enough. The time has come to introduce workflow management for doctors and nurses.”

cine has vast medical knowledge at its disposal and it is beyond the comprehension of most of us. When we ask, “what is the relationship between obesity and arteriosclerosis?” the answer should come in a visual form, simple and clear, and we should not receive hundreds of pages of medical studies.

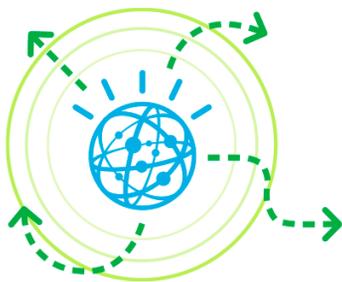
When we talk about Watson, we do not mean a single device or a special-purpose machine. What we mean is a number of services based on artificial-intelligence solutions which can be offered. We will definitely develop the environment (“ecosystem”) required for the proper functioning of such solutions, establishing extensive collaboration with partners within our cloud. For example, we have developed partnerships with Medtronic and Novo Nordisk around diabetes management, and with Johnson & Johnson to provide virtual coaching for patients after joint replacement surgery. We are also applying Watson in the ‘fitness and wellness’ domain, through agreements with Under Armour and Welltok. Such specific information, the prediction of possible scenarios, is very important for prophylaxis and is an incentive encouraging people to change their unhealthy habits.

As of now, we have population-related data at our disposal and, on the basis of this data, we are able to determine risk groups and, for example, conduct medical screening examinations. However, our efficiency would approach the highest possible level if we reached to an even lower level of data and provided doctors with specific recommendations from the system, suggesting to them that they pay particular attention to a certain group of patients in the first place in order to protect them against illnesses and provide them with advice on the course of action to be taken. This is the facilitation of medical decision-taking, an aspect of healthcare with very good development prospects, and one which we have great hopes for.

What are the factors that determine the pace at which investments in information technology develop, with respect to the different countries and regions of the world?

When we examine areas which have been developing most rapidly, the answer is: return on investments in innovative solutions. On the one hand, there are producers introducing new technologies into the market, while on the other hand there are users. It is the latter

“At the level of the entire population, prophylaxis will be replaced by individually determined healthcare plans.”



group that has to be directly and specifically interested in accepting a new solution. In the case of doctors, this could be the promise of receiving a refund of the costs connected with treating a given patient faster because settlements with the payer would be effected more efficiently in the electronic form. In the USA, the 30-day patient readmission penalty turned out to be a factor accelerating the development of innovative solutions. Hospitals started to make investments in eHealth, telemedicine and remote monitoring in order to better look after their patients at home and keep them healthy, and thus avoid having to pay financial penalties. In most cases, money (or, in the case of some countries, a long-term plan) is the motivating factor. However, even countries motivated by long term goals need funds for implementing investment projects. It is important that numerous incentives, not only economic ones, be created.

Patients themselves could become a factor in speeding up changes. When choosing a doctor for ourselves, we base our choice on service quality and expectations regarding the efficiency of treatment. When we must choose between an establishment using IT solutions where it is possible to book a visit online, where our prescription will be sent to us in electronic form and where the doctor has access to our full medical records, and a clinic where you have to book a visit by phone (and the line is always busy) and where hard-copy, incomplete records are used (which have to be supplemented with laboratory examination results brought by the patient), then we would definitely choose the former option – it is safer and more convenient. The more demanding a society becomes, the greater the pressure on service/benefit providers to improve their competitive standing. Following innovations concerning medical equipment, now is the time for IT innovations.

Note that you have to encourage doctors to make use of eHealth tools less and less often. The practical benefits of using them are the decisive factor. In particular, young doctors are keen on registering patient visits on their tablet, audio-recording their interviews with patients, sending prescriptions in electronic form and communicating with other doctors via special professional social networks. IT systems should offer such specific benefits, be user-friendly and smoothly become a part of a doctor's everyday work instead of being a source of additional obligations. When we look

closely at what the work of a nurse looks like nowadays, it turns out that they actually spend as little as 20% to 30% of their day with patients. The remainder of their working time is devoted to creating records and reports, paperwork and work organisation.

You said during one of the sessions of eHealth Week that we are now facing a challenge of re-orientation from systems for gathering patient data to systems focusing on managing workflow. What exactly did you mean by that?

Electronic medical patient records were originally designed to have the same function as hard-copy files. Their primary purpose is to record medical events, and they are not capable of actively aiding medical employees with their work. For example, a doctor or a nurse working at a hospital employing information technology has access to all data regarding treatment, examination results and lifestyle parameters. However, the role played by the system ends with granting access to such data. All patient-related activity still has to be planned by the doctor or nurse on their own, including the routine procedures to be performed. What we would like to achieve is a situation where the system organizes work flow, suggesting, on the basis of information from a given health account, what examination to carry out, when to give the next doses of a medicine to a patient, when to make an injection etc. Taking it one step further, we would like the system to organize work at the hospital, creating duty rosters and assigning tasks to personnel, managing the overall care of every patient in a given ward and optimizing processes. This is the role of a system facilitating workflow management.

Matej Adam presented another application – this time, one meant for nurses. It organizes their in-home care work, can create a list of patients to be visited the next day, present their location and the travel directions on a map, display the medical procedures to be carried out for each one of them, show the time remaining until the next scheduled visit and list critical services. The head nurse handles overall management and can set new task priorities and care strategies.

Will artificial intelligence play an important part in the way that medical services are rendered? What will the influence of technology be on healthcare and social care models?

You only have to look back ten years to realize just how great a technological revolution has taken place. Back then, there were no smartphones, tablets, applications, Facebook, or Twitter. It was difficult to predict that such things would be created. Similarly, it is not easy to say today what the impact of new technology on healthcare will be. However, if you examine current tendencies, you will notice a certain regularity: patients are becoming more and more interested in their own condition and their involvement in managing and supervising their condition – or, in more gen-

eral terms, their interest in the field of prophylaxis—is increasing. Thanks to technology, people will be more aware of what they should do to avoid illness and get back in shape quickly. Healthcare will become more mobile, including remote access to data and remote visits (consultation by means of distance communication). Many eHealth services will be available for a fee but, on the other hand, patients will be paying for specific benefits and comfort. Artificial intelligence will definitely assist doctors in diagnosing and treating more complex clinical cases. Mobile devices will make it possible for many patients to continue their treatment and rehabilitation at home instead of staying at a hospital. Diagnostics will improve thanks to new tests, and it will be possible to carry out many types of examination on one's own using simple and widely available devices, based on blood-sample testing.

So far as routine procedures are concerned, it will be possible to introduce more automation and make greater use of artificial-intelligence tools. It will be similar to what happened with the aviation industry—nowadays, planes can take off on their own, reach their destination and land, essentially without any help from the pilot. In spite of this, human beings are still needed to act in an emergency and to supervise the operation of artificial intelligence. Greater standardization, typical for other sectors of healthcare, is also to be expected. Today, a patient admitted to two different hospitals in one city is diagnosed and treated in two different ways instead of being subjected to only one treatment: the best one for them. Standardization will be connected with increased safety of patient care, a higher standard of care and with minimizing the number of medical mistakes.

When thinking about the future of healthcare, you should consider what Japan is doing and think about its investment in robotics. Robots help elderly and sick patients to maintain a greater degree of self-reliance at home. An interesting detail is the re-definition of some professions in Japan. For example, postmen, as members of one of the few professions that come into contact with most people living in small villages and in cities, are to become one of the links of the healthcare and social-care chains. In Denmark, in turn, post office employees also install and uninstall telemedicine devices at the homes of patients.

The pharmaceutical industry also faces a new challenge. Instead of producing medicines for—and selling them to—the entire population, pharmaceutical companies will offer personalized medical tests and medicines supplemented with m-health devices monitoring the progress of treatment.

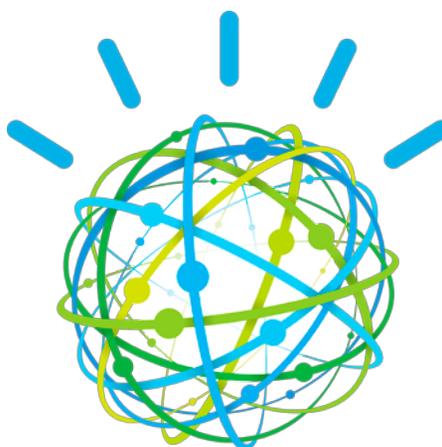
What is particularly important for the new model of a drug store?

Hippocrates said, almost 2,500 years ago, that there are three actors involved in every medical case: the

doctor, the patient and the illness. The role of the doctor is to “follow the science”, while the patient has to collaborate with the doctor in fighting the illness. That model of medicine has been forgotten. We have created a system in which the doctor is the keeper of secret knowledge, guarding the supply of knowledge available. This is not what treatment should be about, and this situation should be changed. If what was previously said about the future is to become true, we need to focus more on creating technologies which people will accept and love because they help them in their daily work, save them time and offer benefits important for doctors, nurses and patients. Just look at what today's business leaders—Amazon, eBay and Facebook—have achieved. Finally, close cooperation between engineers and the healthcare employees for whom eHealth tools are to be created is necessary. We need to avoid creating solutions which are excellent in technical terms and which offer hundreds of functionalities and options and yet which are, at the same time, not practical as far as using them for everyday work is concerned, and which do not meet the expectations of healthcare employees. ■

Images in the text: IBM Watson (www.ibm.com)

“Development of information technologies will make it possible to standardize and automatize procedures, adjusting them to best clinical practices.”





Health literacy:
it is a reformation rather than a revolution but in any event it is a revelation

Overall, literacy and especially health literacy, is one of the major achievements of modern societies which have obliged children to acquire at least to a certain extent, the knowledge required to comprehend written texts. But it is not just mere writing that needs to be understood, we need to find a way to provide access to the thoughts and often times advice in medical texts that involves making them a part of the alphanumeric codes that our brains are trained to decipher to make sense of the world for better or for worse.

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According to the WHO, health literacy is defined as “the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways that promote and maintain good Health.” It can be also be seen as a “constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the healthcare environment”, as the American Medical Association puts it. However it is academically expressed, health literacy at its core means the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions.

Poor health literacy is more likely to be associated with unfavorable health outcomes and a limited use of preventive care. This also means that healthcare costs are on average higher in its absence. It is estimated that up to one half of the US population has limited health literacy standards and it is probably not much different in the European countries. These mechanisms are very well understood and therefore health education materials are being simplified in order to improve patient to provider communication and thus overall health literacy, which is considered to lead to a more effective way of allocating spending in healthcare.

However, it is not only the absence of skills and abilities that render an individual incompetent to comprehend often times very complex healthcare related content or to understand the professional language of physicians and care providers. Also active neglect and turning a blind eye to the obvious seems to be a part of the challenge. So it is not only a question of socioeconomic status but it also concerns the will to break habits, to change and above all to innovate at a personal but also at a systemic level. Due to all of this, it should come as no surprise that health literacy is believed to be a stronger predictor of health outcomes than social and economic status, education, gender, and age.

It seems more and more obvious that we need to address a very well-known phenomenon that is currently a novel aspect of contemporary technological achievement. We are guided in this by the thought

“Technology and medicine seem to have been a matching pair in the West dating as far back as the time of Hippocrates in ancient Greece.”

that technology has already fixed a number of issues concerning longevity, so why shouldn't health-literacy be improved by way of health-understanding and the use of modern technology. The root of this thought lies in the introduction of ubiquitous computing with prospectively 80% of adults carrying around a supercomputer in their pockets by 2020 and this technological advancement of connectivity may also result in their health literacy habits being affected one way or the other. Technology and medicine seem to have been a matching pair in the West dating as far back as to the time of Hippocrates in ancient Greece.

Even today, six out of ten respondents have used the internet to search for health-related information within the last year. The most popular searches are for general health information or ways to improve one's health which includes nutritional information and facts about lifestyle choices. The second most popular search queries are for information about specific injuries, diseases and illness conditions as well as the unwanted side effects of medications. Once again it comes as no surprise that at the current stage the early adapters in their twenties and thirties still lead the field with the silver surfers catching up steadily.

There is a clear trend that is due to what I would refer to as democratization in healthcare, knowing that this might not be the best term to describe what is happening when patients engage with physicians and actively decide about their therapy. It might as well be called enlightenment in healthcare, alluding to Immanuel Kant's famous words (quoted as such in 1784 in his text “What is Enlightenment?”): “Laziness and cowardice are the reasons why such a large part of mankind gladly remain minors all their lives [...]. They are the reason, why it is so easy for others to set themselves up as guardians. It is so comfortable to be a minor. If I have [...] a physician who prescribes my diet [...] – then I have no need to exert myself.” And Kant continues: “I have no need to think, if only I can pay; others will take care of that disagreeable business for me.” This goes along with the “self-imposed nonage which does not lie in the lack of understanding but in indecision and lack of courage to use one's own mind without another's guidance”.

As we can observe in paternalistic medical approaches, these “others” are guardians who have “kindly taken supervision upon themselves to see to it that the overwhelming majority of mankind [...] should consider the step to maturity not only hard, but as extremely dangerous.” This also makes the guardians' lives easier and more predictable because they can fully leverage any effects deriving from this nonage to their advantage in terms of exploiting medically non evidence based value claims in the context of proposition induced demands. This means health literacy, its level of development and its acceptance becomes a deeply ethical question within a lot of groups: Politicians, payers, physicians, patients and the private sector.

The latest driver of “democratization in healthcare” or “medical enlightenment”, to use this phrase one more time, is the so called digital transformation in healthcare. We have seen that a number of other fields have been affected, probably even disrupted, by the introduction of modern technology, especially information technology systems and the change in customer empowerment and business models that has been the eventual result. In a lot of markets this led to the disappearance of the middle man when customers actively engaged with providers and vendors. What is possible in the ebay commerce markets or the direct insurance markets might not yet be feasible in healthcare but we are seeing an increase in the number of companies who are trying just that, actively ignoring regulations that have been around and untouched for decades. One of them is the patient-physician relationship which is considered to be the physical basis for therapeutic success. Lichtenberg, a German poet of the 18th century once claimed that it was the physician's duty to entertain the patient up until the moment when nature has cured the disease. But doctors have lost their entertainment acumen over the years, probably because they were too much in love with professional technology themselves and thus ceased to be the only source, prospective patients turn to in their quest for understanding what might be the cause for their current condition. A lot of the time the first resource people consult is an online search engine followed by specific and dedicated websites including blogs and forums. And we also understand that it is a very private thing to search for

medical information, so the vast majority who used the internet to look for health-related information did so for themselves.

The European Commission's report on the digital health literacy of European Citizens states that over three quarters of all respondents agree that the internet is a good tool for improving their knowledge on health-related topics, and furthermore almost nine out of ten people who looked for health information online, say that they were satisfied with the information that they found. The biggest downside is the inconsistent reliability of textual content, its commercial orientation and a lack of detail. These are the major pitfalls of data acquisition from unreliable sources and it is a pivotal illustration of the accuracy of what is often times heard, that data has become the new oil. Just as in the refining process and fractional distillation, compounds are intellectually separated and can be used in different ways according to their compounding quality which translates into medical reliability and accuracy. This will be the catalytic activation energy that needs to be put into new business models that facilitate the search for sound healthcare related information to get the process going.

Especially important is the fact that healthcare often times deals with decision making under uncertain conditions with a number of influential factors coming in from various sources, it will become key in a connected society to declare the origin and quality of data and



information used by the lay population who want to get to grips with their medical conditions. In the classic patient-physician interaction the principal agency theory framed by professional board exams on display at the doctor's office made sure that healthcare was provided from a reliable and well tested source under the conditions of trustworthiness and efficacy. Nowadays things are not that straightforward anymore. Not only do the borders between healthcare and self-care get blurry, some prosumer electronic companies find themselves in a steady process of change towards understanding the patient's needs and detecting the underlying medical conditions even at an early stage. What will be called disease interception in a couple of years time, started from humble origins in the trenches of epidemiological battles against cholera from times long since past, that helped us to understand the value of prevention. Prevention cannot work without an engaged individual both on the healthcare provider's side and the recipient. This is where health literacy comes full circle. It is thus not about selling more medical interventions; it is about selling the right ones to the right individual at the time and place where they are needed. In times of information overload, trustworthiness issues and the declining reliability of things that were once taken for granted, business models of the future that engage in the patient centric arena need to be able to put real value on the table. Not just for public reimbursement but also to convince the consumer of health goods about the value of a specific product or procedure. Separating the wheat from the chaff may be also be accomplished by using the tools of digital transformation such as self-learning algorithms that interact with a knowledge database that is linked to individual patient data and will be a major asset used to guide patients through the maze of medical information in their search for more opinions and more security. The numbers in the EU report show that almost four out of ten people do not trust information from the internet to make health-related decisions. But then again we already have indicators for the effect that the internet has on well-being: People who have a bad health status use the internet less for health-related queries than healthy people.

There are currently a number of physicians and healthcare professionals engaging in the field of patient enlightenment or patient empowerment through their efforts to increase health literacy. They are either curating their own webpages or medical apps where they provide links to trusted sources or they have started to take action and fill the knowledge gaps with health literacy tools that they have produced themselves. The privately run webpage www.orthopaedie-fuer-patienten.de (orthopedics for patients) is an example of a health care provider taking action and making specific information accessible for patients in a way that they are able to grasp and comprehend. Interestingly enough, payers were not too enthusiastic about Dr. Klein's actions, so he turned his own conviction into a 3 kilo book project. Together with the initiative inno-

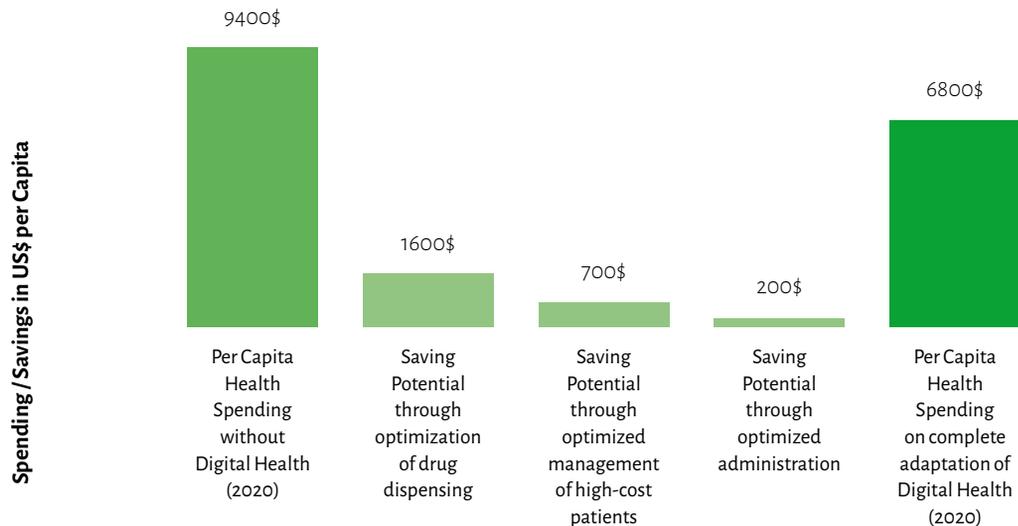
vate.healthcare (<http://innovate.healthcare>) a healthcare hackathon format, run by HealthCare Futurists, this book will now also be made accessible for the digital patient.

In this case health literacy is a product of simplification and communication. It is the core discipline of putting the patient at the center rather than being disease centric. In essence, we are talking about healthcare and not disease-care. It is also a means to get the patient involved in the design and setup of healthcare, which is of course as cumbersome as a new traveler coming into a cozy train compartment. A tool of health literacy needs to be the process of cocreation in healthcare, not only to understand where the patient comes from in terms of values but also their wishes as to how the product works.

It is the so called P4 Medicine that will have a major influence on how we practice healthcare: Predictive, preventive, personalized and participatory medicine are about quantifying individual wellness and taking the mystery out of disease. Individual data clouds fueled by sensors we wear outside, or keep inside ourselves will, to some extent, be able to predict future health status. It will also give us clues as to where prevention makes sense, given our genetic setup, and we will learn to delay the progress of disease or avoid future pathologies. On a personal level we need to acknowledge that genetically we are all different from one another, always confined to the $n=1$ conundrum. The participatory aspect points towards the education of patients and their exchange of experience, for example in social networks which could become a key in behavioral pattern change, just because the interaction with a different peer group can lead to reform on an individual basis. Health literacy then becomes the driving force of change in the digital healthcare age on a personal level.

On a governmental level though there are different forces at work such as rising costs that force the growth of a demographic weave of more engaged healthcare consumers. It is expected that online health literacy programs and mobile health per se will decrease direct

“Telehealth, mHealth and overall eHealth trends point in the direction of more patient engagement needed to comply with the challenges ahead from a political, financial and humanitarian point of view.”



costs of healthcare in the US by 28% in 2020 compared to today's costs (see the graph, source: CMS; US Census Bureau, Bain & Company).

In those healthcare systems, where out of pocket payments do not constitute a large chunk of the gross income on average, governments will be likely to push for more health-literacy as a sustainable means of reducing the costs in healthcare spending. Parts of this cost containment program could be to introduce prosumer tools to run diagnostic tests in a non-hospital setting to deliver fast and accurate care at home. We will most likely see this happen in underserved and rural areas. Telehealth, mHealth and overall eHealth trends point in the direction of more patient engagement which is needed to comply with the challenges ahead from a political, financial and humanitarian point of view. The concept of digital scorecards comprising information such as blood pressure/heart rate, body mass index, cholesterol levels, immunizations, appropriate preventive measures and self-reported status could become another tool in the domain of health literacy where more and more responsibility is given to the individual that is able and willing to follow it up. In the future, the commission has made it clear, that activities aimed at increasing citizens' digital health literacy will be supported. This means that patients will be put in the driver's seat in future digital healthcare. We will see the development of new indicators on how to assess the actual value of eHealth services in cooperation with users. This also ties into the concept of user driven research and innovation in the areas of eHealth. In the future, patient engagement need not remain in the realm of political lip service. Combining the worlds of health workers who also need to develop their digital skills to become an important stakeholder in the digital transformation of healthcare and the reality of patients who need to reliably use the eHealth assets delivered to them, we will hopefully bring about a world of wider acceptance of eHealth technologies. This translates

for doctors into a more meaningful time with their patients and less unnecessary appointments; this may be due for example, to the use of ePrescriptions, medication plans and tele monitoring. Patients on the other hand will have to spend less time, effort and money on unnecessary GP and hospital visits. It is said that 80% of visits to the GP in the UK are from patients requesting repeat medication.

Contrary to what one might think, given all these insights and the obvious coherences, health literacy is still in its infancy in Europe and it also has its limitations in terms of personal discomfort. Even professionals fall short with it when facing fatal conditions themselves. This indicates that it is not merely a question of education level, willingness to break old habits or neglecting to notice health hazards, but that in every individual, questions of value and trust prevail in how states of disease and well-being are perceived, and dealt with. It comes down again to the level of trust expressed towards healthcare providers, the mainstream media and other information carriers. Health literacy makes the patient a partner, it gives more responsibility to the individual but does not absolve the health professional of their responsibility to still act as the patient's advocate, thus respecting the fact that the patient has decided not to remain a minor in the Kantian meaning as stated above. The same principle applies to technological solutions that can support opinion forming in both, the healthcare professional and the patient. Technology can be a means to support but it will most likely not be the key to answering questions about noncompliance, ignorance or intentionally hazardous life styles. By and large, in a society that makes healthcare more and more a public affair because of the way that it is funded through tax money or contributions and with data generation sources such as wearables permeating our daily lives, we must not forget that individuals are still free to exercise their right of not knowing and blatantly ignoring given facts. Even

though, we have asserted above that it is preferable in a number of ways for healthcare systems for the citizen to become a citizen, an educated participant in all things pertaining to the preservation of their health status, and taking action in all matters related to health, we should think about using technology not only to check whether something has been accomplished but also to provide support in actually achieving goals in small steps. Health literacy and its ethical implications do not mean giving up the right to exercise self-responsibility on the altar of public surveillance, even though our assessment might disagree with the individual's choices with regards to staying healthy.

Technological advances in the history of mankind have provided us with a number of tools that have changed the way we live and how we perceive our world. When Gutenberg invented the printing press and after Martin Luther had translated the bible from Latin, the professional language of the clergy at that time, into the lingo of the people, the fundamentals for what we now call the Reformation had been laid. People drew their own conclusions about questions that had been at the heart of a profession and they did that by exercising their right of enlightenment. It is this enlighten-

ment which is sometimes also called democratization that then leads to revolutions, these may be political or technological in nature. It is also the core of innovation, to marvel at the extraordinary within the ordinary and put common things into previously uncommon contexts. Today we can see a similar thing happening: The highly regulated healthcare systems that operate on certifications for medicines, machines and medical practitioners are being infiltrated and sometimes even inundated by companies and entrepreneurial individuals who make use of the digital era's equivalent of printing plates; the internet, and like modern day reformers they constitute a digital transformation by trying to bring literacy to healthcare, questioning information asymmetry and jeopardizing the dearly accustomed status quo of those in the system and thus in charge. Given the fact that our ancestors have already fought the battle about eternal life, it is interesting to see how massive professional resistance is in an area, that only, and by all means professionally, deals with disease and sustaining life, that undoubtedly is one thing above all else: finite. ■

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A new field of health literacy will emerge in consequence of technological possibilities brought about by 3D printed medication. For this novelty and proverbially disruptive technology to unfold it is unthinkable without a full integration into an eHealth network. We might be looking at the next evolution step of the "internet of healthy things". Personalized medicine and precision medicine will be augmented by mass customized medicine. Generic compounds will be printed into new combinations and forms. It is not even clear if pills are the way consumers will take in medicine in the future. Why did we end up with pills in the first place? Is the innovator's question. It will also equip physicians with the possibility to fine dose medications in polypill combinations rather than to be stuck with a fix dose combination. Healthcare be more specific to individual patient needs. On a pharmacy level it might lead to a new and yet old aspect of dose formulation. Most importantly though, for patients there will be the challenge to understand what different compounds are contained in a single pill. Without health literacy on the patient's side and also the technology based closure of the "last meter gap" between pill providers and pill consumers this step will not be possible.



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An innovative eHealth platform
for patients & professionals

Open Health Care System



The Individual Health Account on the Open Health Care System (OHCS) platform collects health-related data in one place and grants access to this data via the Internet. The account data is collected automatically from participants in the OHCS project, namely medical facilities, pharmacies, medical laboratories and hospitals. The data includes information on health issues, doctors visits, issued and dispensed prescriptions, referrals to lab tests, referrals to medical specialists, and lab test results. This information, with the patient's consent, may be shared with the doctor during a visit to his office via the medical software used by the doctor on a daily basis. As a result, the doctor's diagnosis is much more accurate, while the treatment technology used can be cheaper and more efficient. The account also raises the level of treatment safety in medical facilities which participate in the OHCS platform thanks to the automatic control of drug interactions, for example with food, and allergies.



Find out more about Open Health Care System.
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