POLITYKA INSIGHT | RESEARCH

Transforming eHealth into a political and economic advantage

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Executive summary

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. Some say that technology in the XXI century is a paradigm shift, which is unprecedented in history and because of that we cannot see clearly what lays ahead: is it 3D printing of human organs, decreasing the transaction costs in health or providing universal high-quality service to everyone at a fraction cost of the price we pay today.

eHealth is the application of information and communications technologies across the whole range of functions that affect the health sector. This broad definition encompasses a variety of digital applications, processes and platforms including: electronic health record systems, TeleHealth (remote medical consultation), smartphone apps, remote monitoring devices and biosensors, computer algorithms and analytical tools to inform decision making. These essentially aim to use digital technology to improve the collection, management and distribution of data and information. Mobile health (mHealth) is a sub-segment of eHealth and covers medical and public health practice supported by mobile devices. Most of all, it includes the use of mobile communication devices in health and well-being services and information purposes as well as mobile health applications.

The most developed eHealth solutions are in Denmark, Iceland, Finland, Spain and Sweden. There are also those countries with poor results, such as Belgium, Germany, France and Italy. The most interesting is the result of Macedonia, which ranks 11th among the 37 countries studied. eHealth is developed the least in Albania, Montenegro, Bulgaria, Poland and Cyprus. Also Austria, Ireland and Hungary have a relatively low score. We cannot really say how popular are mHealth solutions, but for instance apps dedicated to health and wellness are the sixth most popular.

2-5% of the funds not spent or saved for other health needs. There is a 2:1 return on eHealth investment when benefits were given a euro value, the average breakeven point for the ten eHealth initiatives studied was five years. We project that on average these solutions could decrease the health expenditures of most European countries on average by 0.31% GDP or 5% less spent on health by the taxpayer. A more conservative assumption connected only with eHealth usage as ePrescriptions, ICT systems and fraud control could lower the expenditures of about 0.13% GDP, which saves about 2% on the health budget (or makes these funds available to other treatments).

The smallest savings thanks to eHealth would be in Denmark, Turkey, Macedonia, Spain and Albania (less than 0.16% of GDP). The smallest overall savings would come about in Denmark – just 0.1% GDP because of an early adoption of most eHealth systems. For instance, electronic prescriptions are in use in this country since 1992. Romania would save about 0.17% GDP and Moldova about 0.23%. The smallest changes relative to the size of economy are observable in the countries that spend less. Ukraine could save 0.2%, Bosnia & Herzegovina about 0.26% and some of the wealthier countries 0.41% as in the case of Netherlands, 0.43% in the case of Italy, 0.43% in the Czech Republic, 0.59% in Germany and the most (0.75%) in Austria. In Poland the cost could go down by about 0.35% of GDP.

Increases in efficiency of 3-5%. In Sweden, physicians estimate that ePrescriptions save about 30 minutes daily. Similarly, a survey in Estonia said that prescriptions take now about 10-15 seconds, and new prescriptions taking about 30-60 seconds. If all other factors remain the same thanks to ePrescriptions operating in full capacity and patients would be able to use online visits the average health system could withstand about 0.28 more consultations per capita every year (its 7 now). This might not be much but it increases the efficiency of doctors by about 5% in the most optimistic scenario. Netherlands, Spain and Greece could service more patients thanks to ePrescirptions and online visits. Those countries could have about 0.5 visit more per capita than now (however the increase in efficiency ranges from 4 to 10%).

Efficiency numbers could go up in Norway, Switzerland, Austria, and in the UK the most. Poland could have an increase in efficiency at the level of 0.18 consultations and Ukraine at about 0.28 (both have an increase of 2% in overall system efficiency). The lowest gains would be in Montenegro, Bosnia & Herzegovina, Turkey, Croatia and Albania mainly due to low digital skills and internet uptake. In Finland and Estonia which could also have fewer gains the case is different – over development which means that there is not so much room for more efficiency at the current state of the health systems. Also Sweden would see almost no more gains from more technology used.

Uneven development of eHealth solutions within the EU27 remains a major obstacle in providing European citizens with a satisfying access to cross-border healthcare and the main challenge for the EU is harmonizing the systems. The slow shift of the paradigm centralizing the role of the patient will become more rapid making our assumptions about the savings thanks to the technology even more conservative than they are. Building on the trust that Europeans have in health institutions and the way they convey themselves is essential.

OUR OTHER RECOMMENDATIONS ARE:

- **Invest in twinning's with Macedonia or Turkey.**
- **Assure universal deployment of standardised electronic health records in every EU country.**
- **Create new European registers of chronic diseases.**
- **Use the experience of both public and private sector.**
- **Decide how research data is going to be exchanged between EU member states (interoperability).**
- **Collaborate in R&D.**
- **Raise awareness of data security and privacy regulations.**
- **Increase the digital health literacy.**
- **Assure standards further improving the safety of wearables and apps.**
- **Promote eHealth and mHealth among citizens in all age groups in urban and rural areas.**
- **Do not forget about the regions.**
- **Harmonize the access to internet with high-bandwidth speed (5G).**
- **Do not forget to use soft law measures, i.e. codes of conduct and promote good practices.**

eHealth an introduction

Waiting for technology to change health services

The statement that technology changes healthcare needs no justification. Breakthroughs in data gathering, research, treatments, and communications have equipped medical providers with new tools to work with and innovative ways to practice medicine. It goes without saying that more and more people are using the internet to research their health conditions. This means not only looking up symptoms, but exploring treatment methods and medicines on the web. The Internet has empowered patients to make decisions about their next steps.

Nurses and doctors use hand-held computers to update a patient's medical record and check whether they are administering the correct treatment. Results of lab tests, records of vital signs, and medicine orders are stored in a database that can be referred to later. And as more institutions adopt electronic health records, patients have easier access to their own information so they, too, can understand their treatment. With vast patient history, scientists can better study trends and causes of ailments. This means more breakthroughs to come (OECD 2017a). Technology has also enabled doctors to use e-mail, texts, videos, and conference facilities to consult colleagues from all over the world and at the same time patients can monitor their well-being with dedicated apps (OSOZ 2016).

The advantages of the eHealth services could be summed up as:

- improved quality of care,
- better planning and resource allocation,
- cost efficiency - more efficient health landscape,
- enhancing the evidence base for health service delivery and policy making,
- real-time monitoring,
- providing better, tailored and personalized services,
- preemptive measures.

Paradigm shift around the corner. While eHealth may not have yet changed the underlying principle of healthcare i.e. to improve the health of individuals through care interventions, it has contributed to a fundamental shift in the structure and organization of healthcare systems. Disruptive events occurring in healthcare now, such as economic pressures to curb the escalating costs of care, increased chronic disease, the integration of information technologies everyday life, changes in the standard of care demanded by patients as well as the increased information available to them may be contributing to this paradigm shift which, understandably is likely to be a slow process considering the extent and complexity of the healthcare system. However, we do not know what else lays ahead what might make the change more rapid and e.g. making the cost issue of adopting new technologies irrelevant because we might find a solution straight from the S-F movies as managing to somehow prevent cell death from happening or extending the life span of cells making people immortal or extending their life expectancy e.g. in the S-F series *Expanse* set in the XXIV century the average life expectancy is 123 years.

World Economic Forum asked futurists about the tipping points that they expect to occur by 2025 and more than a tenth of them has something to do with healthcare (WEF 2015). 91.2% believe that 10% of people in the US are going to wear clothes connected to the internet, which in health terms mean real-time monitoring. 86.5% of futurists expect that a first robotic pharmacist is going to be introduced in the US. 81.7% of them expect that a first implantable mobile phone is going to be available commercially. A bit less – 76.4% think that a first transplant of a 3D-printed liver is going to happen, researchers are already looking at the feasibility of duplicating body parts like the outer ear. Probably no censuses are going to be needed thanks to big data available to the governments but also health-records are going to feed the AI-decision making systems available to the doctors helping in making the right diagnosis. Lots of interesting things are going to happen which will be a difficult nut to crack for national and international regulators.

Having said that, it is possible to define two main themes of the report: eHealth and mHealth, which are two connected yet different tools enabled by enhanced connectivity. **eHealth** is

"the application of information and communications technologies across the whole range of functions that affect the health sector". This broad definition encompasses a variety of digital applications, processes and platforms including: electronic health record systems, TeleHealth (remote medical consultation), smartphone apps, remote monitoring devices and biosensors, computer algorithms and analytical tools to inform decision making. These essentially aim to use digital technology to improve the collection, management and distribution of data and information (OECD 2015). As such, eHealth can be applied at all levels of the health system – from clinical situations to macro-level resource allocation." (Peterson et al. 2016).

On the other hand, mobile health (**mHealth**) is a sub-segment of eHealth and covers medical and public health practice supported by mobile devices. Most of all, it includes the use of mobile communication devices in health and well-being services and information purposes as well as mobile health applications. **mHealth** is the use of mobile technologies to support health information and medical practices. It is currently incorporated into health care services such as health call centres or emergency number services, which conventionally depend on existing telephone communication infrastructures. It, nonetheless, includes functions such as lifestyle and well-being apps, health promotion and wearable medical devices or sensors (Peterson et al. 2016).

We spend more on health

A significant importance of health is declared by about 81% of Europeans (Eurofound 2013). In Europe, in fact, it is vastly considered an important political and economical matter. With ever-ageing society, we spend on healthcare more than ever. Since 1970 the life expectancy of a child born in OECD countries has risen by 10.7 years. On average we live now more than ten years longer than we did almost fifty years ago (even longer in the EU 15). At the same time the average expenditures on health almost doubled from 4.5% of GDP in 1970 to 8.9 (see **CHART 1**). In the coming years, due to the longer life expectancy health-related spending will increase in order to meet the needs of an older society.

Patients in the developing countries are less happy with their healthcare. On a scale from one to ten, Europeans asses their health at the mean level of seven. Also health ranks fourth among key most important political issue (Eurobarometer 2015b) for the Europeans (with 18% who list it as one of the two most important issues their country is facing. Only unemployment, immigration, the state of the economy are seen as more important.). However, most of us are only moderately happy with the quality of the health services in the respective countries. The average European gives their health system a score of six out of ten, but the scores are lower in one third of the EU and candidate countries. The highest values include (eight out of ten), Belgium, Iceland (eight), Turkey, Czech Republic, Denmark, Sweden (all with a mean score of seven). The worst include Bulgaria with four out of ten and many Central and East European countries with a score of five: Slovakia, Poland, Lithuania, Hungary, Croatia, Romania and Serbia.

European governments face a growing number of major health challenges, which are putting unprecedented pressures on public health systems. Being the actors responsible for the delivery and financing of healthcare, generally based on the principle of social solidarity, they need to identify policy solutions in this and relevant non-health sectors to best address these challenges. Despite its limited competences with regard to health, the European Union also has an impact (UCL European Institute 2015), particularly through encouraging cooperation between member states, funding health programmes and reinforcing internal market rules.

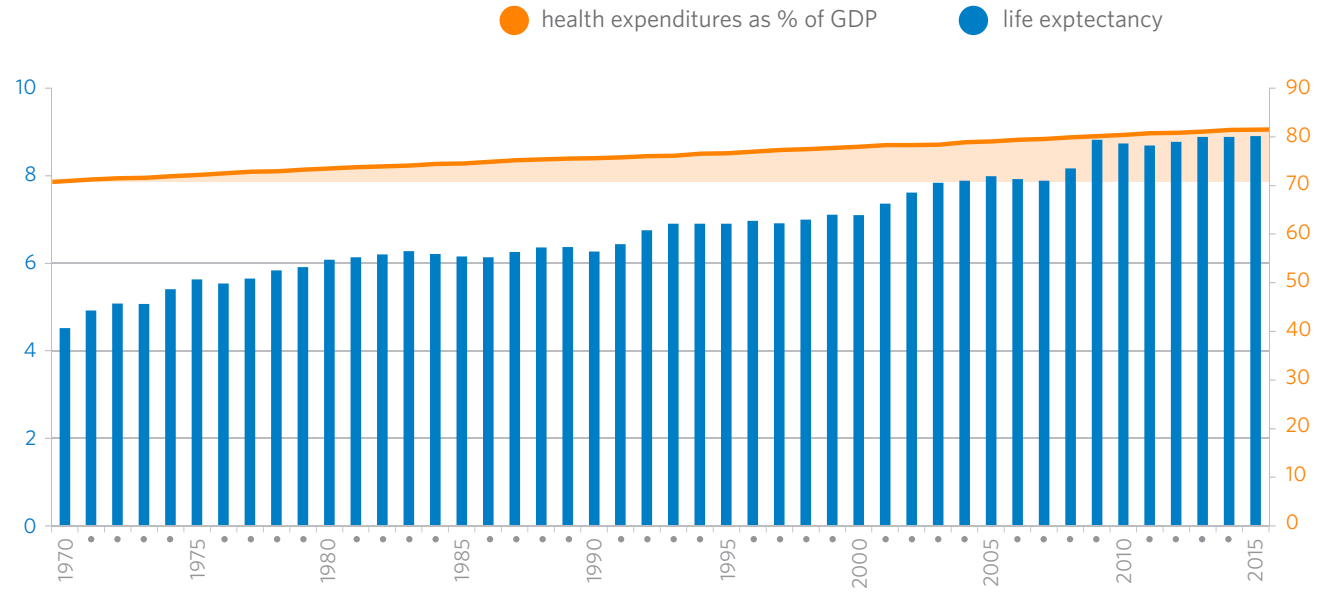
The key challenges facing policymakers are:

1. Awareness that health is more than a medical problem,
2. Maintaining high-quality healthcare,
3. Maintaining access to healthcare,
4. Managing the costs of healthcare.

One of the answers to these challenges lies with employing the products of technological developments to treat a rising number of patients with the same human and financial resources, as we are arguing in this report.

CHART 1. "PAYING A PRICE FOR A LONGER LIFE"
AVERAGE LIFE EXPECTANCY AND HEALTH EXPENDITURES AS % OF GDP IN OECD COUNTRIES 1970-2015

Source: OECD.



Current state of eHealth development

There are no good health systems, because no system can address all the health needs of a society. In theory systems can be divided in those state funded, or private funded and egalitarian and based on some sort of health insurance. But in fact most of the systems are mixed models, which manage the needs of the people with different results. By looking at three weighted metrics—life expectancy, healthcare costs per capita, and healthcare costs as a percentage of GDP—Bloomberg was able to assign 55 countries a health-care efficiency score. The first place for most efficient health-care system was awarded to Hong Kong, followed by Singapore and Spain. Other European countries also ranked high: Italy at sixth place, Greece at 13th, Switzerland 14th, France 15th and, interestingly, Poland at 18th. This was not a ranking of the best health systems but those giving the most "for-a-buck" (Du & Lu 2016).

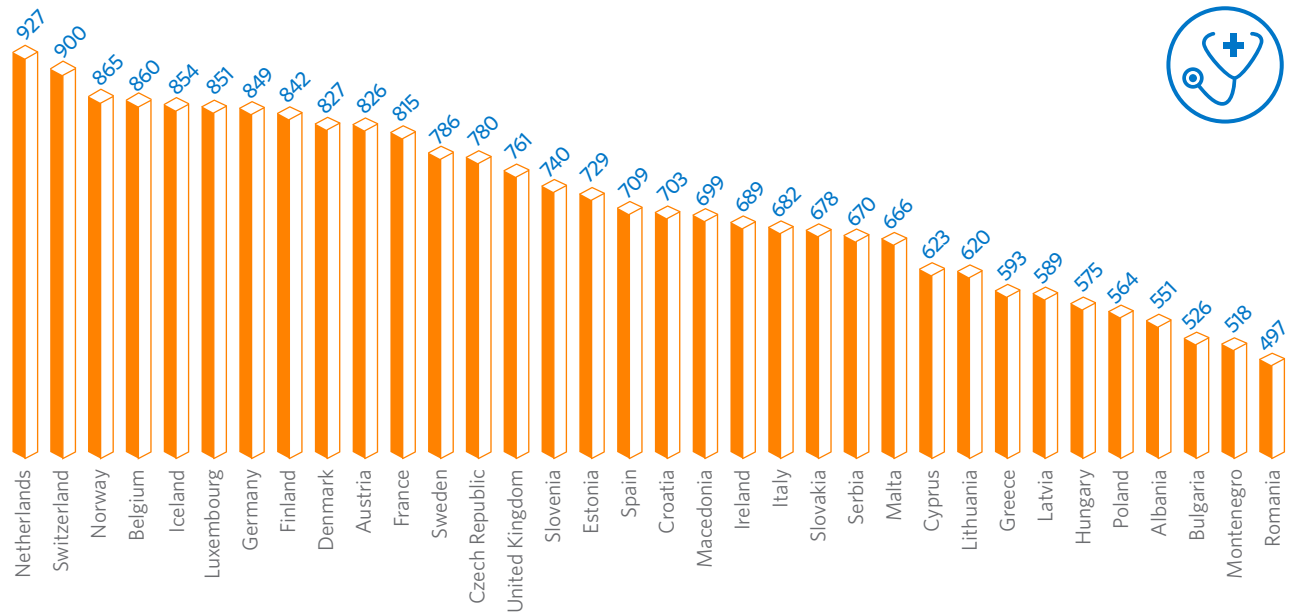
The European Health Consumer Index (ECHI), produced by a Sweden-based private company of health analysts, Health Consumer Powerhouse, ranked the Netherlands as the best-performing health system among the 35 European countries measured. After assessing each one with 48 different criteria, the Netherlands was given 927 points. Switzerland was a close second with 904 points and Norway – third, with 865. The worst health systems are in Montenegro, Poland, Albania, Romania and Bulgaria (see **CHART 2**). The EHCI authors claim that so-called Bismarck health systems, based on citizens taking out insurance from a range of providers that do not provide healthcare, deliver much better results than the "Beveridge systems", such as the National Health Service in the United Kingdom (Health Consumer Powerhouse 2017). But the best health systems do not automatically have the best eHealth services.

Booking an appointment online is still a problem. On the one hand, when we look at the availability of booking this kind of service we get countries where such services do not exist. Poland, Montenegro and Albania offer no possibility to book an online appointment with a doctor. In European countries an average of half of the patients have such a possibility and in Iceland, Macedonia and Estonia – all of them. This demonstrates that the basic eHealth services are still not available to all citizens across Europe, but some countries (such as Macedonia) make rapid advancements (Health Consumer Powerhouse 2016). Eurostat data show on the other hand that the usage of such service (where people declared about having made an appointment with a practitioner via website during the last year) a somewhat different distribution. With highest numbers in Finland (33%), Denmark (32), Spain (28), Sweden and Belgium (19) and the lowest in Greece, Bulgaria, Macedonia (2%) and Slovakia (3), the EU average 10%.

"Dr Google" is becoming more and more popular. About 46 percent of Europeans have web-searched their symptoms. The highest number was

CHART 2. THE BEST HEALTHCARE IS IN NETHERLANDS
EUROPEAN HEALTH CONSUMER INDEX IN 2016 ACROSS 35 COUNTRIES (POINTS)

Source: Health Consumer Powerhouse.



in Finland (67%), Denmark (66) and Norway (64). In comparison, in Germany 62% of individuals seek information about health online and in France the figure reaches 40%. The lowest number of searches was in Italy, Poland, Bulgaria and Romania with figures smaller than 30% (see **CHART 3**).

48% of people living in Europe say they have access to a web-based or a telephone healthcare information service that is publicly available in all parts of the country which, running 24/7, and being interactive. 100% of Bosnians, Icelanders and Swiss say they have such a service available. In Sweden, United Kingdom, Estonia, Macedonia, Denmark and Portugal more than four fifth have a similar service at their disposal. In some countries no information service is available, as in Albania, Luxembourg, Montenegro and Poland. In some only few patients encountered such services (such as Cyprus, Greece and Bulgaria). An important question arises when analyzing the data on how to combine good practices from the private market with public healthcare. In some countries the patients using the private systems can benefit of booking consultations online. The examples

CHART 3. NOT EVERYBODY CAN BOOK DOCTORS ONLINE
PERCENTAGE OF PATIENTS THAT DECLARE THAT THEY ARE ABLE TO BOOK A HEALTHCARE APPOINTMENT ONLINE (PUBLIC HEALTHCARE)

Source: Health Consumer Powerhouse.

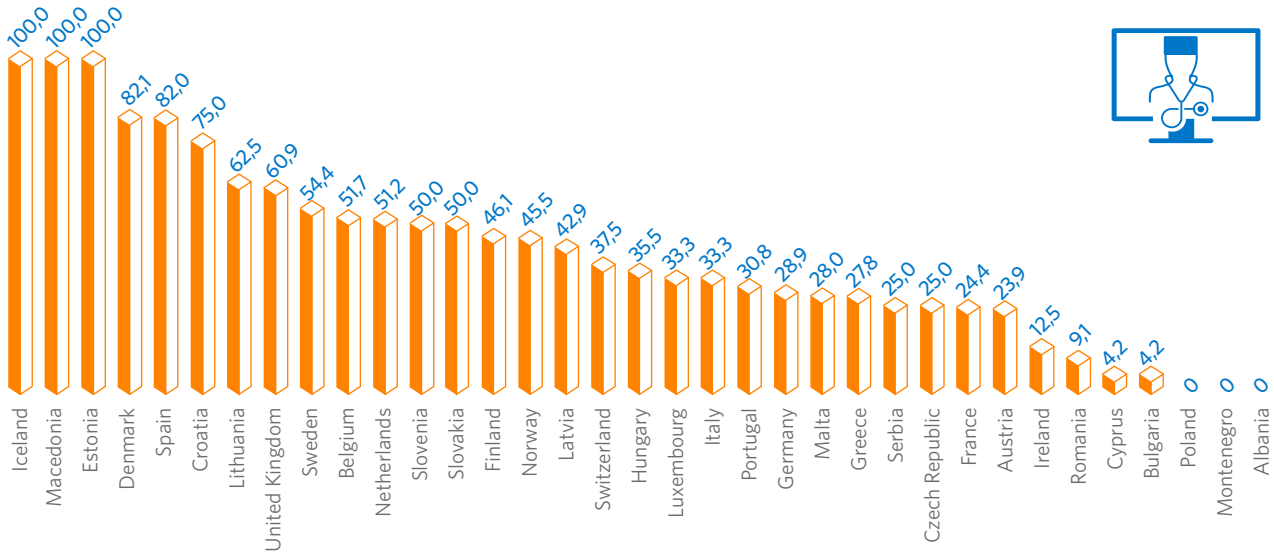
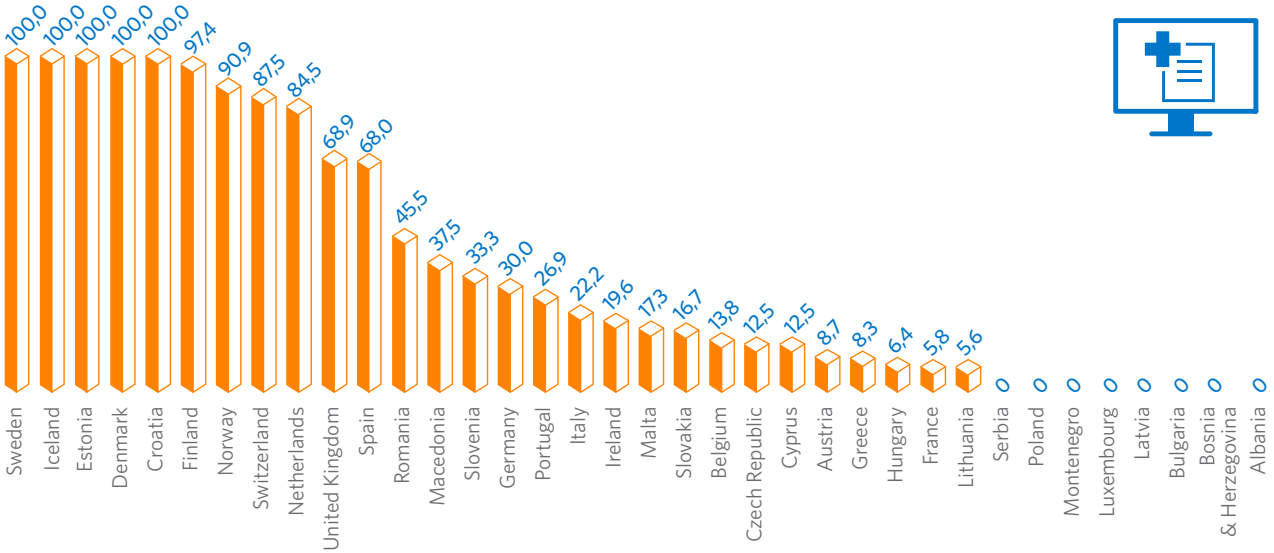


CHART 4. EPRESCRIPTIONS – STILL A NOVELTY
PERCENTAGE OF PATIENTS THAT DECLARE THAT THEY KNOW OF EPRESCRIPTION SERVICES IN USE

Source: Health Consumer Powerhouse.



of good mixtures of the two systems are in Sweden, where more than half of the patients knows of such services.

ePrescriptions are still underdeveloped. 37% of Europeans say that ePrescription services are in use in their countries. Fully functional ePrescription across the country or substantial parts of certain regions exist in: Denmark, England, Estonia, Iceland, Netherlands, Spain and Sweden (see **CHART 4**). Mature pilot projects for e-prescription that are set to become operational, exist in Austria, Belgium, Finland, Italy (regionally) and Norway. Small pilots with a declared political ambition to develop nationwide electronic prescription services are in the Czech Republic, Cyprus, Greece, Poland and Portugal. General Practitioners (GPs) asked about the usage of the service show similar results. About 95-100% of prescriptions are transferred electronically to pharmacists in Estonia, Denmark, Croatia, Sweden, Iceland and Netherlands. In Romania it is 60%, in France – 29% and in the UK – 20. But in most European countries less than 10% of prescriptions is sent using new technologies: Italy – 9%, Ireland, Bulgaria and Belgium – 5%, Poland – 4 and Hungary – 2.

One-third of GPs exchange patient data with other healthcare providers and professionals through electronic channels (34%). In some countries most GPs have such facilities as in Denmark – 92%, Netherlands – 76 %, Estonia – 72. In others this is still under development as in Poland – 11%, Croatia – 10, Bulgaria – 9, Slovakia – 7 and Slovenia – 5. One of the barriers in development of data usage in healthcare is the trust patients have to healthcare providers. Nearly three quarters of people (74%, 4 pp. less than in 2010) say they trust health and medical institutions to protect their personal information, with 24% of people fully trusting them, and 50% only tending to trust them (Eurobarometer 2015a). The trust levels differ a lot across Europe. While more than half of each society declares they trust the medical institutions using their personal data, Romanians, Poles, Greeks, Italians, Croatians and Hungarians tend to be less trusting (58-68% trust their records are on not misused). Fins, Danes, Swedes, Maltese, Lithuanians, Dutch and British tend to be more trusting (90-81% trusting).

However, the trust levels could be lower when taking into account sending information through mobile devices. Patients' responses to a survey in the US indicate they value data security over convenience, with 71% saying the protection of their medical tests and imaging results is more important than convenient access to that information (PwC 2014). Also the US clinicians expressed their distrust towards using data collected from patients' mobile devices and apps. Nearly three--quarters (74%) said they would be uncomfortable relying on a mobile app or device that can check for an ear infection, and 53% expressed discomfort with using a mobile device or app to analyze a patient's urine. Nevertheless the services are said to further develop because of the expected lower overall cost of care for patients and easier access (PwC 2012; PwC 2016b). Therefore, there is a raising need for increasing data protection awareness and digital health literacy, which is one the crucial OECD recommendations (OECD

CHART 5. IN HEALTHCARE I TRUST

PERCENTAGE OF RESPONDENTS DECLARING THEY TRUST HEALTHCARE INSTITUTIONS MANAGING THEIR HEALTH DATA

Source: Eurobarometer.

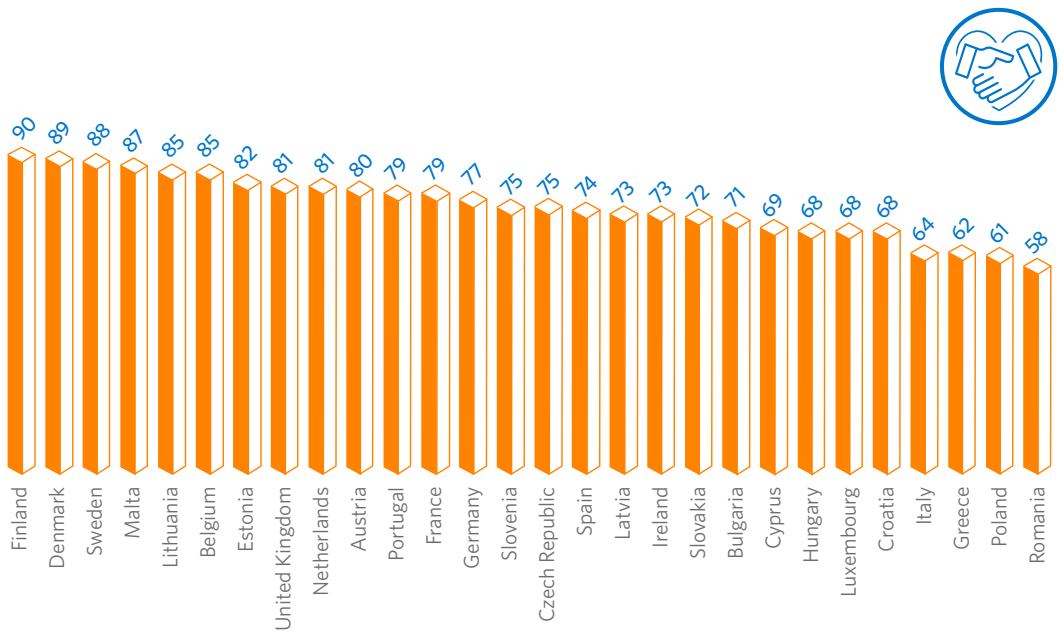
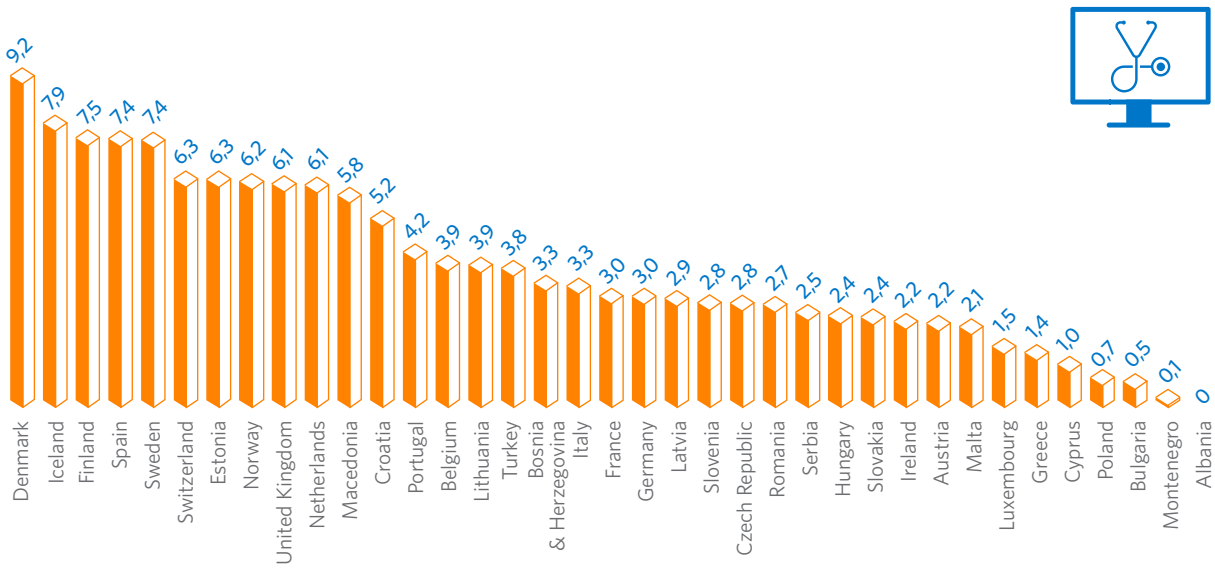


CHART 6. EHEALTH INDEX IN EUROPEAN COUNTRIES IN 2016 (POINTS)

Source: Polityka Insight calculations.



2017a). Moreover, eHealth raises questions about data ownership and the impact that it is going to have on patients (see **CHART 5**).

In order to assess how well countries are performing with regard to development of eHealth services we developed a composite index[1], which enables us to see how the new technology is used in European countries. The most developed eHealth is in Denmark, Iceland, Finland, Spain and Sweden. There are also those countries with poor results, such as Belgium, Germany, France and Italy. The most interesting is the result of Macedonia, which ranks 11th among the 37 countries studied. eHealth is developed the least in Albania, Montenegro, Bulgaria, Poland and Cyprus. Also Austria, Ireland and Hungary have a relatively low score. We cannot really say how popular are mHealth solutions, but for instance apps dedicated to health and wellness are the sixth most popular in one of the EU member states i.e. in Poland (Arak et al. 2015) (see **CHART 6**).

1 It is a summary measure of average achievement in five measures: availability of online appointment booking, e-Prescription status, 24/7 healthcare info service availability and usage of online appointments and usage of ePrescriptions by GPs. The indices were normalized and transformed from a raw variable into a unit-free index between 0 and 10 (which allows different indices to be added together).

State of eHealth debate in the European Union

Citizens' health is an issue close to the heart of national sovereignty, therefore providing healthcare remains member states' obligation and prerogatives. According to the Treaty on the Functioning of the European Union (TFEU), the only relevant area of shared competence between the EU and the member states is "common safety concerns in public health matters"; for the wider objective of the "protection and improvement of human health", the EU may only "support, coordinate or supplement" Member States' action" (Greer et al. 2014). Nevertheless, the EU has broad competencies on environment, health and safety at work, consumer protection, as well as internal market. As a result, in Brussels health policy is frequently seen through the economic prism. For example, health is cited as positive contributor to growth, concerns over age and health of workforce as well as calls for greater fiscal rigeur of health systems in member states are raised. EU involvement in health policies developed around three main axes:

- EU public health policies concerning the well-being of all citizens,
- the application of the free movement principle to national healthcare systems, in particular by the EU Court of Justice (ECJ),
- and the austerity packages and the stricter EU oversight of national budgets (Vollaard & Martinsen 2016).

The EU is shaping health policies through all its main institutions: the Commission, The Council, the Parliament, and last but not least the European Court of Justice (ECJ), which, according to CURIA, pronounced 51 judgments concerning public health and managed to lastingly impact national healthcare services (Obermaier 2016). ECJ has ruled, among others, on cross-border provision of medical services to workers and 'cherrypicking' of cheaper medicines in transborder regions.

An institution particularly engaged in debate on public health is European Commission's DG for Health and Consumer Protection (DG SANCO)[2], which covers, among others, cross-border health care and regulation of medical devices. These areas are particularly relevant for eHealth and mHealth discussions: cross-border health care involves creating electronic registers and ePrescriptions, whilst some health apps fall under EU regulation on medical devices. Another important institution is the EU Health Policy Forum, a regular meeting of 52 umbrella organisations representing European stakeholders in the fields of public health and healthcare. Advisor bodies, namely the European Group on Ethics in Science and New Technologies (EGE), is providing multidisciplinary advice to EU decision-makers at times of rapid development of health-related technologies. The European Commission created two expert groups working on eHealth: the eHealth Stakeholder Group and a temporary eHealth Task Force.

Notwithstanding the EU limited powers within public health, the EU greatly influences member state health systems both by regulation and case law and by elements of the 'new governance' and 'soft power', including cross-border R&D programs, joint research projects, and benchmarking between European countries. Consequently, Brussels shapes policymakers' and citizens' expectations about health standards across the continent; eHealth and mHealth are no exceptions to this rule. There have been also calls for a European healthcare union (Vollaard & Martinsen 2016), and claims that a more universalistic approach to public health in the EU is actually happening by stealth, with an ongoing institutional build-up and adoption of the so-called Patients Rights Directive concerning application of patients' rights in cross-border healthcare as prominent examples (De Ruijter 2015).

Policy priorities

By all accounts, developing eHealth and mHealth systems stands high on the EU public health agenda. It is cited as one of three pillars of resilient health systems, next to improving efficiency in hospital sector and pharmaceutical use, as

2 Other DGs concerned include: DG Research and Innovation, DG Regional Policy, DG Competition, DG Internal Market and Services, DG Employment, Social Affairs and Inclusion administering the European Social Fund, and DG Trade.

EHEALTH POLICY PRIORITIES IN THE COMMISSION'S STRATEGIC PLAN *EHEALTH ACTION PLAN 2012-2020: INNOVATIVE HEALTHCARE FOR THE 21ST CENTURY*[3]:

- achieving wider interoperability of eHealth services,
- supporting research, development and innovation in eHealth and well-being to address the lack of availability of user-friendly tools and services,
- facilitating uptake and ensuring wider deployment,
- promoting policy dialogue and international cooperation on eHealth at global level.

Addressing legal barriers:

- clarifying patients' rights to receive cross-border healthcare, including remotely via telemedicine,
- examining member states' laws on electronic health records,
- assuring effective data protection and integrating the principle of privacy by default and by design,
- clarifying the role of mobile apps in the value chain for mobile health and claryfing legal status of mHealth and well-being apps,
- strengthening the European regulatory framework for medical devices and in vitro diagnostic medical devices.

Supporting research, development, innovation, and competitiveness in eHealth:

- research for health and wellbeing solutions for citizens and health professionals, better quality of care, including of chronic diseases while increasing citizens' autonomy, mobility and safety,
- attention to analysing and mining large amounts of data for the benefit of individual citizens, researchers, practitioners, businesses and decision makers,
- using EU funds to boost user-driven innovation and support fast prototyping, also by public-private partnerships and pre-commerical procurement and public procurement of innovation,
- deployment as well as research and innovation of care for an ageing population,
- fostering the development of a competitive eHealth market.

EHEALTH POLICY PRIORITIES UNDER EU INNOVATION PROGRAMS I.E. *HEALTH, DEMOGRAPHIC CHANGE AND WELLBEING OF HORIZON 2020:*

- an ICT and computational science and engineering framework for digital, personalised, and predictive medicine, including advanced modelling and simulation,
- innovative instruments, tools and methods for unlocking the value of data for advanced analytics, diagnostics and decision making;
- new digital media, web and mobile technologies and applications, as well as digital instruments that integrate healthcare and social care systems and support health promotion and prevention;
- eHealth systems and services with strong user involvement, focusing on interoperability and the integration of emerging patient-centric technologies for cost-effective healthcare.

eHealth policy priorities in the Digital Single Market Strategy for Europe:

- maximizing the growth potential of the Digital Economy by extending citizens benefits from digital services (from eGovernment, eHealth, eEnergy to eTransport) available seamlessly across the EU;
- boosting competitiveness through interoperability and standardisation which can help steer the development of new technologies, digitisation of manufacturing (Industry 4.0) and construction processes, data driven services, cloud services, cybersecurity, eHealth, eTransport and mobile payments;
- investing in inclusive network architecture: 5G fibre-to-home solutions;
- strenghtening an inclsuive e-society by supporting an inclusive Digital Single Market in which citizens and businesses in both urban and rural areas have the necessary skills and can benefit from interlinked and multi-lingual eServices, eGovernment, eJustice, eHealth, eEnergy or eTransport.

Issues at stake according to *Green Paper on mobile Health* (European Commission 2014):

- data protection, including security of health data;
- big data use;
- updating applicable EU legal framework for eHealth;
- patient safety and transparency of information;
- equal access to eHealth;
- interoperability ;
- reimbursement models;
- access of web entrepreneurs to mHealth market.

3 The first eHealth Action Plan was adopted as early as in 2004.

well as supporting innovation and promoting long-term investment in healthcare.

"eHealth – when applied effectively - delivers more personalised 'citizen-centric' healthcare, which is more targeted, effective and efficient and helps reduce errors, as well as the length of hospitalisation. It facilitates socio-economic inclusion and equality, quality of life and patient empowerment through greater transparency, access to services and information and the use of social media for health." (European Commission 2012).

EU regulation challenges

The core EU Single Market principles of free movement of people, goods, and services apply to eHealth and mHealth. From the angle of EU citizens' fundamental rights framework, eHealth can positively contribute to buttressing patients' rights to cross-border healthcare. On the other hand, the advance of new technologies brings concerns about rights to privacy and data protection, cybersecurity concerns, and new frontiers of consumer rights protection.

Data protection and privacy after GDPR

The EU data protection landscape is currently being re-shaped by **General Data Protection Regulation** (hereafter GDPR, Regulation 2016/679[4]) adopted in 2016, which will replace current Data Protection Directive 95/46/EC. The new legal safeguard for EU data privacy will become applicable in all member states from 25 May 2018 . The new regulation will exert a profound impact on processing health data as it establishes the necessity for explicit consent for processing subject's personal and sensitive data. Moreover, data subjects will have a right to object processing their data for direct marketing purposes. However, the organization collecting data will not need further consent for processing data for the following purposes:

- purposes of preventive or occupational medicine,
- medical diagnosis,
- provision of health or social care or treatment,
- management of health or social care systems and services,
- under a contract with a health professional or another person subject to professional secrecy under law,
- in the public interest for public health reasons (the 'public health' ground),
- and when necessary for scientific research.

GDPR aims at bolstering data subject rights – we will have a right to require information about data being processed and correction of wrong data. The famous 'right to be forgotten', which means a right to require a data controller to erase any personal data without undue delay in certain situations, is also in place.

GDPR compliance in private sector

From the viewpoint of the private sector, this implies additional effort for compliance and embracing 'privacy by design' in any new offered product or process. Higher fines for non-compliance with cross-border data transfer will also apply.

Electronic health records and ePrescriptions – GDPR compliance in public sector

GDPR will set a higher data protection bar for relevant public institutions in member states, especially for those responsible for data collection, processing, and retaining. A key element of eHealth policies is electronic health records (EHR), patients' medical records easily available to health practitioners across the EU through websites or apps. The basis for EHR are found in national law, for example in Poland in Health Minister Ordinance from 9 November 2015 concerning types, range, and models of medical documentation and methods of its processing (*Rozporządzeniu Ministra Zdrowia z dnia 9 listopada 2015 r. w sprawie rodzajów, zakresu i wzorów dokumentacji medycznej oraz sposobu jej przetwarzania*). Institutions monitoring and implementing electronic health records are located on national level. In Poland the Ministry of Health is responsible for introducing the Medical Information System (SIM).

A similar privacy protection challenge is related to development of ePrescriptions, systems allowing an electronic transfer of a prescription by a healthcare provider in a primary care or community health centre setting to a pharmacy for retrieval of the drug by the patient.

The collection, retention, and cross-border exchange of data raises questions about data ownership. It is likely that we will witness more and more discussions between the advocates of 'free data flow' on the one hand and the proponents of 'data sovereignty' paradigm on the other.

Soft law measures for mHealth compliance

Another element of the EU privacy policy discussions revolves around the specificity of mHealth apps. Examples of mHealth apps focus on a range of health issues, including malaria, HIV, tobacco and alcohol control, vaccinations, diabetes and maternal health. *According to The Economist* (2016), around 165,000 health-related apps were available at the end of 2016. PwC estimates that the apps will be globally downloaded 1.7 billion times by the end-2017 (PwC 2012). It is key to distinguish between lifestyle and wellbeing apps related to health, which collect various personal data (for example information about hobbies) and wearable medical *devices per*

4 Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

se, which collect precisely health data (for example about blood pressure or heartbeat).

Data related to health is considered sensitive and therefore have higher requirements for protection (European Commission 2014). In 2014 *Staff Working Document on the existing EU legal framework applicable to lifestyle and wellbeing apps* was created. It argued for setting up app industry code of conduct for mobile health apps, which would provide easily accessible guidance on how European data protection legislation should be applied in relation to mHealth apps. App developers welcomed the idea. Under the auspices of the Commission a group of industry stakeholders, including representatives with data protection, self- and co-regulation, ICT and health care background drafted the *Privacy Code of Conduct for mHealth apps* (European Commission 2016). The document includes practical information for app developers concerning: consent, purpose limitation, data minimization, transparency, privacy by design and by default, data subject rights, and limits to data protection (e.g. for marketing purposes). In short, it is a 'how to' guide for app industry compliance with the GDPR. It also aims at improving public trust in the app industry. On 7 June 2016, the Code of Conduct has been formally submitted for comments to the Article 29 Data Protection Working Party. Once approved by the Working Party, the Code will be applied in practice: app developers can sign it on a voluntary basis, thereby committing to following its rules.

Cybersecurity

The EU directive 2016/1148 on security of network and information systems (NIS Directive) entered into force in August 2016 to ensure a high common level of network and information security across the EU, reflecting the increase of magnitude and frequency of incidents breaching cyber security in member states. The Directive applies to both operators of essential services and digital service providers. Member states should apply national measures to determine which entities are subject to obligation regarding the security network and information systems. Upon deciding this, member states should consider if provided service is essential, how many users use it, and what effect would have its disruption on economic or societal activities or public safety. Additionally, there are industry factors, for example for the health sector, the number of patients under the provider's care per year. Public hospitals and private clinics will surely fall under the scope of the Directive, the extent of other eHealth providers responsibility remains to be seen.

Consumer protection, product and services liability

The EU, by means of DG Health and Food Safety, is setting essential manufacturing and design criteria for eHealth products and services. eHealth products comprise 1) hardware devices, including wearable and other remotely controlled medical devices and 2) software packages or interfaces, including apps. eHealth and mHealth are important sectors of the Digital Single Market (DSM) and they fall under the general scope of Directive 2000/31/EC on electronic commerce and The Directive on Consumer Rights (2011/83/EC). However, eCommerce directive excludes liability for internet service providers, including hosting server providers, which are a part of app economy supply chain, consisting also of app developers, app providers, and the app-selling environment.

Medical devices regulation

As indicated above, some mHealth apps may fall under the definition of a medical device or of an IVF diagnostic medical device and therefore may have to comply with the safety and performance requirements of Directive 93/42/EEC concerning medical devices or Directive 98/79/EC on IVF diagnostic medical devices respectively.

80 'notified bodies', accredited by national regulators, approve medical equipment in Europe, for example in Poland by The Agency for Health Technology Assessment in Poland (AHTAPol). Specific national entities with regulatory oversight of mHealth apps for quality, safety, and reliability exist only in 10 OECD countries. Furthermore, national entities providing incentives and guidance on the innovation, research and evaluation of health apps exist in only 16 OECD countries, which give a lot of room for improvement.

The shortcomings of the system of 'notified bodies' have been increasingly evident through the rapid development of health technologies and the fact that most member states have excluded strict liability for 'development risks'. That means the company is not being held accountable if at the time of manufacturing the state of the scientific knowledge was that it could not foresee risk of harm (Hervey & McHale 2015).

Advertising

EU advertising standards are covered by Unfair Commercial Practices Directive (UCPD) and the Misleading and Comparative Advertising Directive (2006/114/EC). eHealth products and services cannot include neither false claims of trust or quality marks and endorsements from public bodies nor unfounded claims that the product can cure illness.

How to spend less giving more

Healthcare costs continue to rise. Patients, clinicians, and policy makers are concerned whether it is possible to control costs while maintaining the quality of healthcare services. The use of information and communication technology (ICT) in healthcare sector (eHealth) could become a useful tool aimed at increasing efficiency, improving access, and raising the quality of care, especially in the case of much wasteful spending due to over usage of certain health services (OECD 2017b).

How to measure benefits of eHealth?

There are two main, mutually alternative techniques for aggregating costs and benefits in healthcare: cost-benefit analysis (CBA) and cost-effectiveness analysis (CEA). They differ with regard to how the benefits are valued (Bergmo 2015). CBA values the health outcome and other non-resource benefits in monetary terms. **CBA is rarely used in healthcare evaluations due to the difficulty in assigning a monetary value to health outcomes** (Sculpher & Price 2003). We do not have data of sufficient quality to assess how much more productive the patient is going to be after treatment than they were before. In CEA, the benefits are measured as health changes. CEA aims to identify whether more benefits can be produced at a lower cost or where lower costs can translate into equal benefits. **CEA is most useful for comparing interventions that address the same health problem.** For example, if the objective of using eHealth technologies in diabetes care is to reduce and stabilize blood glucose levels, it seems appropriate for the end point to measure blood glucose levels (Bergmo 2015). On the other hand, it can be difficult to interpret cost-effectiveness in terms of a specific cost per reduction in blood glucose and especially to see these changes against other treatments influencing other health conditions.

Another approach, a sub-CEA type analysis, is based on using cost-utility analysis (CUA), where the outcome is measured as "healthy years" and valued as, for example, quality-adjusted life years (hereafter QALYs). QALYs were developed to compare health gains, and they are recognised as the primary metric for measuring health status in economic evaluations (Briggs & O'Brien 2001; Drummond et al. 2015). QALYs include mortality and morbidity in one single measure (Drummond et al. 2015). The advantages of using CUA over CEA is that the former uses one generic measure of health improvement allowing direct comparison on the same scale of different types of health effects. Furthermore, a common unit of measure - money/QALYs gained - allows comparison across different healthcare programs. **One of the criticisms of CUA relevant for eHealth is that the benefits might extend beyond health outcomes (Bergmo 2015) and include access, information, waiting time, time saved, and avoidance of burdensome travels (WHO 2016). This is the outcome given by most eHealth services therefore making it almost impossible to count.**

How eHealth could decrease costs of health systems

Unfortunately there is no solid proof that introducing eHealth services (independent of its costs) lowers the costs. Numerous systematic reviews have described the evidence base as inconsistent and have called for more research (McLean et al. 2013; Wade et al. 2010; Mistry 2012; Jaana & Paré 2007; Ekeland et al. 2010; Barlow et al. 2007). A more recent review of reported results is more promising. 23% of the papers concluded that eHealth is effective/cost-effective, and 42% were less confident about the effectiveness/cost-effectiveness. The authors suggested that these initiati-

ves were promising (Elbert et al. 2014). However, a recent large-scale telehealth evaluation could not establish cost-effectiveness. This evaluation was designed as a cluster randomised controlled trial with over 3,000 patients. It found no significant improvement in health outcomes, exhibited no reductions in service use assessed over 12 months, and reported higher costs for the telehealth option compared to usual care (Henderson et al. 2013; Steventon et al. 2013).

A direct consequence of the said phenomenon is that **the governments cannot make up their minds. This inconsistency and a lack of solid comparable evidence on costs and benefits can be one of the reasons for the slow uptake of eHealth interventions** (OECD 2010; Word Health Organization 2011). Without such evidence, it is difficult to estimate the economic impact in solid business cases (Barlow et al. 2012). The implementation of eHealth systems is generally expensive and will have an impact on different healthcare providers, patients, and other stakeholders. Policy makers need demonstrable evidence of costs and benefits. If large-scale eHealth implementation warrants governmental investment, this will also require demonstrable benefits for the patients, providers, and society at large (Bashshur et al. 2013).

For example, in the United States there are many market incentives for consumers to overuse new products, driving overall costs up as a result (Braillon et al. 2010; Himmelstein et al. 2010). Information technology may also fail to decrease the costs of health administration. Contrary to the overall experience of business and government enterprises outside of health, where ICT has increased productivity while hospitals have increased their use of ICT, there was no indication that it lowered costs or streamlined administration. In other words, any savings may have been offset by the costs of purchasing and running new computer systems. **If a paradigm shift happens, extremely changing the technological spectrum, prices of software, computer power and treatment, it would make the services much cheaper lowering the health spending even further.**

2-5%

of the funds not spent or saved for other health needs

On the other hand RAND Corporation in a modelling exercise prepared for the US Congress based on a broad literature survey of evidence of health ICT effects, estimated that potential ICT-enabled efficiency savings for inpatient and outpatient care in the US could average more than USD 77 billion per year (or about 3% of all health expenditures in the country). Additionally, the study noted the potential for significant patient safety benefits from electronic record systems, especially those that can reduce the number of 200,000 adverse drug events, some of which are due to poor information transfer, possibly saving about USD 1 billion per year (Congressional Budget Office 2008). Avoiding two-thirds of the medication errors and adverse drug events that occur in ambulatory care could result in annual national savings of USD 3.5 billion. RAND also noted the potential for improvements in short-term preventive care through reminders to patients and clinicians about compliance with preventive care guidelines. Although e-increased use of preventive services leads to higher, not lower, medical spending overall, RAND concluded that the additional costs are not large and the health benefits are significant. Widespread adoption of advanced electronic health record systems also creates a platform for significant improvements in chronic disease prevention and disease management. **RAND estimated that the potential combined savings of reducing the incidence of chronic disease attributable to long-term prevention and reduced acute care due to disease management would amount to USD 147 billion per year (or 7% of the overall US national health bill).**

The hypothetical lowering of costs is further supported by studies suggesting that the financial benefits from ICT implementation are often observable only many years after the investment was made or until a level of functionality is reached that allows the systems to truly serve the needs of clinicians and system planners. In Canada the national, systemic fiscal cost-benefit after ten years is actually negative (amounting to CAD 1.5 billion), having reached a positive cash flow by year seven and breakeven only by year 11. By year 20, the systemic (national) savings are estimated at almost CAD 20 billion (Stroetmann et al. 2006). This is further supported by a 2007 study by PwC (2007) of nearly 2,000 hospitals in the US, which found that the attainment of productivity improvements and improved service efficiency followed on average two years behind initial health care ICT investment. The same study, however, concludes that the financial breakeven point will strictly depend on the levels of investment. Above a certain level of ICT investment – or tipping point – the cost impacts levels off and is associated with cost reductions. The levelling off occurs despite the added costs of increased ICT capital; that is, ICT capital at some point pays for itself by displacing costs elsewhere in the hospital. **The European Union's eHealth Impact Project, dating back to 2006, covering ten case studies in different countries and contexts, identified a 2:1 return on eHealth investment when benefits were given a euro value; the average breakeven point for the ten eHealth initiatives studied was five years** (Stroetmann et al. 2006). **Additional challenge however is to share good practices between public and private health systems in the same countries and within Europe.**

TABLE 1. EXAMPLES OF POTENTIAL AREAS OF SAVING COSTS AND INCREASING EFFICIENCY

Source: Based on Schweiter & Synowiec (2012).

Patient issues	Opportunities for reducing costs and increasing efficiency
Patient registration	One-off registration
	Information available on subsequent visits
	Serves multiple purposes (e.g. vital statistics registries in addition to care)
Creation of a persistent record	Improved speed and efficiency of care delivered
	Information base developed for variety of direct care and administrative uses
	Data is entered once
Payment for services	Documentation of billing, payment system
	Information about the costs of services covered by the public health system
Remote diagnostics (real-time monitoring)	Reduction of clinic visits
	Saves time for patient
	Improved patient treatment
	More efficient use of time of skilled health workers
Referrals	Efficient access to closest available resources e.g. other specialists
Scheduling follow-ups	Automatic messaging to patients
Disease surveillance	Enables real-time surveillance, resource allocation
Public information within the health dimension	More targeted distribution of information e.g. about vaccinations
24/7 call centers	Decreased need for in-person clinic visits
Early warning systems	Higher prevalence
Administrative issues	
Performance review	Easier and more timely aggregation of data by factors including district, region, provider and disease
Staff communications	Voice and data communications increases efficiency between different providers, doctors etc.
Staff management	Ability to mine data to monitor staff performance through various filters, including those at individual or aggregate level (e.g. provider)
	Possibility of real-time staff supervision
Staff training	Combination of physical and online training e.g. using video conferences during specialist surgeries. It may provide better dispersion of knowledge and faster adaptation to work
Payments	Operations and record keeping efficiency
	Fraud protections, especially from the perspective of the public payer
Supply chain management	Avoiding stockouts
	Fraud protection (e.g. fake medicines or illegal exports)
Research	Development of databases that can be re-used on research projects with new layers added with every single patient
	Reduce repetitive and costly primary research and data collection efforts
Future possibility of reducing the cost of putting a doctor on the market	Introducing AI decision systems that will help the doctors make decisions based on the gathered data and previous research, thus lowering the costs of educating a single doctor

CHART 7. HEALTH EXPENDITURES AND POSSIBLE SAVINGS THANKS TO EHEALTH AND MHEALTH IN 37 EUROPEAN COUNTRIES (AS % OF GDP) IN 2014

Source: Polityka Insight calculations based on OECD, World Bank, Eurostat and EHCI data.

- public health spending
- public health spending after savings due to full eHealth system implementation
- public health spending after savings due to full eHealth and mHealth systems implementation

Sweden	9,70	9,59	9,38
Denmark	9,06	9,03	8,96
Netherlands	9,07	8,91	8,65
France	8,52	8,27	8,01
Norway	7,94	7,80	7,57
Germany	8,11	7,86	7,53
Belgium	7,78	7,58	7,32
Austria	7,98	7,72	7,23
Switzerland	7,35	7,23	7,00
United Kingdom	7,24	7,11	6,90
Iceland	6,99	6,92	6,81
Finland	7,04	6,96	6,79
Bosnia and Herzegovina	6,56	6,43	6,30
Italy	6,57	6,43	6,15
Spain	6,25	6,19	6,09
Malta	6,41	6,23	6,08
Croatia	6,16	6,06	5,93
Slovenia	6,27	6,11	5,91
Serbia	6,08	5,94	5,74
Portugal	5,90	5,79	5,63
Czech Republic	5,84	5,67	5,41
Slovakia	5,45	5,28	5,06
Moldova	5,08	4,96	4,85
Luxembourg	5,22	5,00	4,62
Ireland	4,84	4,69	4,45
Estonia	4,77	4,70	4,51
Greece	4,72	4,59	4,45
Hungary	4,60	4,47	4,31
Romania	4,30	4,22	4,12
Bulgaria	4,34	4,23	4,08
Lithuania	4,19	4,10	3,94
Turkey	4,06	4,00	3,93
Macedonia	3,97	3,91	3,84
Poland	4,16	4,03	3,81
Latvia	3,49	3,40	3,27
Ukraine	3,40	3,33	3,20
Montenegro	3,36	3,26	3,06
Cyprus	3,16	3,06	2,98
Albania	2,78	2,70	2,63

Having in mind that the efficiency gains caused by eHealth (ePresriptions, long-distance diagnosing, databases etc.) and better health effects of decreasing chronic diseases thanks to long-term prevention might be outweigh by the costs of ICT investments, we project that on average these solutions could decrease the health expenditures of most European countries on average by 0.31% GDP or 5% less spent on health by the taxpayer. A more conservative assumption connected only with eHealth usage as ePrescriptions, ICT systems and fraud control could lower the expenditures of about 0.13% GDP, which saves about 2% on the health budget (or makes these funds available to other treatments). It is crucial to have in mind that these assumptions are still optimistic, because the basic scenario is that the expenditures on health are not subject to change – even with the use of new technology because of ageing and needed investments. The smallest overall savings would come about in Denmark – just 0.1% GDP because of an early adoption of most eHealth systems[5]. For instance, electronic prescriptions are in use in this country since 1992. The smallest savings would be also in Turkey, Macedonia, Spain and Albania (less than 0.16% of GDP). Romania would save about 0.17% GDP

5 When we look at mHealth there is a clear upward trend in capabilities (as evidenced by the introduction of higher capacity networks and smart phones), and a clear downward trend in costs of handsets and service. The primary determinant of cost of telecommunications to healthcare users will be some combination of competition in the overall market and special arrangements made for health, either by a carrier for marketing reasons, as well as arrangements with the government.

and Moldova about 0.23%. The smallest changes relative to the size of economy are observable in the countries that spend less. Ukraine could save 0.2%, Bosnia & Herzegovina about 0.26% and some of the wealthier countries 0.41% as in the case of Netherlands, 0.43% in the case of Italy, 0.43% in the Czech Republic, 0.59% in Germany and the most (0.75%) in Austria. In Poland the cost could go down by about 0.35% of GDP.

In the more conservative scenario the range of changes in spending is smaller – from about –0.03% GDP in Denmark, 0.1% in Croatia to 0.26% in Greece. In Poland they would go down just by 0.13% GDP. In the non-EU countries as Albania it would decrease by 0.8%, in Moldova – 0.11%, Bosnia &Herzegovina by 0.13% and in Serbia by 0.14%.

As a whole, countries with less developed ICT i.e. with smaller penetration of broadband connections, fewer internet users and mobile subscriptions and less developed ICT solutions in healthcare gain less in savings because of the investments that they have to perform in order to get to the next level as the more developed countries already did (Torrent-Sellens et al. 2016). Moreover, most OECD or EU15 countries are heavily urbanized, with generally universal access to healthcare (Hage et al. 2013). Much of the investment has therefore gone up to this point into health management information systems and hospital administration, rather than the use of mHealth to increase access for underserved populations which makes changes in usage of mHealth economically worthwhile (Schweitzer & Synowiec 2010).

Bringing more efficiency

More economically feasible is bringing more efficiency to the system. The new technology, although it does not bring cost-effectiveness in every case, can still translate into more efficiency. Its advocates, in particular, point to the potential **reduction in medication errors as a critical advantage**, because a doctor could have more time for the patient or could attend to more patients thanks to more time for inpatient work (OECD 2010). For example, the introduction of ePrescriptions addresses a major cost issue, with pharmaceutical expenditures making up about 20% of a country's total health spending on average (Deetjen 2016). The most advanced ePrescription initiatives are found in Estonia, the UK, Sweden, Denmark, Finland, the Netherlands, Belgium, and Spain, which have particularly high efficiency gains for prescribers of repeat prescriptions. **In Sweden, physicians estimate that ePrescriptions save about 30 minutes daily (HIQA 2012), and 91% of physicians agreed that ePrescriptions helped them to save time compared to hand-written prescriptions (Hellström et al. 2009). Similarly, a survey in Estonia also supported perceived time savings, with repeated prescriptions now taking about 10-15 seconds, and new prescriptions taking about 30-60 seconds (Deetjen 2016)[6].**

There are more direct economic benefits with regard to printing costs of electronic prescriptions. In Estonia, printing costs for paper prescriptions went down from EUR 63,668 in 2009 to around EUR 1,000 in 2010 (Parv et al. 2016). The breakeven point for the country's investment was nearly achieved by mere reduction of paper used: the paper forms, printing and storing them securely—so the cost of the system and the maintenance currently is cheaper than if they bought the paper prescriptions. However, evaluations in the UK showed that paper usage was potentially increased with the release of ePrescriptions in primary care, both because physicians printed physical copies of prescriptions for patients who requested them, and because pharmacists did so for preparing dispensed medications and checking their correctness (Hibberd et al. 2012).

The need for visits to doctors increases, because of the need for prescriptions and ageing of the society. Health systems vary in terms of the number of times the patients consult with their doctors. In public-funded systems in many instances such consultations result in waiting lines, which start from the point the patients books his appointment. Because of that there is an almost unlimited demand for health-services and every politician responsible for health wants to ensure that the system is efficient enough so that every patient can have a chance of visiting a doctor when in need. When we look at the data on the number of consultations per capita in 37 European countries we see that in many of them patients come back very often in order to get prescriptions or there are too few doctors to ensure that the demand for health service is met.

The highest number of consultations appear in Albania, Greece, Bulgaria, Hungary and Ukraine. On average every person living in Albania and Greece visits the doctor 13 times per year. In Bulgaria this figure stands on 13 times, in Hungary – 12 and in Poland, Slovakia, Czech Republic - about 11. In Germany the number is also high – 10, and in Malta – 9. In European countries the average number is 7 visits per inhabitant, which is still high. In Poland, Italy, Austria, Netherlands and Montenegro the number of visits remains approximately at the same level as the European average. In the UK the number of visits is 5, in Denmark, Finland and in Portugal at 4 with the lowest number in Sweden (3).

If all other factors remain the same (ceteris paribus) thanks to ePrescriptions operating in full capacity with almost no delay every person could see 0.17 doctors more every year (on average that makes every system 3% more efficient). This might not seem that much but this is based on a conservative assumption of giving more time to the currently working doctors if the patients still come back to visit the specialists. We do not know how the patients will react to a full ePrescrpitons service. Probably in some countries with underdeveloped information society the number of visits would remain equally high. The countries that could gain the most with the new efficiency translated into more patients that the system can handle every year would be Greece (0.33), Austria (0.26), Norway, Lithuania and Portugal (0.22 in each country). The efficiency would still be present in Sweden, Switzerland, Germany and Bulgaria. The lowest gains would appear in Poland, Serbia, Montenegro, Bosnia & Herzegovina, Turkey and in Albania. However, if the doctors would also use online consultations, then the average health system could withstand about 0.28 more consultations per capita every year. For approximately the same amount of money and the same number of physicians there could be much more consultations. Who would benefit the most?

Netherlands, Spain and Greece could service more patients thanks to ePrescirptions and online visits. Those countries could have about 0.5 visit more per capita than now (however

6 In addition to the prescription process itself, time may also be saved as ePrescriptions facilitate obtaining patients' medications, which prescribers need to know before handing out prescriptions.

CHART 8. GAINS IN EFFICIENCY THANKS TO EPRESCRIPTIONS AND CONSULTATIONS ONLINE CALCULATED AS NUMBER OF CONSULTATIONS PER CAPITA IN 37 EUROPEAN COUNTRIES IN 2014

Source: Polityka Insight calculations based on OECD, WHO, Eurostat and World Bank data.

- doctor consultations per capita
- doctor consultations per capita with ePrescriptions
- doctor consultations per capita with ePresciptions and online visits

Greece	12,97	13,29	13,47
Albania	12,97	13,03	13,06
Bulgaria	12,29	12,49	12,59
Hungary	11,75	11,92	12,00
Ukraine	11,26	11,44	11,54
Slovakia	11,15	11,33	11,43
Czech Republic	11,10	11,29	11,40
Germany	9,90	10,11	10,26
Malta	9,48	9,64	9,73
Lithuania	8,40	8,62	8,74
Macedonia	8,34	8,48	8,59
Turkey	8,25	8,34	8,39
Spain	7,60	7,80	8,11
Romania	7,78	7,91	8,02
Netherlands	7,10	7,27	7,83
Croatia	7,63	7,75	7,75
Belgium	7,40	7,55	7,64
Cyprus	7,40	7,52	7,59
Poland	7,15	7,27	7,33
Austria	6,80	7,06	7,20
Italy	6,80	7,00	7,13
Serbia	6,72	6,83	6,88
Slovenia	6,55	6,69	6,79
Montenegro	6,54	6,65	6,70
France	6,35	6,52	6,61
Estonia	6,35	6,52	6,52
Latvia	6,00	6,17	6,26
Bosnia & Herzegovina	6,05	6,15	6,20
Iceland	5,95	6,14	6,14
Luxembourg	5,90	6,05	6,12
Ireland	5,70	5,84	5,93
UK	5,00	5,14	5,38
Norway	4,25	4,47	4,70
Denmark	4,50	4,69	4,69
Portugal	4,10	4,32	4,47
Finland	4,20	4,36	4,36
Switzerland	3,90	4,11	4,32
Sweden	2,90	3,11	3,11

the increase in efficiency ranges from 4 to 10%). The numbers could go up in Norway, Switzerland, Austria, and in the UK the most. Poland could have an increase in efficiency at the level of 0.18 consultations and Ukraine at about 0.28 (both have an increase of 2% in overall system efficiency). The lowest gains would be in Montenegro, Bosnia & Herzegovina, Turkey, Croatia and Albania mainly due to low digital skills and internet uptake. In Finland and Estonia which could also have fewer gains the case is different – over development which means that there is not so much room for more efficiency at the current state of the health systems. Also Sweden would see almost no more gains from more technology used.

There is a significant potential for eHealth to deliver cost-effective, quality healthcare, and spending on eHealth systems by governments and healthcare systems is increasing worldwide. However, there remains a tension between the use of eHealth and its implementation. Although eHealth may be a rapidly changing field, many of the challenges of implementing systems within organisations remain constant over time and they include both systematic factors, external and internal problems, complexity management, preparation and training, which is not always present, decreasing the potential gains and savings (Ross et al. 2016; Li et al. 2013) and foremost getting the doctors and health managers on board which stops every eHealth initiative (Cowan 2016).

Country profiles

Developed countries

POLAND

eHealth on delay, startups promise to deliver

Poland is a relative beginner in eHealth, but a much-delayed public eZdrowie system is set to start in 2018. Ambitious eHealth development agenda may clash with digital divide, leaving elderly citizens aside. Meanwhile, private entrepreneurs seek opportunities in health innovation.

Population

38.5 million

Demographic profile

25-54 years: **43.5%**,
65 years and over:
16.26%

Life expectancy at birth (2016)

male: **73.7** years

female: **81.7** years

Health expenditure

6.3% of the GDP (EU28 average: 9.9%)

Health expenditure (government + private) per capita 2015 in EUR

1 259 (EU28 average: 2 781)

Annual average growth rate in per capita health expenditure, real terms, 2009 to 2015

2.0 (EU28 average: 0.7)

Physicians density

2.22 physicians/ 1,000 population (2012)

Hospital beds density

6.5 beds/ 1,000 population (2011)

Obesity among adults

27% (56. country in the world)

Number of doctor consultations per person

7.1 (EU28 average: 7.1)

Average length of stay in hospital, in days, per year

6.9 (EU28 average: 8.0 in 2014)

Possible eHealth increases in efficiency

2% more patients could see a doctor

% Population making appointment with practitioner via a website/app

7% (EU average: 13% in 2016)

ePrivacy concerns

98% of Poles are eager to share information via health apps, only 2% have concerns

Possible eHealth savings

0.36% GDP

Mobile internet access

26% (EU average: 47) (2016)

% Population seeking health information on the internet

40% (EU average: 48% in 2016)

eHealth at a glance

According to Euro Health Consumer Index 2015 (hereafter EHCI), Poland ranks low on eHealth, comparing to other EU member states and its neighbours in central Europe. An introduction of an ambitious public eHealth system eZdrowie, co-financed by the European Commission, was spectacularly put on hold in 2015 due to procurement issues and delays in adopting relevant legislation. The planned system would allow patients to access their health registers, introduced ePrescriptions, and a general database of all medical events accessible to medical practitioners. In the absence of general national system, regional eHealth programs were introduced with limited success (e.g. Świętokrzyski System Informacji Medycznej). The current Prawo i Sprawiedliwość (PiS) government announced a major overhaul of healthcare structure for 2017-2018. In addition to planned 49% cap on private co-ownership of public hospitals, the ambitious reform aims at assuring access to healthcare to all Polish citizens, including those without health insurance. This would eliminate the step of consulting an existing insurance database eWUŚ (Elektroniczna Weryfikacja Uprawnień Świadczeniobiorców). Digitisation of health services is hailed as a fourth pillar of Law and Justice reform. Ministry of Health plans to introduce eZdrowie incrementally, starting with ePrescriptions, eAppointments, health registers from 2018 onwards. There are no specifics about the system at the moment and the system does not deliver online booking or even a waitings time check via internet or even phone. Still about 60% of Poles would like to use services like that or even more complex ones as remote rehabilitation (PwC 2017).

Meanwhile, a robust private healthcare sector in Poland provides its own solution. In 2016 Adamed Group, a pharmaceutical and biotechnological company, unveiled the first certified telemedicine platform Medivio contacting patients with certified doctors in Poland. The offer includes access to cardiologic, diabetologic, and psychiatric advice. Medivio platform and related app is accessible through mobile devices and gives instant access to video consultations with doctors and patients' health records. Other services include scheduling appointments, commanding receipts, remote measuring of bodily functions, and alerts for taking medications. Basic health records access subscription costs around 2 euros/month and premium, including all services, costs around 7 euros/month, which is accessible to Poles with average salary of around 1000 euros. Another example is Silvermedia, which developed cloud-based architecture to support the remote monitoring and telerehabilitation of cardiovascular patients, which has medical certification for designing, developing and implementing medical software.

At the same time Luxmed, one of the biggest Polish private healthcare providers with almost 1700 service points has an app, telephone line and online platform that enables the clients to see their test results or even consult with a doctor all that for a price available to the average corporate employee.

It also worth mentioning that Polish surgeons and cardiologists performed for the first time in the world heart surgery using holographic heart and the "holo lens" technology developed by MedApp and the Jagiellonian University Medical College.

STARTUP NATION

» **AlleRad platform – a platform for radiologists allowing to comment on and share radiologist pictures stocked in a cloud. Doctors can bid on X-Ray reading jobs via stock exchange mechanism. The platform was created by Pixel Technology to help radiologists to remotely examine scans. It may reduce costs of reading a scan by as much as 10% in Poland.**

» **ENRICHME – ENabling Robot and assisted living environment for Independent Care and Health Monitoring of the Elderly is a project carried out by EU-sponsored consortium including Poland, Greece, Italy, France, the Netherlands. The project aims at improving the quality of life of elderly people, who are at greater risk of cognitive impairment, frailty and social exclusion, using a service robot within an assisted living environment.**

» **SIDLY Care – wearable technology for monitoring patients vital functions and sharing the information with doctors and family is targeted at pregnant women, elderly people, and people suffering from chronic illnesses. CEO Edyta Kocyk landed on Forbes 30 under 30 list in the 2017 edition.**

SUMMARY

Poland is best at: having a potential in mHealth and eHealth, the country spends less than average but thanks to mobile development (115 SIM cards per 100 people, while the EU average is 84) it could rapidly adapt mHealth solutions thanks to the existing infrastructure

Poland should improve: length of waiting for healthcare services, access to electronic records, and introduce effective ePrescriptions solution

ISRAEL

eHealth on delay, startups promise to deliver

Israeli healthcare is data-driven, thanks to widespread electronic health records. Both private and public sectors are invested in developing research and funding for healthcare innovation. Accessibility of eHealth to patients over 75 years, as well as access to technological benefits for ethno-, socio- and geographically disadvantaged populations, remains a challenge.

Population

8 million

Demographic profile

0-14 years: **27.73%**,
25-54 years: **37.15%**

Life expectancy at birth

male: **73.7** years

female: **81.7** years

Health expenditure

7.8% of GDP (2014)

Health expenditure (government + private) per capita 2016 in US dollars

2910

Annual average growth rate in per capita health expenditure, real terms, 1995 to 2017

in 1995: **1316**,
in 2016: **2910 US dollars**

Physicians density

3.34 physicians/ 1,000 population (2012)

Hospital beds density

3.3 beds/ 1,000 population (2012)

Obesity among adults

27% (49. country in the world)

Number of doctor consultations per person

6.2

Average length of stay in hospital, in days, per year

5.3 days

Mobile subscribers per 100 inhabitants

122

% population accessing Health Maintenance Organizations (HMO) websites to obtain administrative information

78%

Sources: Eurostat, OECD, CIA World Factbook

eHealth at a glance

Israel ranked fifth on the 2015 Global Digital Health 100 list. Computerized health records were introduced as early as in 1995 and they cover 99% Israeli citizens. The official Digital Health Strategy ensures that the four existing compulsory health funds, Health Maintenance Organizations (hereafter HMO), implement eHealth solutions. The leading HMO Clalit introduced big data analytics to detect and proactively treat population with high risk of kidney failure, while HMO Maccabi experimented with early detection of colon cancer system.

The strategy entails creating telemedicine centres across the country, which would function as multidisciplinary medical therapy and support centres for chronic patients. Furthermore, the Ministry of Health pushes for streamlining emergency room workflows by introducing a nationwide management system and ER registration apps for prospective patients.

Although studies suggest that in multicultural societies, disadvantaged groups are more eager than the majority group to use the internet to access medical information (Mesch 2016), an actual access to technological advancement in eHealth is lower among significant non-Jewish and Orthodox Jewish populations; eHealth literacy remains a concern.

Public-private partnerships between hospitals, universities, venture capital funds and the government are a bulwark of Israeli eHealth innovation. There was a 43% increase in funding research in hospitals from 2009 to 2012. According to Survey of Knowledge Commercialization Companies in Israel, commercialisation companies were involved in the establishment of 53 startup companies between 2014 and 2015 alone. 85% of them were established by companies associated with the universities (CBS 2016). Israeli research centres are increasingly and vigorously looking for research opportunities in Asia: Ben-Gurion University of the Negev has partnered with Jilin University (JLU), the biggest university in China, and University of Haifa plans to establish a joint laboratory at the East China Normal University (ECNU) in Shanghai. Meanwhile, in the southern Chinese city of Shantou The Guangdong Technion Israel Institute of Technology is being constructed with support of the Hong Kong tycoon Li Ka-shing. Chinese investors are a regular fixture in Israeli Silicon Valley, looking for cheap tech solutions.

Another trend is exemplified by eHealth Ventures, a digital health incubator with Israeli government support, planning to invest in 40 digital health companies over an eight-year period. The consortium comprises of 2nd largest HMO Maccabi Health Services, top Israeli and US clinics, Israeli pharmaceutical companies, Chinese VC, and received a major investment from a global biotechnology company Amgen. Similarly, MindUP, Haifa's Digital Health Incubator, is joint undertaking of local hospital, international tech companies, global venture capital firms, and the Office of the Chief Scientist of the Israeli Ministry of the Economy. The incubator focuses investments in areas of big data, cloud computing, wearables, personalised medicine, and genomic analysis. Additionally, Haifa hosts an Israeli branch of IBM Research Labs, where Health Informatics department is a cutting-edge research centre testing the applicability of machine learning into healthcare and life sciences.

A sharp focus on fostering startup ecosystems combined with experience in military technology deployment in civilian sector contribute to Israel's advanced position on global eHealth market, including a frontline position in digital mental health innovation. Lifegraph is a behaviour monitoring app used by clinical psychiatrist to track patients' condition while enabling them leave hospital. It aims at minimising the number of re-admissions to psychiatric wards. The app was developed at TAU's Faculty of Engineering and Sagol School of Neuroscience with help from 8200 Entrepreneurship and Innovation Support Program (EISP), an accelerator run by the Alumni Association of the Israeli army's Unit 8200.

STARTUP NATION

- **Camoni – a Hebrew-language Web-based social health network (meaning „Like me" in Hebrew) launched in 2008. Camoni offers 16 doctor-monitored communities devoted to chronic health conditions from diabetes through cancer to obesity and depression. The site connects patients with medical professionals and other patients through blogs, forums, support, internal mail, and chats.**

- **Aerotel – a leading remote health monitoring services company, providing remote ECG (EKG) monitoring, loop event recording, personal safety alarm and personal GPS. The company operates in more than 40 countries and is the leading telemedicine provider in India.**

- **ArchMedicx – an Israeli startup targeted at Russians who seek healthcare treatment abroad, partnering with the biggest Russian e-mail service provider Mail.ru.**

SUMMARY

Israel is best at: introducing electronic health records and public-private R&D with venture capital flowing into eHealth

Israel should improve: equality of access to eHealth for elderly and disenfranchised socio-geographic groups; ER workflow

SWEDEN

Privacy concerns aside, Swedes in all age groups seem ready for eHealth

The Swedish legal system has been traditionally privileging openness and transparency. At the same time technology-savvy Swedes are among the most privacy-concerned Europeans. Sweden has put considerable efforts to digitise its health registers and prescriptions high levels of digital literacy among citizens in all age groups are promising for further development of eHealth.

Population

9.8 million

Demographic profile:

25-54 years: **39.38%**

Life expectancy at birth

male: **80.2** years

female: **84.1** years, 65 years and over: **20.12%**

Health expenditure

11.9% of the GDP in 2014 (EU28 average: 9.9%)

Health expenditure (government + private) per capita 2016 in US dollars

5 000 (EU28 average: 2 781)

Physicians density

3.93 physicians/ 1,000 population (2011)

Hospital beds density

2.7 beds/ 1,000 population (2011)

Obesity among adults

22% (104. country in the world)

Number of doctor consultations per person

2.92 (EU28 average: 7.1 in 2014)

Average length of stay in hospital, in days, per year

5.7 (EU28 average: 8.0 in 2014)

Mobile internet access

76% (EU average: 56% in 2016)

% Population seeking health information on the internet

60% (EU average: 48% in 2016)

% Population making appointment with practitioner via a website/app

22% (EU average: 13% in 2016)

ePrivacy concerns

15% of Swedes have security concerns over communicating with public and administrative services, along Germany it is the biggest percentage in the EU (EU average: 8% in 2015)

Possible eHealth savings

0.21% GDP

Possible eHealth increases in efficiency

7% more patients can get health service

Sources: Eurostat, OECD, CIA World Factbook

eHealth at a glance

Sweden introduced a national eHealth strategy in 2005 and subsequently revised it in 2010, laying strong foundations for development of digital health sector. According to the most recent Swedish Vision for eHealth 2025 – Common Starting Points for Digitisation of Social Services and Health Care adopted in 2016, the country has good prospects of benefitting from the potential of digitisation in area of health thanks to digital maturity of its citizens, high level of digitisation in private and public sectors, and robust ICT sector.

The current strategy underlines the potential of digital health for increasing individuals' independence, participation and influence on society, as well as economic prospects for industry. The program is built upon principles of equality, gender inclusiveness, protection of privacy and information security, efficiency and accessibility, usability and digital participation. The starting point is the regulatory framework for eHealth, cooperation between relevant entities on national, regional, and municipal level, and ensuring that agreed international standards are implemented.

Independent surveys suggest that older Swedes are ready for eHealth (Wiklund Axelsson & Melander Wikman 2016). In 2015 PwC conducted a study "The doctor is in your smartphone" in collaboration with the Swedish eHealth Agency, the Swedish Association of Health Professionals and the Swedish Medical Association. According to the survey, two thirds of Swedes are eager to replace face-to-face consultations with doctors with remote consultations. At the same time, less than 10% of doctors would advise their patients to use health apps available at the moment at the market, but 7 in 10 respondents consider recommending improved apps in the future (PwC 2016a).

Electronic Health Records were adopted quite early, already in the late 1990s. "My medical records" were originally inspired by the home banking concept. Uppsala City Council experimented with opening records to patients in 1997 in the EU Commission funded project Sustains. Due to increased demands of citizens to access their personal health information, the digitised electronic health records (HER) were made accessible to patients in the whole Upssala region 2012 through portal Minavardkontakter.se ("My Health Contacts"), following adopting relevant legislation in 2008. Other tested services include requesting certificates, extending sick leave, communicating with doctors, changing family practitioners. According to a study carried out among local doctors and nurses, majority of doctors assess opening up eHealth records negatively, whereas nurses tend to see more positive effects (Alander & Scandurra 2015). eHealth policy advocates stress that increased patient participation requires improved access to information, whereas health professionals rhetoric advocates more "service to consumers" approach.

Sweden has a long history of developing ePrescription services, dating back to 1984. Today 90% of prescriptions in Sweden are issued electronically, generated by doctors through the national ePrescription management system and then transmitted through a secure network to the national prescription database. ePrescriptions service is available for clinicians and patients in all Nordic countries. However, the service enabling patients to view prescriptions are not commonly available yet (Gilstad et al. 2016).

For more than two decades one state-owned pharmacy chain operated in Sweden. The market was re-regulated in 2009 with several private pharmacy chains. The transition happened on a short notice and many pharmacies experienced difficulties with their digitised dispensing systems (Hammar et al. 2015).

New Karolinska Solna University Hospital in Stockholm is an example of a major research centre on telemedicine, testing new model for healthcare and industry, called innovation partnerships, which are more long-term, in-depth and collaborative than standard partnership agreements. Currently there are more than 25 innovation partnerships with major Swedish and global tech, biotech, and manufacturing companies.

SUMMARY

Sweden is best at: transparent electronic health records, boosting app ecosystem

Sweden should improve: support among healthcare professionals for opening up electronic health registers to patients

STARTUP NATION

» **HälsaFörMig – an official eHealth service provided by Swedish eHealth authority, HealthForMe platform allows secure storage and access to electronic health records. Authorised records and can be retrieved by the application through the API. The platform allows users to develop their own iOs and Java application which will run on collected data.**

» **Mina VårdKontakter (MVK) Health Innovation Platform helps third parties to develop healthcare solutions. The platform is run by Vinnova, a governmental agency promoting innovation and collaboration between uiversities, research centers, and industry. The platform is targeted at freelance app developers, designers, and software companies.**

» **Lifesum – an app for healthier living, better eating; a personalised diet guide creating a diet plan based on health and fitness data. Recognised as 'Best Health and Fitness App' 2014/2015 in App Store.**

»

THE NETHERLANDS

the top European healthcare system runs on eHealth solutions

The Dutch are one of EU's frontrunners in eHealth. Good regulatory framework, clear policy agendas, and solid institutional architecture with Nictiz, a national competence centre for expertise and standardisation of eHealth as a prime example, contribute to the country's top performance in the area.

Population

17 million

Demographic profile:

25-54 years: **39.83%,**
65 years and over: **18.35%**

Life expectancy at birth

male: **79.2** years

female: **83.6** years

Health expenditure

10.9% of the GDP in 2014 (EU28 average: 9.9%)

Health expenditure (government + private) per capita 2015 in EUR

4 321
(EU28 average: 2 781)

Hospital beds density

4.7 beds/ 1,000 population

Obesity among adults

21.9 % (103. country in the world)

Number of doctor consultations per person

8.0 (EU28 average: 7.1) (2014)

Average length of stay in hospital, in days, per year

5.2 (2012) (EU28 average: 8.0 in 2014)

Mobile internet access

76% (EU average: 56% in 2016)

% Population seeking health information on the internet

63% (EU average: 48% in 2016)

% Population making appointment with practitioner via a website/app

21% (EU average: 13% in 2016)

ePrivacy concerns

10% of Dutch have security concerns over communicating with public and administrative services (EU average: 8% in 2015)

Possible eHealth savings

0.82% GDP

Possible eHealth increases in efficiency

10%

Sources: Eurostat, OECD, CIA World Factbook

eHealth at a glance

The Netherlands has been at the top of the European Health Consumer Index several times since the index establishment in 2005. The top quality of its healthcare is increasingly related to advanced eHealth solutions. The adoption of IT technology in hospitals has traditionally been high, especially in radiology and electronic health records. According to the report (Health Consumer Powerhouse 2017), the Netherlands "probably has the best and most structured arrangement for patient organisation participation in healthcare decision and policymaking in Europe."

The Dutch National Implementation Agenda for eHealth was released in June of 2012, setting goals around self-management by patients and care substitutions initiative. The Royal Dutch Medical Association (KNMG) created it in collaboration with the Netherlands Association of Health Care Insurers (ZN) and the Federation of Patients and Consumer Organisations in the Netherlands (NPCF). The partners collaborate to achieve the following objectives: increasing awareness about eHealth possibilities among physicians and other specialists through education as well as drafting and implementing guidelines, to provide electronic care support (core electronic data sets, care and decision support), to support safe electronic storage and exchange of patient data, to develop research about effectiveness of telemedicine and health apps, and to propagate promising telemedicine applications already used on a limited scale, including teledermatology, telemonitoring in chronic heart failure and diabetes, e-mental health and other forms of remote guidance, care and monitoring.

Nictiz is a Dutch National competence centre for expertise and standardisation and eHealth. Its purpose is twofold. First, providing information to health professionals and patients about standards in eHealth as well as possibilities offered by healthcare information infrastructure. Second, monitoring, research, and dissemination of research results. Nictiz produces the annual eHealth Monitor TrendITion™, follows national and international developments such as registration at source, eHealth, epSOS, blue button and big data, and provides a useful overview of laws and regulation in healthcare as well as overview of quality marks, certificates and quality statements in healthcare.

The first regional computerised health record system was started in Leiden in the 1970s. An obligatory national electronic health record Het Electronisch Patiëntendossier was introduced in 2009 after a public consultation about privacy laws concerning health data. The service is provided by Dutch government and accessible exclusively to general practitioners, pharmacists, and medical personnel in hospitals. The patients automatically participate in the system, unless they object for privacy concerns (opt-out model) (van Baardewijk 2009). Doctors can also access patient data through platforms including Patients and eHealth, iZiekenhuis (eHospital) and regional platforms.

Dutch healthcare startups are flourishing, and the scene is Amsterdam and in Eindhoven/Brainport area is bolstered by established manufacturers including Philips, which established the High Tech Campus Eindhoven in 1998. The Dutch Life Sciences & Health (LSH) sector is one of nine "top sectors" in the Netherlands, as designated by the Dutch Ministry of Economic Affairs. It entails a broad range of disciplines including medtech. The government is stimulating public-private partnerships and channeling funds in terms of loans to the most promising medtech startups.

STARTUP NATION

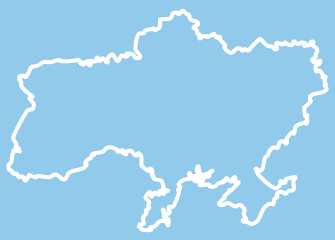
- **Aiden App – emotions-tracking app simplifying communications between patients with depression and their therapists.**
- **G-Therapeutics – Swiss-Dutch neuro-stimulation therapy stratup secured funds from European VCs and the Dutch Ministry of Economic Affairs**
- **MedEye – medical equipment enabling nurses to automatically verify medication at the patients' bedside, helping to timely provide the right dose of medication.**

SUMMARY

The Netherlands is best at: patients rights and information, eHealth institutionalisation

The Netherlands should improve: long term R&D agenda

Developing countries



UKRAINE

enormous potential to jumpstart ailing healthcare system through digital innovation

Ukraine: Better hospital governance, transparent funds tracking, and greater patient empowerment could be achieved with a little help of disruptive digitisation – and continuous political will. The goals include achieving maximal informativeness and minimal regulatory burden in order to transform highly inefficient healthcare system. Rapidly growing local ICT sector and governments' vision for eHealth predict well for the future.

Population

44 million

Demographic profile:

25-54 years: **44.47%**,
65 years and over: **16.05%**

Life expectancy at birth

male: **67.1** years

female: **76.9** years

Health expenditure

3.6% of the GDP (EU28 average: 9.9%)

Physicians density

3.54 physicians/ 1,000 population (2013)

Hospital beds density

9 beds/ 1,000 population (2012)

Obesity among adults

21.7 % (89. country in the world)

Number of doctor consultations per person

(EU28 average: 7.1)

Average length of stay in hospital, in days, per year

(EU28 average: 8.0) (2014)

Mobile-cellular telephone subscriptions per 100 inhabitants

144 (2015)

Percentage of individuals using the Internet

49 (2015)

ePrivacy concerns

No data

Possible eHealth savings

0.20% GDP

Possible eHealth increases in efficiency

2%

Sources: Eurostat, OECD, The World Bank, CIA World Factbook, ICT Development Index Ranking

eHealth at a glance

Ukraine ranks 118 out of 188 countries in terms of healthcare according to medical journal The Lancet. Disadvantages could be turned there into opportunities, as major healthcare system reforms are expected both by experts and underserviced general public. In November 2016 Ukraine adopted crucial healthcare system reform plan, a part of National Action Plan for Reforms, increasing doctors' wages and inspecting whether channeled funds follow the patients, not disappear into thin air as it was often the case earlier. National Health Reform Strategy for Ukraine, scheduled for the years 2015-2020 entails transforming unevenly located medical facilities, deregulating medical services market, introducing efficient mechanism of state funds allocation, and guaranteeing greater autonomy to medical institutions. This gives many opportunities for adopting digital governance and management systems in hospitals, which, compared to institutions in Western Europe, are short of ICT leadership.

The Ukrainian government is pushing anti-graft, transparency measures, including Prozorro, an electronic government procurement system, used for purchasing medical equipment and other supplies in the healthcare sector, and eData, a web portal tracking use of public funds. Ukraine is spending a disproportionately high percentage of its GDP on arrays of hospital beds and thousands of doctors who deliver poor quality, inaccessible services. As a result, when stricken with disease, Ukrainians have to weight almost all financial burdens of medication and care themselves – 86% of private health is financed out of pocket in Ukraine (Holtz 2012), and until March 2016, when new law on pharmaceutical regulations was adopted, medication market was very much restricted ('pharmaceutical curtain'). Overall, it leads to a situation when citizens avoided taking medical care at all, which is especially alarming in a country performing very much below European average on most health-related measures (Ministry of Health 2016).

National eHealth Strategy for Ukraine was adopted in 2016, having been prepared with support of WHO, the World Bank, and the Swiss Agency for Development and Cooperation (SDC). The Ministry of Health, run by US-educated acting minister Ulana Suprun, focuses on improving nationwide in fundamental areas of patient safety, medical services quality, medical care accessibility, patient rights and opportunities, and medical care continuity, in order to drastically improve a 'sclerotic' post-soviet system. Luckily for this sprawling and diverse country, regional eHealth solutions are also considered. An example of such modality is eHealth strategy Volyn 2015-2020, which centres on mother and child health (Volyn Oblast Healthcare Administration 2016). Harmonization and interoperability remain the key challenges.

The national strategy is focused on assuring constitutional right to healthcare in practice and on empowering patients. For that purpose, a better flow of health information both to practitioners and patients is vital. Until recently, electronic software had been used in medical institutions mostly for administrative and statistical purposes (MedStat – statistical reporting tool, in- and out-patient registers, and staff register).

Ukraine starts almost from scratch, yet some progress in relation to eHealth has already been achieved, notably the introduction of cancer, cardio-viscular diseases, TB and HIV/AIDS patients' registers available to practitioners. There are plans to introduce health data dictionary, registry oh health providers, registry of health professional, and registry of health services. More distant plans include a unique patient identification (UPID) system. Introducing advanced systems: ePrescriptions, eConsultation, prevention monitoring, and chronic care management is planned in the foreseeable future (Ministry of Health 2016). At the present stage, Ukraine has to address more rudimentary needs, including control and prevention of diseases (e.g. tuberculosis, polio and HIV) and lack of basic healthcare in armed conflict territories, where destruction of facilities and shortages of medicines and supply remain concerns.

Most of Ukrainian app developers live in Kiev and Kharkov, while Lviv and Odessa are catching up. In addition to providing tailored solutions to hospital management or electronic health records, local ICT sector is increasingly answering health and lifestyle deficiencies, delivering apps promoting healthier lifestyle.

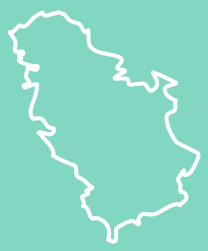
STARTUP NATION

- **ARanEd – augmented reality platform, which scans and visualises the structure of bones, joints, and tendons is the winner of PioneersKyiv Festival 2017.**
- **LifeTracker.io – an app claiming to track "all dimensions of life" with automatic monitoring of mood changes and emotions to optimise daily activities and simplify achieving goals, promoting healthier lifestyle choices.**
- **Titanovo – non-invasive at-home DNA testing service for academic research, physicians, and corporate wellness programs. The company is currently crowdfunding DNA Lifestyle Coach, a test which is supposed to tailor diet, exercise, and mental health plans on the basis of DNA.**
- **Cardiomo – wearable biosensor tracking vital signs and noticing abnormalities in heart operations; important since cardio-viscular diseases are a leading cause for deaths in Ukraine.**

SUMMARY

Ukraine is best at: including eHealth at the core of large healthcare system overhaul, turning present disadvantages into future opportunities

Ukraine should improve: accountability, transparency and efficiency of medical services, expanding eHealth toolkit from rudimentary registers to comprehensive medical records



SERBIA
modernising healthcare through eHealth is a vital part of EU accession process

Incentivised by the prospect of EU accession, Serbia has achieved remarkable progress in terms of eHealth, successfully deploying pilot Integrated Health Information System and setting up ambitious electronic health records agenda.

Population

7 million

Demographic profile:

25-54 years: **41.41%**,
65 years and over: **18.03%**

Life expectancy at birth (2016)

male: **72.6** years

female: **78.5** years

Health expenditure

10.4% of the GDP
(EU28 average: 9.9%)

Physicians density

2.11 physicians/ 1,000 population (2009)

Hospital beds density

5.4 beds/ 1,000 population (2009)

Obesity among adults

21.3 % (63. country in the world)

Number of doctor consultations per person

7.8 (EU28 average: 7.1)

Average length of stay in hospital, in days, per year

9.6
(EU28 average: 8.0)
(2014)

Mobile internet access

33%
(EU average: 56)
(2015)

% Population seeking health information on the internet

37%
(EU average: 48% in 2016)

ePrivacy concerns

Only 5% of Serbs would abstain from contacting government or using administrative services because of security concerns (EU average: 8%)

Possible eHealth savings

0.41 GDP

Possible eHealth increases in efficiency

2%

Sources: Eurostat, OECD, CIA World Factbook

eHealth at a glance

Dynamic development of eHealth strategy in Serbia begun in the mid 2000s thanks to incentives from the European Union and the World Bank. Health Information System for Basic Health and Pharmaceutical Services was developed between 2005 and 2008. In 2009 the Program and IT Rulebook on more detailed contents of technological and functional requirements of the establishing the integrated health information system were introduced. In 2014 Serbia adopted Law on Health Records and Statutory Records in the Field of Health. The Unit for Integrated Health Information System (UIHIS) operates within the Ministry of Health. A pilot Integrated Health Information System (EU-IHIS) funded in the framework of EU pre-accession assistance (IPA) was tested from 2012 to 2015. A program amounting to EUR 2.5 million euro was introduced in selected 19 hospitals. It involved, first, the implementation of hospital information systems (HIS), which includes Electronic Medical History Databases, information on departments and wards, internal reporting and management, and external reporting (e.g. statistics), and second, development of Electronic Health Records (EHR). Those efforts were buttressed by developing health information systems in other institutions, including the military and the police, and support to National Cancer Screening Office. Local Ministry of Health, WHO Europe, UN Office for project Services (UNOPS) participated in the project, and Health Information Think Thank was created. The program trained over 11,000 users: doctors, nurses, hospital administration and staff, as well as IT employees. The framework for interoperability, exchange, and storing digital documents was created.

SUMMARY

Serbia is best at: successfully creating pilot Integrated Health Information System, improving information flow in hospitals, and introducing electronic health records

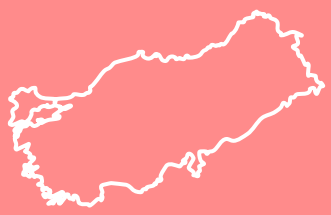
Serbia should improve: eHealth solutions interoperability; expand from testing sites to nationwide applicability

Serbia's main achievements in eHealth comprise creating the database of the insured, a system for Health Insurance Fund, Central Information Service database of health institutions, staff, medical equipment, and coding systems, as well as advanced Hospital Information and Laboratory systems (Nada Teodosijević 2014). Current national pilot projects include: ePrescirptions, screening for breast cancer, issuing electronic invoices, making specialist appointments in hospitals and electronic patient summaries. The key challenges include revising regulatory framework for privacy standards of electronic health records and updating IT Rulebook from 2009, ensuring further sustainable investment in ICT in healthcare, and developing managerial ICT capabilities among healthcare professionals and administration. Coordination of all activities in eHealth in a single agency and/or a dedicated branch of Ministry of Health is also discussed. Despite all its successes in eHealth, Serbia lacks national universal health coverage policy and strategy in this respect and should push for more private funding and public-private partnerships in addition to public investment.

STARTUP NATION

- **VisMedic – telemedicine platform which allows patients to use video link to consult with doctors for information, advice or second opinion.**

- **SkinScan – an app for identifying cancerous moles, winner of Denmark's The Next Step challenge.**



TURKEY

better at eHealth than most EU countries

Turkey is one of the most advanced countries of the Mediterranean Basin with regard to eHealth. With over 80 million citizens, regional disparities and not as efficient bureaucracy eTransformation is the only solution for decreasing spending and delivering services to the whole population which is to increase by a couple of millions by 2050.

Population

80.3 million

Demographic profile:

25-54 years: **43.15%**,
65 years and over: **7.3%**

Life expectancy at birth (2016)

male: **72.5** years

female: **77.3** years

Health expenditure

5.4% of the GDP
(EU28 average: 9.9%)

Health expenditure (government + private) per capita 2015 in EUR

791 (EU28 average: 2 781)

Annual average growth rate in per capita health expenditure, real terms, 2009 to 2015

2.1 (EU28 average: 0.7)

Physicians density

2.71 physicians/ 1,000 population (2012)

Hospital beds density

2.5 beds/ 1,000 population (2011)

Obesity among adults

29.4%

Number of doctor consultations per person

8.3 (EU28 average: 7.1)

Average length of stay in hospital, in days, per year

3.9 (EU28 average: 8.0 in 2014)

Mobile internet access

51% (EU average: 47 in 2016)

% Population seeking health information on the internet

38% (EU average: 48% in 2016)

% Population making appointment with practitioner via a website/app

29% (EU average: 13% in 2016)

ePrivacy concerns

No data available

Possible eHealth savings

0.07% GDP

Possible eHealth increases in efficiency

even **2%** more patients could see a doctor

Sources: Eurostat, OECD, CIA World Factbook

eHealth at a glance

Turkey's National Health Information System (NHIS) initiative has started with the launch of the Health Transformation Program in 2003. NHIS provides a nation-wide infrastructure for easy and efficient sharing of electronic health records. Its aim is to collect health data to the Ministry of Health servers in Ankara from all healthcare institutions scattered over the country including the hospitals, laboratory systems and family medicine systems. One of the basic assumptions of the system was to be centralised but also developed in open standards. The whole process of eHealth is constructed under the umbrella of eTransformation in Turkey (European Commission 2015).

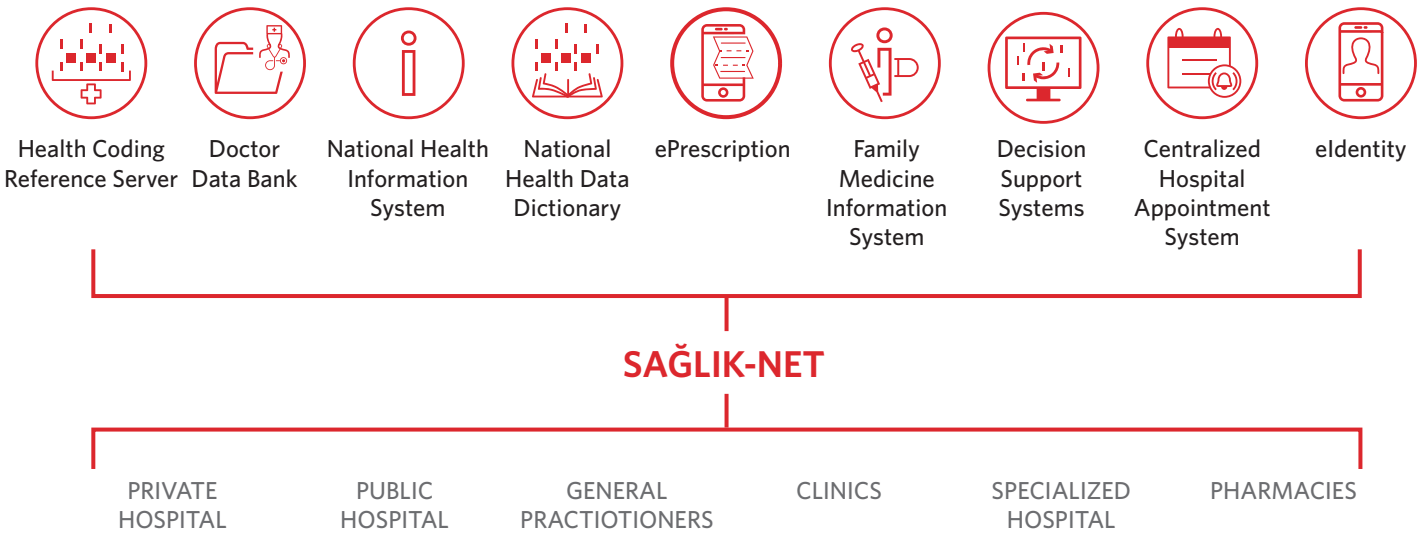
The objectives of the eHealth plan were as following:

- The adoption of national standards for data items, entities and related procedures, and the development of the current and new content of health information in Turkey in accordance with such standards, and its storage in a National Health Data Dictionary (NHDD) accessible over the national eHealth Network, called Sağlık-Net (KÖSE et al. 2014).
- The enhancement of the existing Ministry of Health Wide Area Network into a National Health Information Platform, that is, Sağlık-Net hosting and enabling access to nationally required systems and services, by all Turkey health sector institutions.
- The introduction of a "Family Medicine Information System" (for GPs) and the development and operation of a National Electronic Medical Records system.
- The expansion of the existing security measures of redundancies, firewalls, antivirus, passwords, etc. to cater for profound digital security of all health care transactions that ascertains the identification and authentication of all users and the integrity, confidentiality of all health care messages and transactions.

Sağlık-Net aimed to convert existing networks into a true public health network platform. Its another aim was to link and manage the network of hospitals, family doctors, clinics, pharmacies, specialised hospitals and labs with standards and protocols (Dogac et al. 2010). It also offered tools such as national health digital dictionary, decision support systems, health insurance integration, electronic health records and also digital security systems as eSignature (which is connected with the eID in Turkey which name is e-Nabiz). Following the introduction of Sağlık-Net, in recent years Sağlık-Net 2 platform was established. It was developed to gather patient data from private hospitals, clinics and other healthcare entities. The most important functionality of the Sağlık-Net portal is that, with the introduction of electronic identity cards every citizen can access his personal health records. Moreover, through the portal, the citizens is able to make online reservations in hospitals and in the near future – in all clinics in Turkey.

SYSTEM NETWORK UNDER SAĞLIK-NET

Source: Dogac et al. (2014).



NHIS when fully operational is expected to collect data from over 90% of the field (primary, secondary, tertiary healthcare providers, and family physicians etc.). The data flow in NHIS is not always one-way, that is from the healthcare institutions to NHIS servers. Authorised parties can also query and retrieve the healthcare records from the NHIS servers. Hence, sharing of medical records among healthcare providers will be possible in the future when the necessary legislations are passed. Currently, works is underway to determine legal ground about the access rights of all types of users. Another future plan is the use of the "Doctor Data Base (DDB)" to develop an advance privacy consent mechanism for authorising physicians' access to the EHRs of the patients based on their roles. The patients will able be restrict access to the parts of their EHRs based on the specialty of the physicians. For example, mental disorders of a patient will be accessed only by psychologists ıf the patient specifies so. Finally, an eAppointment system is being developed on Sağlık-Net which will allow the General Practitioners using the Family Medicine System to arrange appointments for their patients in the hospitals.

STARTUP NATION

» **Aumet – an information sharing service for distributors and providers of healthcare in Middle East and North Africa. This online service helps medical suppliers increase their sales by providing them with: access to local market news and tenders in remote markets based on supplier's specialty, and ability to share them with their distributors. For the provider their matching technology recommends the verified distributors who have the longest and verified experience.**

» **Lifemote Technologies - This company develops a cloud platform that stores video recordings from consumer cameras, generates health data and insights to be displayed on a mobile app. Their first app generates baby sleep schedules and snippets of interesting moments using video streamed from a camera. With computer vision and computing power of the cloud it shows what's going on with babes when their sleeping. Next, they plan to develop new apps for new users using the same core tech: sleep for everyone, posture tracking for office workers, activeness tracking for the elderly and medication tracking for chronic patients with no wearables.**

» **MyDoctor.pk – is an app providing a platform for doctors to advertise their services and for patients to make informed decisions on choosing the right specialists. Users can search information, book appointments, search medical facilities and maintain medical records in the software's data base. The crucial factor is the recommendation and feedback about the hospitals and doctors the users visited.**

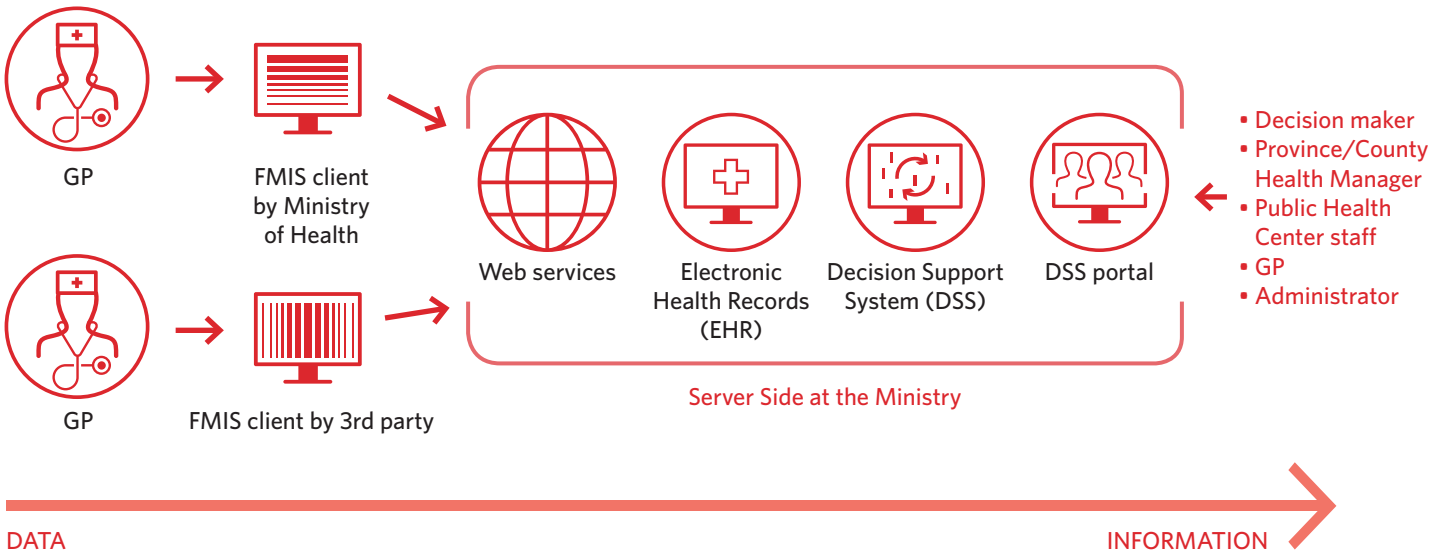
SUMMARY

Turkey is best at: early developing a centralised system for hospitals and patients.

Turkey should improve: the pace of implementing its solutions and invest in prevalence for better health outcomes.

ARCHITECTURE OF THE SYSTEM FOR GPs

Source: Dogac et al. (2014).



MACEDONIA
punching above its weight in eHealth

Macedonia is an overachiever in eHealth. This small country is an example that a persistent government can reform the system just by being sufficiently determined. Despite advances in the field of eHealth, as challenges that need to be worked on are the big numbers of mortality from a handful of diseases and infant mortality.

Population

2.1 million

Demographic profile:

25-54 years: **43.65%**,
65 years and over: **13.09%**

Life expectancy at birth (2016)

male: **73.6** years

female: **79** years

Health expenditure

6.5% of the GDP
(EU28 average: 9.9%)

Health expenditure (government + private) per capita 2015 in EUR

654
(EU28 average: 2 781)

Annual average growth rate in per capita health expenditure, real terms, 2009 to 2015

1.4 (EU28 average: 0.7)

Physicians density

2.62 physicians/ 1,000 population (2009)

Hospital beds density

4.5 beds/ 1,000 population (2011)

Obesity among adults

20.8%

Number of doctor consultations per person

7.5 (EU28 average: 7.1)

Average length of stay in hospital, in days, per year

11.1 (EU28 average: 8.0 in 2014)

Mobile internet access

56% (EU average: 47 in 2016)

% Population seeking health information on the internet

40% (EU average: 48% in 2016)

% Population making appointment with practitioner via a website/app

3% (EU average: 13% in 2016)

ePrivacy concerns

No data available

Possible eHealth savings

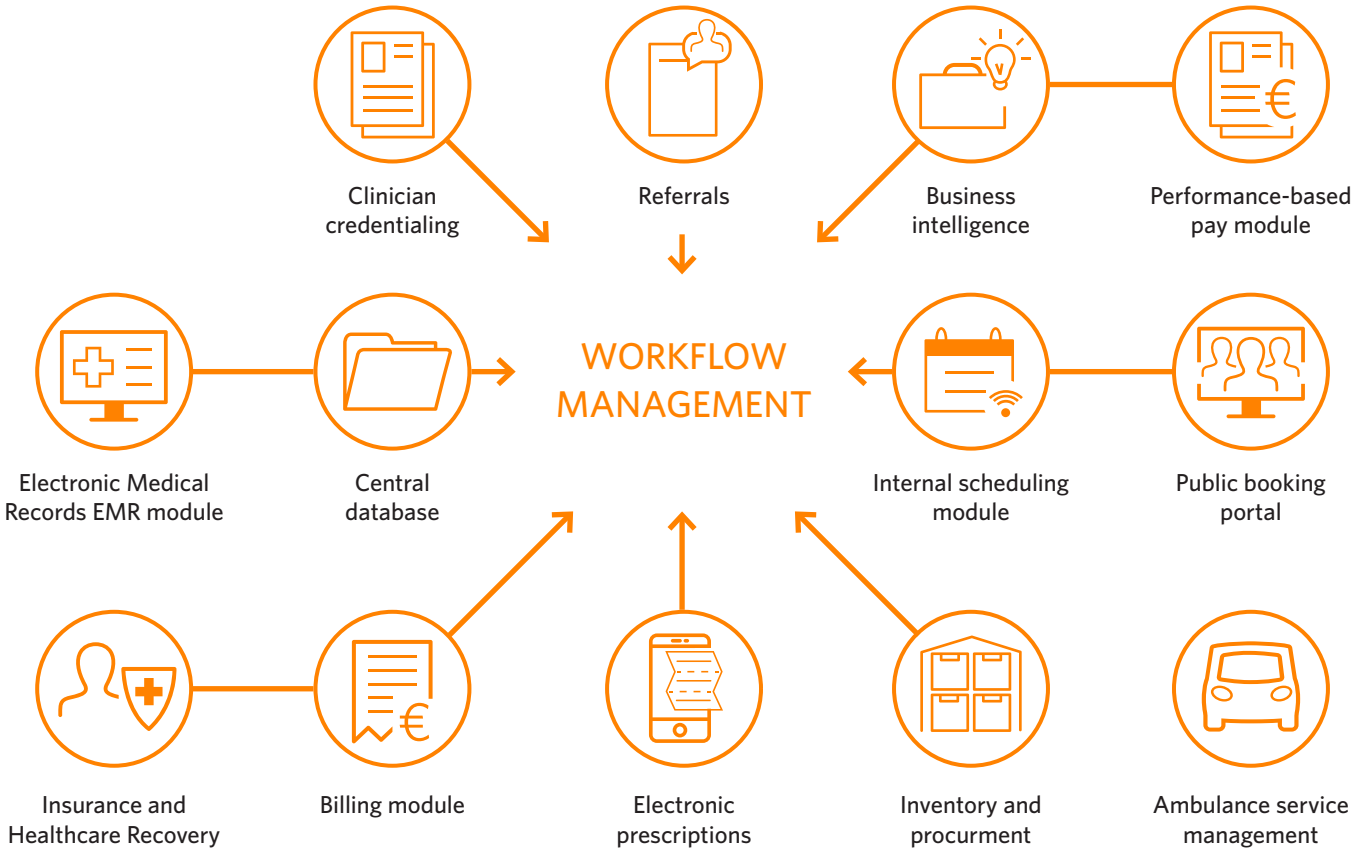
0.08% GDP

Possible eHealth increases in efficiency

even **3%** more patients could see a doctor

Sources: Eurostat, OECD, CIA World Factbook

Source: Velinov et al. (2015).



eHealth at a glance

The healthcare system in Macedonia relies mostly on public healthcare facilities, all funded by the National Health Insurance Fund (NHIF)[7]. Most citizens are insured by the fund (approx. 95%), thus having access to the public healthcare sector. The system is organised as a workflow, beginning on the first level (GPs) and transferring patients to the higher levels (hospital and centre clinic) and back, based on official paper medical documents (referrals, medication prescriptions, hospitalisation admission forms, discharge letters, etc.). Over the past 15-20 years, in order to digitise the paper system, several independent systems were deployed in hospitals and GP clinics, mainly to organise their internal operations and records. During this period there were several unsuccessful attempts to procure an entire national eHealth system (Velinov et al. 2015).

Today, Macedonia ranks 20th according to the Euro Health Consumer Index (EHCI), a comparison of European health care systems based on waiting times, results, and generosity. Macedonia ranks before Italy and Spain, as well as all regional states, climbing 11 spots just in one year between 2014 and 2013 (Health Consumer Powerhouse 2017). Macedonia is a good model how a small country can achieve large progress as a result of its commitment. The doctor in the primary healthcare can schedule an appointment with any specialist in the presence of the patient. These are services that high-income states do not offer.

Before 2013, patients in Skopje experienced long waiting times to see doctors and have diagnostic tests. *MojTermin* (My Appointment) was introduced in the country in 2010, initially to test the technical feasibility for implementing an integrated health information system. Since

7 The Macedonian public health system is organised as a three-level referral-based system, in line with the following scheme: First level: GPs (general practitioners), organised in small clinics of 1-3 doctors. 2,200 total clinics, with a total of 3,100 GPs and 3,000 nurses; Second level: hospitals, each containing 5-50 doctors. Over 400 hospitals, with a total of 4,000 doctors; and Third level: University Clinical Centre Skopje, consisting of 51 clinics and institutes, with a total of 1,100 doctors (Velinov et al. 2015).

its launch in July 2013, it has expanded to more than 5,000 healthcare providers and service points, integrating over 1,000 applications and systems, including secure eHealth records, pharmacy prescriptions, a performance-based pay module, automated provider credentialing, specialist referrals, ambulance service management, public booking interface for health interventions and medical equipment, etc. The system also encompasses features for health policy and resource planning, hospital patient workflow tracking, service billing, healthcare inventory management, general practitioner and specialist practice records management, and others.

In a very short time, health system performance has improved; for example, the waiting time for radiology scans and specialist visits has been reduced from 15 months to less than 7 days. This system has essentially eliminated waiting times, provided that the patient is willing to travel a short distance (the entire country measures approximately 200 km by 130, with the capital Skopje located fairly centrally). Currently under expansion, MojTermin will integrate both curative and preventive services, screening outcomes and risk factors, and will be used for health resource planning and management and improvement of healthcare access and quality. From the user perspective the system made it possible to book appointments online and receive text message reminders and for decision-makers to access a live dashboard to see referrals, prescriptions and requests in real time.

According to the latest amendments of the healthcare law, a directorate for eHealth is established as a separate structure within the Ministry of Health. It aims to support further development of the integrated health information system, as well as concepts for health policy development based on data from this health information system. This structure's mandate is stipulated by the same law, positioning it to serve also as a central coordinative mechanism of the health information system. The system was developed according to six groups of key components (MITRE 2006) including adding layers of administration, laboratory systems, radiology, pharmacy, physician orders and clinical documentation.

Challenges that are present in developing such national systems are the integration or replacement of currently deployed software solutions, user adoption or rejection, and proper user support and training. *MojTermin* addressed this issues in phases. The first phase was very simple, as it represented a web solution that integrated all GPs and a pilot hospitals, followed by web service based access, for integration of all existing GP information systems provided by over 50 different vendors. In the next phase, all three levels of healthcare providers were involved, making it a full national appointment and referral eHealth system. This approach made the user and software adoption very smooth, facilitating further development into a full national eHealth system.

STARTUP NATION

» **Inclinatio – a mobile app which acts as diagnostic tool for osteopathic medicine. It provides an affordable test which can be delivered in a comfortable environment (e.g. at home, in school or in the office) and gives precise results of the body screening with immediate results, thus helping in detecting scoliosis at its early stage**

SUMMARY

Macedonia is best at: developing an appointment system in state-funded healthcare which shortened the waiting lines.

Macedonia should improve: the country still has a way to go on actual medical treatment results, there is no quick fix for this; even with very determined leadership, it will probably be a matter of some five years to produce significant improvement using prevention and changing the lifestyle of Macedonians (e.g. smoking habits).

Recommendations

Uneven development of eHealth solutions within the EU27 remains a major obstacle in providing European citizens with a satisfying access to cross-border healthcare and the main challenge for the EU is harmonizing the systems. Experience and achievements in implementing electronic health records, ePrescriptions, and comprehensive nationwide eHealth programs vary significantly across member states. One may observe differences not only between countries but also regions, with some areas virtually excluded from eHealth.

Nonetheless, Europeanization of eHealthcare is a frequently discussed topic when regulations and cutting –edge soft measures such as standardization of health app market or big data are considered. Thanks to cost effective solutions, the EU candidate countries such as Serbia, Macedonia, and Turkey excel some EU member states, especially the Central and Eastern European countries, in eHealth schemes. The slow shift of the paradigm centralizing the role of the patient will become more rapid making our assumptions about the savings thanks to the technology even more conservative than they are.

Europeans are rather open to eHealth and mHealth solutions, provided that privacy guarantees are in place. Building on that, we want to offer some recommendations to both the EU states as well as any other countries developing eHealth services.

- **Invest in twinning's with Macedonia or Turkey.** EU countries with relatively underdeveloped eHealth should consider learning not from the EU15, but from the EU candidate countries, which have successfully and cost-effectively implemented eHealth solutions. The underdogs in healthcare managed to create systems that countries including Poland, Bulgaria or Romania would like for themselves.

- **Assure universal deployment of standardised electronic health records.** A regionally and institutionally uneven development of EHR among EU27 countries results in inequalities if access to health information, hinders accurate medical statistics and cost-effective governance of healthcare.

- **Create new European registers of chronic diseases.** Creating European diabetes, asthma, cardiovascular diseases or depression registers on the base of Electronic Helath Records would give doctors and researchers an unparalleled overview of Europeans' chronic disease prevalence and lead to better and more cost-effective prevention and care.

- **Use the experience of both public and private sector.** Israeli model of public-private partnerships between universities, hospitals, and venture capital firms should be taken into account. In some countries only the private sector creates eHealth solutions and there are no good practices in the public sector.

- **Decide how research data is going to be exchanged between EU member states (interoperability[8]).** The free flow of data in research across the EU is already having a positive effect scientific on collaboration and achievement of results. However, these regulations are far from a comprehensive approach and the free flow of data does not exist in all sectors especially in health.

- **Collaborate in R&D.** Greater collaboration in eHealth R&D among member states, exchange of knowledge and technical assistance is advisable. Co-operation with China in the area of R&D remains another opportunity for the EU.

- **Raise awareness of data security and privacy regulations.** Patients' low confidence in eHealth and their concerns about data security should be addressed. Effective data privacy regulations and cyber security measures are solutions to this problem. However, laws are not enough to change the attitudes, therefore social campaigns are needed as well as data privacy curriculum at schools.

- **Increase the digital health literacy.** Some Europeans lack in health literacy, knowing what to eat and how often to check themselves and the risks connected with certain lifestyles. Even more lack in digital health literacy that is the usage of new technologies in providing healthcare. In some Eastern European Countries it still a question of competences of the medical staff and their capability to use them.

- **Give standards.** Fighting illicit online pharmacies, improving safety standards of healthcare wearables, better security of health apps should be covered by regulations as well. They should be treated the same way as other healthcare products, since they have a real effect on our wellness.

- **Promote eHealth and mHealth in all age groups in urban and rural areas.** Every government can promote mobile solutions for mental healthcare, supporting people with depression, schizophrenia or bipolar disorder. On the other hand, eHealth solutions can be applied in services for the elderly, patients with terminal or chronic illnesses, and their families.

- **Do not forget about the regions.** Many European countries have regional health systems public as well as private which incorporate eHealth solutions by themselves. They also should be subject to harmonization on EU level and knowledge sharing.

- **Harmonize the access to internet with high-bandwidth speed.** An inclusive digital society is one where citizens have the chance to access the services provided that is why the discussions on 5G development. This would make it feasible for a large portion of the population to stream large chunks of data many hours per day with internet of things devices, when out of reach of Wi-Fi hotspots.

- **Do not forget about soft law measures.** Involving industry stakeholders in creating codes of conduct increases chances of their implementation and boosts public trusts in eHealth entrepreneurship.

8 Data exchange schemes and standards should permit data to be shared across clinicians, lab, hospital, pharmacy, and patient regardless of the application or application vendor and research data should be shared within the EU.

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