



Interregional Coordination for a fast and deep uptake of Personalised Health

Regions4PerMed

Key Area 2: Health Technology in Connected & Integrated Care

Report



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 825812

DESCRIPTION

This report summarizes the content elaborated within the International Conference and the Interregional Workshop which took place online in Wrocław in June 2020 and in March 2021

AUTHORS

Antoni Zwiefka (UMWD), Donata Kurpas, Dorota Stefanika Wojtas, Marta Duda Sikula (WMU), Gianni D'Errico (TLS)

CONTRIBUTORS

Eva-Maria Stegemann (SMWK), Paola Bello (FRRB), Jose Maria Romero Fidalgo (ACIS), Claudia Mariut (TLS)

ACKNOWLEDGEMENT

We would like to give a special acknowledgement to the members of the Advisory Board and Interregional Committee of Regions4PerMed, who actively contributed to the Conference and Workshop with their precious experience and knowledge. In addition, we would like to thank all speakers and chairs / rapporteurs for their active participation in the Conference and Workshop.

This report was closed in March 2022.

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1. Overview of the KA2

The digitalization of healthcare is fostering the implementation of Personalised Medicine (PM). Telehealth or eHealth tools are guiding individualized diagnosis and treatment for patients and have the potential to importantly tackle the main barriers of Personalised Medicine.

The future of European health systems and the implementation of Personalised Medicine in the clinical practice require wise planning and a structured approach to ensure quality as well as long term sustainability. Technology is the way to go, and ICT in particular can provide the desired outcomes for the realization of personalised and patient-centered healthcare systems.

The quality of care must be central for policy- and decision-makers across regions in Europe, in consideration of the crucial role they play in all the Member States in delivering health policies and driving research, innovation and infrastructural investments.

Health services need to prioritize people with multiple chronic conditions (multimorbidity) and this appears to be best done through integrated and patient-centered approaches to meet patients' needs adequately. Despite the growing investment and interest in eHealth, some challenges still need to be addressed, allowing for a broader and more systematic ICT adoption in the healthcare sector. Healthcare services and systems must become more resilient, effective, equitable, accessible, sustainable and comprehensive. The transformation and adaptation require a digitally oriented mindset.

Electronic Health (eHealth) and mobile Health (mHealth) are becoming prominent components of healthcare and encompass a vast spectrum of healthcare services, ranging from electronic prescriptions and medical records to communication with patients to strengthen the therapeutic compliance¹.

One of the main challenges at this stage is the deployment of electronic health records and health-related data to improve health technologies and realize more integrated healthcare systems.

¹Moss RJ, Süle A, Kohl S. eHealth and mHealth. *Eur J Hosp, Pharm* 2019

Electronic Health Records are designed to systematically collect patient information and share it across healthcare providers and settings to help deliver more comprehensive and accurate clinical care

Electronic Health Records (EHRs) are real-time and patient-centered records of health information and clinical care, generated and maintained by healthcare providers. They are designed to systematically collect patient information and share it across healthcare providers and settings to help deliver more comprehensive and accurate clinical care. Substantial investment and increased financial incentives to implement EHRs over the last decade have resulted in widespread EHR adoption in high-income countries².

Many pilot projects in this area are being implemented worldwide and areas of opportunity are being identified to have a potentially global impact. Despite the potential of mHealth applications, many initiatives fail in the pilot stage. Barriers to large-scale adoption such as standards, security, and interoperability are also being identified³.

This Key Thematic Area 2 (KA2) was devised to tackle the main challenges of digital healthcare fostering Personalised Medicine, encompassing technological, regulatory, research aspects and translating the alters into effective and policies to be adopted at local and national level.

² Noura S. Abul-Husn, Eimear E. Kenny, *Personalized Medicine and the Power of Electronic Health Records*, cell, 2019

³ Gleason AW. *mHealth – opportunities for transforming global health care and barriers to adoption*. *Journal of Electronic Resources in Medical Libraries* 2015

2. KA2 Technical conference

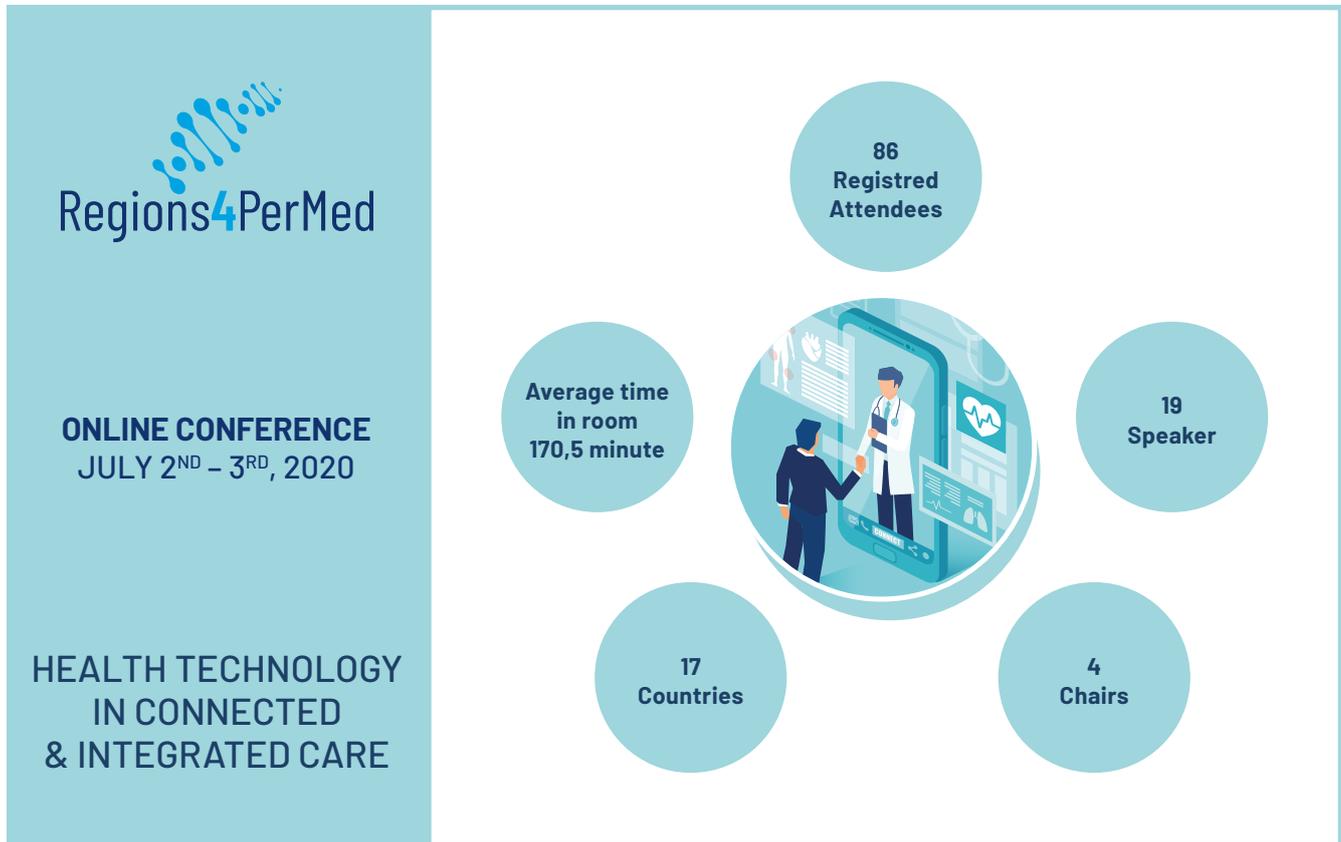


Figure 1 - Conference in a nutshell

In July 2020 the second technical conference on **Health Technology in Connected & Integrated Care** was organized by Wroclaw Medical University in cooperation with the Lower Silesian Voivodeship Marshall Office. Due to the COVID-19 pandemic and related travel restrictions the Conference was held online.

The KA2 focused on the following aspects:

- Improve data for better and more personalised health technologies
- Tacke regulatory aspects of personalised health technologies
- Patient engagement: engage citizens and patients with tools to better manage their health
- Training programs for healthcare professionals
- Health Technology Assessment (HTA) for health innovations.

More informed patients are starting to improve selfcare and adherence to medication, and boost health and wellbeing

Both the conference and the workshop have been built and carried out with the perspective of the Region, considering that at the end of the KA2, a series of key recommendations for regional authorities and policy makers will be issued.

Within the conference in particular, it has been examined the type of impact the new regulations have and the possible solutions that can be adopted at regional level:

- **Training for healthcare professionals:** Health technologies are often advantageous for the patient, but health professionals often encounter difficulties in using devices associated with these technologies, which can increase the risk of accidents
- **Patient Engagement:** There is increasing evidence that more informed patients are starting to improve self-care and adherence to medication, and boost health and wellbeing
- **Economic impact of health technology:** The key point for health technology to access the market and help implement the Personalised Medicine promise is the Health Technology Assessment which needs to be discussed to assess market barriers and identify potential solutions.

The attendees of the conference were experts from academia and industry as well as representatives from regional and governmental entities in health policies coming from a wide range of EU Countries. The numbers of the Conference participation are summarized in Fig.1.

OPENING SESSION - Innovative solutions in the National Health Fund (NHF) Strategy



Figure 2 - Key Values of the National Health Fund Strategy

Katarzyna Wiktorzak from the **National Health Fund (NHF) – Poland** presented the mission, the vision and the goals of the NHF strategy for 2019 - 2023.

The NHF is responsible for designing and implementing integrated care programs in Poland and it works together with service providers to support better health solution for society through preventive actions and through satisfying quality of an accessible healthcare service and effective public funds management. As there is a growing expectation from patients for better and more accessible healthcare services, the National Health Fund drives identification, selection and implementation of innovation in healthcare and encourages the service providers to apply to the advanced technological and management tools. Presenting the public payer as an innovator promoter open to cooperation with various stakeholders of the health care system complies with building the image of the modern institution.

Following this opening session, the day continued with sessions dedicated to different topics.

SESSION I – Connecting the regulatory aspects with Personalised Health Technologies

CHAIR

Marco D’Angelantonio, Health Innovation Management (HIMsa)

Personalised Medicine does not only require cross-border cooperation, but also interdisciplinary collaboration and the involvement of all stakeholders along the healthcare value chain.

SPEAKERS

Jana Makedonska, Scientific Programme Officer at the European Commission - DG RTD presented the Commitment of the European Commission in Personalised Medicine. Dr. Makedonska described how PM and prevention can help us change healthcare systems and highlighted that these are key factors if European healthcare systems want to achieve full sustainability.

Dr. Makedonska presented the different health research programmes supported by the European Commission that serve different health research and innovation needs. She also stressed how Personalised Medicine is an approach that can contribute to the fight against the COVID-19 as well as help mitigate the effect of future epidemics and pandemics.

She presented the major results achieved by the International Consortium for Personalised Medicine (IC-PerMed) project, which, during the last years, has become the most important policy instrument in the field of Personalised Medicine in Europe, bringing together national and regional funders and policy makers from EU Member States and beyond (associated countries are Latin American Countries, Canada, Israel, Turkey and more recently African countries and China). IC-PerMed is helping Europe to become a global leader in PM, supporting the PM science base through a coordinated approach to research and provide evidence to demonstrate the benefit of PM to citizens and healthcare systems. Also, very important is to pave the way for PM approaches for citizens and the implementation of a roadmap based on PerMed Strategic Research Agenda (SRIA).

Personalised Medicine does not only require cross-border cooperation, but also interdisciplinary collaboration and the involvement of all stakeholders along the healthcare value chain.

KEY MESSAGES

- Increase efforts to make sure research results are translated into efficient medical practice
- Research & technology push for personalised healthcare is here, and the user pull is getting stronger. It is very much needed to align supply and demand
- Personalised Medicine requires inter-disciplinary collaboration and needs to involve all the stakeholders along the healthcare continuum
- In relation to education, harmonized strategies to update the curricula of future healthcare workers need to be put in place
- Pricing and reimbursement models should be updated to allow healthcare providers to reimburse innovative healthcare services
- More health economics studies should be carried out to highlight and understand the economic value of PM.

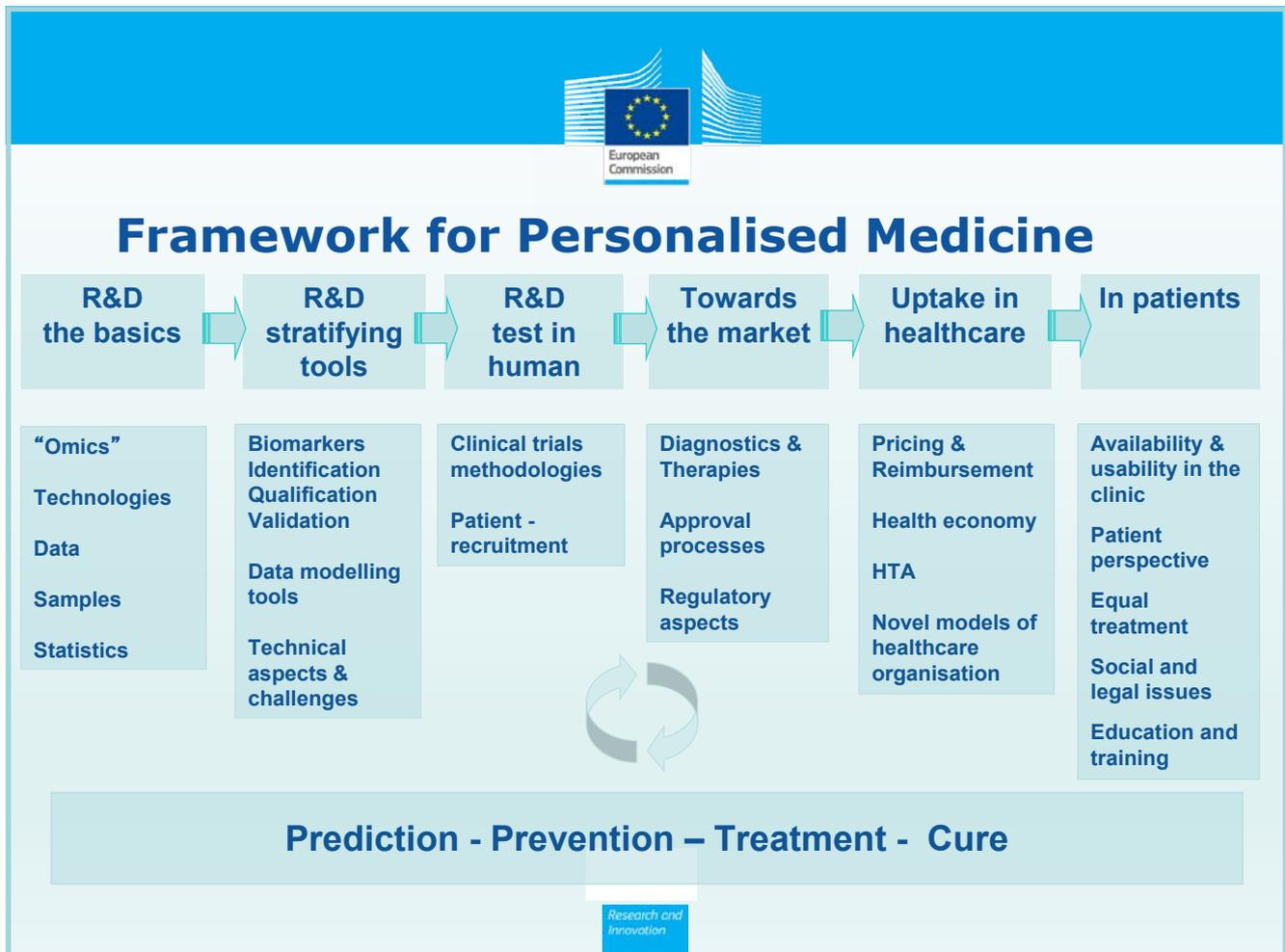


Figure 3 - Framework for Personalised Medicine

Giovanni Giuliani, Value Evidence and Access Leader at Roche

shared with the audience the corporate envisioned future of medical technologies in the Personalised Medicine era.

Dr. Giuliani stressed how the improved understanding of disease biology and availability of meaningful data are leading to increased efficacy in the pharmaceutical research and how there is more and more clinical evidence that personalised treatments are benefiting patients. For this reason, policy measures need to be put in place to favor rapid formulation and adoption of solutions to allow patients full access to new medicines.

In this respect, public-private partnerships with national and regional authorities have become a priority everywhere in Europe.

In Italy, new criteria for Health Technology Assessments (not merely focused on health outcomes and economic performance of therapies, but also on the innovative component) are helping companies to place on the market new solutions (therapies and diagnostics) highly focused on precision medicine. Next generation sequencing options are nowadays available for cancer patients. It is a good start, but the road to an optimal precision medicine pathway is still a work in progress. Evidence and data access remain fundamental: it is important to have digital infrastructures and data infrastructures able to collect data and analyze them. That is why more investment should be channeled on these.

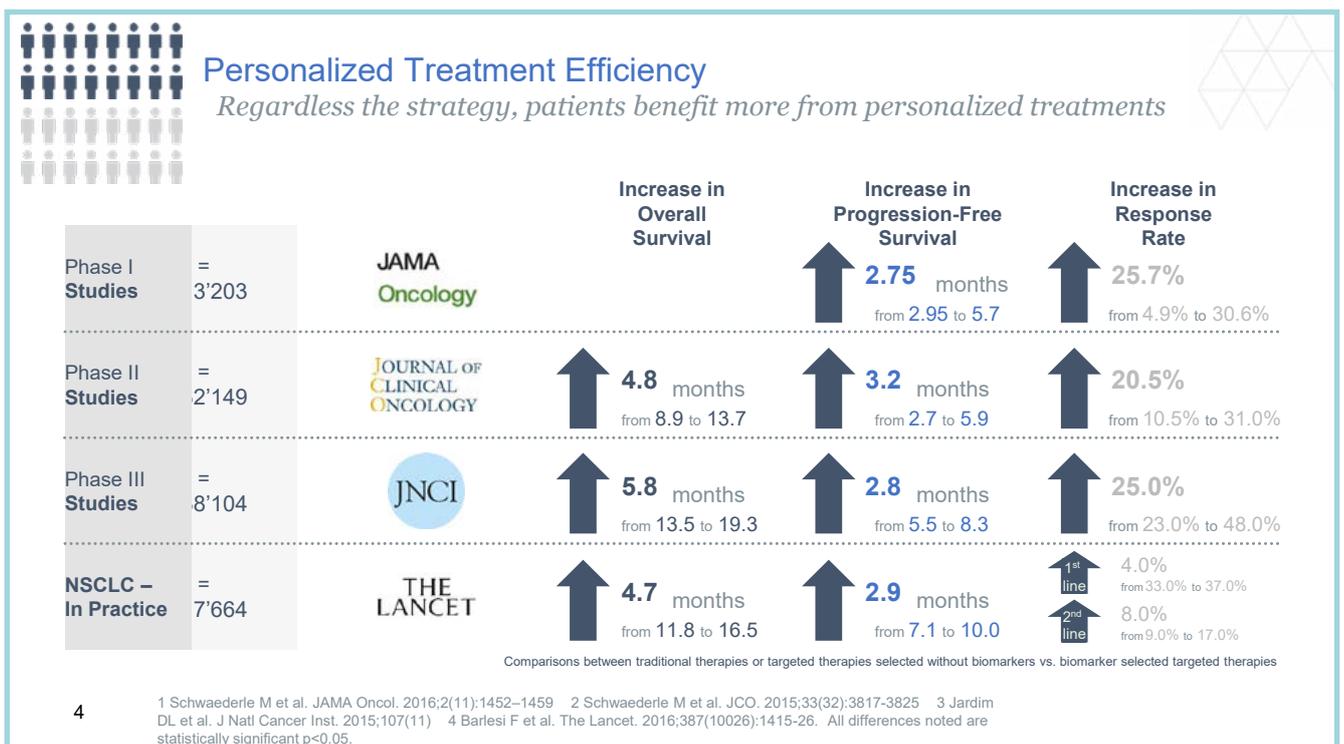


Figure 4: Comparisons between traditional therapies or targeted therapies selected without biomarkers vs. biomarker-selected targeted therapies.

Lastly, Mr. Giuliani provided a list of **critical factors** that need to be tackled in order to bring precision medicine into clinical practice:

- Establish Regional Molecular Tumor Boards for the assessment and reimbursement of precision medicine therapies
- Data linkage between different local data centers to guide treatment decisions
- Guidelines for patients' pathways with rare tumor conditions
- Guidelines for economically sustainable and clinically appropriate testing pathways
- Specific funding and tariffs for NGS testing and molecular driven treatments

Dr. Katarzyna Zoń, Administration and Economics at the Faculty of Law, University of Wrocław pointed out that the modern development of science and technology has created a new prospect for the provision of health services and has significantly influenced the way physicians perform their tasks. It is manifested, among other things, by the possibility of providing health services through ICT. For these advances to be fully deployed and exploited it is important that there is a parallel evolution of the legal frameworks. In this context, Dr Katarzyna Zoń encompassed the legal environment for providing health services via ICT tools within the Polish legislation.

The Polish legislator has introduced the possibility to provide health services through ICT as an "additional" way of providing health services. Despite the introduction of such generic rule, the legislator has not created a special regulation for ICT-based healthcare services. The criteria for assessing the correctness of doctors' conduct remain essentially and regardless of the form of provided health services. It should also be remembered that the legal regulation will not replace the doctor's individual decision.

In this context, it should be highlighted that using this kind of tools mostly depends on medical decision and the legal regulation overrule this principle.



Uniwersytet
Wrocławski

The current legal regulations: The essential issues

- patient's **consent**,
- the obligation of providing a patient with **information**,
 - **medical data** (scope, protection),
 - **medical confidentiality**,
- the legal status of **medical device**,
 - patient's **image**,
 - **financial** aspect (funding),
 - (...),

Figure 5 - The current legal regulations: the essential issues

Determining factors:

- Circumstances deal with the particular patient (illness, health conditions, age)
- The structure/kind of health service
- Due care
- Experience
- Compliance with current medical knowledge
- Compliance with professional ethics.

KEY MESSAGES

The dynamic development of modern science significantly influences the way of providing health services

- Providing health services via ITC or communication systems is admissible in the light of Polish legislation
- Legal regulations will not replace the doctor's decision
- The rules of practicing the medical profession do not depend on how such services are provided
- The criteria for assessing the correctness of a doctor's conduct remain essentially the same regardless of the form of provided health services
- Using this kind of tools mostly depends on medical presumptions.

Dr. Marek Czarkowski, Supreme Medical Council, Center of Bioethics, Collegium Medicum, Cardinal Wyszyński University

described the ethical principles for the patient consent, mandatory for the data valorization and therefore at the core of PM applications.

The basic principle of the respect for the person carries two implications:

1. Individuals should be treated as autonomous agents, and
2. People with diminished autonomy are entitled to higher level of protection. Each individual, to the degree that they are capable, need to be given the opportunity to choose what shall or shall not happen to them.

This implies that individuals:

1. Have the competences to decide and is able to give informed consent
2. Need to be duly informed
3. Understand the situation correctly (comprehension)
4. Are free in their decisions (willingness)
5. Need to receive feedback

Electronic consent, in this regard, should facilitate the patient's comprehension of the information presented during the information process.

It provides full and understandable information, conveyed in a manner that minimizes the possibility of coercion of undue influence regarding the patient's decision and interactive interface, which may facilitate the ability to retain and comprehend information.

In this electronic consent some optional questions might be implemented, in order to assess the individual's understanding

of the informed consent material. If the answers are wrong, the form shifts the person back to the section where the information is explained. The understanding of this information will be again assessed.

Within the electronic consent, some optional questions which assess the individual's understanding of the informed consent can be embedded in order to ensure the risk of misuse of the data and information collected.

KEY MESSAGES

The hidden or overlooked advantages of the e-consent procedure:

- The electronic system used to obtain electronic consent allows cheap audiovisual registration (recording) of the entire procedure
- Record analysis enables:
 - assessment of the correctness and quality of the procedure
 - using these materials to train individuals who prepare and conduct the procedure
- Recordings of the course of e-consent may also be used in the event of disputes or lawsuits

Wiktor Rynowiecki, Director of the Architecture and e-Health Services Division.

Healthcare Information System (CSIOZ) closed SESSION I presenting the Data and Health Technologies within the Polish Health System.

CSIOZ is an agency for public health in Poland. Thanks to the digital infrastructure created by CSIOZ, with the outbreak of the COVID-19 pandemic, significant percentage of patients switched to teleconsultations and electronic appointments. Of significant importance during the outbreak was also the full deployment of electronic prescription. The e-prescription allows patients to use their medicine without physical presence. Patient can collect their prescription based on their personal ID number and four-digit access code in any pharmacy in Poland.

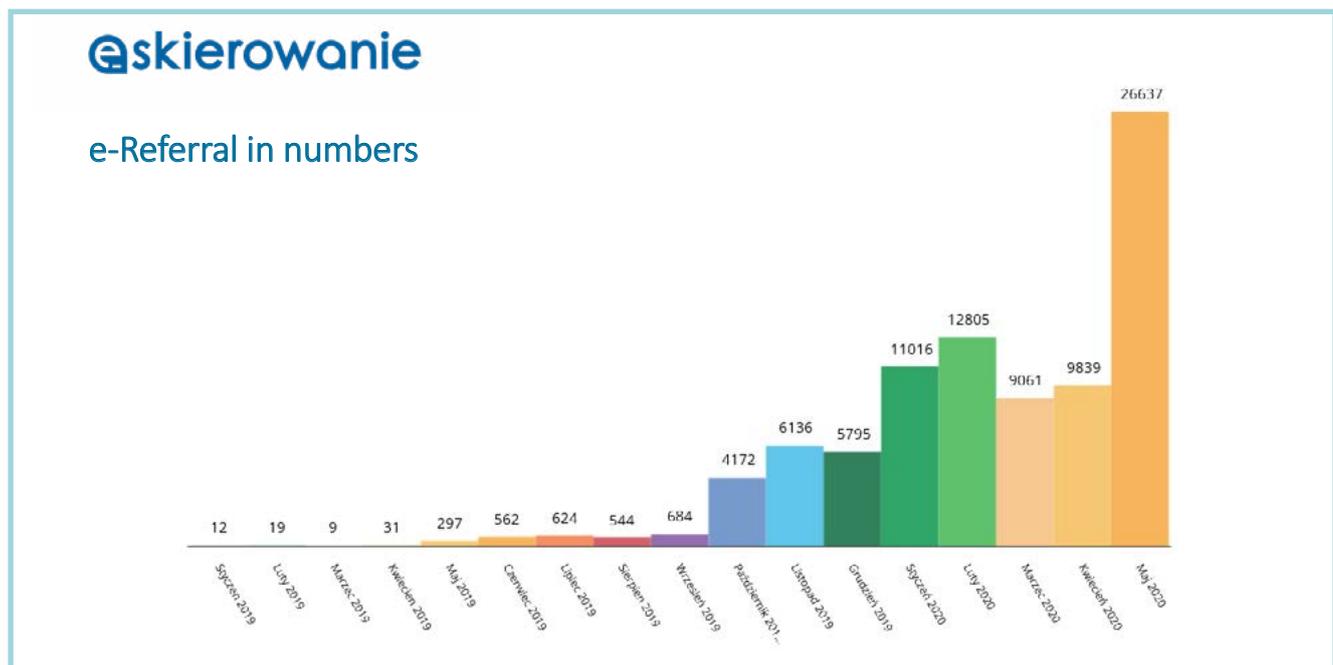


Figure 6 – e- referrals in numbers

For e-health and telemedicine to continue to grow, it is essential to implement electronic medical records and medical event registration.

The digital transformation of the Polish health systems may represent a cornerstone for the implementation of personalised healthcare considered that these innovations have allowed to:

1. Gain access to the personal list of e-prescriptions and e-referrals with associated access codes and key codes enabling their execution
2. Gain access to the history of medical appointments (medical visits and procedures) funded by the National Health Fund
3. Gain access to the history of e-prescriptions and e-referrals
4. Grant access rights to e-prescriptions and e-referrals for relatives to enable execution of e-prescription
5. Grant access rights to e-prescriptions and e-referrals to provide detailed health information for chosen medical professionals
6. Grant access rights to electronic health records
7. Renew e-prescription for medications without the necessity of scheduling an in-person medical appointment (applies for chronic conditions)
8. Get access to the history of medical visits and procedures including children
9. Get access to the history of a paper version of prescriptions created after the 1st of January 2019

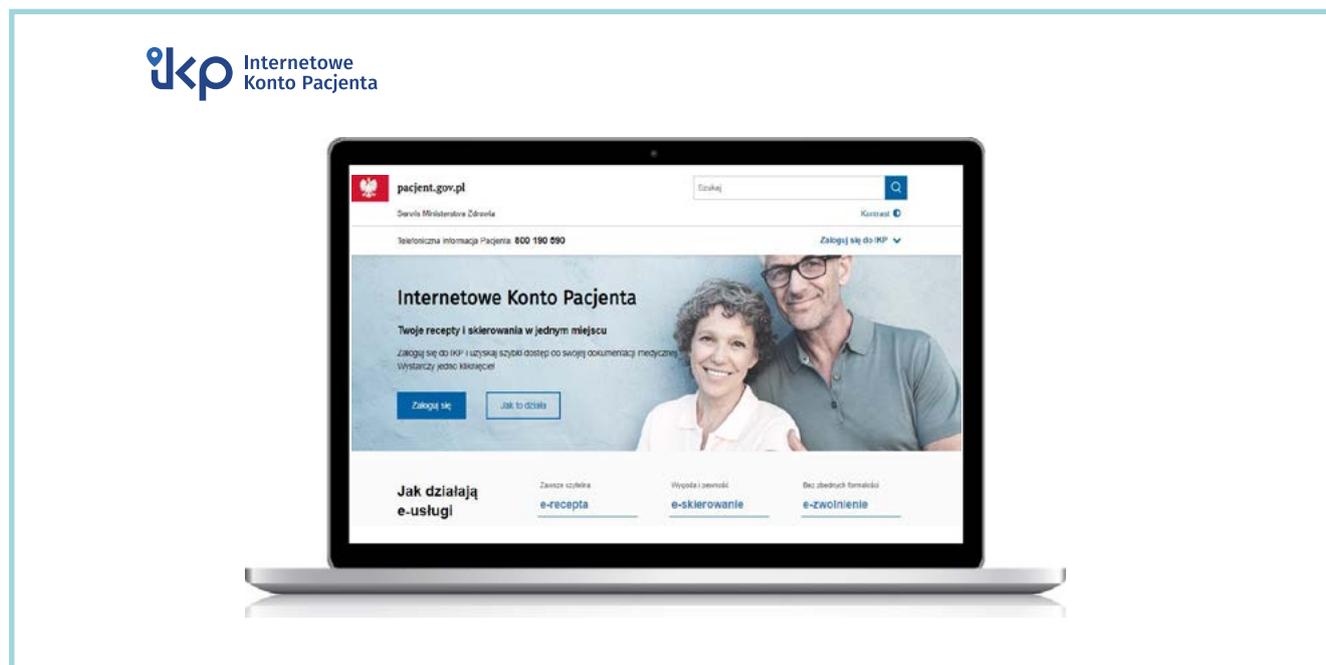


Figure 7 - Internet Patient Account

Internet Patient Account (IPA) is another innovative tool in the healthcare system. It facilitates patients' use of digital services and organize medical information about our health in one place.

During the pandemic:

1. More than 2700 online medical consultation were performed
2. 537 doctors and nurses involved for
3. 24 hours/7 days a week

E-visits can be done over the Internet (e.g., video call, chat) or by telephone. It allows to, among other things:

1. Consult about worrying symptoms or feeling unwell
2. Discuss test results, e.g., blood sugar or blood pressure
4. Ask for e-prescription of the medicines taken for chronic diseases
5. Ask about the dosage of a medication
6. Receive medical advice
7. Receive an e-discharge

The medical professional decides if an e-visit is enough or if a traditional visit is needed.

SESSION II - Patient Engagement - Engage citizens and patients with tools to better manage their health

CHAIR

Olaf Müller - Managing Director at Carus Consilium Saxony GmbH.

SPEAKERS

Tomasz Faluta from **We, the Patients Foundation** presented how the organization is helping patients and citizens to be more aware and engaged on managing their health.

We, the Patients Foundation supports patient participation in healthcare decision-making processes and provides support to patient organizations to communicate their problems and needs more efficiently.

The Foundation conducts scientific research, consultations and training activities for patients and patients' organizations. The mission of the Foundation is to build platforms for cooperation between public administration, patients and their organizations, doctors, academia and business in healthcare.

Mr. Faluta briefly presented some of the most important projects (in terms of outcomes delivered) implemented by the Foundation:

- 1. "Together for Health"**, in partnership with the Supreme Medical Chamber, the Supreme Chamber of Nurses and Midwives, and the Supreme Pharmaceutical Chamber, the project undertakes social dialogue and the social idea of the responsibility of health care institutions by developing, within the partnership, established permanent and transparent mechanisms of social consultations. The realization of the goal may allow strengthening the dialogue and cooperation between public administration and social partners (patient organizations and medical professions).
- 2. "Parents for Health"** has as its main goal the improvement of the quality of preventive pediatric care for children aged 0-5, to develop preventive pediatric care standards for children aged 0-5 years with experts, doctors, nutritionists, nurses and in consultation with parents, so that child patients have their development under the guidance of a professional team supervising the child's condition not only during illness, but also in terms of prophylactic.
- 3. "Hungry for Change"** - an extremely important initiative. The idea was born at the parents' meeting for health. The Foundation wants to show that healthy meals are not difficult to do at all, and above all, they are not expensive.

4. **“Don’t lose your head”** a program for the prevention and early detection of head and neck cancers. The main goal of the project is to implement a pilot prevention program around five voivodeships (the equivalent of a NUTS - nomenclature of territorial units for statistics - 2 regions) in the field of early detection of head and neck cancers (NGiS).
5. **“Patients decide”** - the aim of the project is to prepare selected patient organizations to participate in the public consultation process in healthcare.

The above-mentioned projects can be leveraged to support the implementation of PM since they lay down the conditions for cooperation between public administrations and social partners to promote an active role of patients in health innovation policies, especially in the areas of health promotion and primary prevention.

Dr. Sabina De Rosis from the department of Management and Health, Sant’Anna University presented the advanced experience in studying and deploying Patients Reported Outcome and Patient Reported Experiences.

While patient-reported experience measures (**PREMs**) capture the patient’s view on health service delivery (e.g., communication with nurses and doctors, staff responsiveness, discharge, and care coordination), patient-reported outcome measures (**PROMs**) provide the patient’s perspective on their health status (e.g., symptoms, functioning, mental health). PREMs and PROMs are complementary and are meant to be used together to capture a more complete picture of the patient’s journey.

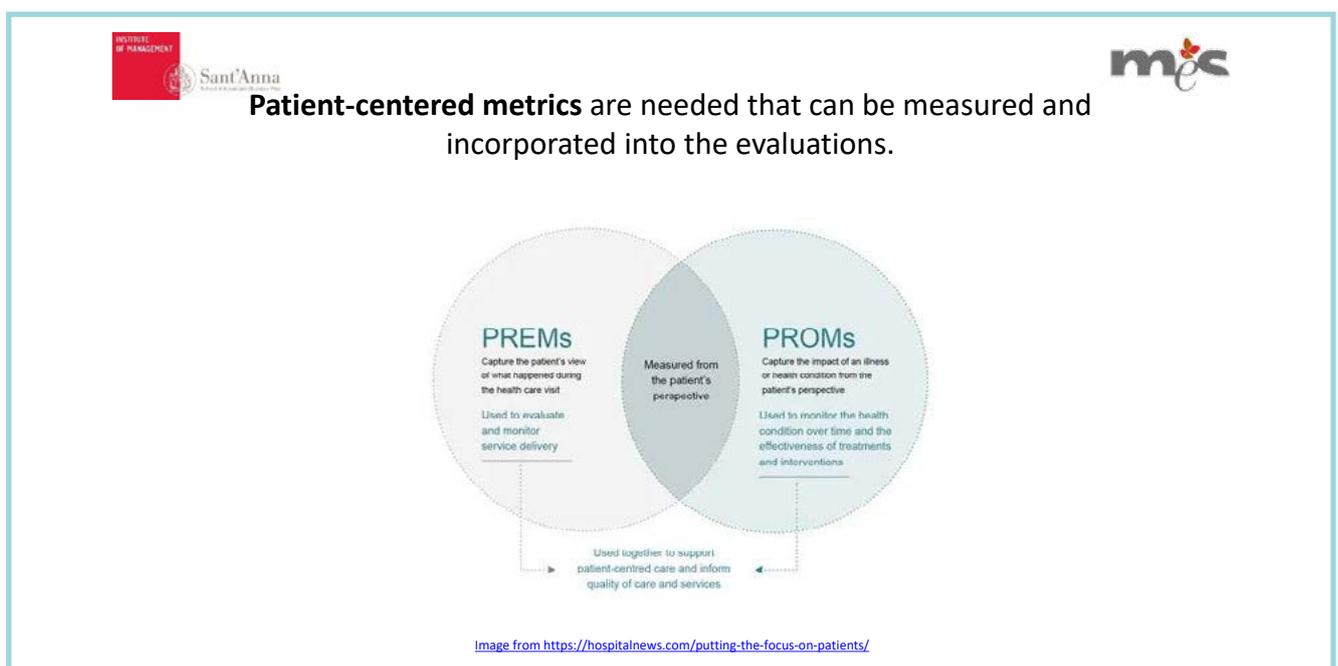


Figure 8 – PROMs and PREMs for Health Technologies

Sabina De Rosis presented the ongoing activities within the Tuscany Region (Italy) that is fully encompassing the patient's voice - collected and reported through digital tools for assessing and therefore improving both the healthcare system quality of care and eventually the patient empowerment and self-care.

Dr. De Rosis highlighted that policy makers should ensure that healthcare systems are really and fully focused on the patients. The potential benefits of including qualitative measures when assessing the outcomes of healthcare services are enormous and this led the Organisation for Economic Cooperation and Development (OECD) to release recommendation to all United Nations health ministries: **Strengthening the international comparison of health system performance through patient-reported indicators**. Several studies show how health authorities are not aware whether health systems truly deliver what people need. Patient Centered Care is itself one aspect of high-quality care and it is a key topic in policy making and inadequate management of PM, a general goal towards which all the health care system are trying to move.

Sant'Anna University conducted periodic surveys in different services and pathways. Due to the limits of health information systems (related to rigorousness and affordability of value based oriented sources of information), these surveys included outcome and process indicators only. Different regions in Italy and outside Italy joined the surveys and in the first 10 years of activities around 170,000 questionnaires have been collected, which assess the quality of the health services from the patients' perspective

KEY MESSAGES

Patient-reported data impact on patient health:

- PROMs and PREMs to support interactions with professionals, during their follow-up, or to evaluate if they need an additional follow-up
- Participation in PROMs and PREMs to improve ability of self-evaluation, health literacy, adherence, and outcomes
- Integration with the Electronic Health/Medical Record to improve individual care
- Integration with services provided to patient to improve the care experience and empower patients

Katarzyna Wiktorzak, Head of Cross-sectoral and International Projects Section, Department of Analysis and Innovation from National Health Fund (NHF), gave a second presentation where she provided her experience on how to engage citizen and patients with tools to better manage their health.

Mrs. Wiktorzak presented the **Personalised Health Care (PHC) Plus Pilot Model** a programme worth nearly PLN 76 million (almost € 20 million) which is coordinated by the NHF in collaboration with the World Bank as part of the operational programme Knowledge Education Development 2014–2020, and financed by the European Social Fund, and co-financed by the NHF.

The main objectives of the programme are to:

1. Improve the quality of Personalised Health Care (PHC)
2. Increase the number of healthcare services available in PHC
3. Improve the coordination of PHC.

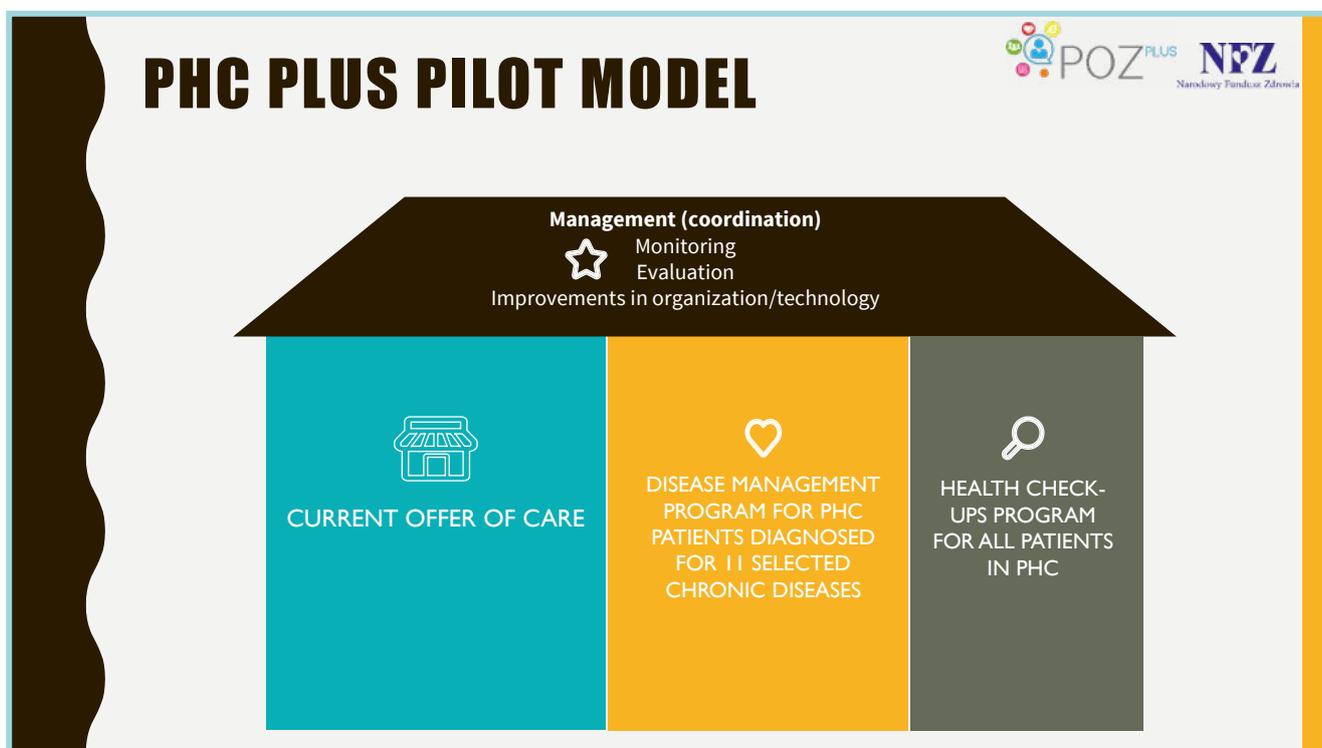


Figure 9 - National Health Fond - PHC Plus Pilot Model

The model is to be patient-centered and preventive rather than service-centered and remedial. It was developed in the process of analysing and reviewing coordinated care examples from other countries (Northwest London Integrated Care, Alaskan Nuka System of Care, Kaiser Permanente from the USA, German Gesundes Kinzigtal, Program-for-Results reforms from China and Costa Rica, and many more). It was also consulted with a number of stakeholders: Ministry of Health, NFZ, healthcare providers, non-governmental organisations, healthcare professionals and, last but not least, PHC patients (27). Finally, in 2017 a small-scale test of coordinated PHC was carried out on 122 patients of 13 PHC clinics and analysed before the PHC Plus was officially launched (28).

Mrs. Wiktorzak highlighted that when patients are fully engaged in taking care of their own health, they are more willing to follow the doctor's recommendation and smoothly take a step towards self-care and management of their own health.

In this perspective, the NHF tries to encourage the patients to participate in preventive programs, use free tools and technologies use motivations, techniques, orders etc. but unfortunately, it will not help much if patients are not motivated to change.

Mrs. Wiktorzak showed various types of tools which the National Health Fund use for the implementation of Personalised Healthcare.

Training - on website, YouTube etc.:

1. Workshops, E-learning on NHF Academy
2. Meetings with Providers' Teams to discuss challenges and share practices, on-going coaching, webinars
3. Guidelines, books, study materials (some of the publications are also for children - NHF published the coloring books for children with the subjects related to health and of course the materials are in the electronic form and the patient can easily download it from the website).

Other types of support are:

1. M-health applications for patients, patient self-management tools
2. On site visits
3. Constant feedback on quality progress
4. e-Health and telemedicine, individual patient account
5. Personalised Care Plan (PCP)
6. Educational visits

NHF monitoring, evaluation and benchmarking tools:

1. Constant feedback from patients (surveys)
2. Feedback from the dashboard (database analysis)

KEY MESSAGES

- The National Health Fund should further develop the potential in providing tools to patients
- Healthcare providers should facilitate patient's communication with the doctor by introducing a new type of service based on telemedicine and telehealth diagnostic, while strengthening the patient to manage their own health

- The primary care physician team should watch over the patients because they have a better and closer contact with them and they know their needs.

Dr. Antoni Zwiefka from **Public Health Department, Lower Silesian Marshal Office** brought his contribution to the discussion about innovative tools for a better management of patient's health. The Patient Rescue Support Project WRIST-BAND DEVICE (WRP).

Traditional solutions are no longer meeting the needs of an ageing society. The goal of the project is to develop an innovative concept of care adapted to solve problems related to the demographic change. The current development of technology gives the opportunity to create services that support an independent life of the older people.

This is how the Patient Rescue Support (PRS) was created. The project has been implemented in 2016 by Autumn People Foundation, in Lower Silesia. The project covers half of Lower Silesia region.

The WRIST-BAND DEVICE can work in two ways:

1. It collects basic data (real time physiological signals) on a wrist as a supportive tool helping a person with frailty without requiring intervention of the ambulance - data from the bracelet ID given to the dispatcher
2. It can provide access the clinic data to doctors and medical staff.

The project represents another tool to guide healthcare systems towards personalised and patient-centered systems.

Prof. Tjalf Ziemssen, University Clinic Carl – Gustav Carus, discussed with the audience the barriers and challenges for the introduction of eHealth approaches into chronic networking care of patients with Multiple Sclerosis.

Multiple Sclerosis (MS) is a very complex, chronic disease, where the central nervous system is attacked by the immune cells, and it mostly affects young adults. The life expectancy is not reduced significantly, and the patients must live with the disease for a long period.

The big problem is that usually the diagnosis and the therapeutic intervention is delayed. In Multiple Sclerosis neurons die in the brain, and a delayed diagnosis significantly worsens the severity of the progression. Prof. Ziemssen developed the **BRAIN - Brain Health Initiative**, which implements a strategy to maximize lifelong 'brain health' in people with MS and includes recommendations on how to achieve this goal, grouped under three overarching themes.

1. Minimize delays in diagnosis of MS and in the time to treatment initiation

2. Set goals for treatment and ongoing management that will optimize outcomes for every person with MS
3. Consult the most robust evidence base possible when making treatment and management decisions

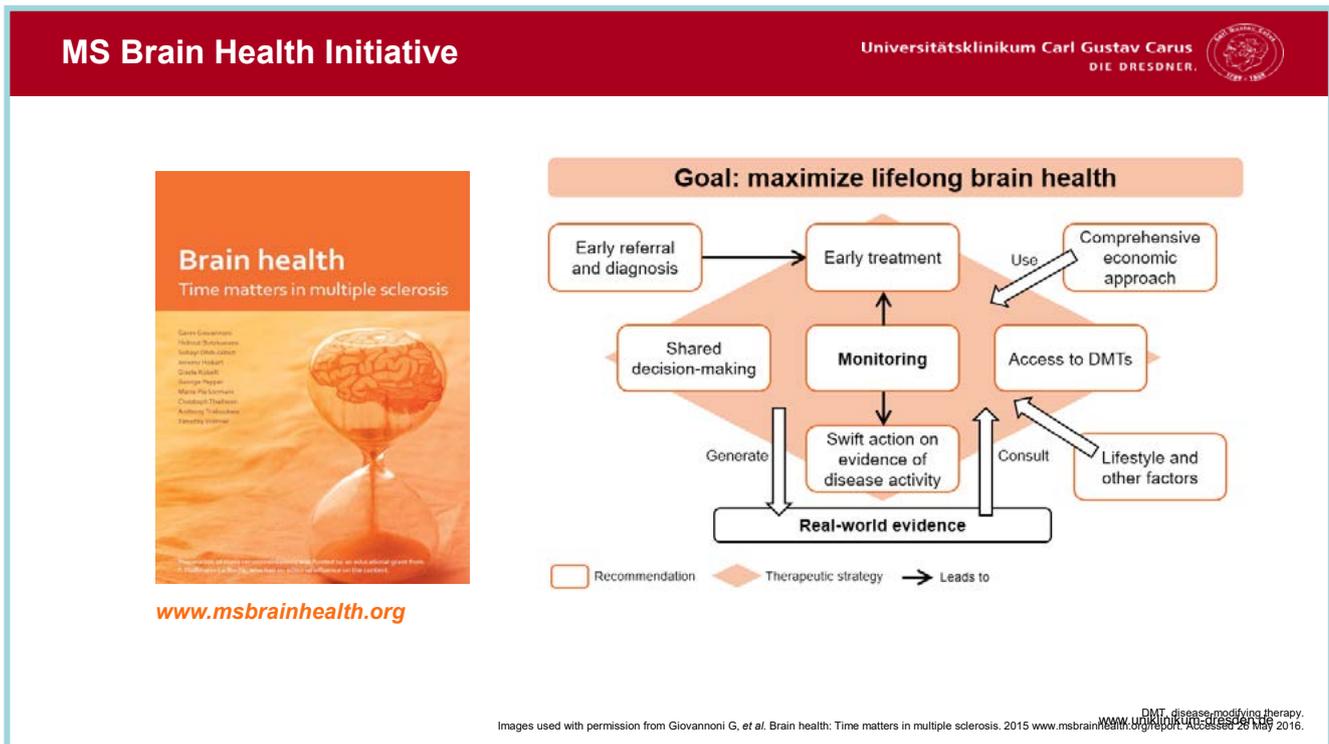


Figure 10 - MS Brain Health Initiative

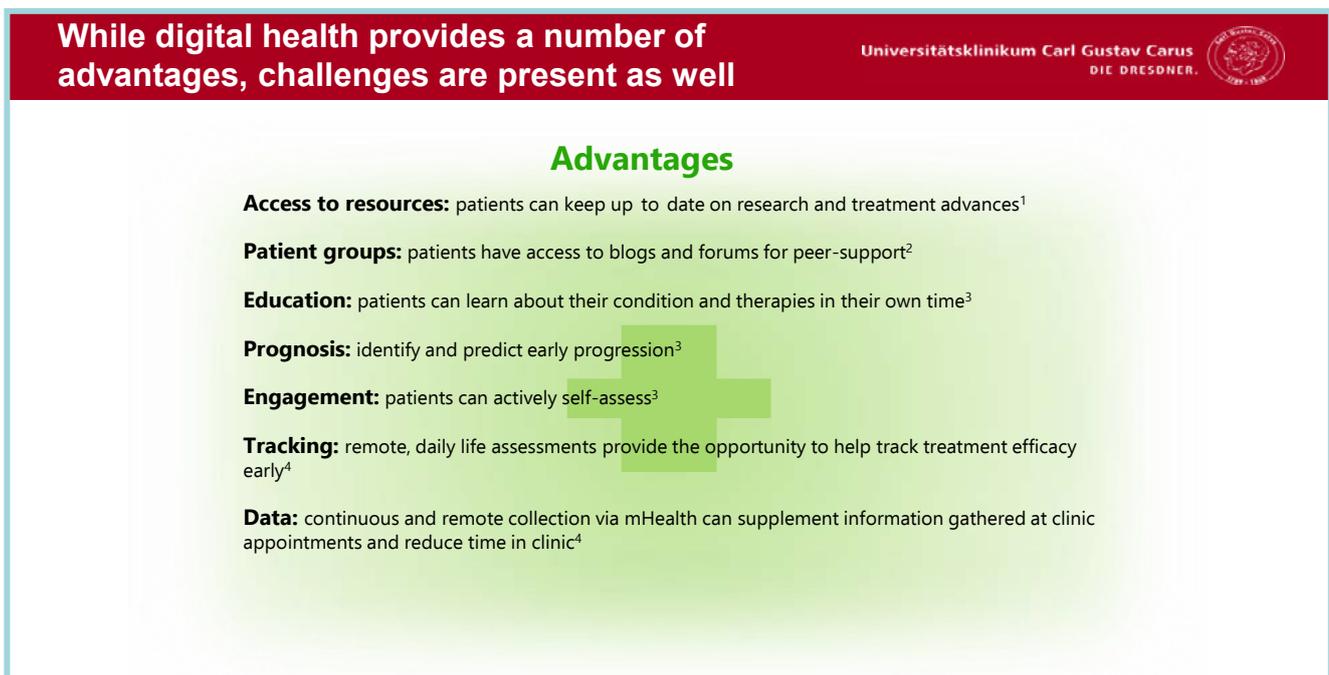


Figure 11 - Advantages of digital health in Multiple Sclerosis

The MS Brain Health Initiative aims to connect with the diverse audiences directly and indirectly involved in MS care to help implement these changes.

The multidisciplinary MS Brain Health Steering Committee guides the initiative’s ongoing strategy for the global dissemination and implementation of the recommendations presented in Brain Health: time matters in multiple sclerosis. The Steering Committee includes authors of the original report and representatives from patient organizations.

Data collection is of paramount importance. This can be important in the feedback loop as data can tell patients which treatment works best for them.

Nowadays it is possible to continuously generate data which cannot, unfortunately, be taken into clinical practice.

In order to move towards personalised patient care solutions in MS, Prof. Ziemssen highlighted different steps:

1. **Better measurement of MS disease:** Create a **community** and **regulator-accepted** endpoints and outcomes that will redefine the measurement of MS disease progression, and thereby change the understanding of MS
2. **Better management of the MS disease:** create **tools** to enable the better management of disease progression
3. **Leveraging across Neuroscience:** **establish** processes, standards, and platforms **to facilitate broad use of digital tools, big data, and advanced analytics across our neuroscience portfolio**

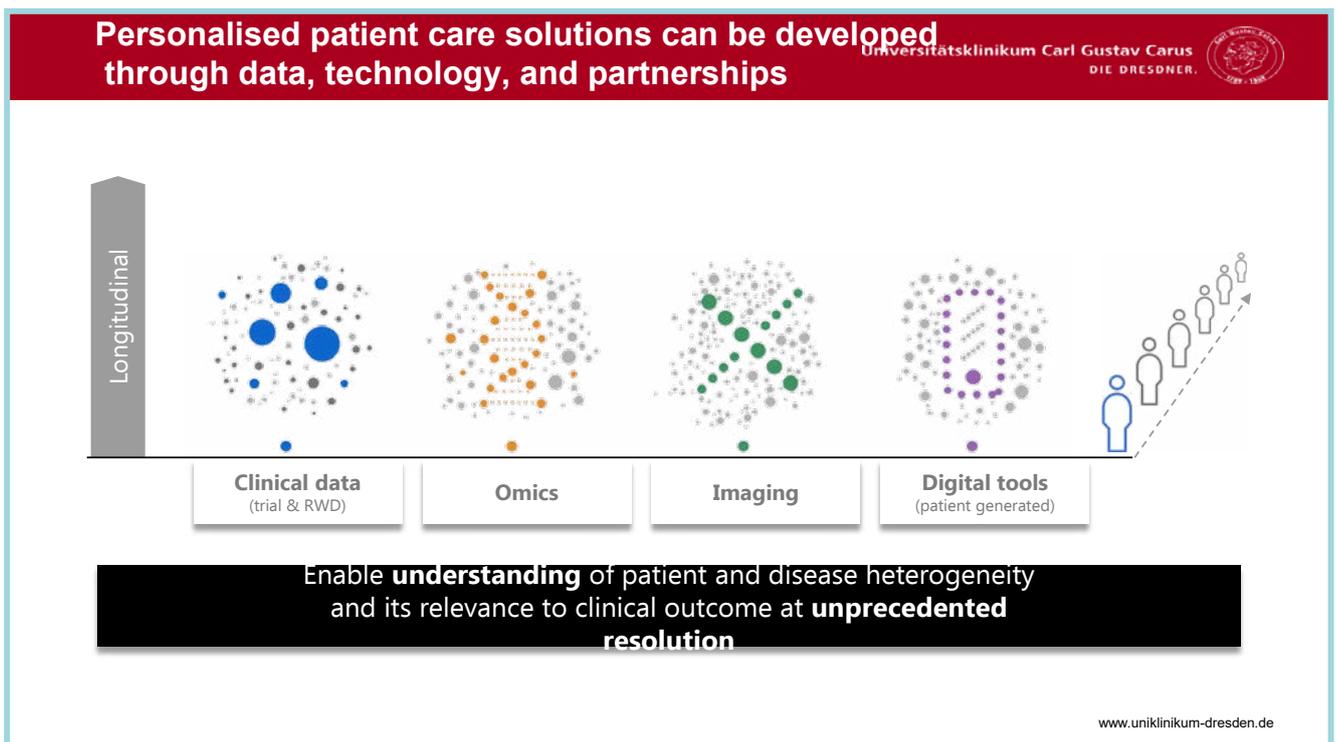


Figure 12 – Personalised patient care solutions in MS

SESSION III - Healthcare & Health Technology Assessment for health innovations.

CHAIR

Prof. Victoria Tkachenko, Shupyk National Medical Academy of Postgraduate Education.

SPEAKERS

Marco D'Angelantonio from **HIMsa** presented the information about technology-enabled home care at the time of coronavirus and how it can become useful for the implementation of PM. He highlighted the problem of the difficult time of coronavirus for home care.



Figure 13 - Coronavirus, the next global catastrophe

Marco D'Angelantonio brought to the attention of the audience on how HIMsa developed an application to monitor the health status of patient also through data collected by medical devices shipped directly to patients. Depending on the level and complexity of the morbidity, there is several data collected by devices, analyzed and then sent to the clinician to help taking a medical decision.

This has improved the management of COVID-19 patients, reduced the pressure on the healthcare system, but also paved the way to a higher level of remote monitoring of people with

chronic illnesses and represent the key aspects to implement more personalized approaches within the Polish healthcare systems.

The principle that enabled HIMsa to develop and use their system is the same that could enable personalized healthcare solution to be deployed on a large scale throughout Europe.

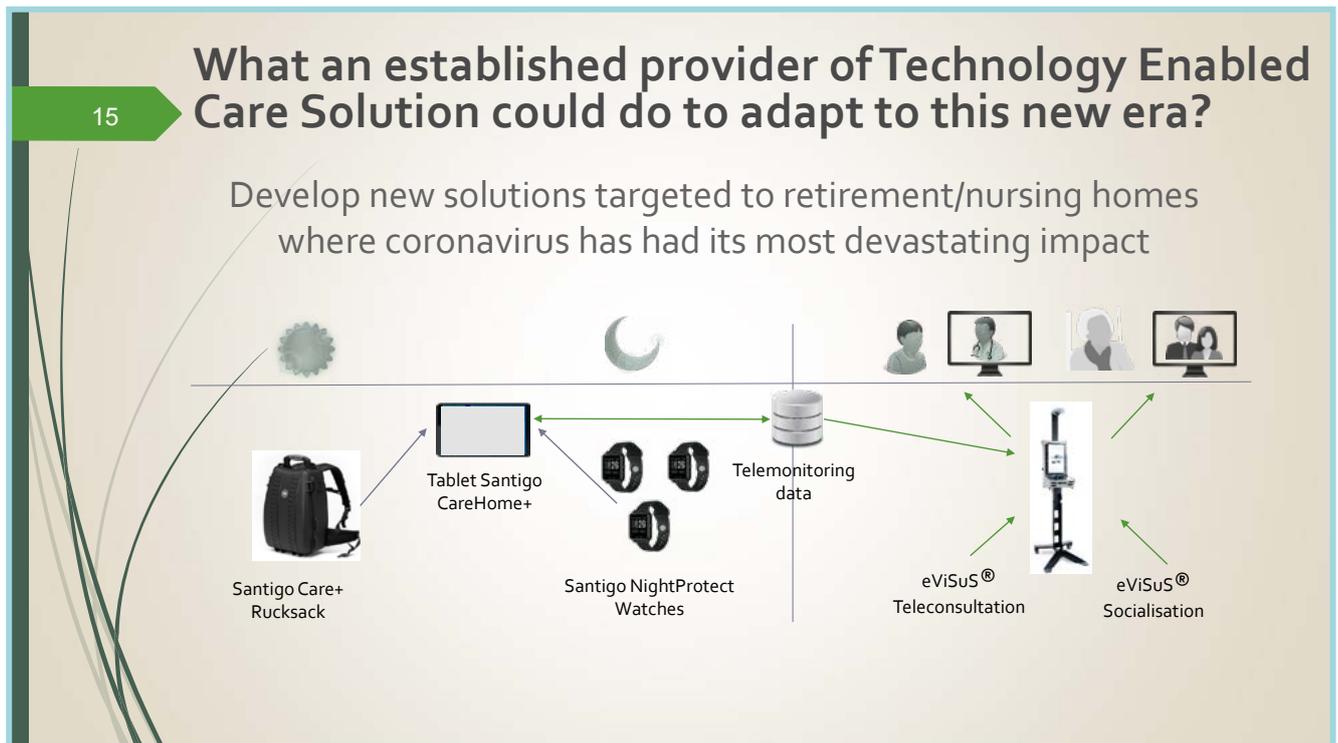


Figure 14 - Technology Enabled Care Solution and the potential adaptation

KEY MESSAGES

- Investments in Technology-Enabled Care have been demonstrated to be useful for a better management of the pandemic and there is clear evidence about the benefit it brings to Personalised Medicine
- Suppliers are more important than the technology itself (there are elements such as logistics, registration of patients and automatic configuration of applications, ease-of-use, reliability, and know-how of the supplier)
- There is a clear need to build a partnership relation with health suppliers rather than impose a one-off deal at the lowest possible price

Jagoda Kowalik, Technical Account Manager from Cardiomatics Company informed about digital health technology solutions that are radically transforming the clinical practice.

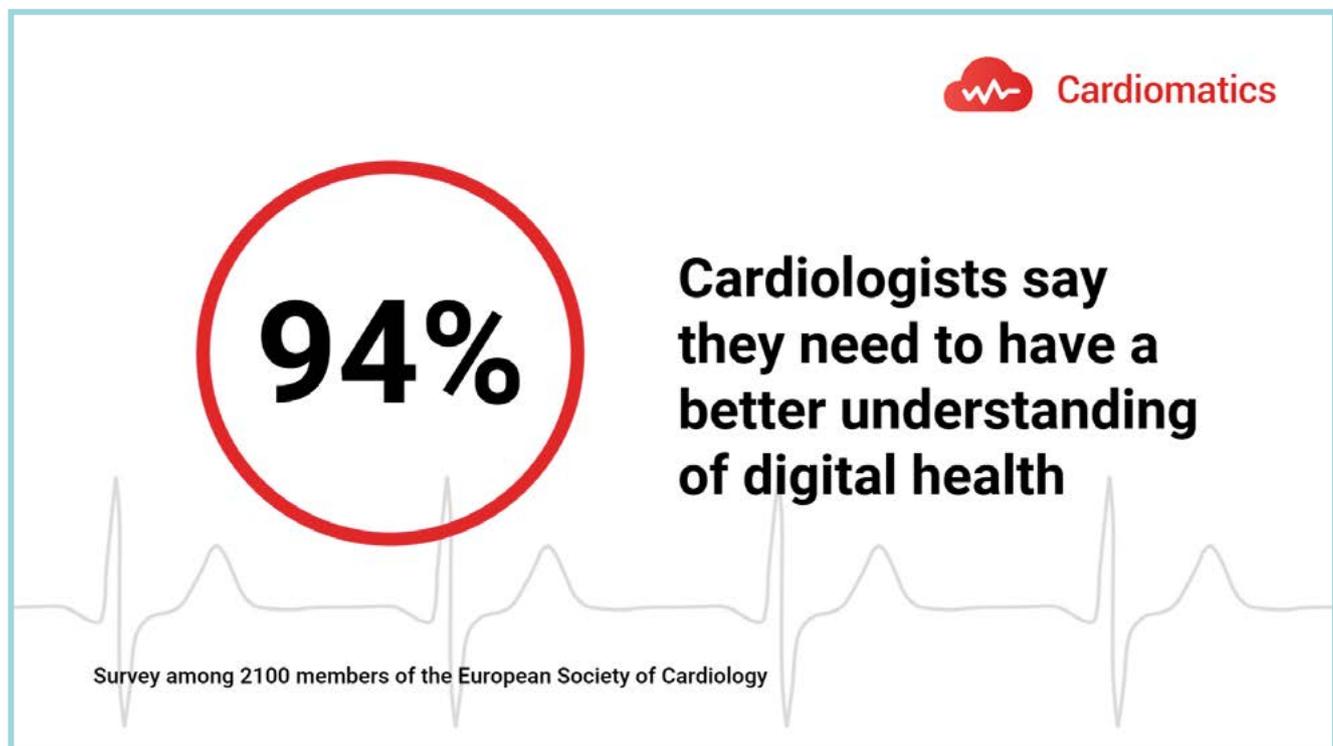


Figure 15 - Using Cardiomatics by Cardiologists

Cardiomatics created an educational program to increase digital awareness within medical students and medical professionals. Artificial Intelligence (AI) is becoming part of our daily activities in almost every aspect of our lives. Cardiomatics aims to increase digital and technological literacy about solutions that are about to enter the market.

One of the main focuses is to disseminate knowledge on AI-related solutions.

As Ms. Kowalik pointed out, AI assists clinicians in their decision-making process and allows them to perform more tasks more efficiently.

AI-assisted solutions can be of great support especially for young doctors in their activities, like evaluating the outcomes of an electrocardiogram (ECG). A good interpretation of this signal is crucial for the diagnosis but comes with years of experience.

That is why Cardiomatics applies advanced machine-learning techniques to get the maximum possible value out of an ECG recording. In other words, it's a big calculator that replaces the old school methods of ECG analysis. So, the more ECGs the algorithm sees, the more experienced it becomes. It has already seen billions of heartbeats up until now and is growing weekly with the data that are provided by over 200 of the weekly users over five European countries.

Part of the program is free access to the Cardiomatics platform for educational purposes.

Basic Program Components:

- Access to Cardiomatics web platform for educational purposes
- Detailed instructions for students and for teachers
- Materials on role of AI in medicine
- Support for teachers Additional Program Components
- Lecture from tech/medical/business experts
- Bespoke classes on AI in medicine
- Site visit in Cardiomatics headquarter (Kraków, Poland)

Ms. Kowalik highlighted that Cardiomatics AI-based ECG interpretation tool has a clinically proven value.

Cardiomatics products allow cardiac arrhythmias to be assessed more effectively and to minimize the time needed for cardiologists to evaluate data received from the Holter monitor due to the use of Cardiomatics' algorithms, which are based on Artificial Intelligence.

Cardiomatics offers cutting-edge, cloud AI-based digital analysis of data from Holter ECGs. It is a medical-grade system based on accurate algorithms which ensure high-quality and trusted outcomes.

Also automating such routine tasks can be a boon for healthcare professionals in times of a pandemic that represents an unprecedented drain on human resources.

The solutions presented above complement the decision-making process in the systems of care for patients with acute and chronic diseases.

KEY MESSAGES

- The use of modern technologies should take place in cooperation with the users of these technologies
- There will be limitations in the communication on the line: users vs. service provider
- The use of modern technologies complements which don't replace the decision-making process of professionals in constant contact with patients and their caregivers.

Joanna Gruchot from Wroclaw Medical University presented the **Heartbit_4.0 project**: application of innovative Medical Data Science technologies for heart diseases.

Within the HeartBIT_4.0 project, the excellence partners/ consortium members from Germany and Czech Republic train the staff from the Wroclaw Medical University in the field of data science and application of data science techniques to medicine.

Joanna Gruchot pointed that the support of medical care requires new skills related to effective control of applied medication and methods of treatment. There are available technologies to facilitate continuous patient monitoring, including the generation of warning signals, enabling real-time decision support (at the bedside) as well as the ability to dynamically respond to emerging medical conditions and to personalize complex medical care. In the face of progressive digitization, which also involves medicine, acquiring skills based on modern, advanced and state-of-the-art computational and analytical techniques, is essential.

As she explained, the leader of the consortium (The Department of Heart Diseases) has no experience in using modern state-of-the-art methods of analysis and interpretation of large medical data sets. Due to the lack of these skills in the post-industrial era of Big Data and e-society, the Department is forced to accept a secondary role in the contemporary development of biomedical sciences.

Establishing the consortium under Horizon 2020 twinning programme and thus formal cooperation with the leading scientific departments from the European Union member states with a higher expertise in biomedical data science will significantly increase the scientific potential of the whole University.

Moreover, the acquisition of the competencies described above will make Wroclaw Medical University a valuable partner for future cooperation, research projects at the national and international level. The acquisition of the above-described competences in cardiology will be the first step in implementing this approach in other fields of medicine so that the ultimate beneficiary of the HeartBIT_4.0 project will be the entire university.

Slawomir Kmak, Healthcare Affairs Director from StethoMe presented their smart solution to improve primary care diagnostics for lung and heart screening, an innovative way to do diseases prevention.

The purpose of the company is to deliver the telemedicine solution, which is a missing puzzle piece in the remote interaction between doctor and patient. With their solution they are able to facilitate both the diagnostic and treatment process of lung and heart diseases.

The first element is the smart stethoscope, the physical device

that enables precise auscultation of both heart and lungs. The second element, the most vital one, is the deployment of AI to analyze detected pathological sound due to pulmonary infections, asthma, COPD, etc. Their algorithm can detect four main classes of abnormal sounds to facilitate and support the physician in taking a proper decision, especially the auscultation.

It creates a unique connection of two products:



StethoMe® Smart Stethoscope

StethoMe® is a smart electronic stethoscope. It enables more precise auscultation of patient's lungs and heart.



StethoMe® AI Algorithms

StethoMe® AI is a smart sound analysis system based on AI algorithms that detect and classify abnormal lung sounds.



Figure 16- StethoMe Smart Stethoscope + StethoMe AI Algorithms

Mr. Kmak highlighted that it is a certified medical product. Both elements are certified II class medical diagnostic tool.

Currently the auscultation performed by StethoMe is 29% more accurate than specialists and general physicians, but the stethoscope can also be used as a standard analog device daily in the consultation office providing notes or with vital feedback regarding day-by-day oscillation and examinations.

The idea was to generate a real medical history from the examination to prove, to build some medical data, electronic health record and to also adjust the patient condition to his individual personalised form. The solution itself can be used on the one hand by the patient themselves, at home by people without any clinical background and without any knowledge, and by caregivers. On the other hand, the company supports the prevention diagnosis.

Mr. Kmak highlighted that the company is not a telemedicine provider, nor a healthcare provider. The company is open to

work with different partners in telemedicine and healthcare provision fields, for example hospitals or insurers interested in utilizing the telemedicine services for their clients or their patients. This is a safe model where the company doesn't store any sensitive, vital patient data. Everything stays on the medical provider site.

This is something that can really revolutionize everyday interaction with the healthcare provider at least at the primary care level or in the chronic disease management approach.

Tomasz Gondek co-founder of **SensDX**, presented a solution to detect etiology of the infection in point of care settings through protein biomarkers. They focus on a wide variety of pathogens, both viruses and bacteria.

The idea behind the company thinking – advancing diagnostic tests, which should be precise as genetic testing (through Polymerase Chain Reaction - PCR), low cost for laboratories, easy to use at home by non-professionals. The test is able to do everything that the laboratory does, but in an environment which is not professional.

SensDX wants to bring these devices at patients' home and carry out testings as reliable as laboratory tests but quicker and in a more efficient way. The device has a multiple use reader, it is connected with the computer or mobile, and it detects even a small amount of protein in a sample. SensDX deploys patent pending technologies to create stable biofilms capable of binding specific, targeted molecules of tested pathogens or biomarkers. It is a robust approach that allows to produce biofilms testing for the presence of viruses, bacteria, RNA, DNA, oncological markers, etc.

He highlighted that the unique thing is that people don't need to be qualified, they don't need to have any specific knowledge to use it.

The tool has changed the core part of part of how pathogens will be detected, and it gives the power to the physician and other users to use the antibiotics properly, to choose the treatment of patients properly and to decide directly about a treatment when the physician is talking with the patient.

It will change how the system is built. It will create a completely new environment and process for detecting and screening the patients for example in oncology, for other uses when quick screening is needed and for not allowing people that could be infected to enter any space that is forbidden.

At the same time the company is working on tests for the intimate infection and urinary tract infection. SensDx will start from testing in home spaces, from the clinics, from the test used by the professionals as nurses and physicians.

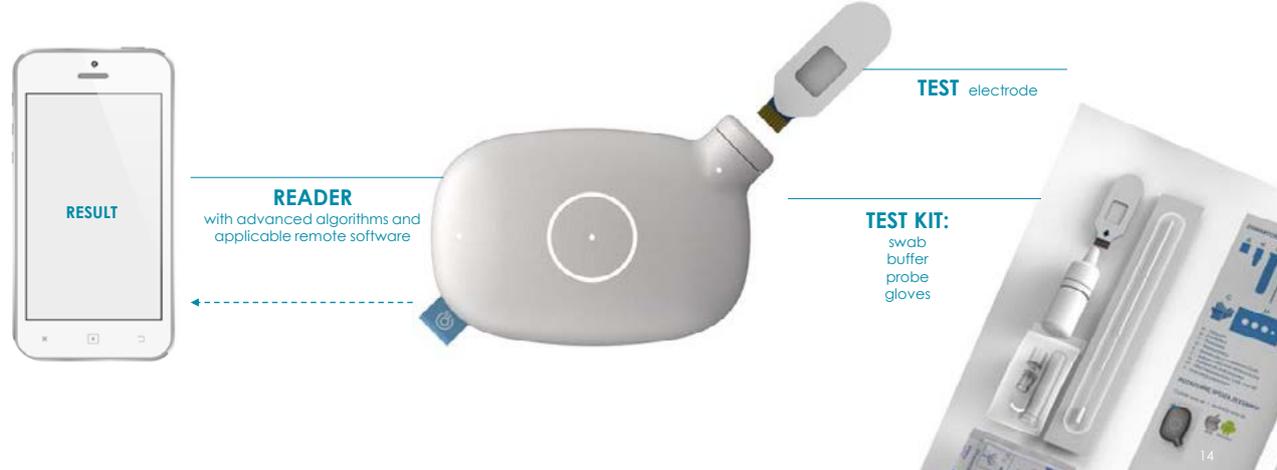
The company plan is also to reach out with the test to the homeless. The data from these tests can be transferred to the Global Positioning System (GPS) and then decide how the treatment should be implemented.

So, from the company's point of view it is a combination of something existing on the market with a new technology and other sensors.

SensDx can deliver such solution



ACCURATE, QUICK, EASY-TO-USE AND LOW-COST diagnostics of a spectrum of infections



READER
with advanced algorithms and applicable remote software

TEST electrode

TEST KIT:
swab
buffer
probe
gloves

Figure 17 - ACCURATE, QUICK, EASY-TO-USE AND LOW-COST diagnostics of a spectrum of infections

2.1 Main outcomes of the conference

Personalised Medicine requires cross-border and inter-disciplinary collaboration and the involvement of stakeholders along the healthcare continuum. The European Framework Programme for Research and Innovation Horizon Europe is providing funds to validate innovation in clinical setting through interregional and interdisciplinary collaboration

Developing and validating the potential in providing proven tools solutions for patients and health care providers to facilitate the patient's communication with the doctor.

New methods to gather the patients's voice (PROs and PREs) should be used to validate new organizational healthcare settings. The introduction of this new type of service is based on telemedicine and telehealth diagnostic, while strengthening the patients to manage their own health.

Prevention is key if we want to achieve sustainable healthcare systems.

Harmonized strategies to update the curricula of future healthcare workers are needed.

Standards, processes, and platforms to facilitate broad use of digital tools, big data, and advanced analytics across our neuroscience portfolio should be encouraged

Technology can help in detecting emergencies and supporting healthcare professionals by giving them early access to health information and recommendations. Public-Private Partnerships should be encouraged in this field.

Health Care Providers should encourage the scope of identification, selection, and implementation of innovation in healthcare and promote the service providers to apply advanced technological and management tools.

The institution of multidisciplinary teams is fundamental. Precision medicine especially in this pioneer phase requires competencies and only a highly specialized and synergistic approach of different people may provide these competencies.

Artificial Intelligence is becoming part of our daily life as well as healthcare professionals' lives and is already applicable in image and signal processing, symptoms, and diagnosis support.

2.2 In situ visits

Due to the COVID-19 pandemic, the in-situ visits could not be organized in person, virtual presentations were given instead.

2.2.1 Cardiomatics



Cardiomatics acts in the field of cardiac electrophysiology, facilitates and speeds up the diagnosis of arrhythmia. Trusted by cardiologists and by patients, it developed a certified medical device perfectly suiting the needs and its mission is to make ECG analytics available to everyone.

As a standard, analysis of Holter ECGs is performed manually by healthcare professionals. It can be difficult and time-consuming and is a growing problem in the treatment of common heart disease, especially in the times of COVID-19.

Cardiomatics is a medical-grade system class IIa based on accurate, clinically validated algorithms which ensure high-quality and trusted outcomes of ECG analysis.

The cloud tool speeds up diagnosis and drives efficiency for cardiologists, clinicians, and other healthcare professionals to interpret ECGs – automating the detection and analysis of some 20 heart abnormalities. The software can integrate with more than 25 ECG monitoring devices, offering a modern cloud software interface as a differentiator versus legacy medical software.

The customizable, multi-language cloud platform significantly reduces the time of analysis by seamlessly and quickly transferring data into an application and performing detailed



Figure 18 – ECG analysis report

analysis and interpretation of it. Shortly thereafter, the doctor receives a detailed test report on which he or she can base his or her diagnosis.

The AI tool has analyzed more than 3 million hours of ECG signals commercially to date. The software is currently being used by more than 700 customers in 10+ countries, including Switzerland, Denmark, and Germany.

The Cardiomatics team is still developing its product to fit into more patients' and physicians' journeys. In the future, this will include pediatric applications, direct-to-consumer analysis, and broadening diagnostic yield.

2.2.2 Infermedica **Infermedica**

Infermedica's objective is to transform healthcare.

The healthcare industry has never been so advanced, to guide patients in the right care, makes it easier to pre-diagnose, triage, and direct your patients to appropriate medical services. Unfortunately, there are still so many patients who don't receive the right care at the right time.

Infermedica thrives in the face of this global challenge by focusing on leading-edge technology to create patient-oriented solutions, including reliable pre-diagnosis, which significantly improves patient flow and enhances patient satisfaction.

Over the years, Infermedica has worked to make primary care more accessible for patients and to provide AI-driven support for health professionals. The company human-centric health applications are appreciated by users worldwide for helping them to make informed health decisions.

Infermedica develops its diagnostic engine to collect intake, check symptoms, and guide patients to the right care.

The technology can also detect emergencies and support healthcare professionals by giving them early access to health information and recommendations. Infermedica tackles the problem of inappropriate use of medical services and misdiagnosis, providing insurance companies, hospitals, and health systems with a set of advanced preliminary diagnosis and triage tools, that include products: Symptom Checker, Call Center Triage, Emergency Room Triage, and Medical Active Pharmaceutical Ingredient (API).

The company uses artificial intelligence and machine learning to assess symptoms and find patterns in data.

Thanks to algorithms, Infermedica gets smarter over time. Besides, the team of physicians verifies every piece of information that is added to the medical database to ensure that patients get safe and reliable recommendations. To date, the physicians involved in the project have spent over 20,000 hours doing the review.

Infermedica:

- Helps insurance, healthcare and pharmaceutical companies increase efficiency, improve patient flow, and reduce costs
- Its technology combines the power of algorithms and the experience of doctors
- Develops mobile, web and chatbot apps that are easy to use and integrate
- Its apps operate in 18 languages and the language catalogue is being constantly expanded.

2.2.3 Medical Simulation Centre, Wroclaw Medical University

The Medical Simulation Centre is one of the most innovative investments of the Wroclaw Medical University. It has six rooms similar to those of a real hospital, where students practice their skills using interactive and highly advanced equipment:

- operating room
- intensive care room
- labour ward
- Emergency Room (ER)
- ambulance simulator
- nurses' room

The Medical Simulation Centre is still working on the development of didactics in Wrocław. It is a project of the Polish Ministry of Health co-financed by the European Social Fund.

The goals of the Medical Simulation Centre are:

- Educational and scientific activities for academic teachers
- The purchase of equipment for the Medical Simulation Centre
- Implementation of the development program

Simulation advantages:

- Avoided risks to patients and learners
- Tasks/scenarios created to demand
- Repeatedly practiced skills
- Training tailored to individuals
- Transfer of training from classroom to real situation

Simulation limitations:

- Simulation is as good as the educational program and faculty
- Need for development of standardized methods of assessment

Improving the quality of Health Care in the Polish public health system - Patient's safety program:

- Medical errors report
- Inspection
- Problem analysis
- Conclusions
- Program and Training
- Evaluation of effects



Figure 19 - Medical Simulation Centre at WMU



Figure 20 – Emergency department at Medical Simulation Centre at WMU

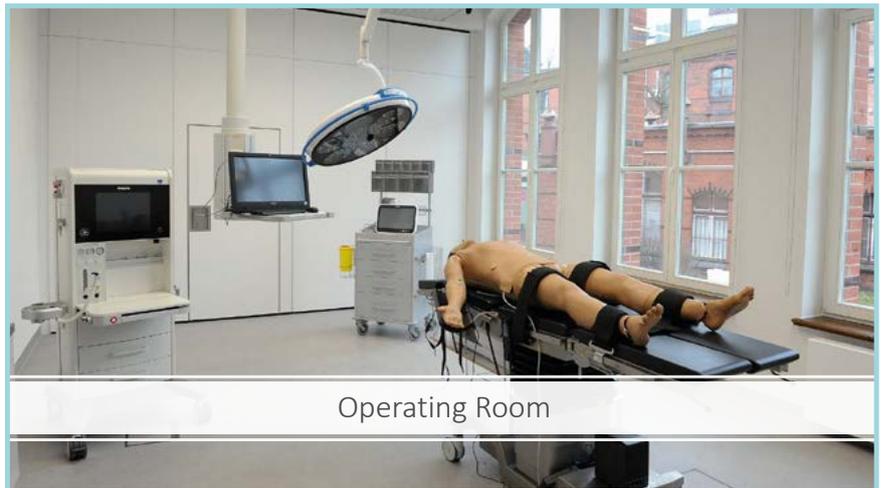


Figure 21 – Operating Room at Medical Simulation Centre at WMU

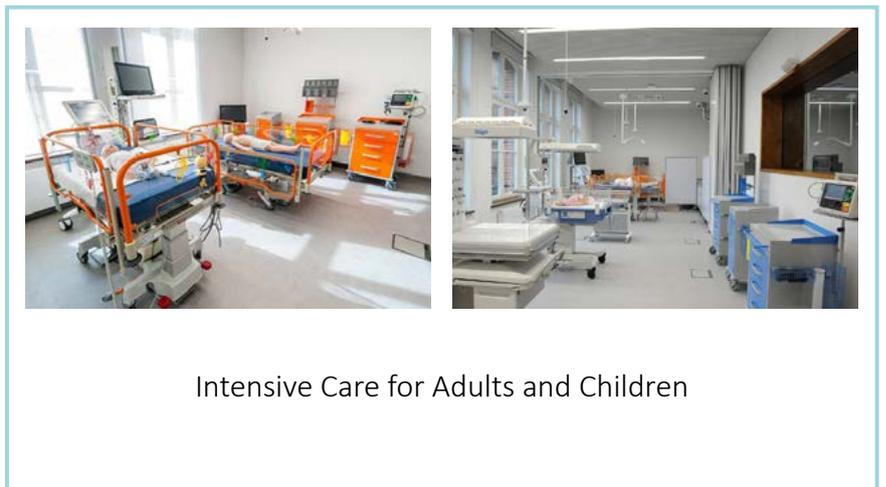


Figure 22 – Intensive Care for adults and children at Medical Simulation Centre at WMU

3. KA2 Second interregional Workshop

The Workshop has been hosted by Marshal's Office of Lower Silesia Voivodeship and represented a follow-up of the KA2 Conference. The event took place on March 23rd and 24th, 2021, in an online mode, due to the COVID-19 restrictions.

The aim was to trigger further discussion on how the main challenges highlighted within the Conference can be tackled at regional level. The Workshop enabled international stakeholders to virtually witness the principles of implementation of Personalised Medicine and healthcare paradigms in terms of policy, investment, and governance.

With all these aspects in mind, all speakers and panelists have been selected according to their expertise and their ability to fuel the debate. Furthermore, each session has been organized with the purpose of leaving time for discussion among participants. The attendees of the event were regional and governmental entities involved in health policies coming from project's partner's countries (Italy, Poland, Germany, and Spain) and beyond.

The main roles during the sessions are described below:

CHAIR

The role was to open the discussion, introduce the topic, give the floor to the speakers, and manage the Q&A session.

RAPPORTEUR

focusing on the discussion, the Rapporteur took notes during the debate that followed the presentations of the speakers, he/she would raise questions to orientate the debate (in case questions led the discussion out of topic) and, at the end of the session, summarized the main points discussed that could be common issues/common solutions, new best practices, suggestions, etc. Those main points were presented by the Rapporteur the day after, during the plenary session.

SPEAKERS

either experts/policy makers/representatives of the public or private sector that presented best practices around the session.

The main objective of the Workshop was to facilitate co-operative exchanges among participants to explore healthcare technologies as well as integrated care solutions.

All Speakers, Chairs and Rapporteurs have been actively involved in the organization of the Workshop. They were provided with a briefing document as a guide to learn about expectations on their roles, biographies, and topics of the speakers' presentations. In addition, teleconferences were organized with Speakers, Chairs and Rapporteurs of each session, to elaborate the session structure and to identify challenging questions, aimed at triggering the debate among participants.

The main objective of the Workshop was to facilitate co-operative exchanges among participants to explore healthcare technologies as well as integrated care solutions. The plan was to discuss "Best Practices" examples, as well as capacity building activities and policy co-creation with all the regional authorities and stakeholders.

The Workshop focused on **five Policy Intervention Areas**:

1. Connecting the regulatory aspect with Personalised Health Technologies
2. The use of open and interoperable platforms for data integration within health care services
3. Healthcare for health innovations
4. Personal data management
5. Remote monitoring and tele-assistance

The organizer of the event was Lower Silesia Marshall Office, with the scientific supervision of Wroclaw Medical University. Both hosting entities are placed in Lower Silesia, Poland. All presentations of the Workshop were conducted remotely via an online platform.

The development of the agenda for the Workshop started from the input given by the experts who presented at the Conference.

The overall introduction to the topic has opened the agenda followed by discussions leading to defining regional path(s) towards Personalised Medicine and healthcare. Outstanding "Best Practice" examples, as well as capacity building activities and policy co-creation with all the regional authorities and stakeholders involved have taken place. The Workshop and sessions within the meetings have started with keynote lectures focusing on the value of data and the political responsibility. The workshop's main objective was to facilitate co-operative exchanges among participants to explore healthcare technologies as well as integrated care solutions. Eventually, the agenda of the event shall bring us closer to a common ground, which derives from and relies on the notion of the use of data sharing and patients' and citizens' trust in digital technology in healthcare systems.

The first Workshop Day began with the welcome message delivered by Waldemar Plinski on behalf of the Director of the Health Department of the Marshal's Office of the Lower Silesian Voivodeship, followed by an introductory speech by Gianni D'Errico, Project Coordinator at the Fondazione Toscana Life Sciences, who has outlined the goals of the Workshop.

Following the opening session, the day continued with sessions dedicated to the other key intervention areas. The first part of the morning was dedicated to Regulatory Aspects, introducing the main challenges that national and regional health systems need to tackle to foster the translation of personalised health and medicine into real life settings. The panel sessions enabled participants to elaborate on the topics identified below as policy intervention areas.

POLICY INTERVENTION AREA 1 - Integrated care and personalised health

The point of the panel was that the development of new and digital solutions, specifically designed and targeted at various healthcare systems, requires synergy with stakeholders. Digital healthcare is a prerequisite for Personalised Medicine and personalised healthcare. Such approaches and actions are highly desirable and necessary to identify appropriate and possible m- and e-Health perspectives that are capable of redefining the way we interact in the healthcare system. The development of m- and e-health technology allows for continuous monitoring of patients, provides information on health, and, more importantly, represents the basis for patients' self-empowerment.

Thanks to **integrated care**, which we interpret as a **combination of medical and social care**, it is now possible to develop and implement a strategy that can support the personalization of patient health using technologies based on innovative processes. In terms of the patient's health needs, but also the process of personalizing patient care plans, it is important to create fluid and effective systems for future users. The analysis of satisfied and unmet needs of the patient requires examining the functionality of the system from the point of view of end users (doctors, nurses, patients, caregivers). It is important to know how to instill confidence in any new system. This should take into account aspects closely related to regulations and laws that directly relate to the safety and well-being of those interacting with the system. Currently existing technologies do not yet solve all problems related to healthcare.

CHAIR

Maria Szaśiadek from **the Medical University in Wrocław**, who talked about Personalised Medicine based on genetic changes.

The new approach to healthcare is a classic approach to PM that has been well developed in the past and is still not a closed topic. The presentation concerned Personalised Medicine based on genetic changes in oncology. This is the field in which Personalised Medicine began. The new approach to healthcare is based on the process of cancer transformation of all genes that are linked together in a complex network of interdependencies.

Knowing how all these genes are regulated by other genes upstream in the signaling pathway and regulate the activity of the genes themselves seems very important. It is a “vertical” system of regulation, and at the same time, the interrelationships of genes were expressed as “horizontal” bonds – e.g., by modifying the tumor ecosystem at the local (tissue) level and throughout the body (e.g., immunological). Such a new approach is a challenge for Personalised Medicine.

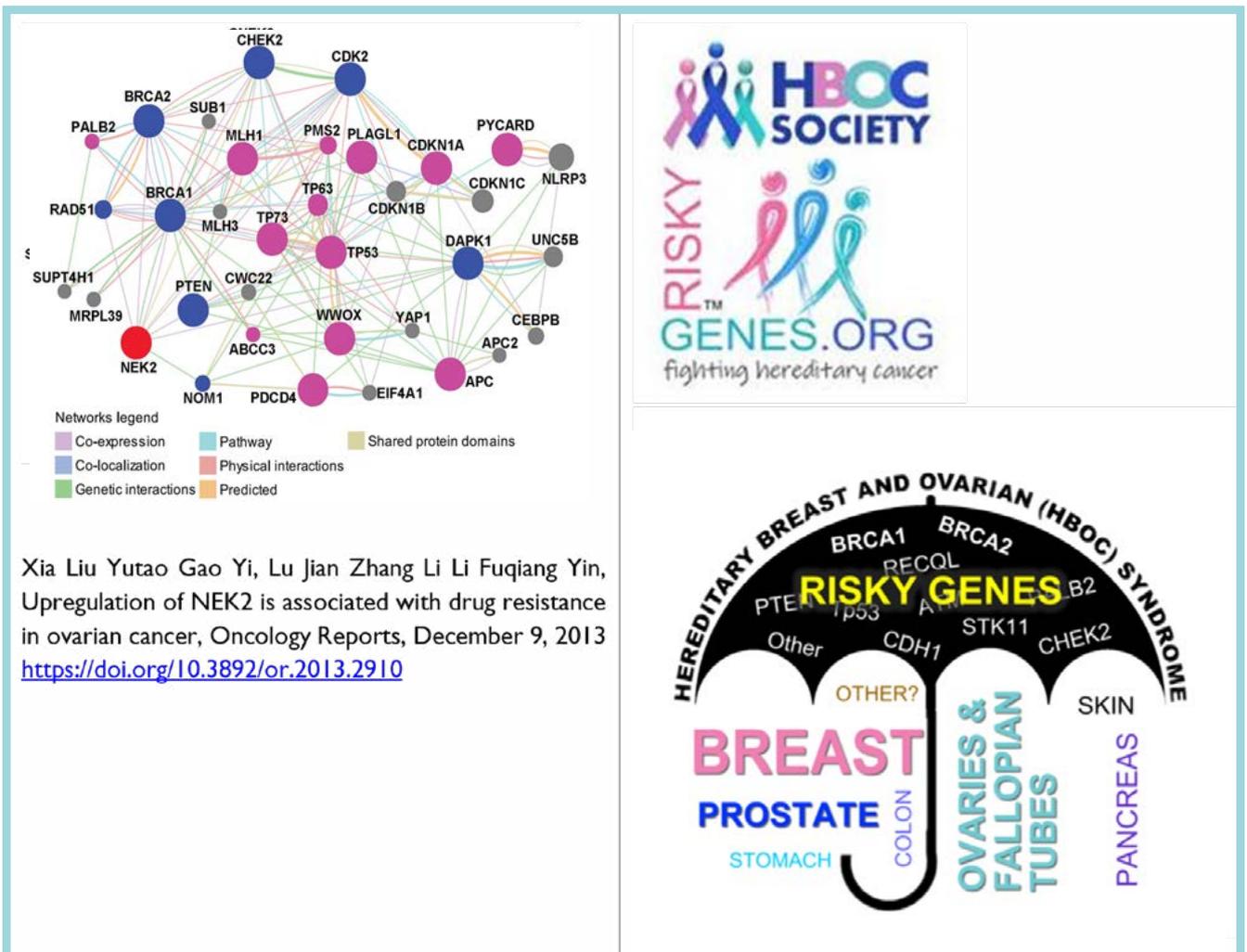


Figure 23 - Cancers are characterized by high genetic diversity, despite the same clinical manifestations of the disease.

This phenomenon is described by the concepts of genetic, allelic, and non-allelic heterogeneity. The term non-allelic heterogeneity means that the same disease may be conditioned by pathogenic variants in different genes. Cancers are characterized by the high clinical diversity as different cancers could result from the different mutation in the same critical gene. This is the truth for both hereditary and sporadic cancer.

Understanding that the same signaling pathways may be activated in different neoplasms lead to a modification of rules of classification of neoplastic tumors for the purpose of targeted management: the molecular classification has become important parallel to the organ-based classification. Treatment against specific molecular alterations that cause pathology is successful in many different cancers, however in limited period (about 2 years). It is necessary to note that Personalised Medicine provides a possibility of individualized treatment of a specific cancer patient. Identification of genetic alterations in cancer cells allows for applying of molecularly- targeted treatment, thus optimizing clinical effects of therapy, minimizing both side-effects and costs of therapy. Targeted therapy is effective for about 2 years. Thereafter, genetic background of disease changes, leading to non-response to therapy.

SPEAKERS

Esteban de Manuel Keenoy, **Kronikgune Institute for Health Services Research**, has presented "Digitally enabled integrated person-centered care".

Mr. De Manuel Keenoy pointed that for Personalised Health Challenges, which are based on anticipation, longitudinal perspective care and multidimensional actions need to be undertaken. Anticipation is key to prevent the occurrence and to avoid predictable complications through treatment and optimal management. Next, well-defined plan of care and follow-up, self-management, and actions monitoring performance and compliance are important for Longitudinal Perspective Care. Very important for Personalised Health are also Multidimensional Social Actions.

He presented the **Project JADECARE** (JADECARE Joint Action - Kronikgune Institute), realized within the framework of the European Commission 3rd Health Program (2014-2020), which was developed to:

- Reinforce the capacity of health authorities to successfully address important aspects of health system transformation, in particular the transition to digitally enabled, integrated, person-centered care

Collaboration and consensus seeking across all stakeholders were recognized as imperative features of their local environments and a basis for assuring continuity of practices.

- Support the best practice transfer from the systems of the “Early adopters” to the ones of the “Next adopters”

JADECARE Consortium was based on 17 Competent Authorities, 31 Affiliated Entities and 23 “Next adopters” from 15 European Countries and worked on the challenges connected with Health systems from all Europe covering different funding systems.

While there are numerous contextual differences between countries/healthcare systems where the original Good Practices are implemented, there are three overlapping core elements of sustainability, that were commonly regarded as highly important.

- Policy environment: the practices are embedded in the national or regional policy frameworks (health strategies, policies, funding mechanisms) and strong vertical linkages were established between relevant institutions and networks. The important feature is also the presence of political consensus on the needs, objectives and strategies on how to achieve health system transformation, resilient to political changes.
- Sustainability of ownership: Each original Good Practice is complex, consisting of a variety of interventions and there are different governance structures that are responsible for its continuity. Sustainability is facilitated by high level policy individuals, managers and champions, regional/local health organizations and departments, and/or integrator companies which engage in various formal and informal networks.

Culture of collaboration and consensus-seeking: culture as a set of beliefs, values, behaviours, perceptions and local conventions strongly influences practice implementation and its sustainability. Collaboration and consensus seeking across all stakeholders were recognized as imperative features of their local environments and a basis for assuring continuity of practices. The common and central goal in integrated care initiatives is easily accessible, seamless, highly coordinated care, from a patient’s perspective.

Another systemic approach to care is proposed by the Integrated Care Pathway Project. The aim is to merge hospital and primary care structures under one single organization, focusing on clinical and functional integration. The strategy deploys an integrated care model capable of providing continuity of care both at health and social care levels. Beneficiaries are aging people, patients, social workers and Nursing homes.

Another systemic approach of the Basque Region to integrated care is the Structured Program for Empowerment of Patients

and Caregivers. It was created based on experience of two projects KRONIKON and CareWell - realized with Lower Silesian Voivodeship Marshal Office. Patient empowerment general objectives are based on patient assessment, identification and explanation of diseases. Additionally, very important is adherence to treatment and self-control of symptoms and warning signs.

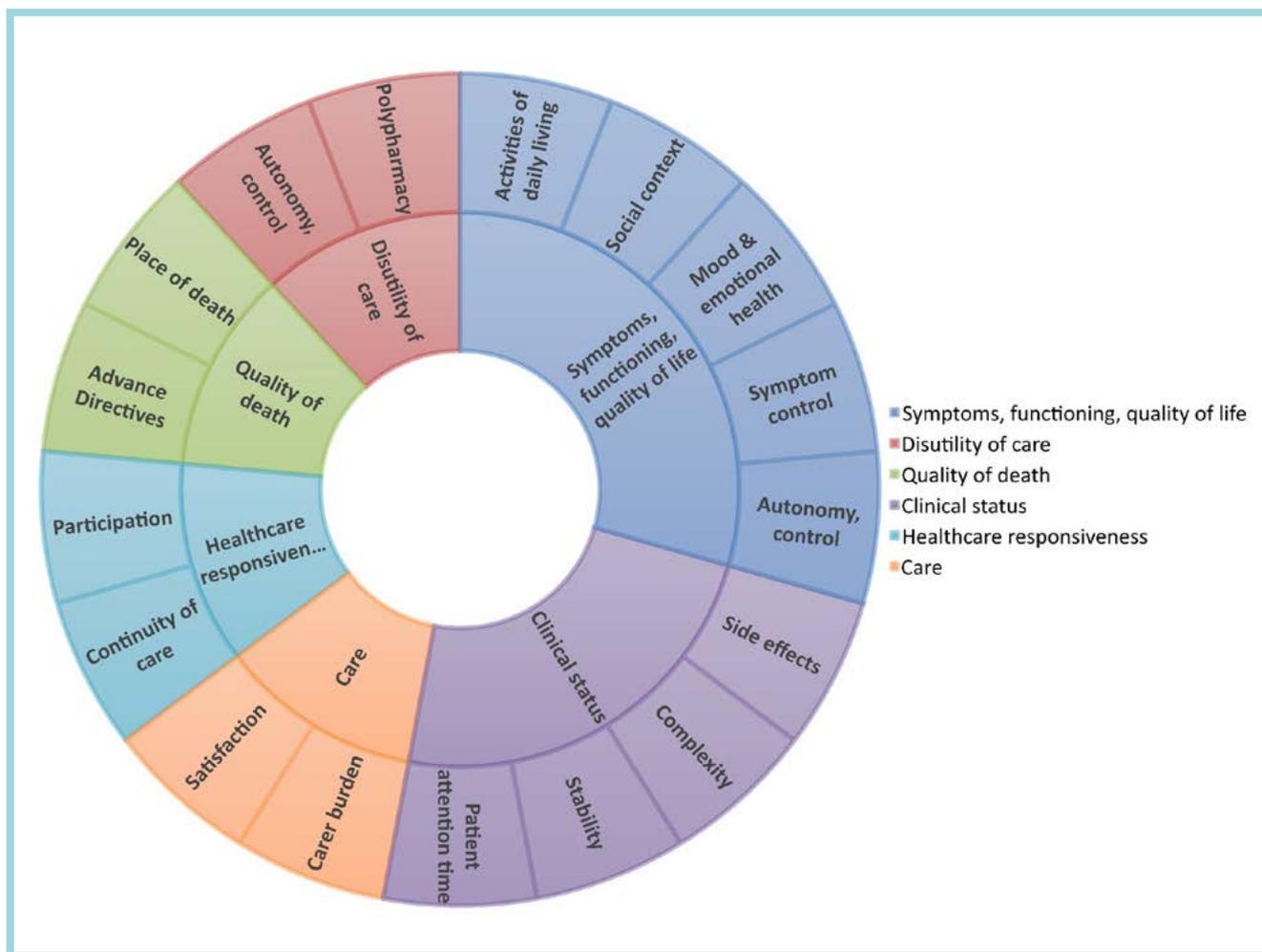


Figure 24 – Possible model of Health Outcomes

There are some challenges according to Health Promotion Innovations in models and approaches, which are dealing with social determinants of health, taking a life-course approach including early years development, focusing on population health and enabling equity and access. By engaging people, businesses and institutions, we can change the re-orientation of the model of care to people-centered care and home care. Health and social integration are also important for networks and multidisciplinary health and social care partnerships for Personalised and Predictive Medicine. Management paradigm

changes are also necessary and possible by using standards, accreditation and regulations. Participant co-design and co-decision is possible for better outcomes and measurement of experience for empowering patients, people, and communities. Rights and responsibilities and accountability are at the basis of workforce redesign. Sustainability is reached through community development by integrated care business models for funding and contracting that promote health outcomes. The social return on investment is possible.

Adriano Fernandes, Head of Innovation at Misericordia of Amadora, presented Patients' needs approach.



Figure 25 - The Integrated Care solutions to address unmet needs

He started his presentation "Patient's met and unmet needs", with the description of the region in Portugal where ICT initiatives within this context are being implemented. He focused on the integration of care and on patients' needs. The beginning of the presentation covered the overall framework and foundation of care services, highlighting its layers and priorities and different approaches. He pointed out that aspects of integration and personalization of care drive the mission of all involved stakeholders regarding care services. The system built over the years in the region is evolving and adapting to ever-changing contexts and demands. He also noted that the system's evolution is user-centered and aimed at maximizing the cost-benefit ratio, with particular attention being paid to sustainability and integration. In the

subsequent slides, Mr. Fernandes explained how the region and stakeholders collaborate to best meet the user's needs. Adriano referred to integration and personalization of care provided.

Also, he offered an insight on the Golden Circle of Integrated Care which is the foundation of Integrated and Person-Centered Care Model in the region of Amadora. Dr. Fernandes provided further information on the achievements and organizational framework of the system. He stressed the importance of collaboration and cooperation in the process of care delivery. The user of services and the system is followed and guided through all stages beginning with the entry, then into the actual phase of integrated and personalized care to reach the exit point finally. The transitions and the user's path in the system is specifically designed to meet the needs and expectations of those in need, including patients, formal and informal caregivers, professionals, and even various stakeholders.

At the end of the presentation, Dr. Fernandes admitted that there is always a lesson to be learned because no matter how hard you try to predict the outcomes, you continually expose yourself to some new challenges and ideas.

Key Messages

Policy Intervention Area 1

- *Integrated care should ensure equity and access*
- *Integration of healthcare services should encompass health and social aspects*
- *Payment and reimbursement policies need to encourage acute providers to expand across the care continuum rather than within hospitals*
- *Integrated care strategies should involve people, industry, scientists, environment and policy makers in a quintuple helix-approach*
- *Policy maker should invest in scalability of e-services. In this process, it is important to minimize the risks that are generally associated with the implementation of new technologies on a large scale.*

POLICY INTERVENTION AREA 2 - Open and interoperable platforms for data integration within health care services

CHAIR

Rafal Dunal, Vice President of the Polish Chamber of Healthcare IT (PIIM) has presented topic on “Telemonitoring as a source of big data”.

The process of defining and implementing of fundamental changes in the Polish healthcare IT systems is ongoing: new central medical registries are being created, new information-sharing requirements have come into force, medical records migrate to electronic ones, e-prescriptions, e-assignments and other documents are being introduced. The burden of implementing all these changes will be on entrepreneurs working in IT healthcare area, while financing all the modifications will fall on medical entities. It is our belief that community of providers and users of these solutions is not integrated enough and needs a broad, strong and effective representative, who could be a worthy counterpart to governmental institutions. The legal form of Chamber of Commerce gives such a representative a special empowerment because it benefits from privileges granted to self-governance bodies and is strongly funded in the law.

The Polish Chamber of Healthcare IT unites both entrepreneurs who are suppliers and users (doctors, clinics, hospitals) of ICT systems in health care. As main tasks of the above-mentioned groups we have development, implementation and/or financing of the upcoming changes in medical informatics in Poland. There is proposition of constructive solutions to indicate computerization methods and consult legislative changes to emphasize benefits.

In case of telemedicine, sources of data are based on remote patient monitoring (ECG, spirometer, thermometer, blood pressure meter, glucometer) and self-monitoring (questionnaires, self-examination). Internet of Things (IoT) use cameras, beacons, smart home devices like air quality. Devices, as well as wearables (watches, GPSs, accelerometers, cameras) and e-visit/e-consultations (audio/video recording, photos, dicom). The view we have broadly adopted in this report is e-healthcare, which could almost be said to be: the future is certain. These changes may indeed have the potential to radically transform healthcare, but this potential has not yet been realized. So, these are challenges: data collection and storage methods, standards and protocols for sharing (open public datasets) and their privacy and legal aspects. The quality of data and the possibility of its processing (computing power) are also important. Infrastructure and the possibility of financing it are also an important element.

SPEAKERS

Dr. Javier Mar, OSI Alto Deba, introduced the topic of random forest machine learning models to predict dementia-related neuropsychiatric symptoms thanks to real-world data.

Neuropsychiatric symptoms (NPS) are the leading cause of the social burden of dementia, and there is often a reduction in the quality of life of patients and caregivers. Families are not keeping patients at home. In addition, only 8% of new drugs currently intended for Alzheimer's disease are used to treat NPS. Their impact on the population is underestimated as they are not well encoded in medical records. From the population perspective, information tools are needed to monitor intervention plans. The incidence of NPS is between 56% and 98%. This was measured in clinical samples using questionnaires such as the Neuropsychiatric Inventory (NPI), which are rarely used in clinical practice.

In principle, it can be said that there is a paucity of data on morbidity. In dementia, estimating the prevalence of NPS requires efforts to diagnose it over time through a series of cross-sectional studies.

Real World Data (RWD) has been described in an Organisation for Economic Co-operation and Development report as "broad data" because it covers large populations but includes limited amounts of outcome and exposure data. In line with this, machine learning (ML) tools have been postulated as having more capacity to predict complex clinical conditions like NPS and being able to convert RWD into "smart data". It is possible to use predictive models based on machine learning tools to identify the presence of psychotic and / or depressive symptoms in RWD patients diagnosed with dementia to inform social care and healthcare. By estimating the incidence and prevalence of dementia and related NPS in a population database covering the entire Basque population (2.2 million), it was hypothesized that drug prescriptions, along with other clinical variables, could be used to build a predictive model to identify NPS associated with dementia. A retrospective study was also designed to assess validity. EHR data was used to identify dementia-related NPS by collecting data from dementia diagnosis to completion of follow-up. Subjects: patients diagnosed with dementia in OBI living on December 31, 2018 (N = 31,000). Validation of the diagnosis of dementia in this registry showed appropriate predictive values (positive and negative predictive values of 95.1% and 99.4%, respectively).

There are two NPS patterns: these are the depression cluster and the psychotic cluster. A validation study was conducted on a random sample of 4003 dementia patients, EHRs were individually assessed by a trained clinical coding technician under the supervision of a psychiatrist, reviewing

It can be said that there is a paucity of data on morbidity.

physicians' notes for evidence of the presence of these two types of symptoms. Correlation between the presence of NPS on the EHR scale and the NPI score in a small sample of patients (50 cases) diagnosed with dementia and living in the community. EHR showed lower sensitivity than NPI, but no less specificity. There were two response variables in the EHR documentation: a depression cluster and a psychotic cluster. Potential explanatory variables were also considered: age, gender, institutional status, accompanying diagnoses (diabetes, hypertension, dyslipidemia, thyroid disease, Parkinson's disease, stroke, cardiovascular disease, head trauma, depressive disorders and psychotic disorders) and pharmacological treatment.

Data was collected on all prescriptions containing the drug: N06D (donepezil, rivastigmine, and galantamine and memantine), N06A (antidepressants), N05A and N06C (antipsychotics) taking into account prescription changes and the frequency and prevalence of legal highs in the Basque population.

Given the dynamic nature of the demented population, a retrospective study was conducted in the Basque Health Service database (Real World Data) in early and late 2019. Among 631,949 people over 60 years of registered searches, more than half of dementia patients had NPS, as indicated by the presence of key terms in electronic health records. Although NPS are not encoded in the diagnostic registry, they are treated with antipsychotics and antidepressants, allowing important predictive models to be developed by combining ML and RWD tools. Given their good results, predictive models can be used to systematically estimate the prevalence of NPS in population databases. The strength of the study is the population approach, the sample covers the entire population of reported dementia cases. A 12% NPS record indicates a low clear diagnosis of the problem, although prescribing antipsychotics and antidepressants indicates a problem. Machine learning can be used in population databases to convert large data (RWD) into intelligent data.

In summary, NCPs are underestimated as they are not measured and therefore no effort is made to measure them as they are believed to be irrelevant.

Edyta Rogula from **BIOCAM, Poland**, presented AI approach to Doctor's Workload Reduction.

BIOCAM is an innovative company, which develops medical technologies that increase the comfort of patients' lives and allow to improve the health care system. The development of minimally invasive endoscopic examination methods is another good practice and BIOCAM mission.

They focus on greater patient comfort, reducing the cost of medical facilities and popularizing the capsule being endoscopic solution. Innovative capsule help patients and medical doctors by offering significant reduction of time and costs of digestive system tests. It saves time from 10 hours to even 30 minutes. The use of several types of light sources and innovative imaging methods (advanced imaging solutions) allows our solution to see more like traditional endoscopic capsules. Due to the use of intelligent solutions, it will be possible to stop the capsule at the place of detection of the lesion and immediate surgical intervention.

Thanks to real-time imaging it is possible to use wireless communication, the doctor will be able to monitor the examination on an ongoing basis. In addition, the device will warn the doctor of any danger. A very interesting approach to the assessment of classifiers was presented, which consisted in minimizing false-negative results to miss any abnormal changes and any diseases. It is better to classify patient as sick than mistakenly classify them healthy.

There are some innovation limitations because it will not replace doctors, but it can reduce their workload. Also, the data labeling is time-consuming and costly. In case a network looks only for polyps, it won't find any bleedings.

Finally reducing doctors' workload by an AI system is possible, but it won't replace the human. Thanks to capsule endoscopy and a cloud system, patients can be at home and the data can be sent to the doctors.

Key Messages

Policy Intervention Area 2

- *Adopt standard protocols for data collection and storage methods*
- *Have sound privacy policies in place to allow data sharing across regions*
- *Adopt high qualitative standards for data processing*
- *Increase investment on health data infrastructures*
- *Increase citizen trust on the use of data for research, innovation, and organizational purposes.*

POLICY INTERVENTION AREA 3 – Healthcare for health innovations

CHAIR

Patients' preferences and unmet needs are considered, allowing to agree on goals and priorities making the patient an equal partner in the care process.

Marcin Kotwicki who gave a presentation focusing on the **eCare project**, a European action that aims to encourage elderly people to live independently, detecting and preventing loneliness and isolation, promoting healthy habits and exercise.

The initiative focuses and caters for the elderly and their needs regarding the frailty prevention and management. He pointed out that it is essentially important to pay attention to unmet needs of the end users. Integration of health systems is multidimensional and complex and involves different stakeholders. Marcin stated that the challenges of the future and the sustainable health systems require intelligent solutions supporting the continuum of care for frail patients.

The author stated that the ageing society and the frailty associated with it pose a dramatic and profound implications for planning and delivery of health and social care. The policy intervention eCare refers to is driving the need to change and adapt for the goal is to deliver disruptive digital solutions for the prevention and comprehensive management of an important social problem.

The project aims to deliver an ICT solution encouraging independent living, wellbeing and to relieve health and care services, including budget pressure and expenditures. This is an enormous effort, and it must be given due attention by decision as well as policy makers in different regions across Europe. It was clearly pointed out that there is a link between the integration of various care providers and the quality of clinical outcomes we shall not forget about. The project itself is aligned with the key European policy priorities regarding digital health and care. The development of the solution seeks to provide empowerment for the patients and the health care professionals.

What is more important, patients' preferences and unmet needs are considered, allowing to agree on goals and priorities making the patient an equal partner in the care process. The speaker explained that the foundation of the project relies heavily on objectives related to aspects such as self-care, integration, empowerment, and interoperability of the solution.

SPEAKERS

Oscar Zanutto, **Coordinator of FABER at ISRAA**, Italy introduced the topic of Virtual Coach and Chat Bot interactions for the cognitive improvement: experiences coming from H2020 Value Care Project.

He provided the input on the aim of the initiative, which is to deliver outcome-based integrated care to older people to improve their quality of life and their families, while also making European health and social care systems more sustainable. He elaborated on the concept of ValueCare and its implications for the system it operates within. It was highlighted that the value-based concept originates from Porter's studies. In ValueCare it is developed in seven European cities with different pathologies (high blood pressure, mild to moderate frailty, neurological condition and stroke).

The aim is to build an integrated care system between health and social services by proposing an app-based platform that connects informal and formal caregivers and supports health empowerment through virtual coach. He presented the need to focus on the benefits of digitalization and implementation of innovation in health systems. Significant healthcare improvements can be achieved when intelligent ICT innovations are applied to the healthcare system. Regions can support this process through international collaborations and partnerships, identifying needs and common values.

Clear goals need to be set within public and private networks to create models of best practice. This will trigger a shift in the current state of art, encouraging more local relations, cooperation, and collaborations that will facilitate the uptake and scaleup of innovative healthcare.

Marta Turkiewicz, MSc GlucoActive Ltd. Presented Control Diabetes, Everywhere, Always.

This presentation followed with an interesting insight on the management of diabetes and its implication for health care systems. She noted that a Continuous Glucose Monitoring system (CGM) is a compact medical system that continuously monitors blood sugar levels almost in real time. To use a CGM, a small sensor is placed onto the patient's abdomen. Sensor includes a tiny cannula that penetrates the skin and allows to take glucose readings throughout the day and night. Generally, the sensors must be replaced every 10 to 14 days. She highlighted some of the facts regarding the burden of diabetes.

The author of the presentation stated that 463 million adults (20-79 years) are living with diabetes; by 2045 this will rise to 700 million and 1 in 5 of the people who are above 65 years old has diabetes. Diabetes caused 4.2 million deaths. What is even more striking, considering the impact of the pandemic, people with diabetes are at increased risk of developing COVID-19. The speakers and presentations on personalised health care from the perspective of service providers and for decision and policy makers in the Regions.

Regions and policy makers base their decisions on the

It is worth noting that not only digital changes, but also cultural changes have led to an organizational transition towards a system where the synergetic action of different players integrates and personalizes the care path, thus meeting the health requirements of each patient.

efficacy of health services. It is worth noting that not only digital changes, but also cultural changes have led to an organizational transition towards a system where the synergetic action of different players integrates and personalizes the care path, thus meeting the health requirements of each patient.

Key Messages

Policy Intervention Area 3

- *Promote not only digital change but also cultural change*
- *Tailor policy to the specific context in which it will be implemented: the successful integration of a given policy in a particular health care context might not be automatically transferrable to another health care context.*
- *Policy makers should critically assess the available scientific literature and look at examples of places where comparable policies have been implemented. Policy-makers should preferably not only learn about what happened in other places, but instead learn from other places.*

POLICY INTERVENTION AREA 4 - Personal data management

CHAIR

Marco d'Angelantonio from **Health Insight Solutions GmbH**, presented "The quest for a trade-off between Big Data exploitation and GDPR requirements".

Health Insight Solutions GmbH, based in Munich, was founded in 2007 to develop innovative technology products, solutions, and holistic concepts in the field of modern monitoring and care. The company has developed, commercializes, and implements a family of health management and monitoring solutions for chronic patients and frail individuals at home and in residential settings. Over time, it has installed its solutions in 14 European countries and its technological platform supports since 2017 the largest program in Europe for monitoring and coaching Type 2 diabetes patients.

At the beginning, the presenter emphasized that he was not an advocate of the GDPR, but that he understood that opposition to the GDPR is not a popular opinion. He explained that he is generally against laws that impose strict restrictions on research, is a heavy burden for enterprises, especially for SMEs, and do not achieve the purpose for which they were designed. In addition, he added that most people do not even read the privacy statement when they visit a new website, especially because, in most cases, not accepting the privacy policy means being denied access to information or services that one needs/wants to consult.

The Chair questioned whether companies' compliance with GDPR really protects personal data and it seems evident that lawmakers are not always aware of the practical implications of the laws they vote.

The presented does not doubt that lawmakers in the European Union are committed to acting in the interests of citizens. Unfortunately, laws that are great on paper can have devastating results when applied. One particularly good example is the Italian law "Equo canone", which was meant to allow everybody to rent a flat for a fair price. When it entered into force it simply killed the house rental market because the revenues from a fair rental were not attractive for house owners. The Regulation on Medical Devices is another good candidate for playing against the interest of people whom it intends to protect.

Information is the most valuable resource in the Information Society in which, according to our politicians, we live.

The mantra of the Information Society is that successful economies will be those that outperform the others in creating,

Successful economies will be those that outperform the others in creating, using, distributing, manipulating and integrating information.

using, distributing, manipulating and integrating information. The capitalization of companies such as Facebook and Google, that did not even exist when the concept of Information Society was first introduced, demonstrates that our politicians were real visioners. Citizens' right to decide what can and cannot be done with their data is not questioned but some ethical issues remain unresolved. Is it acceptable that, for protecting personal information, it could end up entrusting children to a babysitter without knowing that she has psychiatric problems or starting an intimate relationship with a person, not knowing that he/she is HIV positive?

The presenter strongly defended the position that interest of society should always take precedence over the interest of the individuals. Regulations such as the GDPR are intended to protect the interests of the individual, but do not necessarily protect the interests of the entire society. Huge amounts of health data stored in hospitals, clinics, registries should be used to improve our research on health, disease, correlations between events occurring at different times in an individuals' life. There are ways of linking the interests of individuals with the interests of society by using pseudonymization and anonymization algorithms that protect the individual while providing valuable information for research. Access to pseudonymized and anonymized data for research purposes should be unrestricted, provided the research is ethically sound. A lot of personal information is related to health and is mainly collected for clinical purposes. However, there are many other purposes for which it could be used. These include organizational, educational, public health, disease surveillance, quality measurement and forensic purposes. It is not so sure that everyone cares about protecting his/her health data. There are people, including the presenter, who have no problem with publishing their medical records even on the Internet. After all, why not to turn the GDPR the other way around and state that health data are always available for research, unless individuals express their will that they should not. There are several good laws in the medical field that have adopted this position. An example is the Italian law nr. 91/99 on organ transplantation. It is certain that there is a lot of empirical knowledge hidden in health databases and that we still know very little about the laws that govern life. Using the enormous amount of data contained in health databases can extract empirical knowledge about life and disease. These databases are scattered across all healthcare institutions and just in Europe contain data about ½ billion people tracked over several decades, evidence-based medicine is real and the presenter had a go at it as early as in 2003.

Access to pseudonymized and anonymized data for research purposes should be unrestricted, provided that the research is ethically sound.

Ilona Anna Urbaniak, PhD from **NASK/POLAND** has presented the importance of quality assessment of compressed and

resized medical images.

NASK is a National Research Institute under the supervision of the Chancellery of the Prime Minister of Poland. Their key activities involve ensuring security online. Responding to network security violations occurring in Poland and coordinating corrective actions is the responsibility of the Centre for Cybersecurity, which also comprises the CERT Poland team (www.cert.pl).

The Act on the national cybersecurity system lists us as a Computer Security Incident Response Team (CSIRT), which coordinates responses to incidents reported by key service operators, digital service providers and local authorities. All users can report incidents to the NASK CSIRT, and we also provide analytical and R&D services as part of the Polish cybersecurity system. NASK is also tasked with managing website names for the .pl domain.

Remote medical record access has gained popularity in the healthcare industry as it enables remote diagnosis, quicker access to a specialist, remote monitoring and makes the communication between physicians regarding a patient's medical history faster. Transforming proprietary medical imaging software into web- and mobile-enabled platforms is a recent progress in medical imaging technology. It involves the transfer of the image content and patient information of DICOM images over networks and displaying them on the client side, usually a web browser. Web browsers provide a universal platform for computer and mobile devices and allow medical images to be accessed without the use of specialized software. However, the trade-off often is reduced image quality.

The images that are received on the client side are often altered versions of their original counterparts that remain stored on the server side. The access time (that it takes to display an image that was transferred over the network) is usually the most critical concern of medical imaging software developers. Moreover, the DICOM standard is not compatible with typical web browsers. The compatibility can be achieved by extracting the image content from DICOM as JPEG, which is supported by web browsers.

Those image operations cause loss of image quality and may introduce undesired artifacts. There has been a lot of research done on the effects of a single operation (i.e., compression, window levelling and interpolation). Irreversible compression of medical images has been extensively studied in the literature with allowable and safe compression ratios provided for each anatomical part and imaging modality. The effects of interpolation for medical images has also been extensively researched for decades. For the purpose of displaying images on mobile enabled platforms, all of the above operations are

Remote medical record access has gained popularity in the healthcare industry as it enables remote diagnosis, quicker access to a specialist, remote monitoring and makes the communication between physicians regarding a patient's medical history faster.

often applied to an image before it gets displayed to the user. In this work we study the effects of these operations on the diagnostic quality of medical images. We perform quantitative analysis of image quality and study the degradations introduced when the lossy operations are applied to an image.

Piotr Krajewski, CEO at **Cancer Center in Wroclaw/Poland** has presented AI in Oncology.

The Oncology Center is the winner of the International Conference on Medical Image Computing & Computer Assisted Intervention (MICCAI) in the field of:

- 2015: MRI + Biopsy (brain tumor)
- 2016: PET segmentation (lungs)
- 2019: Histopathological cancer detection
- 2020: The challenge to assess the degree of prostate (PANDA)

The Cancer Center solves the problems of patients whose diagnosis takes too long, and doctors who may lack manpower as well, related to the legacy technology used and processes that reduce performance. In addition, data scientists dealing with low availability of high-quality datasets can train algorithms.

The proposed solutions are based on a safe one and a compatible cloud platform, the components of which are:

1. Internet browser of pathology and radiology
2. Expert market: validating the second opinion
3. API-based (supporting the application ecosystem)

There were five times more patients per day per doctor and two times more costs thanks to this simpler procedure. Such a system has been implemented for prostate cancer. In this case, 1 in 8 men get prostate cancer, which is 1.1 mil new cases / year and ~ 307,000 deaths cases.

Benny Eklund from **University Hospital of Uppsala, Sweden** presented the last topic of the panel on RELIEF PCP - Open competition to develop innovative ICT solutions that improve self-management of chronic pain patients.

An approach based on nine challenges was presented to improve situations in chronic pain healthcare in the healthcare industry:

1. Improvement on the knowledge of the patient base data before first visit (efficiency)
2. Improvement on following up (monitor) with the patient and the treatment
3. Increase effectiveness of adherence to treatment

4. Increase self-management and self-empowerment of the pain: integrate the patient with their healthcare
5. Improvement of patients' education related to their condition
6. Provide effective communication channels between patients and clinicians
7. Guarantee access to social networks (that put patients in contact with other chronic pain patients and patient organizations)
8. Clinically-validated information
9. Ensure data for research purpose

The results of this research show that there were too many contractors to meet the "challenges" that are difficult to implement. The effort required to turn a prototype into a workable clinical trial system could not be assessed. There was a big difference in the three hospitals involved in the project.

The contractors lacked a national infrastructure and different languages were an additional difficulty as the project was carried out in three different countries. Citizens' ability to access data was also found to be important for reasons of improving disease treatment as a new form of patient engagement and empowerment. Cross-border access to their own data may also be of increasing importance for patients

The results of this research show that there were too many contractors to meet the "challenges" that are difficult to implement.

POLICY INTERVENTION AREA 5 – Remote monitoring and tele-assistance

CHAIR

Dr. Christian Pohl, from **Health Insight Solutions GmbH in Munich, Germany**, who has presented “Health Monitoring: History, Developments & Best Practice”.

The presentation was briefly emphasized that there were not so much technical possibilities that are decisive for a successful implementation, but rather the change of processes in the health system that make this implementation possible in the first place.

First of all, the definition of “health monitoring” and telemedicine should not only be used as an example to explain the terms, but also to point out the problem that many terms in this field are currently not fundamentally clarified, which often leads to misunderstandings. For example, Health monitoring and telemedicine refer to completely different processes, goals and implementations, but are nevertheless often used synonymously.

Afterwards, the focus was placed on the explanation of the health monitoring approach and on the definition of the goals. The focus of health monitoring is on the continuous expansion of prevention spaces, which enables the earliest possible intervention. The use of technology and the evaluation of data are subordinate to this goal. Digitalization is divided into three different phases, each of which differs in its approach. Although they build on each other chronologically, their application and implementation are often confused. The first phase is characterized by the digitalization of existing processes. The second phase is characterized by an expansion of existing processes through digitalization. In the third phase, completely new processes are created through digital possibilities. Although industry etc. are already in this third phase regarding innovations etc., the health sector is often still in phase 1.

Finally, a brief outlook was given on the current trends that demand further technological development, as well as the future visions. The trends identified are self-care, which means the patient is an actor for his or her own health control within the health system. In addition, there is an increasing individualization of the solution in terms of patient pattern, equipment, features which used to be call “Swimming/Floating/ Modalized Solution”. This refers to the need to provide the patient with individual health content.

It was pointed out that the healthcare market is at a crossroads with regard to its telemonitoring technologies. One trend of

Health monitoring and telemedicine refer to completely different processes, goals and implementations, but are nevertheless often used synonymously.

development will go in the direction of health monitoring that takes care of prevention for chronically ill patients and elderly persons and persons with increased health risks. The other trend of development will take on the improvement of lifestyle technologies, i.e., serving people who want to live (even) healthier. The need to strictly observe this separation when offering these solutions on the market is pointed out.

SPEAKERS

Łukasz Bula, CEO of Telemedycyna Polska has presented "Personalized medicine in ECG remote monitoring".

The Telemedycyna Polska is the leader of telemedicine services in Poland inspired by the possibilities of medicine and motivated by the development of technology, it has been involved in the creation of innovative telemedicine services since 2005. By guaranteeing the highest standards of care, it increases the availability of medical services in the field of telecardiology and telecare services.

Telemedycyna Polska is the leader of telemedicine services in Poland, inspired by the possibilities of medicine and motivated by the development of technology, it has been involved in the creation of innovative telemedicine services since 2005. By guaranteeing the highest standards of care, it increases the availability of medical services in the field of telecardiology and telecare services. They support the transformation of medical services to accelerate, scale, and optimize services using telemedicine solutions, keeping the patient's well-being in the spotlight. By supporting the transformation of medical services to accelerate, scale and optimize services using telemedicine solutions, they keep patient well-being at the center of attention. A physical / virtual room was proposed where medical staff collaborate to make fast, reliable and effective real-time decisions based on information sent by patients - e.g., continuous monitoring of the heartbeat. In real time, 3,000 patients are monitored 24/7 by cardiologists. Decisions are made by one team providing an ECG description for 150 medical facilities all over Poland. Every activity is action-oriented - e.g., there is a team focused on detecting atrial fibrillation.

The development of home care is where the home becomes the preferred place of care and the Care Management Center, where technology and human activities are based on standardized patient processes and paths is ensured by remote medical care. It is an appropriate model of personalized actions through prevention and early detection of patients at risk. Using the developed algorithms, the results are analyzed, and the treatment strategy is determined.

CHAIR

Krzysztof Waszkiewicz, from **Hitachi, Poland**.

Today's situation around the world should be a final call to introduce next generation telemedicine supported by data integrations with wide spectrum of devices, including both consumer and professional.

We are surrounded by data, and we have been aware of this for a long time. Recently we have realized that medical data are significantly important as the COVID-19 pandemic has pushed us to make any possible effort to recover from this huge thread. Tech giants like Apple and Google joined their forces to build a framework capable of helping us in avoiding spreading the virus. Proximity detection and threat alert can be realized using billions of mobile devices with iOS and Android every day of our lives. At the same time, both companies had to stay compliant and keep our privacy, so they did a tremendous job to balance between data security and flexibility of the solution. That made us even more relying on the mobile-gathered data.

On the other hand, we constantly need medical care. Depending on our age, people need more or less support to stay healthy for a long time. COVID-19 has strictly limited that possibility and in many cases, it forced a switch to digital and remote care. In a new reality we need to provide the doctors as much information about us as possible as those experts have just lost their hands, ears and eyes, which are so important in interviews and examinations. That is why modern medical care needs to implement new approach in this area. Connected healthcare which equips the patients with both professional and consumer devices to gather required data which could fill the gap made by remote consultations. In the same model we already collect the data from fitness bands and other devices we can leverage more professional equipment to rebuild doctors' eyes and hands, partially but significantly better than nothing. On the other hand, like Apple, Google and many more we need to stay compliant in storing and transferring the medical records. Having huge experience in financial sector helps significantly in this area. Durable medium solutions and modern, metadata driven electronic archives are ready to serve today. We have every single technology needed to provide data security. Therefore, today's situation around the world should be a final call to introduce next generation telemedicine supported by data integrations with wide spectrum of devices including both, consumer and professional.

Finally, there are new possibilities getting open for us all with this huge amount of data. Then we should finally leverage this fact to support advances in predictive medicine. AI-driven analysis already helps the doctors to determine different course and progress of long-term diseases, including cancer. Including collaborative and connected healthcare approach we could achieve this goal as a side effect. To be successful, again like many others we need to stay compliant. That's the potential opportunity to implement pseudonymization and

make such approach simple. In full compliance with the GDPR, we could provide analytic systems and medical researchers with huge amount of data keeping the patients anonymous until they need help or at least a hint to get engaged in predictive healthcare. In this matter, again, experience in financial market can be a driver to provide the solution almost instantly.

SPEAKERS

Kazimierz Frączkowski, PhD from **Wrocław University of Technology, Faculty of Computer Science and Management**, gave his presentation about Role Played Games in Personalized Data collection.

Currently, COVID-19 has exacerbated the rapid increase in the number of people suffering from metabolic syndrome, a combination of risk factors for the development and progression of cardiovascular disease and diabetes. The reason for this is the global epidemic of obesity and diabetes as a consequence of the modern lifestyle. Lockdown limited interpersonal contacts and decreased physical activity, causing 24% of men in the age group of 20-44 years and women of 44-65 years of age to gain weight from 2-4 kg.

In order to monitor the above-mentioned unfavorable phenomena and at the same time motivate people to limit them, it is necessary to use ICT technologies, which work well in times of limitations caused by COVID-19 in the e-Economy. In medicine, and mainly in health care, these are narrative games that allow to collect information about the patient's health and behavior in an innovative way and teach correct habits or motivate to change bad behavior by using the gamification mechanism.

The game consists of scenarios in which the actor (doctor) asks questions to the player (patient). The scenario itself is selected randomly or triggered by events that preceded it (for example, information about high sugar levels). Such a structure is intended to create a scenario that describes the correct reaction to an unfavorable measurement, allows the transfer of knowledge about healthy habits or conduct a simple form of a medical interview that could eventually suggest the patient to contact a doctor or suggest a change in habits (Fig. 28).

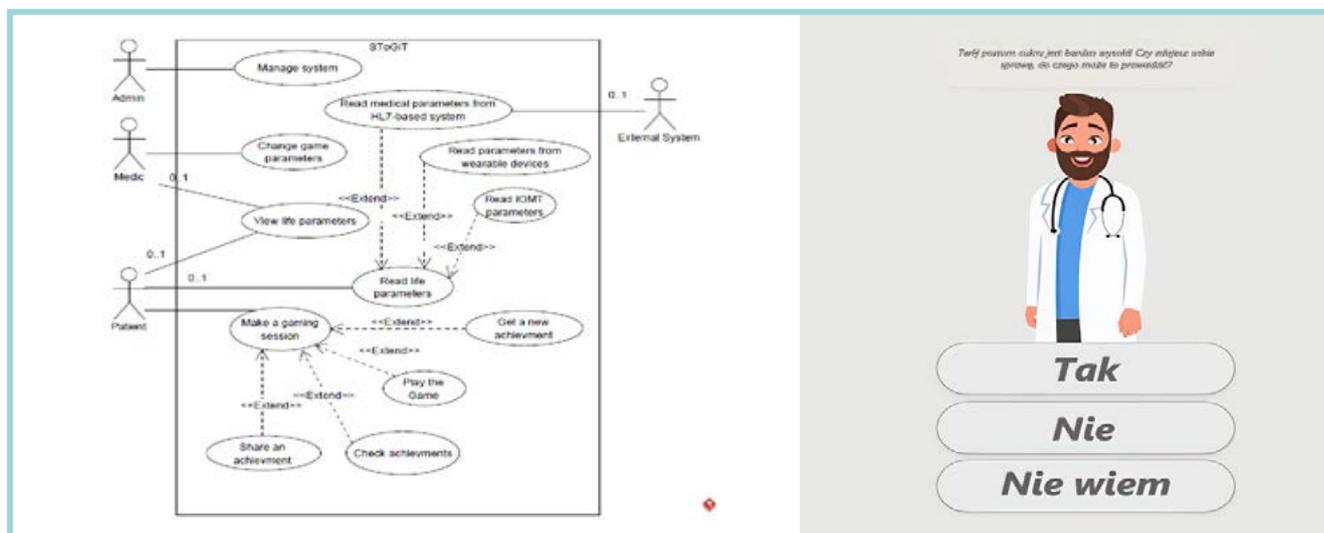


Figure 26 – Use case model and game mobile SToGiT application interface.

The development of the latest technologies based on the interdisciplinary nature of modern knowledge creates many opportunities for the use of mobile technology solutions in health care and patient rehabilitation. The use of mobile technologies in healthcare may soon bring positive economic effects. The number of hospitalized patients in favor of telemedicine solutions will decrease. The ubiquity of smartphones has contributed to the unprecedented progress in mobile sensor technology and their interaction with mobile applications. Their extensive capabilities, advanced functions, small size of pressure sensors, glucometers and their availability on the market mean that the presence of these devices in everyday life is increasing. Thanks to the collection of large amounts of data on behavior and health, it will be possible to create BigData collections, which will be used to build intelligent personalized prevention and early detection algorithms in the form of an interactive computer game and to create a community that compensates for the limitations caused by the COVID - 19 epidemics.

Dr. Christian Wielage from **Health Insight Solutions GmbH in Munich, Germany**, presented “Development of Interfaces, Integration & APIs” The keynote lecture gives a brief overview of the status of the integration of vital monitors and other devices whose data transmission takes place via Bluetooth. The standard that is currently changing from BT 3.0 to BT 4.0 was presented. Reference was made to the lack of certification of the Bluetooth modules and the attempts to certify them via Continua, among others. The Bluetooth charging model was briefly discussed to show that it hinders standardization. Finally, the problems, especially connected with security, with the implementation of Bluetooth devices were briefly discussed.

The Health Technology in Connected & Integrated Care Workshop witnessed a high participation of policy makers, representatives of universities and research hospitals from different regions.

Key Messages

Policy Intervention Areas 4 and 5

- *Access to pseudonymized and anonymized data for research purposes should be unrestricted, provided the research is ethically sound*
- *Integrated healthcare systems require harmonized policies across hospital and regions*
- *Integration of care requires a deep understanding of patients' needs and risk status, in addition to permitting access to such information by multiple health care providers. To achieve this, data and electronic health records must be available, uniform, and coordinated, accessible by professionals across the care pathway. A technological infrastructure of this kind would allow for efficient patient management throughout their care pathway*
- *A common prerequisite for providing consistent, coordinated care is the involvement of primary and community services, such that primary care acts as a platform on which integrated care can be implemented. Family care practitioners should be empowered to coordinate and keep informed of their patients' management*
- *Clinical leadership, with common and shared values, is necessary to create and maintain collaborative relationships with others throughout the health system*

NB: The Key recommendations have been formulated after additional desk research

Main Outcomes of the Workshop

Implementing integrated care can improve health care outcomes, enable equal access and produce financial savings making healthcare systems sustainable. A broad effort by health care systems should therefore be made to achieve this goal. Improving the quality of healthcare is crucial for politicians and decision makers in different regions of Europe. This is related to concern for the future of European healthcare systems and the implementation of Personalized Medicine in clinical practice. Ensuring quality and long-term sustainability requires a policy based on planning and a structured approach. Support for the realization of personalized and patient-centered health systems is information and communication technology that can deliver the desired results. Health services should be prioritized, especially when it comes to people with multiple chronic conditions (multiple diseases), and it seems best to do this through integrated and patient-centered solutions. In order to adequately meet the needs of patients, it is necessary to collect personalized information. Despite growing investments and interest in e-health, there are still many challenges to be faced in this regard. A broader and more systematic implementation of ICT in the healthcare sector is needed. Healthcare services and systems must be capable of collecting and analyzing personalized patient health information.

Many pilot projects in these areas are being implemented around the world and areas of opportunity are identified that could potentially be global in nature. We ask the European regional and local authorities to be committed and build upon these and to implement the recommendations Regions4PerMed has provided.

