Bsport+

WHITE PAPER ON ASSISTIVE TECHNOLOGIES

FUNDACIÓN intras

Co-funded by the Erasmus+ Programme of the European Union

Bsport+

Co-funded by the
Erasmus+ Programme
of the European Union

Co-funded by the Erasmus+ Programme of the European Union

INTRODUCTION: SCOPE AND PURPOSES

This White Paper aims to map the potentials of healthcare digitalisation in the European context and to explore the challenges that accompany the opportunities that this digitalisation process offers. The document also provides an overview of the state of the evidence for using health technologies in specific groups of people with disabilities, resulting from the scientific literature on the topic and from explorative research conducted within the BSPORT+ project framework. Finally, a series of recommendations to address barriers and unlock the full potential of technology in the European healthcare system are proposed.

Overall, it is widely recognised that technology can play a crucial role to support the healthcare system in several areas, from patient empowerment to prevention and early detection of disease, to diagnosis, treatment and care management. Artificial intelligence, blockchain, virtual reality, and personalised mobile apps are, at present, among the most promising health technologies.

Thanks to technological innovation in the realm of healthcare, patients' healthcare experiences are becoming more and more personalised and convenient. For example, the creation of intelligent healthcare platforms and mobile devices helps to provide patients with real-time health information and more self-monitoring opportunities. Further, Cognitive Technology, Big Data, and Health Analytics help collect more precise information (thus reducing the number of clinical errors) and offer patients greater access to their medical records. Also, technology enables healthcare providers and stakeholders to collaborate with one another, be more efficient, handle more complex tasks, and improve patient care.

However, it should be considered that, for most of the time, the development of technologies used in healthcare has primarily been technology- or producer-driven. The need to focus more attention on the needs of end-users (e.g., customers, care professionals, and caregivers) to make services and devices more purposeful, accessible, and easy to use has been outstanding only recently. In this respect, gaming, for instance, has opened new alternative approaches for patient health education, health promotion, skills development, and rehabilitation. Also, leveraging the full potential of technology in healthcare means investing specific efforts to enhance access and affordability of high-quality health products and services, also considering the vital need to adapt to continuous changes in consumers behaviours.

EU APPROACH TO DIGITAL HEALTH

In the last decades, several new healthcare challenges have arisen, related, for instance, to the increasingly ageing population and the emergence of new communicable diseases. These concerns, combined with the continuous advances in Information and Communication Technology (ICT), have led the European Commission to set at the centre of the healthcare agenda the need for an urgent reform of the EU healthcare system to provide EU citizens with high quality, person-centred digital services that would help to create a healthier society. Such a reform, based on the maximisation of technologies' potential, offers new opportunities to transform the way health and care services are traditionally delivered to new and innovative patterns of care based on people's needs, determining a crucial shift from the paradigm of treatment to that of prevention and primary care to achieve and maintain wellness, and from systems essentially focused on institutional care to more integrated and community-based welfare facilities.

Overall, there is a consensus about the potential of technology in assisting the design and provision of person-centred care services and lowering healthcare-related costs and supporting interoperability across national boundaries. According to a recent report published by Medtech Europe (2020), the use of technology in healthcare, and in particular of artificial intelligence, has a socioeconomic impact that can be quantified in terms of effects on health outcomes, financial resources and time spent by healthcare professionals. More in detail, it is estimated that, annually, more than 300,000 lives can potentially be saved only thanks to wearable devices (e.g., accelerometer bracelets, smartwatches and activity trackers), with €50.6 billion of potential savings. In addition, applications for personal health monitoring (e.g., use of wearables and personalised apps to prevent and manage health conditions) and those related to collecting real-world data for research and development (e.g., electronic health records) save €45.7 and €38 billion, respectively. In general, applications based on artificial intelligence have the potential to save 1,659 million to 1,944 million hours every year that healthcare professionals could dedicate to higher-value activities.

In this respect, it must be noticed that the increasing interest for and use of technologies in healthcare systems should not be interpreted as a process of dehumanisation that results in patients being seen as merely connected bodies that can be analysed and monitored remotely through an ICT tool; instead, the digital development of healthcare is to be intended as a mean to place the patients back at the heart of medical practice and care, and that allows to empowering them to manage their health conditions proactively and more independently, as well as helping them to make more informed and wellness-oriented lifestyle choices.

As part of the EU's commitment to developing actions for the digital transformation of health and care systems, the European Commission has published several communications on technology and the provision of health products and services. These include:

- A White Paper, "Together for Health: A Strategic Approach for the EU 2008-2013", dated 23 October 2007 (http://ec.europa.eu/health-eu/doc/whitepaper_en.pdf);

- "eHealth Action Plan 2012-2020 – Innovative healthcare for the 21st century", dated 6 December 2012

Co-funded by the Erasmus+ Programme of the European Union

(http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=4188);

- A Green Paper on mHealth dated 10 April 2014 (http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=5147);

- A staff working document on the existing EU legal framework applicable to lifestyle and well-being apps dated 10 April 2014 (https://ec.europa.eu/digital-agenda/en/news/commission-staff-working-document-existing-eu-legal-framework-applicable-lifestyle-and) (this accompanied the Green Paper). A summary of this report and the responses can be found at https://ec.europa.eu/digital-single-market/en/news/summary-report-public-consultation-green-paper-mobile-health

The most recent document issued by the European Commission is a Communication on the digital transformation of health and care (2018), where a series of priorities have been outlined. Simultaneously, an expert group, the eHealth Stakeholder Group (representing health tech industry, patients, healthcare professionals and research community), has been created, tasked with providing advice and expertise to the Commission, particularly on the priorities identified in the Communication on enabling the digital transformation of health and care, that are:

- citizen's access to their health data;

- personalised medicine through shared European data infrastructure, allowing researchers and other professionals to pool resources (data, expertise, computing processing and storage capacities) across the EU;

- citizen empowerment to take care of their health through the appropriate use of person-centred digital tools.

Each of these priorities involves patients, service providers, and, more in general, healthcare providers across EU, since the digital transformation offer a wide set of opportunity for all these parts involved in the process. On one side, digital transformation gives patients the opportunity to access innovative and more efficient personalised healthcare knowledge, infrastructure, and services; on the other side, it helps service providers and producers to improve their services, and therefore the impact of these services on people's health outcomes. Finally, for healthcare providers this means achieving better patients' outcomes with significant cost reductions and resources saving. For instance, it is estimated that healthcare professionals spend 25% to 30% of their time gathering and analysing medical and patient care data due to the absence or inefficient use of electronic health records. Further, most doctors have to invest the personal effort to seek information on the latest protocols, best practices and international updates. The lack of readily available relevant information can result in uninformed clinical decisions. Such decisions can lead to prescription and dosage errors, creating adverse drug events (ADEs) that cost EU healthcare systems 2.7 billion EUR per year in care costs and account for 1.1% of all hospitalisations in the EU.

The main challenges of healthcare digitalisation

Despite the substantial number of benefits related to the digital reform of the healthcare system, several challenges need to be considered to unlock the potential of technology in healthcare fully. Among these, those related to regulatory and legal aspects, such as the need to guarantee equal access for patients and health data protection and privacy issues, deserve particular attention.

As regards the guarantee of equal access for patients to services, the critical issue is about finding strategies ensuring adequate digital literacy levels for all, such that, independently of other personal or contextual factors, all patients can acquire, understand and use information responsibly to promote their well-being and stay healthy. In this perspective, a key role is played by citizens and patients themselves, that should be aware of the importance of having basic Information Technology literacy.

Conversely, service providers need to be aware that technology might be entirely unfamiliar to specific subgroups of the population. Indeed, despite the increasing popularity of the Internet, there is consistent evidence documenting substantial inequalities in access to and use of health technology that could depend not only on access opportunities but also on how information is presented and disseminated. Specific political and regulatory commitment to reducing health inequalities, discrimination in the provision of care, and using health technologies is strongly needed.

In partial connection with this matter, citizens must be guaranteed their fundamental right not only to access their health data but also to decide whether and when to share such data. In general, the healthcare sector is highly regulated, regardless of whether operating in the physical realm or using digital tools. Overall, it is acknowledged that disclosure of personal health information could negatively impact the patient’s personal and professional life. It is for this reason that the processing of information relating to a person’s health includes the processing of sensitive personal data (referred to in the Data Protection Directive as “special categories of data”), which has a greater level of legal protection (Art. 9, General Data Protection Regulation (EU) 2016/679 - GDPR). On the other hand, the processing of health data is crucial for the good functioning of healthcare services, and to advance research and healthcare practices, and, overall, to improve public health.

In the specific matter of health digitalisation, eHealth and mHealth in Europe must be in compliance with both the GDPR 2016/679, replacing the Data Protection Directive 95/46/EC, and the Directive 2002/58/EC on the protection of privacy in the electronic communications sector (E-Privacy Directive). More specifically, the E-Privacy Directive contains specific rules regarding:

Marketing communications;

The storage or gaining of access to information stored in users’ equipment (such as by way of cookies and similar technologies);

The security of communications services;

Data breach notification;

The privacy of traffic and location data.

Co-funded by the Erasmus+ Programme of the European Union

In general, the rules on storing/accessing the information on a user's device are not limited to personal data, but any data on the device and such storage/access is only permitted if the user has given his consent.

Alongside the relevant legislative framework, regulators in the EU have issued guidance on the practical application of the law to real-world conditions. These reinforce the fundamental concepts which data controllers must keep in mind when processing personal data in the context of mHealth and eHealth initiatives. To name a few instruments, the Article 29 Working Party issued a working document on the processing of personal data relating to health in electronic health records in 2007 (http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2007/wp131_en.pdf), and an Opinion document on apps on smart devices in 2013 (http://ec.europa.eu/justice/data-protection/article-29/documentation/opinion-recommendation/files/2013/wp202_en.pdf), providing clear information about processing to end-users before app installation. In addition, the opinion reminds app developers of the need to:

Obtain consent from the user (where the app in question stores or accesses data stored on the user's device);

Observe the principles of purpose limitation and data minimisation;

Take adequate security measures;

Observe reasonable retention periods;

Observe fairness in the processing of data collected from and about children specifically.

Also of interest are the mHealth Green Paper (2014), the Staff Working Document on the existing EU legal framework applicable to lifestyle and well-being apps, the European Data Protection Supervisor Opinion on mHealth (2015; https://edps.europa.eu/sites/edp/files/publication/15-05-21_mhealth_en_0.pdf) and the Code of conduct for mHealth apps (2016; http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=16125), specifically aiming at fostering citizens' trust in mHealth apps, raise awareness of and facilitate compliance with EU data protection rules for app developers. Citizen's trust is a crucial issue for improving the quality of data that health apps collect and process so that they might be linked to electronic health records and thereby effectively be used in clinical practice. Unfortunately, to date, most of the lifestyle and well-being apps available have no clear evidence of their quality and reliability. This raises particular concern about the ability of consumers to assess their usefulness, thus potentially limiting their effective uptake for the benefit of public health.

Again, as already mentioned above, the challenge here is to empower patients with adequate knowledge and digital health literacy, providing them with clear explanations of benefits generated by healthcare digitalisation and appropriate skills to use health technologies successfully.

Successful use of healthcare technologies also requires stakeholders at multiple levels (governments, healthcare professionals, academia and industry, as well as society at local, national and European levels)

Co-funded by the Erasmus+ Programme of the European Union

to cooperate and clearly define their roles and responsibilities.

Finally, it should not be underscored that digitalisation in European health systems also poses substantial financial challenges. First, technologies, especially those using artificial intelligence, have a cost whose relationships with benefits are still under investigation. Some centres of excellence, as an example, are conducting cost-benefit studies to assess the value of introducing artificial intelligence into their care pathways, but there is not a consistent and joint commitment across Europe. Further, with healthcare systems shifting towards a more digital pattern, healthcare professionals have to adjust their clinical pathways accordingly and then need to be trained for this, and new job profiles with the right mix of IT and medical skills must be created to train them.

THE PROMISE OF BIG DATA

Technological advances have helped to generate more and more data. This has led to the creation of the term Big Data, which refers to the abundant health data accumulated from numerous sources, including electronic health records (EHR), medical imaging, genomic sequencing, data from internet searches and social media, data collected from cameras, mobile phones and radio frequency identification, monitoring devices worn by patients in clinical trials or devices attached to smartphones. The use of Big Data analytics in healthcare poses additional privacy concerns that should be considered.

Big data can be classified into two main categories as follows:

- Organised data: in general, this data refers to content that has a defined format and length such as numbers, date generated and string content. These data are formed from various sources such as mobile phones, computers, various sensors and weblogs. Examples of these data types include electronic health records, home treatment and monitoring data, prescriptions from doctors, etc.

- Unorganised data: in general, this data refers to content that does not have a predefined big data format. Most data are generated from various sources, such as social media data, mobile data, and video and web content. Examples of unorganised health data include social platform health data from Twitter, Facebook, user blogs, doctors' notes and medication diaries, for instance.

The primary sources of Big Data include:

- Internet search data and social media postings;

- Data collected by cameras, mobile phones and radio-frequency identification;

- Monitoring devices worn by patients in clinical trials or as devices connected to smartphones.

As can be imagined, given the variety of formats, types, and sources of big data, which exceeds the amount of data traditionally used for storage, processing, and analytical power, it becomes impossible to manage this data using traditional software or internet-based platforms. This makes it challenging to achieve a transformation of the medical sector as big data promises. However, where technological improvements can be made to convert big data into valuable and actionable information, interesting results can be achieved. Indeed, big data would enable the movement towards value-based healthcare and tend to reduce healthcare costs. Moreover, with the wealth of information derived from big data, increasingly accurate medical decisions can be made. More clearly, there are two main drivers encouraging the healthcare sector to embrace big data: on the one hand, the shift from a so-called pay-for-service model, which rewards financially for performing procedures, to a value-based model, which rewards based on the health of the patient population. The other driver is that the information obtained can refine the understanding and, therefore, the clinical practices associated with certain diseases, injuries, etc. The increased knowledge that medical data provides can also help to improve the health of patients.

This improved approach derived from big data is not only about treating individual patients but also about gaining a better understanding of the cohorts of patients who are at higher risk of disease, thus enabling a proactive approach to prevention. In short, healthcare big data analytics can identify abnormal patients who consume healthcare services far beyond the norm or can be used to educate, inform and motivate patients to take responsibility for their own well-being. Furthermore, by bringing together financial and clinical data, it can highlight the efficiencies and effectiveness of treatment plans. Thanks to Big Data, in short, it will be possible to link diseases - such as obesity, cardiovascular diseases, depression - to human behaviour, lifestyle or other causes that are characteristic of a given geographical area or group of people.

At this stage, the complexity of managing big data lies in processing and then exploiting this massive amount of data. Various analytical methods such as data mining and artificial intelligence can be used to examine the data. The implementation of artificial intelligence algorithms would allow the large enterprise to achieve automated decision-making through the implementation of machine learning methods such as neural networks and other artificial intelligence techniques.

Beyond the benefits that the usability of big data can bring, there are still some very critical aspects that need to be taken into account. One of these is the impact on the privacy of individuals. Much of the information collected may contain personal data and even sensitive personal data. In addition, new personal data can be created by Big Data analysis, such as by combining the test results of a clinical trial with information posted on social media about the patient's lifestyle in order to work out if they are likely to develop any medical conditions.

- When collecting personal data for the purposes of Big Data, organisations must consider what data subjects expect in relation to data processing. Key questions include:

- What were they told would be done with their data?

- Would they reasonably expect their data to be analysed?

- Would the use of their data for Big Data analytics be incompatible with the reason(s) it was collected for in the first place?

The key answer to all these questions lies in the principle of transparency (Article 13 and 14 GDPR), which requires that any information or communication relating to the processing of personal data is easily accessible and easy to understand to the data subject. Thus, the most effective strategy to ensure users' rights been protected is to make them aware of the purposes for which their personal data are processed. In addition, the organisation must be confident that the information being used is adequate, relevant and not excessive for the proposed purposes. Organisations should also think carefully about the adequacy of the security steps they are taking. This is particularly relevant where the data being analysed is stored in a cloud, potentially hosted by a third party and potentially located outside the European Environment Agency (which raises concerns due to the laws in the host country), or where it is being shared with another organisation, to carry out the analysis.

In some cases, where sensitive personal data is being used, the data subjects' consent may need to be

Co-funded by the Erasmus+ Programme of the European Union

obtained. In others, the organisation may demonstrate that the use of Big Data is necessary for the legitimate interests of that company (provided this causes no unwarranted prejudice for the individual).

PEOPLE WITH DISABILITIES AND HEALTH TECHNOLOGY: INSIGHTS FROM THE MATCHING PERSON & TECHNOLOGY MODEL

The Matching Person & Technology Model was developed by Scherer in 1998 as a process of assessment and person-technology matching measures that could be used internationally.

Framed within a person-centred approach, the person-technology matching process helps to promote user engagement and guides a person-provider team in selecting the most appropriate assistive technology or “support solution” for the individual’s functional gain and quality of life, includes specialised devices as well as general or everyday technologies.

Technologies are meant to make our lives easier and better, but it doesn’t always happen. It is important that individuals feel comfortable with technologies and know how to use them to their benefit. While a user must adapt to the unique features and demands of technology, technology must be adjusted or adapted to accommodate the individual needs and preferences of the user.

The MPT process identifies the factors that influence these areas. The use and non-use of technology as conceptualised in the Matching Person and Technology model has been validated by many researchers and authors working in a variety of settings.

The MPT process contains a series of instruments (self-report checklists about consumer predispositions to and outcomes of technology use) which take into account:

the environments in which the person uses the technology,

the individual’s characteristics and preferences, and

the technology’s functions and features.

Characteristics within these three components can each contribute either a positive or a negative influence on technology use. If there are too many negative influences, the chance of the technology being successfully used is significantly reduced. In fact, the technology itself can appear perfect for a given need, but if the user does not possess the appropriate personal characteristics or does not receive needed support, that perfect technology may go unused or be misused.
The MPT process contains a series of instruments. Each instrument actually constits of a pair of instruments - one designed for the provider of technologies (counsellor, therapist, teacher, employer, trainer, etc.) and the other intended for the technology user (client, student, employee). Each instrument is quick, easy and self-explanatory. They were developed from the experiences of technology users and non-users through participatory action research to ensure providers and users work together to achieve the following goals:

User goals and preferences drive the MPT process;

The degree of match between user and provider perspectives is assessed;

Providers are guided into considering all relevant influences on the use of technology while focusing on the

Co-funded by the Erasmus+ Programme of the European Union

user's quality of life;

Mismatches between a proposed technology and a potential user are identified in time to reduce inappropriate use or non-use and eliminate the accompanying disappointment and frustration;

The most appropriate technology is selected among a wide variety of possibilities;

Appropriate training strategies are identified for an individual's optimal use of technology.

The MPT assessments are designed to inform, not to replace professional judgment. The aim is to indicate areas in need of further assessment and intervention, their overarching assumptions being that (a) each match of person and technology is unique and requires individual attention, and (b) technologies are means for achieving goals, not ends in themselves.

Co-funded by the Erasmus+ Programme of the European Union

PEOPLE WITH DISABILITIES AND HEALTH TECHNOLOGY: EVIDENCE FROM RESEARCH

In the framework of the BSPORT+ project, research using both primary (surveys of people with disabilities and professionals) and secondary data (literature review) was conducted to gather information about i) if and how technologies can effectively support people with disabilities in engaging and maintaining healthy lifestyles, ii) what are the benefits of technologies for improving participation in sport and physical exercise, dietary behaviours and the adoption of healthier lifestyles, and iii) what are the unmet needs of people with disabilities related to the use of technologies for accessing healthy habits.

Results from the literature review

The literature search yielded a total of 148 articles published between July 2002 and July 2020. One hundred twenty-eight articles met the criteria. The literature review confirmed that technology could help people with disabilities to engage in healthy lifestyles. Technology has been shown to have not only the potential to help compensate, at least in part, for physical limitations (if any), but also to effectively support patients in managing chronic disease and associated risks, thereby increasing the degree of empowerment for self-care practices, as well as enhancing skill development and knowledge acquisition for behaviour change.

In general, the literature consistently suggested that to be considered effective, technology-related tools and services have to meet a series of criteria such as: being free accessible and easy to use; being delivered through portable devices, possibly small enough to hold and operate in hand; providing users with training sessions; integrating the possibility to receive health information; overall, having a user-centred design.

Overall, critical and yet-to-be-improved aspects of the technologies, that emerged from the literature review, refer to the following elements:

taking into account the needs of the target group;

integrating apps to record physical activity with an app to monitor psychological well-being;

app listings should be required to explicitly state which health professionals (if any) were involved in its design,

facilitating the use of technology devices to avoid excluding anyone who may be unfamiliar with the use of these devices,

better design,

implement and integrate patient devices into routine care and patient processes that together support health and wellness,

greater reliability of measurements,

provide education tools and decision support through mobile apps,

Co-funded by the Erasmus+ Programme of the European Union

provide information about app use,

include rewards or incentives,

need for collaboration among a diverse group of experts in order to produce better apps.

If further improved, technologies could increase user satisfaction and improve health outcomes related to their use.

Results from the surveys

The exploratory research that was conducted interviewing people with disabilities and health or sport professionals offers additional insights into assistive technology and people with chronic illnesses. A total of 154 respondents over the age of 18 completed the user survey.

The majority of the sample was between the ages of 19 and 50, was female, and had a bachelor's degree or higher. In terms of employment status, about half of the sample was employed.

Respondents had difficulties in at least one of the following six general functional categories: mental health and neurological related disorders; digestive, metabolic, immunological, and endocrine systems related disorders; skin related disorders; seeing, hearing and vestibular related disorders; cardiovascular, haematological, and respiratory systems related disorders; neuromusculoskeletal and movement-related disorders. On average, participants reported having three functional limitations/difficulties among those listed.

The online survey of people with disabilities revealed that nearly all respondents frequently use smartphones, personal computers, and television and that their experience with technology was satisfactory. Participants said that technologies help them stay in touch with people and increase their opinion of themselves. Most reported using technology-based devices or services that provide health information and technology-based devices or services for self-monitoring of nutrition and exercise. In addition, most of the sample reported that using technology has helped them to always achieve their goals and that they feel more confident (secure, self-assured) when using technology.

However, a relatively high percentage of respondents reported that they were not at all or only somewhat satisfied with the degree to which these technologies had improved their quality of life.

The decision to stop using technology, where applicable, seemed to be overall associated with technology-related factors rather than personal factors, including the worsening of health/physical conditions of the user or user's forgetting to use the device. Among the technology-related factors, the limited adaptation of the device to the user's basic needs/preferences/expectations, the need for a better or different device, and the fact that the device stopped working properly were considered the most critical factors that led users to stop using the device

Several factors were considered necessary to increase the frequency of use of and satisfaction with technologies: the multi-functionality and the provision of clear instructions for use, the convenience of use, free or low cost, privacy and high levels of security, flexibility to adapt to different user needs, and the adoption of a multidisciplinary approach (e.g., nutrition, exercise, psychological support, etc.).

As regard the online survey of professionals, a total of 99 experts were interviewed. Most were women, and their ages ranged from 31 to 40 years. Most of the sample had a bachelor's degree or higher. Regarding the sector of employment, almost half worked in health care.

A high percentage of professionals reported that they would suggest/recommend the use of technology-based devices or services to their patients/clients. Among the factors that professionals mentioned as positively influencing patients/clients' use of technology-based devices and services for health, nutrition, and sports/exercise, the most important was the user's desire to use technology; other important factors were the desire for independence, cooperation with the therapist and the rehabilitation plan.

As regards the factors that might influence professionals in the provision/recommendation of technology-based devices and services for health, nutrition, and sports/exercise, almost all professionals reported that knowledge of technology-based devices and resources and passion for improving outcomes for their patients/clients are important factors influencing professionals' provision or recommendation of technology to their patients/clients. Adequate education about technology-based devices and resources was also rated as a factor that strongly influences the provision or recommendation of technology.

Co-funded by the Erasmus+ Programme of the European Union

CONCLUSIONS

MAPPING A PATH FORWARD

The analysis illustrated in this document demonstrates that technology can deliver significant benefits for European health systems and EU citizens. Furthermore, the current evidence supporting the potential of technology in providing more efficient healthcare pathways offers a basis for increased adoption and harmonisation of related benefits across all EU Member States.

To unlock the full potential of technology in healthcare, European health systems need to improve various areas. These include citizens' empowerment, skills training for healthcare professionals, data access and control, and how such technologies are evaluated.

As the dialogue on the future of technology in healthcare progresses, the analysis here presented has identified some policy priorities to tackle the challenges discussed in the previous sections. The recommendations are intended for a wide range of national and EU stakeholders that might play a role in the successfully integration of technologies in European health systems. These recommendations can help accelerate the benefits of technology and ensure they are harmonised across all EU Member States:

Develop policy frameworks to build trust amongst consumers and foster the adoption of AI in healthcare;

Advance skills among healthcare professionals and digital health literacy among citizens (especially patients) to ensure the benefits will be achieved equitably across the EU.

Build data policies and infrastructure to foster seamless access, connectivity and sharing of high-quality, harmonised data;

Define collaborative partnerships across healthcare professionals, academia, decision-makers and industry;

Ensure appropriate commercial incentives and reimbursement mechanisms to foster innovation in Europe and support patient access;

Advance data interoperability;

Moreover, a shift to proactive disease prevention could empower patients and further engage them in care decisions. At the same time, a fair balance must be made between data privacy and the benefits that data-driven insights can generate. As technology progresses, applying it without due care could lead to problematic outcomes, as well as public reluctance to accept or use it. As devices get smarter, they rely more on algorithms to make suggestions (e.g. showing the links between behaviour, biometrics and disease) and take actions (e.g. surgery-assisting robots). This could result in ineffective actions if the data on which decisions are based is incomplete and thus unreliable, vulnerable to tampering by cyber-attackers, possibly biased, or simply incorrect. This requires a fresh look at how we make sure these approaches will have the intended effects.

These barriers can be overcome with the collaboration of all stakeholders in the healthcare ecosystem: policymakers at all levels (EU, national and regional), healthcare providers, academia, industry and citizens. With this broad partnership, technological innovation and adoption can help ensure high-quality care for European citizens and put the EU at the forefront of a very innovative industry.

Co-funded by the
Erasmus+ Programme
of the European Union