World Health Organization
REGIONAL OFFICE FOR Europe

FROM INNOVATION TO IMPLEMENTATION

eHealth in the WHO European Region

2016

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TO IMPLEMENTATION

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This report is accompanied by an online interactive annex providing options for detailed display and analysis of the 2015 WHO global survey on eHealth data for the European Region. The annex can be found at: http://portal.euro.who.int/en/data-sources/ehealth-survey-2015

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FOREWORD

Growth in the use of eHealth for achieving universal health coverage in Europe

I am delighted to present this report on the status of eHealth in the WHO European Region in 2016.

The report is based on data provided by Member States in the 2015 WHO global survey on eHealth and highlights the key messages and trends identified.

eHealth has experienced a period of significant growth and maturity in recent years. Examples of technology adoption in the health sector are today commonplace in every Member State in the European Region. Such investments are most often seen in the context of achieving health system reform, providing new and innovative modes of health care delivery or offering efficient methods of access and exchange of health information. Most notable, however, is the transition of eHealth to a subject of strategic importance for policy-makers.

In the WHO European Region, the Health 2020 policy framework was adopted by Member States as an overarching value- and evidence-based health policy framework for health and well-being. It addresses the socioeconomic rationale for improving health and makes a strong, evidence-informed case for investment and action through integrated approaches to health promotion, disease prevention and well-being. Health 2020 is a living expression of the commitment to universal health coverage – the belief that all people should have access to the health services they need without risk of financial ruin or impoverishment. eHealth's role in underpinning the achievement of universal health coverage is now clearly recognized and is frequently highlighted by Member States as being fundamental to the sustainability and future growth of their own national health care sectors. The evidence of this is clear. Innovative technologies are extending the scope and reach of health care services to previously difficult-to-reach population groups, breaching geographical divides and achieving new levels of cost–effectiveness in the delivery of care.

In addition to measuring the substantial progress made by European Member States in adopting eHealth, this report highlights a number of new and emerging areas of technology that hold great potential for improving the quality and effectiveness of both health care and the health policy that supports it. big data and social media are two such areas: the value to be gained through these mechanisms, and how the evidence derived from them may feed health policy and informed decision-making, are only beginning to be understood.

I urge all Member States and relevant partners within the WHO European Region to recognize and act upon the key messages and recommendations presented in this report. We need to ensure the collective, intersectoral engagement of all stakeholders for the future of eHealth and to leverage the strengths of each in implementing the Health 2020 policy in Europe.

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ABBREVIATIONS

A

AKDN – Aga Khan Development Network
API – application programming interface
app – application (program)
ATC – Anatomical Therapeutic Chemical (classification system for drugs)

B

BAN – body area network

C

CARINFONET – Central Asian Republics Health Information Network
CDSS – clinical decision support system
CEN – European Committee for Standardization (in French, Comité Européen de Normalisation)
CIS – Commonwealth of Independent States
COPD – chronic obstructive pulmonary disease

D

DCMI – Dublin Core Metadata Initiative (vocabulary terms to describe resources)
DICOM – Digital Imaging and Communications in Medicine

E

ECG – electrocardiogram
eHGI – eHealth Governance Initiative
EHII – European Health Information Initiative
eHN – eHealth Network
EHR – electronic health record
ELGA – elektronische Gesundheitsakte
epSOS – European Patients Smart Open Services (project)
EU – European Union
EU-28 – the 28 countries belonging to the EU after July 2013
EURORDIS – European Organisation for Rare Diseases

G

GOe – Global Observatory for eHealth
GP – general practitioner
GPRS – general packet radio service

H

HIS – health information system
HITCH – Healthcare Interoperability Testing and Conformance Harmonisation (project)
HL7 – Health Level Seven International

I

ICD – International Classification of Diseases
ICNP – International Classification for Nursing Practice
ICT – information and communication technologies
ICPC – International Classification of Primary Care
IHE – Integrating the Healthcare Enterprise (project)
ISA^2 – Interoperability Solutions for European Public Administrations
ITU – International Telecommunication Union

L

LOINC – Logical Observation Identifiers Names and Codes

M

MOOC – massive open online course
MVSP – multilingual virtual simulated patient

N

NCD – noncommunicable disease
NCSP – Nomesco Classification of Surgical Procedures
NeRN – Nordic eHealth Research Network
NHS – National Health Service (United Kingdom)

O

OECD – Organisation for Economic Co-operation and Development

P

PbD – Privacy by Design (framework)
PSI – public sector information

R

ReEIF – Refined eHealth European Interoperability Framework

ABBREVIATIONS

S

SEEHN – South-eastern Europe Health Network
SNOMED CT – Systematized Nomenclature of
Medicine – Clinical Terms
STaRC – Study, Trial and Research Centre
STORK – Secure Identity Across Borders
Linked (project)

W

WEB-RADR – Recognising Adverse Drug
Reactions (project)

EXECUTIVE SUMMARY

This report on the status of eHealth in the WHO European Region examines the results of the 2015 WHO global survey on eHealth to provide insight on how it is being used, major areas of development, perceived barriers to adoption and potential areas of growth.

The key outcomes of the report provide evidence of an increasing appetite for eHealth and indicate that tangible progress is being made in the mainstreaming of technology solutions to improve public health and health service delivery.

Through initiatives for health sector and health information system reform, Member States are now actively building upon their national foundations for eHealth to deliver public health and health services in a more strategic and integrated manner. They acknowledge and understand the role of eHealth in contributing to the achievement of universal health coverage and have a clear recognition of the need for national policies, strategies and governance to ensure the progress and long-term sustainability of investments. However, leveraging eHealth as a national strategic asset demands a more coordinated approach to planning, implementation and evaluation. Evidence of the importance of this approach is observed through a majority of Member States developing national strategies or policies for eHealth, universal health coverage or national health information systems, and ensuring sustainable funding for their implementation.

More important, however, is the recognition that successful investment in eHealth requires far more than just the acquisition of technology. A holistic view of the impact and changes required to organizational processes, structures, roles, standards and legislation is needed, as well as consideration of the specifics of human resources, education, reimbursement and the culture of those who will be utilizing the eHealth services – any of which can serve to derail initiatives if neglected. Perhaps the most revealing messages, echoed by the results from the survey, is the need for stronger political commitment for eHealth, backed by sustainable funding, and for effective implementation of policy that is protected from frequent changes in the national political landscape.

The key statistical findings of the report are summarized below. Of the 53 Member States in the European Region, 47 responded to the 2015 WHO global survey on eHealth (an overall regional response rate of 89%). Results are based on data available at the time of analysis and percentages shown are calculated in accordance with the number of non-blank responses to each survey question. In making its key recommendations, the report draws upon evidence from the survey results together with the collective experience of several eHealth and health information experts. These recommendations are a call to action for all Member States in the WHO European Region to take appropriate steps to strengthen their existing national eHealth foundations and to accelerate activities for future development and adoption of eHealth.

Key findings from the survey data

eHealth foundations

— 84% of respondents (38 Member States) have a national universal health coverage policy or strategy, of which 74% (28 Member States) report that the policy or strategy specifically refers to eHealth or information and communication technologies in support of universal health coverage.

— 70% (30 Member States) have a national eHealth policy or strategy, of which 90% (27 Member States) indicate that their policy or strategy refers explicitly to objectives or key elements of universal health coverage.

— 69% (31 Member States) have financial support available specifically for the implementation of their national eHealth strategy or policy.

— 89% (40 Member States) have universities or technical colleges providing students with training on how to use information and communication technologies and eHealth, and 82% (37 Member States) provide

training to professionals on how to use information and communication technologies and eHealth.

Electronic health records

— 59% of respondents (27 Member States) have a national electronic health record system; 69% of those (18 Member States) have legislation governing its use.

— 50% (22 Member States) report that funding is the most important barrier to implementing national electronic health record systems.

Telehealth

— 27% of respondents (12 Member States) have a dedicated policy or strategy for telehealth; an additional 36% (16 Member States) refer to telehealth in their national eHealth policies or strategies.

— Teleradiology is the most prevalent telehealth programme in the WHO European Region: 83% (38 Member States) report its use. Remote patient monitoring is the second most prevalent telehealth programme, with 72% (33 Member States) utilizing these services.

mHealth

— 49% of respondents (22 Member States) have government-sponsored mHealth programmes.

— 73% (33 Member States) do not have an entity that is responsible for the regulatory oversight of the quality, safety and reliability of mHealth applications.

— The use of mHealth for access to patient records has increased by 25% since the 2009 survey.

— The use mHealth for appointment reminders has risen by 21% since the 2009 survey.

— Three Member States (7%) have carried out evaluations of government-sponsored mHealth programmes.

eLearning

— 66% of respondents (29 Member States) use eLearning for students of health sciences.

— 71% (32 Member States) use eLearning for in-service training of health professionals.

— The main reason for using eLearning was reported as "improving access to educational content and experts" by 96% (27 Member States) for students and by 94% (30 Member States) for professionals.

Social media

— 91% of respondents (40 Member States) report that individuals and communities use social media to learn about health issues.

— 81% (35 Member States) report that health care organizations use social media to promote health messages as part of health promotion campaigns.

— 14% (6 Member States) have a national policy to govern the use of social media in health professions; 81% (35 Member States) report having no such policy.

Health analytics and big data

— 13% of respondents (6 Member States) have a national policy or strategy regulating the use of big data in the health sector.

— 9% (4 Member States) have a national policy or strategy regulating the use of big data by private companies.

Legal frameworks

— 80% of respondents (36 Member States) have legislation to protect the privacy of an individual's health-related data in electronic format in electronic health records. This has increased by nearly 30% since the 2009 survey.

— 53% (24 Member States) do not have legislation that allows individuals electronic access to their own health data in their electronic health records.

— 50% (22 Member States) report that individuals have the legal right to specify which health-related information in their electronic health records can be shared with health professionals of their choice.

— 43% (19 Member States) have policies or legislation that defines medical jurisdiction, liability or reimbursement of eHealth services.

Key recommendations

Political commitment

Explicit political commitment by governments in the European Region to adopting eHealth is required. This commitment needs to be backed by sustainable funding for the implementation of eHealth programmes and actions for capacity-building and evaluation that are aligned with a national strategy for eHealth.

Dedicated eHealth strategies

An inclusive and intersectoral approach to the development of national eHealth strategies is recommended – to ensure their relevance to all stakeholders and to promote shared action in achieving health objectives. Member States are further recommended to use the methodology described in the WHO and International Telecommunication Union *National eHealth strategy toolkit* as a basis for developing their national vision, action plan and monitoring and evaluation frameworks for eHealth. Having a national eHealth strategy that embodies the elements of achieving Health 2020 policy is a key enabler for strengthening people-centred health systems and public health capacity.

Legislation on electronic health records

Detailed legislation surrounding the use of national electronic health records should be further developed and harmonized by Member States. Such legislation should ensure that patient rights in relation to access and management of data are appropriately addressed.

Guidance on telehealth

Member States should consider the development of targeted, intersectoral strategies and policies to guide national telehealth implementation.

Adoption of standards

A systematic approach to the adoption of eHealth standards for data exchange and interoperability needs to be taken, with a national body in each Member State clearly identified to govern this process. Member States are recommended to adopt the European Union's Refined eHealth European Interoperability Framework and to introduce a quality management system for interoperability testing, a set of appropriate testing tools and quality label and certification processes.

Regulation in mHealth

Member States are recommended to establish an entity responsible for the regulatory oversight of mHealth applications and to carry out evaluations on the impact and benefits of mHealth applications operating in their national settings.

Increasing digital and health literacy

Digital and health literacy among both health professionals and the public should become an area of focus to ensure that eHealth is successfully adopted and that health inequalities are reduced with the digitization of services.

Increasing the use of eLearning

eLearning in health for both students of health sciences and health professionals should be increased, where appropriate. Member States are also encouraged to formally evaluate their eLearning programmes.

Increasing guidance on social media use in health and big data

National policies and strategies on regulating the use of big data in the health sector need to be addressed by national health and information and communication technology entities, and should include a clear position on the use of big data by private companies. Similarly, Member States are recommended to develop national policies governing the use of social media in health professions.

Actions by WHO in support of developing the eHealth agenda in the European Region

The WHO Regional Office for Europe will:

— intensify open and active partnerships with the European Commission, Organisation for Economic Co-operation and Development, World Bank, nongovernmental organizations and other international stakeholders engaged in developing and promoting eHealth, with the aim of leveraging the collective strengths of each in providing harmonized support to Member States;

— under the umbrella of the WHO European Health Information Initiative, engage with Member States in the European Region to build capacity for implementing and managing eHealth as a national strategic asset and to further its role in reforming national health information landscapes;

— continue to support international development of eHealth standards and frameworks for interoperability;

— act as a knowledge broker for development of best practices for eHealth and innovation within a European context.

The findings, recommendations and actions of the report highlight Member States' increasing interest in and commitment to implementing a diverse range of national eHealth services. For success to be sustained and the full potential of investments to be realized, however, stronger political commitment for eHealth is required. Such commitment can be delivered through stable governance and funding mechanisms for eHealth, together with a clear and actionable national strategy for eHealth. Policy-makers are also recommended to monitor and evaluate eHealth investments carefully to ensure that they contribute as expected to the achievement of national health goals. Finally, the need for structured education programmes for health professionals and students of health sciences in the disciplines of eHealth cannot be overemphasized.

Together, the findings and analysis provided in this report offer a detailed insight into the development of eHealth in the European Region. Through the recommendations and actions proposed, WHO will continue its support to Member States in developing their national eHealth environments as a strategic component in the achievement of universal health coverage and Health 2020 policy objectives in the European Region.

This report was produced by the WHO Regional Office for Europe with the aim of presenting a regional status of eHealth development and emerging trends in Europe.

Innovation to implementation

The outcomes and key messages of the report are based on data collected through the 2015 WHO global survey on eHealth, together with the assistance of a number of key practitioners in the field of eHealth. A number of relevant case examples have been selected to illustrate national success stories and the practical application of eHealth in different settings. The title *From innovation to implementation* embodies a key finding of the report – that eHealth in Member States across the WHO European Region has transitioned towards becoming a national asset for implementing Health 2020 policy, strengthening health systems, delivering on the promise of person-centred health and reforming national health information landscapes (see Annex 1 for definitions of terms used in this chapter). Progress in eHealth has moved not only from piloted innovation projects to the implementation of established initiatives but also from a novel concept to a strategic policy goal.

Health 2020: the European health policy framework

In the WHO European Region, the regional health policy framework, Health 2020, aims to support action across government and society for health and well-being. Health 2020 calls for intersectoral whole-of-government and whole-of-society approaches to "significantly improve the health and well-being of populations, reduce health inequalities, strengthen public health and ensure people-centred health systems that are universal, equitable, sustainable and of high quality" *(1)*. Health 2020 gives European policy-makers a vision, a strategic path, a set of priorities and a range of suggestions about what works to improve health, address health inequalities and ensure the health of future generations.

National eHealth programmes are active contributors to the delivery of Health 2020 policy implementation through approaches to strengthening people-centred health systems and improving public health capacity. They facilitate the development of sustainable mechanisms for delivering health services, provide timely access to essential health information and enable increased quality of care. As such, the role of eHealth is evolving and challenging the understanding of traditional processes and skill sets in clinical settings and the application of local and global evidence in developing health policy and effective public health action.

eHealth supporting universal health coverage and reducing social inequities

The 2015 WHO global survey on eHealth examined the application of eHealth in support of universal health coverage, which all WHO Member States committed to achieving in 2005. Universal health coverage ensures that all people, everywhere, have access to health-related services without enduring financial hardship in order to obtain them. The goal of universal health coverage has its foundation in the WHO constitution of 1948, which declares health as a fundamental human right. The Health for All agenda, initiated by the Alma-Ata declaration of 1978, further supports the idea that health coverage applies to all regardless of age, gender, location, nationality, ethnicity and income level *(2)*. Universal health coverage directly affects the health of a population and is a characteristic feature of a government's dedication to supporting the well-being of its population. It reduces poverty and social inequalities, increases education, assists sustainable development and enables individuals to actively contribute to their families and communities, thereby empowering all people to be healthier, more productive and more involved in their own health and well-being.

Increasingly, it is being recognized that eHealth plays a unique and pivotal role in achieving universal health coverage. It extends the scope, transparency and accessibility of health services and health information, widening the population base capable of accessing the available health services and offering innovation and efficiency gains in the provision of health care. The concept of universal health coverage is often represented in three dimensions: the portfolio of health services offered to (or needed by) individuals, the population or population groups covered by such services and the proportion of direct costs paid by consumers in order to receive these services (out-of-pocket expenses). These dimensions are often visualized using the universal health coverage cube (see Fig. 1) to illustrate interlinkages between the dimensions and to visualize the size and nature of a country's progress in achieving universal health coverage.

Fig. 1. Three dimensions of universal health coverage
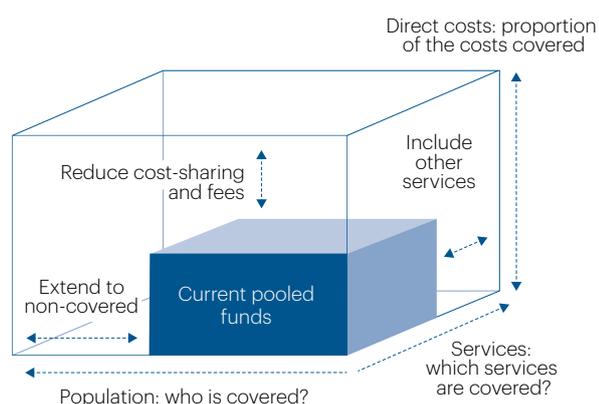
Source: WHO (3).

Universal health coverage also recognizes that health does not function separately from the rest of societal influences and that many factors which may seem unrelated to health often have a direct bearing on the health of a population. It compels all sectors of society to recognize their interrelated roles in ensuring health, extending beyond traditional approaches to health and social care and encouraging intersectoral engagement and action to achieve positive outcomes on the health of populations. Strong economies, stable governments, urban planning, transportation, employment and occupational surroundings, environment, education, social support networks and culture all affect health. Encouraging and increasing collaboration and sharing of evaluations and information on eHealth among countries can strengthen the European Region and increase Member States' leadership role for the rest of the global community.

The role of WHO and eHealth in the international context

At the international level, the role of WHO in eHealth is mandated through two World Health Assembly resolutions: WHA58.28 (2005) on eHealth *(4)* and WHA66.24 (2013) on eHealth standardization and interoperability *(5)*. These resolutions broadly shape WHO's contribution to the global eHealth agenda and capture a request for assistance by Member States "…to make appropriate use of information and communication technologies in order to improve care, to increase the level of engagement of patients in their own care, as appropriate, to offer quality health services, to support sustainable financing of health care systems, and to promote universal access". In particular, both resolutions recognize the importance of "access to fuller and more accurate information in electronic form on patients at the point of care" and the "need for international, multistakeholder assistance in the development of eHealth and health data standards and interoperability". Non-state actors such as civil society and private actors, particularly technology developers and service providers, are recognized as having an important role in the ongoing development of eHealth; as such, they are seen as primary drivers of technology-based innovation within the health sector. Globally, WHO works as a mediator to

bring government and non-state actors together around a portfolio of shared eHealth interests and seeks to develop guidelines and recommendations to lead the formation and prioritization for its strategic development and implementation.

Regional offices mobilize action on WHO's global eHealth mandate by supporting Member States in their implementation of national health sector reforms or through capacity-building in the context of national strategic programmes for eHealth. Within the European Region, WHO delivers on its eHealth mandate in three ways:

— by fostering partnerships with major international stakeholders working to advance eHealth;

— through sharing of global best practices and standards precipitated from successful eHealth implementations;

— by working directly with governments to address their technical and strategic needs for eHealth and health information.

The ongoing transformation of public health, health service delivery and health information in Europe

Every health system in Europe faces challenges in delivering high-quality, effective and safe care at an affordable cost. Over the last decade, the progressive adoption of technology in health has brought about a significant revolution in the way health and health service delivery are viewed and in the means by which patients and health care providers interact with one another. At the core of this technology-led transition is an adjustment in the way health information is captured, viewed, processed, exchanged and stored. This has led to significant adaptations in our understanding of what constitutes health information, how it can and should be used, where it resides, and by whom and how it should be accessed.

In the pan-European context, the positive impacts of eHealth are often realized through national health reform initiatives that integrate disparate components of the health sector and drive the shift towards putting the patient firmly at the centre of care. The role of eHealth in reforming the national health information landscape is often undervalued, however, and requires effective action through national strategies for planning, investment and long-term maintenance of national health information systems (HISs), which in turn provide a credible and timely body of evidence in support of strategic decision-making in health.

As an overarching initiative to address inequalities in health information and facilitate its consistent application across Europe, the WHO Regional Office for Europe has established the European Health Information Initiative (EHII) *(6)*. This multimember network, composed of Member State representatives, the European Commission, the Organisation for Economic Co-operation and Development (OECD) and other stakeholders, is committed to harmonizing health information; improving its comparability and quality; and making health

information more available, accessible and easy to use. The vision of the EHII is the creation of an integrated, harmonized HIS for the entire European Region to provide evidence for policy-makers. The six key areas and underlying values of the EHII are illustrated in Fig. 2.

Fig. 2. Underlying values and key areas of the EHII

Adding it all up	EHII key areas
Underlying values – Maintaining compatibility with existing monitoring frameworks, including global ones – Applying the life-course perspective – Aiming to reduce inequalities – Enhancing interagency collaboration – Enhancing intersectoral collaboration	1. Development of information for health and well-being with a focus on indicators 2. Improved access to and dissemination of health information 3. Capacity building 4. Strengthening of health information networks 5. Support for health information strategy development 6. Communications and advocacy

Source: WHO Regional Office for Europe (6).

The role of eHealth in empowering individuals

Over the past decade, eHealth has played a key role in expanding access to diagnostic services, improving the quality of services, increasing coordination between providers, improving patient management, helping to overcome physical distances between patients and providers and engaging patients in their own health and well-being. In the policy context described, WHO recognizes that well-performing health systems are crucial if population health and well-being are to be achieved. In the WHO European Region, Member States share a commitment to health system strengthening. The vision of people-centred health systems put forward by Health 2020 recognizes this. At the 65th session of the Regional Committee for Europe in 2015, two priority areas for the 2015–2020 period were agreed with Member States as areas of focus: transforming health services to meet the health challenges of the 21st century and moving towards universal coverage for a Europe free of catastrophic out-of-pocket payments *(7)*. The findings described in this document confirm that eHealth is a foundation for the achievement of these priorities.

Recognizing the central role of individuals as informed and engaged partners in decisions affecting their own health and well-being, the transition to patient-centred care models is evident across all European Member States. eHealth solutions are often deployed in the context of facilitating this transition and benefits attributed to a patient-centred approach such as safety, efficacy, available treatment options and variable delivery modes all contribute to individuals' ability to manage their health and the health of their community. Considerable expertise in preventing and managing illness can be acquired if individuals are empowered and given

appropriate resources through which to participate in the delivery of care. Investing in enhanced co-participation models of prevention and treatment offers real opportunities to improve health affordably and with greater patient satisfaction.

The 2015 WHO global survey on eHealth

Development of the survey

The global survey on eHealth instruments are developed by the WHO Global Observatory for eHealth (GOe), with consultation and input from relevant eHealth partners. These partners included governments, WHO regional and country offices, collaborating centres, professional associations and international organizations. Based on this input, combined with results and feedback from responding Member States, the survey is amended and updated.

The purpose of the WHO global surveys on eHealth is to determine and observe benchmarks in the adoption and progress of eHealth at the national, regional and global levels. The first survey, conducted in 2005, focused on national-level information to establish a baseline. The second, conducted in 2009, built on the base of knowledge acquired in the first survey, contained more detailed questions and included a focus on eHealth themes. The 2015 survey examined eHealth in the context of its role in supporting universal health coverage. The objectives of this third survey were to measure the global progress in eHealth development and adoption from the previous survey results, to explore forward-looking eHealth trends and to review current barriers to eHealth adoption. The eHealth themes used in the 2015 survey are reflected in the chapter structure of this report.

Implementation of the survey

The third WHO global survey on eHealth was launched in March 2015 and concluded in August 2015. It was primarily implemented in digital format but was also made available in paper format for completion by Member States. The survey instructions and questions were available in all official global WHO languages plus Portuguese, and all Member States in the European Region were formally invited to participate. The health ministry in each Member State was asked to nominate a national survey coordinator to manage the process of identifying relevant national eHealth experts and incorporating their input to the survey. The guidance notes for the survey coordinators encouraged them to convene a one-day meeting with all identified experts to ensure mutual understanding, consistency and completeness of the national survey response. Upon receiving the input from national experts, the survey coordinator was responsible for reviewing and submitting the results to WHO.

Report methodology

Data processing

Only data for the responding Member States in the WHO European Region are analysed and discussed in this report. The response rate for the 2009 WHO global survey on eHealth was 68%, with 36 of the 53 countries in the Region submitting data. For the 2015 survey, 47 of the 53 countries submitted data, giving a response rate of 89%. The data from Belarus, however, only became available after the conclusion of the survey analysis, so the results presented in this report are based on the 46 Member States' responses that were available at the time of analysis.

To analyse the data, all non-English responses were translated into English and survey responses were checked for consistency and other errors. Not all countries responded to all questions, and the analysis presented in this report is based on *non-blank responses to each individual question*. The data from the 2015 survey were analysed in the autumn of 2015 by staff at the WHO Regional Office for Europe and the WHO Collaborating Centre for eHealth and Telemedicine at the Norwegian Centre for Integrated Care and Telemedicine. Data analysis was performed in Microsoft Excel and SPSS Statistics formats. Results are frequently given as both the percentage of all respondents to a specific question and the number of countries giving a particular response. Unless otherwise stated, use of the terms "Europe" and "European Region" refers to the WHO European Region and use of "country" or "countries" refers to one or more of the 53 Member States in the WHO European Region.

Data were aggregated and analysed by additional groupings, such as subregion and World Bank income group (see Annexes 2 and 3 for details), to explore further trends. Results were examined in greater depth and external health and technology indicators, such as Internet usage, were introduced into the analysis where relevant. The results of the 2015 survey are compared to previous survey data where available and applicable. It should be noted that the questions in the previous surveys were worded somewhat differently and that the subject matter is not entirely consistent for comparison.

Limitations

Acknowledging the inevitable time lag in the observable benefits and return on investment of eHealth adoption, especially in large-scale initiatives, the WHO global surveys on eHealth highlight the importance of developing a focus and capacity for monitoring and evaluating progress on national eHealth development. The surveys represent high-level efforts to measure the continued development of global eHealth; this report on eHealth in the WHO European Region illustrates the progress made since 2009.

The survey focuses on eHealth development at the national level, which excludes some initiatives and activities as they are outside its scope. The number and range of questions also differ among the thematic areas. Definitions of terms and detailed instructions for

the survey were given in order to maintain consistency; however, inconsistencies and variations in responses were found throughout the results. WHO accepts the responses provided by Member States at face value, which inherently includes differences in interpretation of the questions and responses. As Member States were limited to one response per country, a consensus was needed to best represent the situation in the country as a whole, even though eHealth activities may vary within a country or may not meet the survey criteria. Further, the data presented here do not include responses from other stakeholders, such as patients, communities, health care providers and the eHealth industry.

About this report

This report and other publications in the GOe series are directed at a readership of ministries of health and of information technology and telecommunications, public health practitioners, researchers and academics, eHealth professionals, organizations involved in eHealth and private sector partners. It is organized according to the thematic areas explored in the 2015 WHO global survey on eHealth and focuses on eHealth in the European Region. Each chapter includes a description of the topic area based on the definitions given in the survey and begins with key messages derived from the results of the survey; these are further elaborated upon in the chapter text. Case examples from Member States in the Region are used to illustrate each thematic area. These were identified by contributors to the report and from responses by Member States to the survey questions. The criteria for inclusion of case examples were relevance to chapter content, learning potential of the initiative and geographical spread within the Region. Each thematic chapter of the report concludes with a list of recommendations. These are made by the WHO Secretariat on the basis of the survey data received and observations of good practices and operations in Member States.

Chapter 1 focuses on the importance of building foundations to ensure the growth, maturity and sustainability of national eHealth development. It explores national policies or strategies that address universal health coverage, eHealth and HISs, as well as funding sources for eHealth programmes. This chapter reports on language support through multilingual health information and services and on building health workforce capacity in skills and knowledge of eHealth and health technologies.

Chapter 2 concentrates on the use of national electronic health record systems. These are used for collecting, processing and sharing patient information; they affect universal health coverage through the provision of thorough and time-efficient patient information-sharing at the point of care. It examines national legislation that governs the use of these systems, the types of facilities that use them and how widespread their use is among health facilities in European Member States. The chapter also reports on ancillary systems that link to national electronic health record systems and the application of international standards to support these. Additional technology-assisted functions used in the health

sector are also reported, as are the reported barriers to implementing electronic health record systems.

Chapter 3 describes how national and cross-border telehealth is being used in Member States. Information on national telehealth policies or strategies is reported with an examination of the extent to which they address how telehealth contributes to universal health coverage. The chapter gives overviews of telehealth programmes and services and information on evaluations of government-sponsored telehealth programmes, reported barriers to implementing telehealth and additional insights from Member States.

By using mobile technologies, health information, medical services and data delivery can reach wide geographical areas and assist in achieving universal health coverage. Chapter 4 discusses mHealth initiatives, which have increased markedly in the WHO European Region. It reports on policies or strategies that guide such programmes, the role or function of health authorities in mHealth, regulatory oversight and guidance and incentives for the development and evaluation of mHealth are reported. The chapter further provides an overview of mHealth programmes and the barriers to implementing them reported by Member States.

Chapter 5 addresses the implementation of eLearning for students of health sciences and health professionals. Skilled health workers are essential for the progress of universal health coverage, and the use of eLearning in their education and training supports improving their skills and knowledge. The chapter describes how widely eLearning is used, which student and professional groups are offered eLearning and the main reasons that Member States choose to use it, as well as the reported barriers to implementing eLearning programmes.

Social media in health can support universal health coverage through the direct involvement of health care consumers and providers, and by reaching wide audiences with health information and promotion initiatives. Chapter 6 examines its use and delivers information on national policies or strategies for the

use of social media and on how social media is used by health care organizations, communities and individuals.

Chapter 7 presents the development and use of health analytics and big data and how they can contribute to universal health coverage through improved country, regional and global health information. It reports on national policies or strategies regulating the use of big data in the health sector and on the reported barriers to the adoption of big data for health.

Chapter 8 is the final thematic chapter of the report and examines national legal frameworks addressing matters related to health care, such as medical jurisdiction, patient safety, the protection of patient data and the reimbursement of eHealth services. Legal frameworks addressing the right to health, access to services and the rights of patients can confirm commitments to universal health coverage. The chapter also discusses collection, use and reuse of data as elements of eHealth, which require legal frameworks to define roles and create certainty in the relationship between health care providers and consumers.

The concluding chapter emphasizes the importance of both the progress made so far and continued progress in eHealth for the WHO European Region. Member States are advancing their national foundations for eHealth development and cultivating the strategic delivery of eHealth services. They acknowledge that eHealth can further their progress in achieving universal health coverage and recognize the support that governance mechanisms and national strategies can provide to guide this. This chapter summarizes the results of the 2015 GOe survey and links them to the central aspirations for eHealth in the Region and globally.

The report's annexes list key definitions and outline both the subregional and the World Bank gross national income per capita groupings used in the report. A further interactive annex is available as part of the WHO European Health Information Gateway, where readers are encouraged to explore the survey results and data for the Region.

eHealth involves a broad group of activities that use electronic means to deliver health-related information, resources and services: it is the use of information and communication technologies (ICT) for health. eHealth foundation actions build an enabling environment for the use of ICT for health. These include supportive eHealth policy, legal and ethical frameworks, adequate funding from various sources, infrastructure development and developing the capacity of the health workforce through training *(8)*.

Key data from the survey responses

— 84% of Member States in the WHO European Region have policies to support their progress in achieving universal health coverage.

— 70% of Member States have a national eHealth policy or strategy.

— 69% of Member States have financial support available specifically for the implementation of their national eHealth strategy or policy.

— 60% of Member States report having a policy or strategy guiding the development of their national HIS.

— 89% of Member States offer education or training on how to use ICT and eHealth.

Background

The use of technology and Internet connectivity provides new methods for utilizing and improving public health services (see Annex 1 for definitions of terms used in this chapter). For example, eHealth can be used to provide treatment to patients without the need to travel to a doctor; to educate health professionals through online learning; to track diseases and epidemic outbreaks; to facilitate health promotion initiatives; and to support public health. eHealth is one of the fastest growing sectors in the overall health care market and can be used at the local, national, regional and global levels as a resourceful means to promote and strengthen health systems and health information *(9)*. It encompasses the ability to document, manage, find, use and share information to support health and social care. The use of electronic processes in health encourages the efficient use of health-related resources, including reducing costs, increasing the speed of delivery, saving time, preventing the overuse of or dangerous interactions in medications, reducing travel and removing the need for a physical space to treat every patient.

In recent years, broadband penetration in Europe has reached high levels and the pricing of mobile devices and data plans has fallen considerably *(10)*. The majority of people in the WHO European Region now access the Internet at least once per day *(11)*. Nearly half of Europeans with Internet access search for health-related information *(12)* and empowered patients talk to their physicians about health information they find online *(13)*. European populations are rapidly becoming accustomed to conducting business and personal affairs online through the proliferation of Internet banking, email, smart phones and eCommerce solutions. As such, it is widely anticipated that the demand and capacity for managing health-related activities online will increase.

While more efficient and effective health information and services are desirable, there are notable challenges in laying the foundation for eHealth within Member States and across regions. Procuring ICT, acquiring access to the necessary technology and having a stable telecommunications infrastructure are crucial. Securing funding for both initial resources and the continued maintenance and development of eHealth systems is also essential. Well developed eGovernment and guidelines on the collection, transfer, storage and use of patient information, as well as on how eHealth will be regulated, monitored and sustained, are needed. Capacity-building is also required to ensure that the current and upcoming workforces are educated in delivering care services electronically, and that populations are encouraged and equipped to actively participate in eHealth programmes. While these key challenges require significant resources for planning and execution, many Member States in Europe are overcoming these and other barriers to provide a portfolio of efficient and accessible health services, enabled by eHealth. Key steps in developing or strengthening national eHealth programmes are typically outlined through a national eHealth strategy or policy. Case example 1 provides an illustration of the role eHealth can play in creating new and accessible health services.

Case example 1.
eHealth expanding services to remote areas in the Russian Federation

Collaboration between the Norwegian Centre for Integrated Care and Telemedicine and Nenets Autonomous Okrug in the Russian Federation is helping to improve health care for remote and nomadic populations in this region. Nenets Autonomous Okrug has a population of more than 43 000 in an area covering some 176 000 km2, where some communities are located up to 500 km from the nearest neighbouring settlements. This has a major impact on providing health care services, with challenges including a lack of road connections between the city, Naryan-Mar, and villages. Air travel is the main means of transport for both health emergencies and planned consultations.

A project funded through the grant scheme for Norwegian–Russian collaboration in health and related social issues, administered by the Royal Norwegian Ministry of Health and Care Services with significant support from both Russian and Norwegian partners, looked at how technologies can be used to address such issues. Telemedicine was first used in Nenets Autonomous Okrug in 2000, with the implementation of the Russian federal programme "Children in the north". Although telemedicine is well established in the Russian Federation, challenges include ensuring continued training for those working in health and a legal framework for distance health services. As well as the two largest health care institutions – the Nenets Regional Hospital

in Naryan-Mar and the Central District Polyclinic in the Zapoljarnyj municipality – Nenets Autonomous Okrug has 15 remote clinics and health centres. Between 2000 and 2014, more than 4000 telemedicine consultations took place, over 1300 of which were for children *(14)*.

The project examined how the telemedicine system could also be used for health promotion and to provide information about healthy lifestyles. In addition, it looked at ways of improving the organization and logistics of telemedicine, such as providing preventive health care and improving early detection of diseases by arranging the health and medical monitoring of nomadic reindeer herders when they are staying near villages.

Other initiatives included encouraging health workers to use technology that they may find intimidating and educating, recruiting and involving new employees. The project also looked at how technologies can be used for health monitoring of pregnant women and infants, without the need to travel by air to meet specialists in Naryan-Mar – a journey lasting up to two hours. A proactive approach was taken to inform the population of Nenets Autonomous Okrug about telemedicine practice through interviews on television and radio, in newspapers and via the Internet. In addition, the project also looked at establishing a professional network on eHealth in inaccessible regions.

Results of the survey: national policies and strategies

The 2015 survey revealed that 84% of respondents (38 countries) have a national universal health coverage policy or strategy. Of those, 74% (28 countries) responded that their policy or strategy makes a specific reference to eHealth or ICT in support of universal health coverage. This indicates that the majority of countries have acknowledged the benefits of adopting a universal health coverage approach and are using technology to strategically achieve their own national health objectives.

A national approach for eHealth organizes the objectives for using ICT specifically in the health sector, and 70% of respondents (30 countries) indicated that they have a national eHealth policy or strategy. Of those, 90% (27 countries) indicated that this policy or strategy refers explicitly to objectives or key elements of universal health coverage. This demonstrates that Member States largely recognize the role of eHealth in achieving universal health coverage and are taking concrete action through policy and strategy development. However, 10 years after Member States resolved to achieve universal health coverage *(15)*, some countries have still not begun acting on this commitment. Table 1 shows the trend in eHealth policy or strategy adoption in the Region, based on results from previous global eHealth surveys.

Table 1. Trends in eHealth policy and strategy adoption

Percentage of countries with a national eHealth policy or strategy	2005 n=26	2009 n=36	2015 n=43
	73% (19 countries)	89% (32 countries)	70% (30 countries)

Sources: 2005 data from the 2008 WHO publication Building foundations for eHealth in Europe (16); 2009 data from the 2011 WHO publication Atlas – eHealth country profiles: based on the findings of the second global survey on eHealth (8).

A national policy or strategy for an HIS organizes the vision and actions to meet the health information needs of the country. Of the responding countries, 60% (27 countries) reported having a policy or strategy guiding the development of their national HIS, and another 22% (10 countries) reported that their HIS was addressed within the scope of their eHealth policy or strategy rather than as a separate document. Eight countries (18%) reported that they had no policy or strategy to guide the development of their national HIS. This indicates that the majority of respondents still see an HIS as distinctly different from eHealth, while a small group view the HIS within the context of their national eHealth implementation. Shown by subregion, the proportions of Member States that reported having a policy or strategy for an HIS, for eHealth and for universal health coverage, are given in Fig. 3 (see Annex 2 for subregional groupings). Case example 2 gives an example of effective policy implementation using eHealth to improve health care delivery and integrate health information nationally.

Fig. 3. Member States with policies or strategies addressing eHealth, universal health coverage and HISs, by subregion

Legend:
- Universal health coverage policy/strategy (n=45)
- eHealth policy/strategy (n=43)
- HIS policy/strategy (n=45)

Y-axis: Percentage of Member States (0–100)
X-axis categories: EU-28, CIS, CARINFONET, SEEHN, Small countries, Nordic countries

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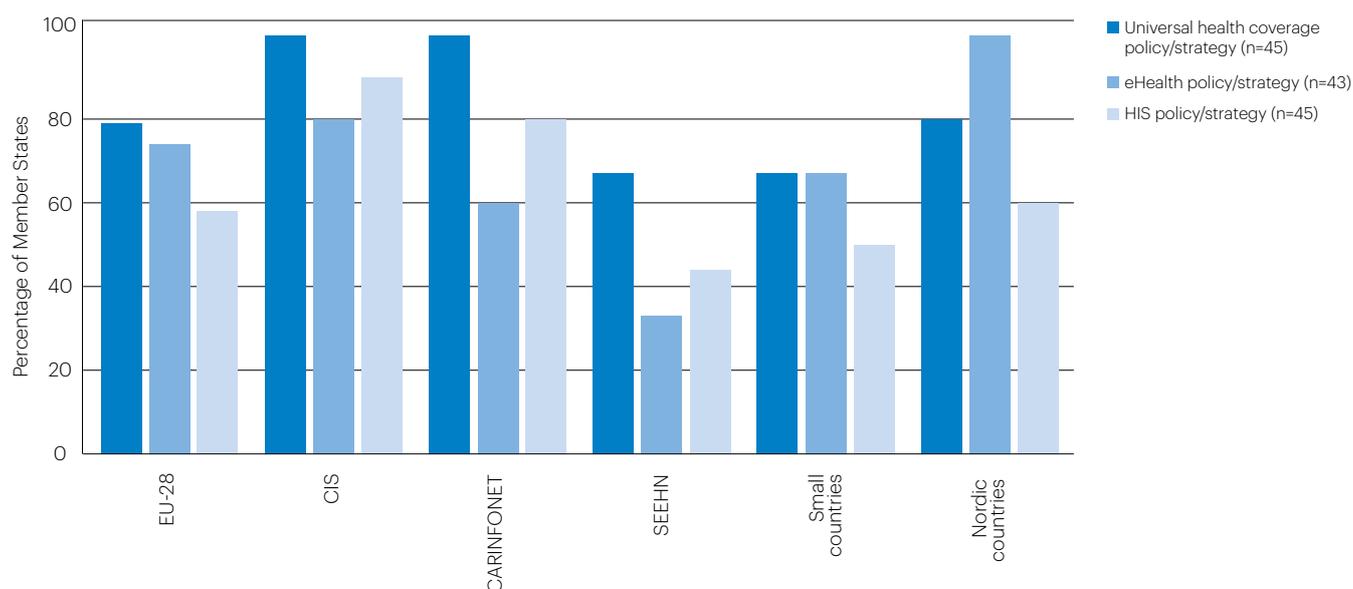
Case example 2.
eHealth and an integrated HIS in the former Yugoslav Republic of Macedonia

MojTermin (My time) started in the former Yugoslav Republic of Macedonia in 2011 to improve the scheduling of clinical appointments and reduce long waiting times to see a doctor or to have diagnostic tests. Initially, it was used in three public institutions but soon expanded to public hospitals and primary care providers, and continues to develop. All public and private health institutions, all booking of health services in these institutions, referrals and prescriptions, electronic health cards for citizens and electronic health records on each patient are now incorporated into *MojTermin's* services. The cloud-based system is designed to be scalable by using modular programmes and solutions that can be integrated with one another and with other health care applications. It combines the HIS within the eHealth services, and the modules include beneficial services such as registering for organ transplantation, shared decision-making on health policy, text messaging notifications for appointment times and a live dashboard showing requests, referrals, most frequent diagnoses and prescriptions in real-time. The Ministry of Health, the Health Insurance Fund, the Institute of Public Health and medical and health care institutions plan to integrate automated processes and practices to all levels of health care, including pharmacies and administration *(17)*.

The Ministry of Health reported that waiting times for diagnostic imaging had significantly decreased, that waiting times in health facilities had been reduced, that no duplicate or false patients had been identified and that the minimum working times per physician and per medical device had been identified. While there have been technical hurdles, including Internet connectivity problems and lack of electricity, the Ministry of Health made it clear that no problems with the system would prevent any patient from receiving the necessary health service. In a 2015 survey by the Ministry of Health, over 80% of Macedonian and Albanian patients reported being satisfied with the system, doctors noted improvements in notifying patients if their appointment would be cancelled or delayed, over 70% of patients were satisfied with the appointment and waiting times at the doctor's office and fewer than 7% of patients failed to attend their scheduled appointments without cancellation *(18)*. With a strong vision for eHealth and the specific goals of improving scheduling and waiting times for clinical appointments and diagnostic tests, *MojTermin* has achieved goals and demonstrated how strategic eHealth planning leads to success.

Progress on developing national eHealth governance

Countries that have more advanced eHealth foundations are beginning to transition from strategies for implementation to updates on the progress of their efforts and approaches for scaling up and adding new services. A detailed national strategy for eHealth helped Sweden to develop a strong foundation. Since its initial eHealth strategy in 2005, Sweden has revised the national focus to empowering and motivating individuals to co-developing eServices; increasing national coordination of health and social care; improving access to information for decision-making in care; and increasing focus on national and international issues related to eHealth *(19)*.

Furthermore, the country's strategic objectives for eHealth now include broadening the scope for research and improving its application in decision-making; improving the technical infrastructure for better and more secure sharing of information; continuing work on terminology and standards in order to increase the coordination and consistency of information; and developing legal and regulatory frameworks in eHealth.

Today, most countries in the WHO European Region have policies or strategies outlining eHealth goals, measures and implementation objectives and achievements. However, there is still a need for adequate governance and legislation to address the advances that eHealth is bringing and for strengthened monitoring and evaluation to track and assess implementation. With respect to national legislation governing eHealth, Member States are often only guided by a general legal framework.

This means that developers and users of eHealth have to navigate many legal grey areas, and that adequate guidance and support are still limited. In response, many countries are realizing the need to evaluate their eHealth strategies and activities in the context of legislation governing the development of technical eHealth solutions, such as electronic health records, mHealth solutions and ePrescription services. This is particularly pertinent in cases where such technology has the ability also to operate beyond national borders. Growth in the establishment and expansion of national agencies that oversee national eHealth infrastructure development, however, is an indication of the commitment of Member States in the Region to address these issues. Case example 3 illustrates the importance of national eGovernment platforms in developing eHealth and digital welfare sectors.

Case example 3.
e-Transformation in the Republic of Moldova

In 2011 the Moldovan government adopted a strategic programme for governance technological modernization (e-Transformation), with the goals of improving performance, responsiveness and transparency *(20)*. Its aim was to create a unified government portal for individuals and businesses to access information and services and a shared technology platform for public institutions by 2020. The project is broken down into two main components:

— eLeadership capacity and enabling environment – to support eGovernment and drive the eTransformation agenda, eLeadership and digital capacity training, civil servant capacity-building, strategic communications and partnerships, policy development, project management and the development of policy, technical, legal, and regulatory frameworks;

— shared infrastructure and eService development – to launch the government cloud computing infrastructure (M-cloud) and generate eGovernment services.

One of the key components of the e-Transformation project is an open government programme that will reduce and prevent corruption, increase transparency and enrich public services *(20)*. The government has already published a database on public spending and created an open data portal, and the programme will use social networks and social media to ask for public opinion, share information, encourage innovation and promote transparency as a means to engage the population in government decisions. Further, the platform will support authentication, electronic payments, notifications and audit services; the government expects to create savings in time and finances by eliminating unnecessary paperwork, reusing available data, streamlining processes and reducing errors. The e-Transformation project and the M-cloud infrastructure lay the groundwork, which the health sector can use and benefit from. The results of the project have strongly contributed to the Republic of Moldova's ranking as number one among lower-middle income and low-income countries in the 2014 and 2015 Global Innovation Indexes *(21, 22)*.

eHealth governance in the European Union (EU)

The eHealth Governance Initiative (eHGI) *(23),* financially supported by the European Commission, aims to develop policy recommendations, guidelines, reports and a coordination platform in order to better integrate eHealth into national health policies. The coordination platform serves to unite Member States and interact with eHealth stakeholders so that knowledge and strategy development in the field of cross-border eHealth interoperability are shared and can be discussed together. The eHGI is supported by the European Commission's Joint Action to support the eHealth Network. The eHealth Network (eHN) is a voluntary network connecting national authorities responsible for eHealth.

It finds its legal foundations in Article 14 of EU Directive 2011/24/EU on patients' rights in cross-border health care *(24)*. Specifically, Article 14 on eHealth institutes a voluntary network of national eHealth authorities to have responsibility for eHealth and cooperation among EU Member States in the field of eHealth. The eHN focuses on the areas of interoperability between health systems, standardization, knowledge exchange and monitoring and assessment of implementation. It also looks at global cooperation and positioning, enhancing continuity of care, achieving trust and security in eHealth and ensuring access to safe and high-quality health care. The Network will set down guidelines for data and procedures for the use of medical information in research and for public health; it has already adopted guidelines on data to be included in patient summaries and ePrescriptions, and on

an organizational framework for eHealth national contact points. Furthermore, the eHN adopted the Refined eHealth European Interoperability Framework (ReEIF) in 2015 *(25)*. Sharing information across the continuum of care is a key element of successful health systems integration *(26)* and the development of effective eHealth architectures is an important factor in strengthening national health information networks and in facilitating the transfer of health information across borders. Collaboration is crucial to foster sustainable eHealth development, and EU Member States are asked to play an active role by contributing to and translating decisions into equivalent national activities and regulations.

Frameworks for monitoring and evaluating eHealth

There are very few examples in the European Region where countries have adopted a systematic approach to the monitoring and evaluation of national eHealth implementations: this is an area that will benefit from further political support and technical development. For policy-makers, it is important that there is transparency when evaluating eHealth policies and that policy development is itself based on relevant data, research and experience. There are often difficulties in obtaining meaningful and timely data on the performance and use of national eHealth implementations and the effectiveness of policy options for eHealth. The Nordic eHealth Research Network (NeRN) was initiated in 2012 to compare and develop indicators on eHealth services and outcomes in the Nordic eHealth policies *(27)*. It aims to identify useful data for national and international policy-makers and scientific communities by evaluating eHealth strategies, looking at and monitoring existing eHealth targets, testing and proposing data collection methods and distinguishing variables in data. In a 2015 publication, NeRN reports on lessons learned from a novel approach to monitoring eHealth through the evaluation of national data logs as performance-based indicators for the use of eHealth *(28)*. The work of NeRN highlights the importance of stakeholder involvement when verifying outcomes and shows that that sociocontextual characteristics need to be considered when developing evaluations. It also emphasizes that the focus and goals of eHealth policies change over time, that professional qualifications and educational systems differ among countries and that multidisciplinary collaboration will be beneficial to ensure that surveys use accurate and focused language, concepts and terms *(29)*.

Funding

Sources of financing for the development of eHealth vary; the primary sources of funding are public or quasi-public sources, such as general budgets for health or ICT *(30)*. Private insurance companies or public technology and innovation agencies may also be involved in financing eHealth. The reimbursement of eHealth services by the public budget is still rare in many countries and largely depends on project-based sourcing. One main funding challenge shared by many countries in the WHO European Region is the difficulty in justifying significant expenditure on eHealth out of the public budget, especially when

legislation on eHealth is still pending. Complexities in measuring the return on investment for large-scale national initiatives are also a barrier to establishing sustainable funding for eHealth.

Within the EU, action within eHealth promotes a wider strategy for the development of ICT. The European Investment Bank and the European Innovation Partnership on Active and Healthy Ageing, among other funding organizations, also invest in health-related innovation. Over the past 20 years, the EU has invested hundreds of millions of euros towards the development of sustainable and personalized integrated services, including eHealth tools and solutions *(31, 32)*. The EU's main funding programmes that currently focus on eHealth include Horizon 2020; the Innovative Medicines Initiative; Active and Assisted Living; the EU Health Programme 2014–2020; and the European Structural and Investment Funds.

Results of the survey: funding

The survey asked about funding availability for eHealth programmes to establish which sectors are making financial support available for eHealth. Table 2 shows the type of funding available for eHealth programmes in 2015, with Member States grouped by World Bank gross national income per capita grouping *(33)* (see Annex 3 for these groupings). Table 3 shows the type of funding available in 2015 by subregion; Table 4 shows the trends in available funding in the WHO European Region since the 2005 GOe survey.

Public funding is the most available type in the Region: 93% of Member States responded that public funding is available for eHealth programmes. Of these, 69% are classified as high-income countries, 19% upper-middle and 12% lower-middle. Public funding was referred to in the GOe survey as financial support provided by government at the national, regional and/or district level.

The second most common type of available funding is donor or non-public development funding, with 53% of Member States reporting its use. Interestingly, 50% of those who report the use of donor and non-public development funding (12 countries) are classified as high-income countries. This type of funding was referred to in the GOe survey as financial or in-kind development support by agencies, banks, foundations or other non-public funding bodies at the international, regional or national levels; 14 countries (31%) report that this funding type is not available.

Private or commercial funding is available in 49% of Member States and 42% (19 countries) report that such funding is not available. Only one upper-middle income country reports that private or commercial funding is available for eHealth programmes. The GOe survey referred to this type of funding as financial or in-kind support by the private or commercial sector.

Public–private partnership funding is available in 47% of Member States, with 44% (20 countries) reporting it is not available. The majority of countries where public–private partnership funding is available are high-income countries (71%; 15 countries). Public–private partnerships were referred to in the GOe survey as joint ventures between public organizations and private sector companies.

It is also notable that 69% of Member States (31 countries) report that financial support is available specifically for the implementation of their national eHealth strategy or policy. The results indicate that funding for the implementation of planned activities is more readily available in higher-income countries. Of the respondents, 12 countries (27%) report no available funds to support the implementation of their national eHealth strategy or policy.

Table 2. Type of funding available for eHealth programmes, by World Bank gross national income per capita groupings

Source of funding	High-income (n=29)	Upper-middle (n=10)	Lower-middle (n=7)
Public (n=42)	69% (29 countries)	19% (8 countries)	12% (5 countries)
Private or commercial (n=22)	68% (15 countries)	5% (1 country)	27% (6 countries)
Donor or non-public development funding (n=24)	50% (12 countries)	21% (5 countries)	29% (7 countries)
Public–private partnerships (n=21)	71% (15 countries)	10% (2 countries)	19% (4 countries)
eHealth policy implementation (n=31)	74% (23 countries)	19% (6 countries)	7% (2 countries)

Table 3. Type of funding available for eHealth programmes, by subregion

	Public	Private or commercial	Donor or non-public development funding	Public–private partnerships	eHealth policy implementation
EU-28	100% (24 countries)	46% (11 countries)	42% (10 countries)	46% (11 countries)	83% (19 countries)
CIS	80% (8 countries)	70% (7 countries)	90% (9 countries)	60% (6 countries)	50% (5 countries)
CARINFONET	80% (4 countries)	40% (2 countries)	80% (4 countries)	60% (3 countries)	60% (3 countries)
SEEHN	100% (8 countries)	25% (2 countries)	88% (7 countries)	13% (1 country)	50% (4 countries)
Small countries	83% (5 countries)	0%	17% (1 country)	17% (1 country)	33% (2 countries)
Nordic countries	100% (5 countries)	40% (2 countries)	0%	80% (4 countries)	100% (5 countries)

Note: The totals may not equal 100% as Member States report a mix of funding and may belong to more than one subregion.

Table 4. Trends in available funding for eHealth programmes

Source of funding	2005 (n=26)	2009 (n=36)	2015 (n=45)
Public	81% (21 countries)	97% (35 countries)	93% (42 countries)
Private or commercial	50% (13 countries)	47% (17 countries)	49% (22 countries)
Donor or non-public development funding	N/A	36% (13 countries)	53% (24 countries)
Public–private partnerships	42% (11 countries)	31% (11 countries)	47% (21 countries)

Sources: 2005 data from the 2008 WHO publication Building foundations for eHealth in Europe (16); 2009 data from the 2011 WHO publication Atlas – eHealth country profiles: based on the findings of the second global survey on eHealth (8).

> **Public funding is the most available type in the Region: 42 countries (93%) report that public funding is available for eHealth programmes. Thirty-one countries (69%) also report that financial support is available specifically for the implementation of their national eHealth strategy or policy.**

In addition to available funding types, the survey also asked about the nature of funding contributions for eHealth over the past two years and the proportion and type of funding contribution utilized. Table 5 summarizes the funding contributions for eHealth programmes in the WHO European Region over the past two years and Table 6 shows these funding contributions by subregion.

Public funding is the most common type for eHealth programmes in Europe: 98% of Member States report that this was used in the past two years. Of these, 65% received more than half of their funding from public sources. This confirms that a large majority of governments in Europe are systematically investing in eHealth.

Donor or non-public development funding is the second most common source of eHealth funding, with 61% of Member States reporting use of this type of financial support. While two countries report that more than 75% of their financial support is through donor or non-public development funding, the remaining 23 countries report that this contributes to less than half of their eHealth funding.

Private funding is the third most common type of funding for eHealth: 51% of Member States report having received this type of contribution over the past two years. In all responding countries, however, private sources make up less than one quarter of their total funding. This indicates that while many countries receive this type of funding, it constitutes only a small portion of the total.

Finally, public–private partnerships are the least common type of funding. In total, 43% of Member States report receiving this type of funding for eHealth over the past two years. They also report that less than one quarter of their total funding for eHealth programmes originated from this source. Case example 4 provides an example of the use of donor funding to develop HIS capacity.

Table 5. Funding for eHealth programmes 2013–2015

Source of funding	Member States where funding source was used	Member States where funding source was not used	Member States using this funding in less than half of all national health care facilities	Member States using this funding in more than half of all national health care facilities
Public (n=44)	43 (98%)	1	15 (35%)	28 (65%)
Private or commercial (n=44)	22 (51%)	21	22 (100%)	0
Donor or non-public development funding (n=42)	25 (61%)	16	23 (92%)	2 (8%)
Public–private partnerships (n=43)	18 (43%)	24	18 (100%)	0

> " In the past two years, 98% of countries report having used public funding for eHealth. Of these, 65% received more than half of their funding from public sources, confirming that a large majority of governments in Europe are systematically investing in eHealth.

Table 6. Proportion of funding contribution for eHealth programmes 2013–2015, by subregion

	EU-28	CIS	CARINFONET	SEEHN	Small countries	Nordic countries
Public funding was less than half of total funding	17% (4 countries)	50% (5 countries)	40% (2 countries)	63% (5 countries)	20% (1 country)	0%
Public funding was more than half of total funding	83% (20 countries)	50% (5 countries)	60% (3 countries)	25% (2 countries)	80% (4 countries)	100% (5 countries)
Private funding was less than half of total funding	50% (12 countries)	67% (6 countries)	50% (2 countries)	25% (2 countries)	20% (1 country)	60% (3 countries)
Private funding was more than half of total funding	0%	0%	0%	0%	0%	0%
Donor/non-public funding was less than half of total funding	46% (10 countries)	100% (9 countries)	100% (4 countries)	88% (7 countries)	20% (1 country)	0%
Donor/non-public funding was more than half of total funding	5% (1 country)	0%	0%	0%	0%	0%
Public–private partnership funding was less than half of total funding	48% (11 countries)	33% (3 countries)	50% (2 countries)	13% (1 country)	20% (1 country)	80% (4 countries)
Public–private partnership funding was more than half of total funding	0%	0%	0%	0%	0%	0%

Case example 4.
Growing HIS in Serbia

Serbia has benefited from several projects aligned towards the development of a national foundation for eHealth *(34, 35)*. A community assistance for reconstruction, development and stabilization project, called "Development of HIS for basic health and pharmaceutical services", initiated the development of electronic health records for Serbia. This was furthered by the Ministry of Health's Serbia Health project, which also developed a database of health resources and classifications and realized HIS in four hospitals. Next, a hospital information system project focused on standardization and expansion of the infrastructure. This project integrated data delivery in health care and extended the HIS to another 10 hospitals, covering the health care needs of 30% of the population and moving towards a national HIS. Serbia has also established an eHealth Unit in the Ministry of Health and amended the Law on Health Care *(36)* and Health Care Insurance Act *(37)*.

The EU-funded Integrated HIS project aimed to use technology to improve health services and align them with EU standards for health care *(38)*. One of the goals was to evolve from paper-based administrative methods in health care and begin to use more efficient and effective information systems to improve the quality of care delivery.

Using HISs will also allow Serbia to deliver more cost-effective services, improve health system management and patient-centred care delivery and support the advancement of evidence-based health policies. The Integrated HIS project was successfully completed in 2015, with the integration of electronic health records and two hospital information systems in 19 Serbian health care institutions (clinics, hospitals, and specialized health institutions), and the integration of the HIS with laboratory information systems in selected hospitals and institutes *(39)*. It also included capacity-building for hospital staff to learn to use and maintain the system. This project helped to establish a sustainable technology foundation for an integrated national health system in Serbia, which the Ministry of Health will now expand. With the successful integration of electronic health records, public health efforts can draw upon the insight gained from such content. In particular, the Ministry of Health is interested in health reports, technical reports and reports on the electronic health record portal. These are also steps towards developing a structured health analytics function, where the HIS can provide insight into, for example, the most frequent diagnoses and those diagnoses having the most readmissions to hospitals.

Capacity-building in eHealth: multilingualism

For universal health coverage to reach all people, language support is needed to provide both services and information. Linguistic challenges occur in both the speaking and understanding of information, decreasing the quality of the communication and ultimately the likelihood of meeting the needs of patients. When discussing causes, interventions and detailed treatment guidelines for health conditions, it is important that medical professionals and patients understand each other. Linguistic challenges in health sectors are common in the WHO European Region, especially in countries that have large immigrant populations *(40)*. High mobility and the increasingly common practice of patients seeking elective care in other countries have made it clear that cultural contexts, including linguistic challenges, within health care settings will become more prominent in the future.

A national policy or strategy to incorporate multilingualism includes delivering health information and eHealth products, services and applications that are culturally sensitive and in the relevant languages for the community being served. Some countries, which are officially multilingual, may have separate facilities or services for people of different ethnic origins, yet linguistic challenges are still frequently part of the encounters *(40)*. Research shows that financial benefits can be achieved if linguistic barriers are overcome *(41)* and has pointed out the need to incorporate multilingual features into eHealth tools *(42)*. eHealth services and infrastructures will need to address these issues in order to avoid communication inequalities due to differences in technical ability, literacy, language and cultural diversity.

Results of the survey: multilingualism

Of the respondents, 16 countries report that they have a policy or strategy on multilingualism, while a further 16 report having no such policy or strategy. Seven countries report that they are unaware of whether such a policy or strategy exists and six report that a policy or strategy on multilingualism is not applicable due to the language situation in their country. Among those countries that report having a policy or strategy on multilingualism, the year of adoption ranges from 1917 (in Finland) to 2013 (in Poland). Countries reporting that their government-supported health websites provide information in multiple languages make up 76% of respondents (34 countries); 13% (six countries) do not have government-supported health sites in multiple languages and 11% (five countries) report that this is not applicable due to the national language situation. Table 7 presents the trends in Member States adopting policies or strategies addressing multilingualism. The 2005 and 2009 survey results are based on countries reporting whether they had policies or strategies that promote both the availability of information in local languages and that recognize cultural diversity, which is slightly different from the 2015 survey, which asked only about multilingualism. Case example 5 illustrates the importance and benefits of addressing multilingualism in health care settings.

> " **Linguistic challenges in health sectors are common in the WHO European Region, especially in countries that have large immigrant populations.**

Table 7. Trends in existence of a policy or strategy addressing multilingualism in health

Member States addressing multilingualism	2005 (n=26)	2009 (n=36)	2015 (n=45)
	42% (11 countries)	42% (15 countries)	35% (16 countries)

Sources: 2005 data from the 2008 WHO publication Building foundations for eHealth in Europe (16); 2009 data from the 2011 WHO publication Atlas – eHealth country profiles: based on the findings of the second global survey on eHealth (8).

> **As one of the pillars of universal health coverage, well trained health workers are an essential part in providing high-quality, accessible services.**

Case example 5.
Multilingual health through technology

UniversalDoctor, UniversalNurses and UniversalWomen are Internet-based programs that enable multilingual health conversations *(43)*. They are available through the web (for use on a computer) and as apps for smart phones and tablets. These enable multilingual consultations and effective communication by allowing each party to use their own language. All three use large text and audio functions to make the programme usable by people with hearing and vision impairments. Furthermore, the mobile apps for all three do not require an Internet connection, so they can be used in any location once downloaded, whether in the country of residence or during travel, and updates and additional languages are added for free.

UniversalDoctor is designed to facilitate conversations between health professionals and patients who speak different languages. The web-based program is robust and extensive, intended for use in hospitals and clinics, and delivers more than 5000 phrases, questions, answers and explanations in more than 30 languages. The web program was also the winner of the United Nations World Summit Award in 2014 on mHealth. The mobile app offers 13 languages (English, Spanish, French, German, Chinese Mandarin Simplified, Japanese, Moroccan Arabic, Portuguese, Catalan, Russian, Romanian, Polish and Italian) and works on different types of service platforms, making it available to anyone with a smartphone or tablet. Both the web and mobile versions organize information to assist naturally with medical history-taking and clinical visits (patient admission, immediate medical needs, medical history, symptoms, physical examination procedures, diagnosis, treatments, questions regarding treatment and additional health advice).

UniversalNurses is designed for multilingual communication between nurses and patients, offering medical translations in six languages (English, Spanish, French, Russian, Romanian and Arabic) *(44)*. This program runs with the same translation software as UniversalDoctor and is available to use on a computer and tablets. UniversalWomen is a similar program, also running on the UniversalDoctor platform *(45)*, which offers medical translations in six languages (English, Spanish, French, Russian, Romanian and Arabic) that can be used on computers or via the mobile app. UniversalWomen is designed to facilitate medical conversations about pregnancy, childbirth and maternal health, and also includes educational information and advice to support healthy pregnancies and safety in motherhood. Both the UniversalNurses and UniversalWomen programs offer hundreds of medical-related questions and answers with associated audio recordings to further explain medical issues in their own language.

WHO is also working to support the health of migrants, in accordance with the 2008 World Health Assembly resolution WHA61.17 on the health of migrants *(46)*. Linguistic and cultural barriers are frequently informal barriers in access to care for migrants and refugees *(47)*. The WHO Regional Office for Europe established the Public Health Aspects of Migration in Europe project in 2012, which is working within the Health 2020 framework to address migrant health and strengthen public health capacity to manage emergency-related migration *(48)*. eHealth can improve communication across health sectors and with the public, and can increase the capacity of health systems to address the needs of migrants and refugees. The University of Perugia and the Umbria Region in Italy have exemplified this through their Health for Migrants website and mobile app, offered in seven languages *(49)*. This is a free service to support migrants in navigating the Italian health and social service system.

Capacity-building in eHealth: education and training

The educating and training of health and social care students and professionals in ICT and eHealth is fundamental to furthering any national eHealth strategy. eHealth affects many aspects of care delivery and is an increasingly important tool for decision-making in the delivery of such care. As one of the pillars of universal health coverage, well trained health workers are an essential part in providing high-quality, accessible services.

Increasing training on ICT and eHealth, including the use of social media for health, will equip new professionals in their knowledge of online health information resources

and their ability to distinguish relevant and accredited information. Professionals will need to know how to use eHealth effectively to be able to educate and support patients and their families in their self-management, as well as understanding how eHealth affects their professional and legal accountability. Research on evaluating eHealth education highlights several crucial issues, outlined below (50, 51).

— Interdisciplinary clinical teaching teams are often engaged, but the involvement of expert health informaticians is still lacking.

— Guidelines and recommendations by the International Medical Informatics Association exist, but most eHealth education modules do not seem to refer to these when designing their course contents and learning outcomes.

— eHealth education modules are often elective elements of education programmes, and explicit requirements from external accreditation bodies are rare.

— eHealth training is often presented as a standalone subject rather than being integrated into different subjects across clinical disciplines, which is potentially more effective in consolidating and extending in-depth eHealth skills in students.

— The potential use of innovations such as eLearning, simulations and mobile technologies in support of practical eHealth training is not being fully exploited.

Education and training in eHealth supports and motivates students and professionals to be comfortable engaging in eHealth, even as it continues to develop. Studies indicate that while most health care professionals have used eHealth solutions in clinical settings, such as electronic health records, many of them did not feel competent in their overall eHealth skills (52–54). This highlights the important issue that eHealth training should both be integrated into medical education curricula and be an integral part of continued professional education.

Results of the survey: education and training

The 2015 survey asked countries about teaching health sciences students on how to use ICT and eHealth. Of the respondents, 40 Member States report they have universities or technical colleges providing students with training on how to use ICT and eHealth. In addition to the standard medical curricula, it is important that students are taught how eHealth can be used to increase the quality of care, support their work functions and provide assistance to patients. However, in most of those countries, this training is offered in less than half of their tertiary institutions. Of the countries who do offer eHealth training, and who provided further breakdown of the delivery, 64% (25 countries) report that this is offered in less than half of their institutions; 36% (14 countries) offer training on ICT and eHealth to students in more than half of their institutions.

When asked about which professional groups are offered in-service training on ICT and eHealth, 37 Member States report that this training is offered to all seven of the groups

listed in the survey (see Fig. 4) and several other professional groups: medical technology, medical physics, allied medical professionals, mental health, social sciences and health leaders. For health professionals, 68% (25 countries) offer this type of training in less than half of all institutions.

Fig. 4. In-service training for professionals on ICT and eHealth
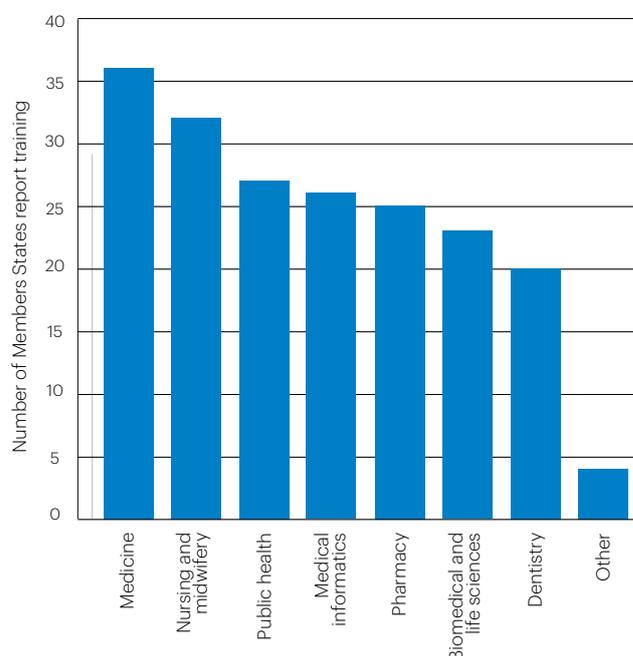
Again, as seen with training for students, the majority of countries offer this type of training in less than half of their institutions or organizations. Apart from training for students, the reach of ICT in health care settings reveal that there is a need to train and educate professionals and experts already in the field in order to ensure comprehensive use and better implementation of eHealth. Investing in eHealth education should not only include health care professionals using ICT but should also focus on those who are designing eHealth solutions, experts on eHealth and managers of eHealth programmes. Table 8 shows the trend in Member States reporting that they train and educate health sciences students and health professionals on ICT skills and eHealth, showing an increase from previous GOe surveys.

Table 8. Trends in ICT and eHealth training for capacity-building

	2005 (n=25)	2009 (n=34)	2015 (n=45)
ICT and eHealth training for students of health sciences	80%	82% (28 countries)	89% (40 countries)
ICT and eHealth training for health professionals	75%	77% (26 countries)	82% (37 countries)

Note: information on number of countries for each category is not available for the 2005 data. Sources: 2005 data from the 2008 WHO publication Building foundations for eHealth in Europe (16); 2009 data from the 2011 WHO publication Atlas – eHealth country profiles: based on the findings of the second global survey on eHealth (8).

Capacity-building in eHealth: digital and health literacy

Digital literacy involves a range of knowledge, skills and behaviours to appropriately and effectively engage individuals in activities related to digital information and technologies. Certain levels of computer skills are required to perform searches and navigate health websites, which are not typically designed for beginner-level abilities. A second set of skills, often referred to as health literacy, is also required to comprehend health information. Health literacy is a person's ability to find and understand information about health and services in order to make health-related decisions (55).

Digital and health literacy are important not only for professionals and students in health fields but for all individuals. Poor health literacy is considered to be one of the strongest predictors of individual health – more so than education, employment, income, age and race (56). Individuals with lower health literacy have less access to health information and face greater difficulties in understanding information about illnesses, diseases and treatments. They also have less knowledge of health-promoting behaviours, will seek out fewer preventive health services such as vaccinations and cancer screening, and represent an increased burden on health systems in the long term (57). Individuals with lower health literacy are often less confident when speaking with medical professionals and are hesitant to reveal their lack of understanding.

While efforts are under way to educate and train those formally involved in health and social care, there are fewer efforts that emphasize the relationship between quality of care and patient empowerment. A study conducted for the European Commission on health literacy reports that while many countries have initiated activities related to health literacy (either by promoting it or revising health information to be more easily understood), only six countries have national objectives to increase health literacy (58). Another project on health literacy in the EU found that groups most vulnerable to the risks of limited health literacy include those reporting their social status as low, their health status as poor, low education, financial difficulties, limitations due to health problems, co-morbidity in long-term illnesses and an age of over 75 years (59). As eHealth services expand, it is also important to develop major campaigns around health and digital literacy for the patients who will ultimately benefit from these services. Increasing health literacy improves an individual's access to information and their ability to effectively use it – empowering them to be actively involved in their health. Health literate individuals can search for and understand health information easier than those who are not. This translates to real benefits for health systems when individuals are able to play a more active role in improving their own health and well-being, utilizing preventive health services and understanding their conditions and expected effects of treatments.

In examining the relationship between health inequalities, digital and health literacy and eHealth, a report by the EU eHealth Stakeholder Group provides several recommendations and examples of best practices to advance eHealth in Europe and to reduce inequalities. These recommendations include improved affordability of and access to eHealth solutions, improving user-friendliness of eHealth and tailored solutions (according to a user's abilities, so that they can use eHealth in a meaningful way), evaluating the outcomes of eHealth for a stronger base of evidence, and improved digital health literacy and education for users at all literacy levels (60). Another recommendation in the report is the focused integration of eHealth into health and social care system policies and strengthening the connections between EU and national or regional policies on eHealth. Benchmarking and observing patterns in health inequalities can inform health policies and put inequalities in context (61). eHealth has the potential to bring health services to a wider population, and the ability to increase the personalization of these services. However, with a lack of focus on educating individuals on how to use health technologies, certain populations will remain vulnerable to lower levels of digital and health literacy and hence digital exclusion. Case example 6 is an illustration of good practice in developing tools to improve health literacy.

Case example 6.
Public access to health education in Denmark

Visualcare.dk is an online health portal that offers short films on health-related products and solutions. The videos are used by professionals in health and social care and by the population to learn about health conditions and care practices. The videos offer both general and specific knowledge. Through free access to educational videos, individuals are able to improve and increase their ability for self-care. Professionals also use the videos for education on care techniques and to learn about welfare technologies available on the market and how to properly use them. Visualcare.dk aims to educate society and address future needs in health and social care and issues related to culture and ethics.

Tryg med Barn (Safe with Child) is a public information portal. It provides material and educational videos related to pregnancy, birth and the first months after a child is born. The website is in six different languages and covers information for both mothers and fathers.

Patienthåndbogen (Patient's handbook) is an online encyclopaedia of medical information. The website is targeted towards patients and relatives, and the content is written and revised by medical practitioners and specialists. The goal is to provide residents of Denmark with reliable health information. Similarly, *Lægehåndbogen* (Doctor's handbook) is the online encyclopaedia targeted towards Danish medical and care professionals. Both contain over 3000 medical articles and more than 2000 illustrations, images and videos about a wide variety of symptoms, conditions, treatments and general health. Anyone can access the handbooks through the websites or the National Danish eHealth Portal, or download the free apps for mobile devices.

Summary

The use of electronic processes in health encourages the efficient utilization of health-related resources, including reducing costs, increasing the speed of information-sharing and service delivery, saving time, providing safer and higher-quality care for patients and removing the need for a physical space to treat each patient. This chapter has focused on the importance of building foundations to ensure the growth, maturity and sustainability of national eHealth development. Clear priorities and strategies for building eHealth foundations lead to improved intersectoral collaboration across the continuum of care, improving the capacity of the health workforce and resulting in sustainable outcomes. Improving eHealth governance by integrating eHealth into national health policies is needed to create strong, coordinated political leadership. Furthermore, aligning national frameworks with European-level priorities promotes the coordinated, consistent and coherent leadership needed for sustainable and interoperable eHealth in the European Region.

More than half of the countries in the WHO European Region (28 Member States) report that they have a national policy or strategy on universal health coverage specifically referring to the use of eHealth and 30 countries have a national policy or strategy on eHealth. Further, 31 countries report that financial support is available specifically for the implementation of their national eHealth strategy or policy. These results show that Member States have built national foundations for the strategic delivery of eHealth and that many countries are transitioning from implementation frameworks to strategies for scaling up. Countries that have more advanced eHealth foundations are reviewing the progress of their efforts and approaches and adding new services.

Of the survey respondents, 16 countries report they have a policy or strategy on multilingualism, while a further 16 report having no such policy or strategy. As the prevalence of eHealth services is growing among European Region Member States, and with the increasing use of cross-border services, it is increasingly important for countries to offer health information and services in more than one language.

Legal issues are no longer the main barrier to implementing eHealth as the previous GOe survey showed; in 2015, Member States report funding as the most important barrier. Public funding is reported as the most available type of funding, with 93% responding that public funding is available for eHealth programmes. Furthermore, over the past two years the majority of Member States in the WHO European Region received at least three quarters of their total eHealth funding from public sources. Despite public funding sources being the most widely available and used type of support, many

Member States also seek out funding through private sources, donor and non-public development funds and public–private partnerships. Sustainable financing is fundamental for the continued development of eHealth to ensure that programmes are maintained and sufficiently evaluated and can expand to reach more people and through additional services.

While nearly 90% of Member States report that students of health sciences and health professionals receive some degree of training on ICT and eHealth, this training is available in less than half of their institutions. Building health workforce competence is also critical in ensuring the adoption, use and improvement of digital services in the health sector.

Recommendations

— Member States are recommended to build and maintain foundations for eHealth through clear policies and strategies. These should be developed using an intersectoral approach that ensures relevance to all stakeholders and promotes shared action in achieving health objectives.

— Use of the WHO and International Telecommunication Union (ITU) *National eHealth strategy toolkit (62)* by Member States is strongly encouraged for developing the national vision, action plan and framework for monitoring and evaluating eHealth.

— Establishing effective and inclusive governance for eHealth should be a priority action for Member States. Such governance should have accountability for the strategic development of ICT within the health sector, including building and maintaining the national eHealth architecture; managing large-scale procurements; ensuring interoperability and adoption of eHealth standards; and developing health workforce capacity for eHealth.

— Efforts should be made by Member States to create sustainable financing strategies for the continued development and implementation of eHealth, such that programmes are maintained, sufficiently evaluated and can expand as appropriate.

— Educational institutions and relevant professional organizations should increase training and education on ICT and eHealth for health workers and students of health sciences in order to strengthen workforce capacity and stimulate innovation within the health sector. Further improvement in digital and health literacy education for both professionals and the general public is required. This should be incorporated into national health objectives and be supported by the provision of information on health in multiple languages, as appropriate.

ELECTRONIC HEALTH RECORDS

2

Electronic health records (EHRs) are real-time, patient-centred records that provide immediate and secure information to authorized users. EHRs typically contain a record of the patient's medical history, diagnoses and treatment, medications, allergies and immunizations, as well as radiology images and laboratory results. They expand on the information in a traditional paper-based medical record by making it digital and thus easier to search, analyse and share with other authorized parties. An EHR system plays a vital role in universal health coverage by supporting the diagnosis and treatment of patients through provision of rapid, comprehensive and timely patient information at the point of care.

Key data from the survey responses

— 59% of Member States in the WHO European Region have a national EHR system.

— 69% of Member States have legislation supporting the use of their national EHR systems.

— 50% report insufficient funding as the most important barrier to EHR system implementation.

Background

EHRs enable the effective circulation of timely medical information in paperless form among all concerned parties. They assist with a variety of uses, including direct patient care, patient care management, patient care support processes, financial and other administrative processes and the support of patient self-management. EHRs also help in preventing medical errors, especially those related to allergies and drug interactions. This is particularly important in the light of the ongoing challenges posed by population ageing and the increased number of chronic and multimorbidities. Further, several secondary uses of EHRs can also be distinguished: patient safety, regulation, quality assurance and surveillance, research, public health and policy support. A significant benefit of the secondary use of EHR data is for clinical and epidemiological research purposes, leading to larger clinical trials, a greater diversity of participants and high-quality clinical data at a lower cost. The broad benefits of EHR systems echo the main benefits of eHealth: improved access, efficiency and quality of care.

Results of the survey: national EHR systems

An EHR system is often implemented under the responsibility of a national health authority. This allows a patient's medical history to be made available to health professionals in different health care institutions and provides a link to related national health services such as pharmacies, laboratories and specialist emergency and medical imaging facilities.

Of respondents to the 2015 WHO global survey on eHealth, 59% of Member States in the European Region report having a national EHR system, according to the definition given in the survey.[1] However, respondents differed in their interpretations; a number of Member States indicated that while they do have a national EHR system, its implementation did not conform to the survey definition provided. This illustrates that there is wide interpretation of how EHR systems are defined, structured and accessed. Another issue in defining a national EHR system is that countries may have such systems within several subnational regions, but these do not connect to a national EHR service or may not interoperate with each

1   The 2015 GOe survey defined a national EHR system as "most often implemented under the responsibility of the national health authority and will typically make a patient's medical history available to health professionals in health care institutions and provide linkages to related services such as pharmacies, laboratories, specialists, and emergency and medical imaging facilities".

other. Of the respondents, 27 Member States reported having a national EHR system: 16 high-income countries, eight upper-middle and three lower-middle (see Fig. 5) (see Annex 3 for World Bank gross national income per capita groupings). Of these, 18 countries, none of which are lower-middle income, report having specific legislation governing the use of their system. In addition, Denmark reports that it has five EHR systems, which connect nationally, and that national laws cover the use of the data, but that there is no specific legislation governing the use of the separate EHR systems. With relatively few Member States in the European Region reporting specific legislation governing the use of their national EHR systems, it appears that this remains an area in need of further development. Fig. 6 shows the Member States with national EHR systems and with legislation on these by subregion (see Annex 2 for subregional groupings). Case example 7 provides an example of a national EHR implementation.

Fig. 5. Member States with a national EHR system and legislation on it, by World Bank income grouping
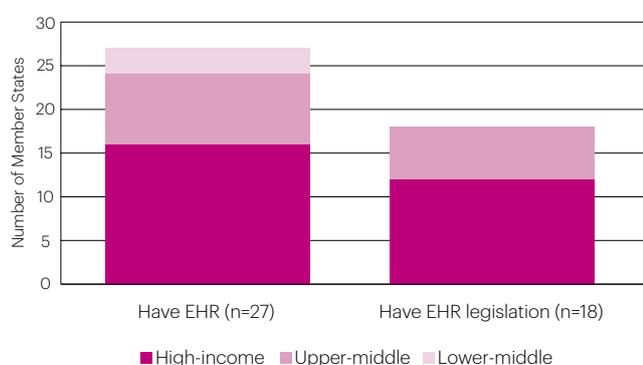
Fig. 6. Member States with a national EHR system and legislation on it, by subregion
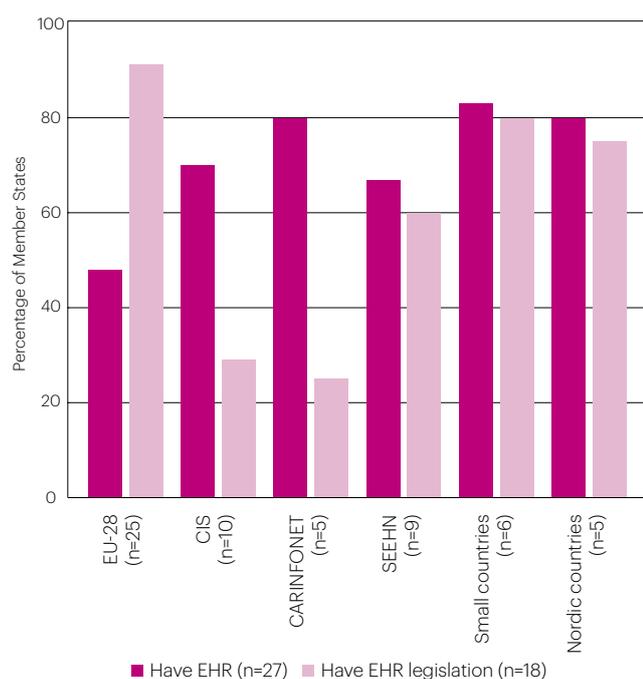
Case example 7.
eEstonia and success with EHRs

Estonia launched its EHR system in 2008 *(63)*. In doing so, it became the first country in the world to fully implement an EHR system on a nationwide scale, with records covering an individual's medical history from birth to death. In 2009, Estonia implemented a health information exchange to upload all medical documents into the system. This use of eHealth has also been supported by legislation, with Estonia's Health Information System Act (2007) and the Government Regulatory Act of Health Information Exchange (2008). Around 1.35 million people now have documents on the system (98% of the population) and ePrescriptions now account for 98% of all prescriptions issued.

By law, all health care service providers, regardless of public or private ownership, must upload patients' data from their own systems into the national HIS. This is facilitated by the use of a digital stamp, meaning that medical professionals do not need to sign each individual document. The system also has a digital image database for medical images, improving the efficiency of diagnosis and health care provision and avoiding the duplication of clinical analysis. This facilitates the exchange of information between all stakeholders, shifting from an institution-centred to a patient-centred HIS. Patient consent is not needed for data to be uploaded into the HIS, but an opt-out mechanism allows patients the right to partially or completely restrict access to their EHRs.

Patients, including foreign nationals, can view their EHRs by logging onto *Minu e-tervis* (My eHealth) using an electronic identification card or a mobile phone ID. Each time a medical professional accesses a patient's data, it is logged by the system. Patients can see who is accessing their data and have the legal right to ask why their data is being accessed. In addition, Estonia's My eHealth platform enables patients to book appointments and screenings and receive appointment reminders through a digital registration platform. The system also provides services including ePrescriptions, teleconsultations, immunization passport, virtual health checks and eAmbulance.

Estonia offers a range of eServices in what is known as eEstonia. These services, in addition to eHealth, include eTaxes, eSchools, eCommercial registries and eElections, among others. One of the key elements of eEstonia is that its databases are decentralized and distributed in a service-oriented architecture so that new services can be added as and when appropriate and each government agency or business can choose the product that is right for them. These decentralized databases, including those for health, are linked to each other through X-Road, the public ICT infrastructure of the government. X-Road allows searches to be performed across the different databases, as well as large data sets to be transmitted across them and secure data exchange between the state's information systems. More than 170 databases offer their services over X-Road in Estonia and the infrastructure can also be scaled up as more databases come online.

Results of the survey: services using the national EHR system

Those Member States indicating the presence of a national EHR system were asked to further qualify the types of health facilities using it (see Fig. 7). Among respondents, 26 Member States report use of the national EHR system in primary care facilities, such as clinics and health care centres; of these, 64% (16 countries) use it in more than half of the available primary care facilities. Regarding secondary care facilities, such as hospitals and emergency care centres, 25 countries report use of their national EHR system; of these, 63% (15 countries) use it in more than half and 54% (13 countries) in more than three quarters of the available secondary care facilities. In tertiary care facilities, such as specialized care centres, 22 countries report use of the national EHR system; of these, 55% (12 countries) use it in more than half and 41% (9 countries) in more than three quarters of the available tertiary care facilities. Three countries also use the national EHR system in other types of facility, including day hospital and emergency medical services (used in less than half of the available facilities), medical centres and private doctors (used in more than half of the available facilities) and an electronic registrar for polyclinics (used in less than one quarter of the available facilities). Case example 8 illustrates the use of ICT to improve health care services for Roma populations in Greece.

Fig. 7. Use of national EHR systems in health care facilities

Legend:
- Member States using EHR systems
- Using EHR systems in >50% of facilities
- Using EHR systems in <50% of facilities

Y-axis: Number of Member States
X-axis: Health facilities (Primary care, Secondary care, Tertiary care)
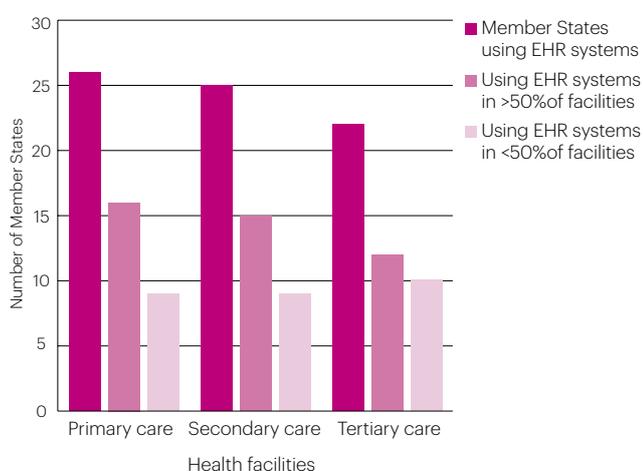
" **59 per cent (27 countries) report having a national EHR system. A number of additional countries indicated that they also have an EHR, but did not consider their national implementation to conform to the survey definition given.**

Case example 8. Electronic records for Roma populations in Greece

Greece has used ICT to look at ways of improving health care for the Roma community in the municipality of Trikala. Roma populations in Greece often have limited access to specialized health care services. In 2009 the municipality of Trikala, which has a Roma community of about 1000, set up a pilot project to improve the population's access to health care through telemonitoring and the use of electronic medical records.[2]

The municipality runs a health and social care centre for those living in Roma settlements. The pilot project was under the supervision of the Greek Ministry of Health, in cooperation with hospitals in Trikala and Karditsa. The project gave local primary health providers telemonitoring devices that could record data relating to vital signs including electrocardiographs, spirometers, oximeters, blood pressure monitors, glucometers and a laptop. Data on vital signs were transmitted through general packet radio service (GPRS) to a central webserver. This enabled specialist doctors in Trikala's general hospital to interpret the information and provide local doctors with diagnostic advice, integrating services between primary and secondary care. In addition, 70 volunteer Roma patients were given electronic medical record smart cards, which enabled doctors to access their health records during hospital consultations. Only authorized parties can access this information, using a personal identification number. Upon completion of the project, it was recognized by the Ministry of Health and the Council of Europe as an example of good practice.

2 Electronic medical records are in-house electronic versions of the traditional paper charts used in clinical care, whereas EHRs include additional information about the broader spectrum of health from all clinicians involved in an individual's care and can be shared electronically with other authorized clinicians.

Countries were asked whether their national EHR system was linked to other associated clinical systems (see Fig. 8). Of the 27 countries with a national EHR system, 78% (21 countries) reported that it was linked to a laboratory information system; 70% (19 countries) to a pharmacy information system, such as ePrescription; 63% (17 countries) to a picture archiving and communication system and 48% (13 countries) to a pathology information system. Only five countries reported that their national EHR system was linked to an automatic vaccination alerting system, and another six listed other systems, including a transfusiology system, a tuberculosis information system, a diabetes mellitus information system, regional HISs, preventive health record systems, a radiology information system (minus images) and care summary reporting systems. It is promising to see EHRs linking with ancillary HISs, as connecting multiple levels of health sectors via national EHR systems indicates continued development in eHealth and integrated care.

Fig. 8. National EHRs linking to ancillary HISs

Results of the survey: standards to support EHR systems

The use of international standards in support of national EHR system implementation was also examined. In total, 24 countries indicated their use by selecting from a list of recognized standards (see Fig. 10). International Classification of Diseases (ICD) and Health Level Seven International (HL7) Messaging are the most prevalent standards adopted in the European Region, used by 83% and 79% of countries, respectively. ICD and HL7 were also reported as the two most widely used standards globally in the 2009 WHO global survey on eHealth.

Digital Imaging and Communications in Medicine (DICOM) is the third most prevalent standard used in EHR system implementation: 63% of respondents reported its use. In addition, half of the respondents provided additional standards, the most prevalent being three countries each reporting the use of Integrating the Healthcare Enterprise (IHE) and Anatomical Therapeutic Chemical (ATC) classification system for drugs. Two countries each reported the use of Nomesco Classification of Surgical Procedures (NCSP), International Classification of Primary Care (ICPC and ICPC2) and International Classification for Nursing Practice (ICNP).

The 2015 survey also examined diverse applications used to support services in the health sector (see Fig. 9). Electronic medical billing allows health providers to submit their bills electronically for the payment of services; 30 countries (67%) report use of electronic medical billing while 12 countries (27%) report no such use. Supply chain management information systems assist in the tracking and registering of finances, materials and information through the supply chain from manufacturers to distributors, health service providers and health consumers; 28 countries (62%) report the use of such systems while 9 countries (20%) report no such use. Information systems on human resources for health allow health care leaders to find current information on the national health workforce so that they can track, manage and deploy human resources, assess problems, design interventions and evaluate them as an evidence-base for decision-making. A majority of respondents (76%; 34 countries) report the use of human resources for health information systems, while 20% (9 countries) report no such use.

Fig. 10. Standards used to support national EHR systems in the European Region
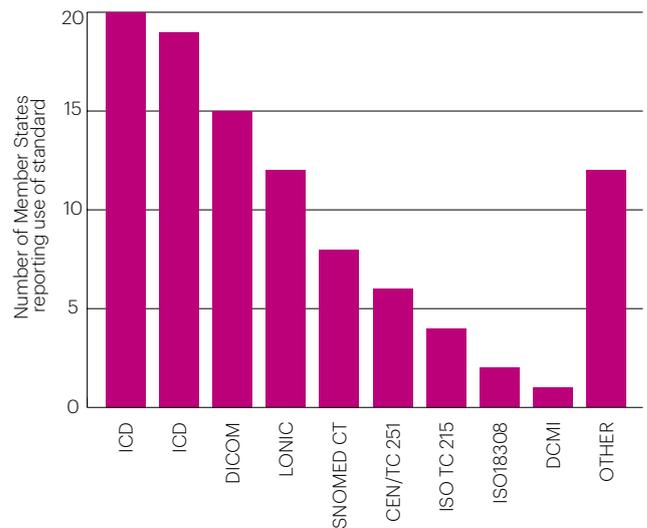
Note: additional standards reported (represented as "other") were: International Organization for Standardization European standard (EN/ISO) 13606 client card conditional access module (CCAM-LUX) International Classifications of Functioning, Disability and Health (ICF) Universal Integrated Circuit Card (UICC) Norwegian Centre for Informatics in Health and Social Care (KITH) extensible markup language (XML) kind messages for electronic healthcare record (KMEHR)

Fig. 9. ICT-assisted functions in the health sector

The 2015 survey examined 10 specific barriers to implementing EHR systems, which were rated by respondents on a scale from "not a barrier" to "extremely important barrier" (countries could select one or more barriers and were asked to specify the degree of importance for each). Funding is reported as the most

prevalent: 22 countries report it as a very important or extremely important barrier to EHR implementation. Capacity and infrastructure are the next most important barriers reported by 15 and 13 countries, respectively, rating them as a very or extremely important barrier. The results for barriers to national EHR system implementation are shown in Fig. 11. Four countries provided additional barriers, all rated as very important. These included a lack of incentives for measurable results, poor cooperation among institutions, difficulty for small-scale health institutions to fulfil legal requirements and lack of experience with ICT implementation in long-term care.

Fig. 11. Barriers to implementing EHR systems
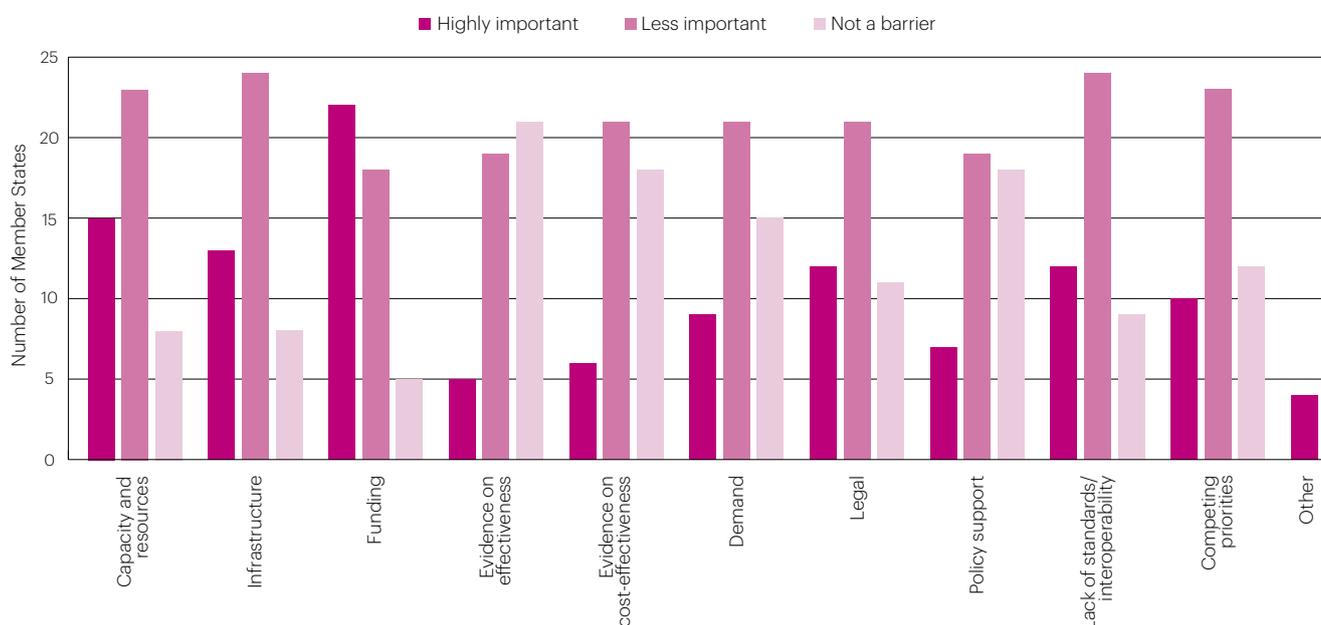
Laying the interoperability foundation for EHRs in the EU

In recent years, EHRs have featured prominently in the European Commission's eHealth Action Plan 2012–2020 and Health Programme 2014–2020, as well as in multiple actions published in the Digital Agenda for Europe *(64)*. Even with these action plans, there are still significant variations in EHR adoption across the EU and major differences in the way EHR systems are legislated among the countries that have implemented them.

The refined Directive 2011/24/EU on the application of patients' rights in cross-border health care laid an important foundation for the ability of EU citizens to receive treatment in another EU country and be reimbursed for the services they receive. This Directive, among other things, draws attention to "technological developments in cross-border provision of health care through the use of ICT". It encourages "Member States to work together on developing measures which are not legally binding but provide additional tools that are available to Member States to facilitate greater interoperability of ICT systems in the health care field and to support patient access to eHealth applications" *(24)*.

As part of the technical work in support of this Directive, the ReEIF – which was adopted by the eHN in November 2015 – seeks to present a common refined framework for managing interoperability and standardization challenges in the eHealth domain in the EU *(25)*. It also provides an overview of potentially relevant use cases and appropriate links to the existing and available profiles from the major international consortia in the area of standardization and interoperability. The ReEIF puts a long-term focus on six levels of interoperability (ICT infrastructure, applications, information, care process, policy, legal and regulatory) necessary for national, regional and cross-border eHealth services. Additional evaluation is needed to ensure that barriers are addressed and interoperability frameworks are sufficiently implemented. Through project funding, studies, research and policy initiatives, the EU is active in developing and supporting cross-border interoperability of eHealth *(65)*, examples of which are described in Table 9.

> **Twenty-two countries reported funding as a very important or extremely important barrier to implementation of their national EHR. This is followed by capacity and infrastructure as the next most important barriers.**

Table 9. Studies, projects and networks in the EU promoting cross-border interoperability of health services

Name of project or study	Relevance to cross-border interoperability
Healthcare Interoperability Testing and Conformance Harmonisation project (HITCH)	HITCH created a roadmap and database of related tools on interoperability testing and certification (both cross-vendor and in-house) in eHealth (66).
eHealth Interop (Mandate 403)	Mandate 403 is a mandate to European standards organizations on ICT in eHealth to create consistent standards for interoperability in eHealth and EHRs (67).
STORK and STORK 2.0 (Secure Identity Across Borders Linked)	These two projects established an interoperable platform for secure cross-border and cross-sector identification and authentication so that individuals could access public services in any participating areas (68). STORK established the electronic identification platform and STORK 2.0 focused on providing access to eLearning and academic qualifications, eBanking, public services for business and eHealth.
SemanticHealthNet	This project worked towards enhancing organization and governance for semantic interoperability in clinical and biomedical information (69). The goal was to create scalable and sustainable pan-European processes so that EHRs improve clinical research, public health and patient-centred integrated care.
NETC@RDS	This project aimed to integrate electronic European health insurance cards with existing eHealth and electronic identification infrastructures in 17 EU Member States (70). The project concluded in 2011 and the European Network for Electronic Data exchange in the health care sector was formed to continue the project's work (71).
SmartCare	This project promotes integrated approaches and interoperable service components for providing health and social care for ageing adults in Europe (72). Using existing ICT to create a platform that is open and multifunctional, SmartCare services will support multivendor access to the platform for sharing data, designing and executing care strategies. Ultimately, the project aims to provide evidence on the impact of integrated care and develop building blocks, guidelines, specifications and organizational models in order to extend services to other regions in Europe.
European Patients Smart Open Services (epSOS)	epSOS was a European Commission project that ran for six years, ending in 2014 (73). This large-scale pilot, involving 25 EU Member States, focused on developing and evaluating a service infrastructure for cross-border interoperability between EHRs. The pilot developed a seamless system infrastructure and architecture for health care that included a translated ontology. Specific goals of the project concentrated on electronic health cards to provide patient health summaries, facilitate ePrescriptions and allow for the secure sharing of patient data.
Antilope	This project aimed to further eHealth interoperability through use of the ReEIF and by promoting the adoption of a quality management system for interoperability testing, a set of testing tools and quality label and certification processes.
Expanding Health Data Interoperability Services	This thematic network of more than 20 national and regional partners involved 17 countries and focused on cross-border eHealth services (74). Aiming to further develop interoperability within the European Region, it builds upon work by the eHN, epSOS, eHGI and others.

Note: for examples of research projects and policy initiatives, including those described in Table 9, please see the European Commission's eHealth EIF: eHealth European Interoperability Framework (75).

Tackling cross-border interoperability of EHRs is a significant, resource and time-intensive undertaking. Mature national eHealth infrastructures, robust standards-based national systems with data in structured forms, legislative regulation in cross-border deployment and common services and specifications will facilitate cross-border eHealth services (76). Further information on interoperability can be found through the European Commission's Interoperability Solutions for European Public Administrations (ISA²), which develops and maintains the European Interoperability Strategy, the European Interoperability Framework, the European Interoperability Reference Architecture and the European Interoperability Cartography (77). ISA² aims to ensure interoperability for cross-border and cross-sector interaction between public administrations, businesses and people. Case example 9 describes a pilot for cross-border interoperability of EHRs between Finland and Sweden.

Case example 9.
Cross-border ePrescription initiatives

In Finland, the national EHR system was implemented through a 2002 government decision that called for a nationwide interoperable EHR system by the end of 2007. There is currently 100% EHR coverage in both specialized and primary care settings, at both local and regional levels, and the services of the National Archive of Health Information cover 87% of the Finnish population (76). The current Finnish ePrescription service followed as a logical development of EHR adoption and was agreed upon as part of National Archive in 2005; however, the concept itself had first been initiated in much more rudimentary forms in the 1990s (76, 78). The Act on Electronic Prescriptions was passed in 2007 and ePrescriptions officially began in May 2010. ePrescriptions now make up over 90% of all prescription services in public and private health care in Finland (79). Joining the Finnish ePrescription Centre is mandatory and, from 2017, ePrescriptions will be the only option available for dispensing medication (76).

In Sweden, the EHR system in its current form was officially rolled out in 2009 as the first stage of the Swedish National Patient Summary Initiative; it reached 100% coverage in 2012 *(80, 81)*. Like Finland, Sweden has a long history of developing ePrescription services, dating back to 1984 *(82)*. Initially perceived as an alternative to traditional paper-based prescriptions, today 90% of prescriptions in Sweden are issued electronically *(83)*. ePrescriptions are generated by doctors through the national ePrescription management system and then transmitted through a secure network to the national prescription database. Two factors are credited with the success of the ePrescription in Sweden: the national database for ePrescriptions and a structured implementation strategy *(83)*.

A pilot project in the Tornio valley established a functioning cross-border ePrescription service between Finland and Sweden, based on epSOS specifications. The service came as a natural extension of the Nordic exchange of paper prescriptions, which had been in operation since the 1970s, and as a complement to the national ePrescription services in place in the two countries *(82)*. The pilot project, which concluded in mid-2014, implemented cross-border ePrescription services in four pharmacies in Sweden and three in Finland. The challenges encountered in the project were primarily legal and organizational in nature, though these were overcome by implementing specific amendments to the existing ePrescription laws in both countries.

Comments and lessons learned from Member States

In responding to the survey, 15 Member States provided additional comments in relation to their national EHR system implementations, including reflections on the survey questions, clarifications of their responses, information on specific aspects of their health systems and adoption strategies that have proved successful. Two countries report that their national EHR systems are under development or that additional, supportive systems are not yet fully integrated. One country reports that while it has the components required for a national EHR programme, not all of its systems contain a patient's full medical record; hence, it felt that it did not meet the survey's definition of a national EHR.

One Member State described the bottom-up approach to development, which required strong collaboration between all stakeholders and formalized engagement through a number of instruments and working groups. The system's rules – such as architecture, standards, consent, access management and patient roles – are defined by consensus of the collaborating parties. In this way, the national authorities primarily create and maintain the essential basic services, such as the identification and authentication of actors, data encryption, key registries and standards dissemination, and ensure compliance with laws and regulations.

Another Member State highlighted what it felt to be shortcomings in the survey instrument in not capturing the nuances of different EHR implementation approaches, such as having local or regional EHRs that adhere to key standards, are supported by national components and are interoperable. It suggested that future surveys need to allow for flexibility in how EHRs are defined and make provision for countries to report EHR systems at the national level, local level EHR systems supported by national infrastructure and completely local EHR systems. Furthermore, it commented that while the role of standards is fundamental, there is also a need to have open systems that enable information to flow between them and that the next survey could include reporting on open application programming interfaces (APIs).[3] A supporting comment from another Member State echoed that their national EHR system is based on a network of federated, interoperable frameworks consisting of regional EHR systems. One country observed that the levels of ICT support asked about in the survey focus on the primary and secondary levels of health care and do not include much focus on the tertiary levels of health care.

Another Member State viewed the definition of a national EHR system as limiting from the perspective of defining a national health authority as the responsible entity for creating links between health care providers. In this country, these providers are privately organized, so the responsibility for establishing and using the system is an obligation of the private providers and not a national authority. While the exchange of health information takes place within a national infrastructure, it is at a local or regional level, so the Member State responded that there is no national EHR system, based on the definition used in the survey. It further stated that the implementation of EHR systems within health care institutions is, in general, very high (in some primary care, it is close to 100%), but interoperability within and between segments of the health sector is scarce. It also mentioned that patients' accessibility to their own health data is very limited.

Finally, a comment was made regarding relevant information for managing the health care workforce. It was pointed out that while certified health care specialists are registered in a register of medical practitioners, it is still difficult to assess the workloads and other relevant information related to these personnel. This hinders evidence-based decision-making for managing the workforce.

Summary

An effective national EHR system assists with comprehensive and timely documentation of diagnosis and treatment of patients and represents a tangible resource for the support of universal health coverage. EHR systems are more often becoming a key element of national eHealth strategies and over half of the Member States in the WHO European Region report having a

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3 Open APIs are publicly available – they allow software developers to access proprietary software and to see how apps communicate and interact with each other.

national EHR system (27 countries); 18 of these have specific legislation governing its use. These numbers would be higher if a broader definition of how national EHR systems can be structured and governed was considered. The survey results show that national EHR systems are now utilized in a majority of primary and secondary care facilities, as well as a notable number of tertiary care facilities in the Region. As part of their operation, EHR systems frequently link to auxiliary clinical systems, the most common being laboratory and pharmacy information systems (in 19 and 21 countries, respectively). These results indicate that national EHR systems are maturing and their use is expanding.

The use of international standards to support national EHR systems promotes interoperability with other health-related ICT systems and with cross-border health services. A number of case examples and international projects have illustrated efforts made on interoperability in health and social care services thus far. ICD and HL7 are the most widely used international standards in support of national EHR systems, in both the 2015 and 2009 WHO global surveys on eHealth. While standards and interoperability are still important barriers to implementing EHRs, funding is reported as the most important barrier by nearly half of the European Member States responding to the 2015 survey.

In addition to EHR systems, Member States reported on other ICT-assisted functions that support processes in the health sector. Over three quarters (34 countries) report using human resources for HISs, two thirds (30 countries) use electronic medical billing systems and more than half (28 countries) use supply chain management information

systems for health. These systems assist with many of the complex functions and processes in health and social care delivery and are beneficial services to strengthen the health system.

Recommendations

— Active development of national EHR systems should continue within the framework of a national strategy for eHealth – encompassing a patient-centric approach to the design, access and ownership of information stored within the EHR system. Sustainable funding for development and maintenance of the EHR system needs to accompany planned activities.

— Engaging intersectoral partners and patients in the process of EHR system development is important in order to better understand the need for sharing of health information beyond traditional health and social care sector boundaries.

— Appropriate national legislation governing EHR systems and their use should be defined. Where applicable, local and regional EHR systems should be integrated with national systems.

— Member States are recommended to establish strong national governance for eHealth interoperability and are encouraged to develop a standardized approach using the EU's ReEIF *(25)*. A quality management system for interoperability testing, a set of appropriate testing tools and quality label and certification processes are essential components to consider for developing national eHealth interoperability.

Telehealth involves health services delivered from a distance. It encompasses remote clinical diagnosis and monitoring (such as with telemedicine), and includes a wide range of non-clinical functions encompassing prevention, promotion and curative elements of health. It often involves the use of electronic means or methods for health care, public health, administration and support, research and health education.

Key data from the survey responses

— 62% of Member States directly address telehealth in their policies or strategies.

— 83% of Member States use teleradiology.

— 72% of Member States use remote patient monitoring.

— 63% of Member States use telepathology services.

Background

Telehealth improves access to health services by removing time and geographical barriers. It reduces the need for in-person consultations and travel, allowing patients to receive health services where it is most convenient for them. Telehealth also increases the quality of care by empowering patients through education and self-monitoring and is considered to be a key component in advancing integrated care and in managing demand on health sector resources.

Results of the survey: national strategies and policies

The 2015 WHO global survey on eHealth asked whether Member States have dedicated national telehealth policies or strategies. Of the respondents, 12 countries (27%) report having a dedicated telehealth policy or strategy and another 16 (36%) refer to telehealth as part of their national eHealth policy or strategy, while 17 (38%) have no dedicated telehealth policy or strategy. With 28 countries (62%) directly addressing telehealth through policies, the European Region shows progress since 2009, where less than 30% of Member States in the Region had full or partial implementation of their national telemedicine policies or strategies *(84)*.

As a follow-up question in the 2015 survey, countries were asked whether their national policy or strategy includes objectives on how telehealth supports universal health coverage. Of the 28 Member States that either have a dedicated telehealth policy or strategy or refer to it as part of an overarching eHealth policy or strategy, 70% (19 countries) report that these policies address how telehealth contributes to universal health coverage. This indicates that those countries taking a strategic approach

to telehealth adoption realize the connection between telehealth and universal health coverage and are actively addressing the role of telehealth in this context.

Results of the survey: telehealth programmes in Member States

Member States were also asked to provide an overview of their telehealth programmes by operating level (see Fig. 12) and type of programme (see Fig. 13). Programme operating levels were classified as local or peripheral (health posts or centres providing basic care), intermediate (public and private hospitals and health centres, including district or provincial facilities), national (public or private hospitals, laboratories and health institutes), regional (health service providers in the same geographical area) or international (health service providers in other countries). Programme types were classified as informal (early adoption of telehealth but with no formal processes or policies available), pilot (telehealth is tested and evaluated in specific situations) or established (telehealth programmes have been running for at least two years and are expected to continue for at least another two years).

Fig. 12. Telehealth initiatives by programme operating level

Local (n=66) Intermediate (n=55) National (n=88)
Regional (n=36) International (n=12)
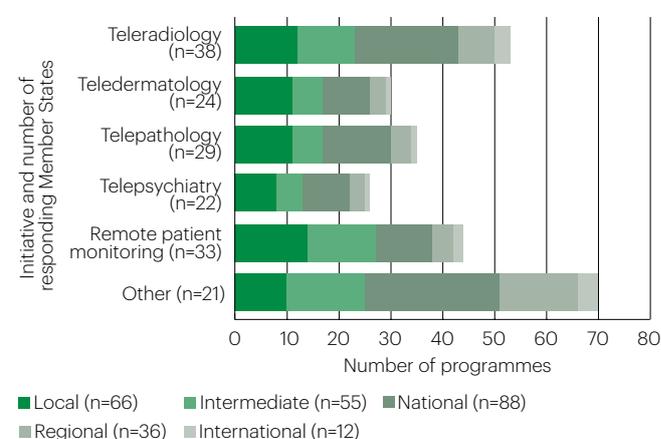
In the 2009 survey, teleradiology was the most prevalent service in the European Region, with 75% of countries reporting such programmes, half of which were

established *(84)*. In 2015 it is again the most prevalent telehealth programme in the Region – 83% (38 countries) of respondents use teleradiology – and it is also the most established service, with 65% (26 programmes) reported as established, primarily at the national level.

Fig. 13. Telehealth initiatives by programme type
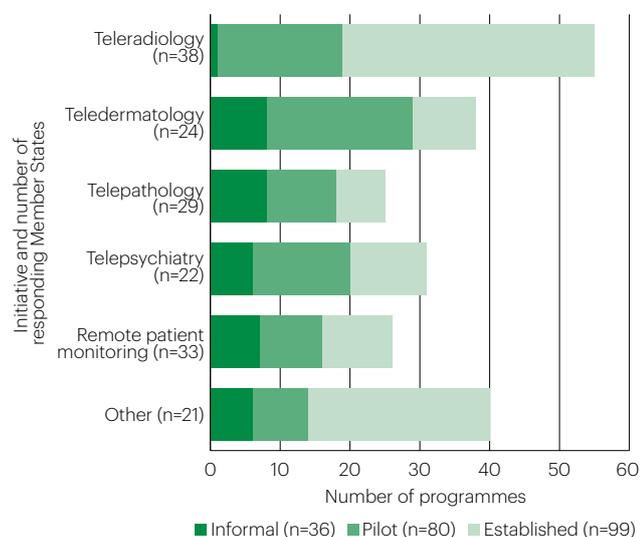
Telepathology and teleradiology are part of a larger evolution from traditional film to digital labs in health services. This requires large investments in equipment, infrastructure, training for personnel and changes in workflows, which could explain why such well-known services are not yet further established. Only a few countries report having established programmes for other telehealth services such as teledermatology, telepathology, telepsychiatry and remote patient monitoring. Remote patient monitoring has the highest number of piloted programmes, indicating that this is a growing area of interest and development. Teledermatology and telepsychiatry require lower investment and training costs than teleradiology and telepathology, but adopting these services still necessitates changes in workflow, organization and process. In the European Region, 52% of respondents (24 countries) report having teledermatology programmes, 63% (29 countries) telepathology programmes, 48% (22 countries) telepsychiatry programmes and 72% (33 countries) remote patient monitoring programmes. Fig. 14 shows increases in these specific services since 2009, although it should be noted that more countries responded to the 2015 survey. Further, the 2009 survey asked about telemedicine initiatives, whereas the 2015 survey asked about telehealth initiatives and included the additional category of remote patient monitoring.

Another 23 Member States listed other telehealth initiatives, with general telehealth, remote care and telecardiology the programmes most often mentioned. A range of other innovative telehealth initiatives was reported, including interpreting, mentoring, rehabilitation, neurology and neuropsychiatry, oncology, neurosurgery, gastroenterology and more, as shown in Table 10. These additional programmes have more intermediate, national, regional and international

representation than any one of the specified programme categories. The "other" category also has more established programmes than any of the specified categories, and almost as many pilot programmes.

Fig. 14. Trends in telehealth initiatives, 2009 and 2015
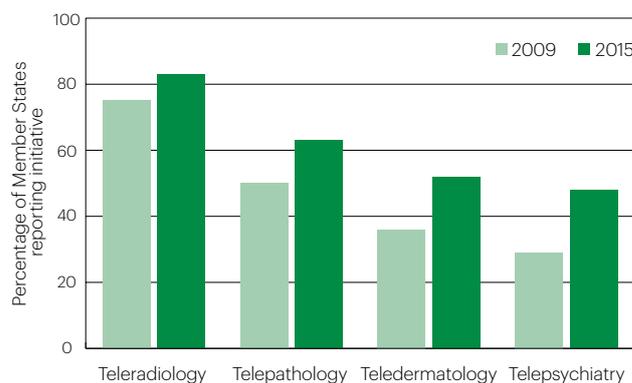
Table 10. Additional telehealth services

Telehealth programme	Member States reporting service
General telehealth services, telehealth hub or unit, health institutes, networks	7
Remote care or monitoring	6
Cardiology or echo cardiography	5
Stroke	3
Consultation	2
Diabetic retinopathy, treatment of diabetic ulcers	2
Distance learning	2
Independent or assisted living technology	2
Multidisciplinary care conferencing	2
Neurology, headache	2
Primary care, clinics	2
Radiology	2
Rehabilitation, cardiac rehabilitation	2
Other telehealth programmes: dialysis, emergency medicine, gastroenterology, interpreting, mammography, mentoring, neurosurgery, oncology, orthopaedics, psychiatry, psychogeriatrics, oral anticoagulation therapy management, transfusion medicine	1 each

Evaluations of telehealth programmes

As telehealth and its supporting technologies have become more mainstream in recent years, various solutions have been trialled by Member States seeking evidence about benefits in expanding and improving health delivery, and improving efficiency, quality and cost of care. These projects are often aimed at testing remote monitoring and management of patients with acute and chronic illnesses, as well as general health promotion. Telehealth has undeniably become one of the largest areas of growth in health care delivery in the WHO European Region, though more evaluation and evidence are still needed. There is currently a shortage of documented economic benefits and cost–effectiveness of telehealth solutions, most likely due to evaluations typically being small-scale, short-term and often hampered by

technical issues, organizational barriers and design methodologies that are not robust *(84)*.

Furthermore, many telehealth-related studies use different technologies, have different outcomes in mind and involve a range of health systems and delivery models in varied cultural contexts. These issues in the heterogeneity of telehealth research make it difficult to compare seemingly related studies. When economic benefits are evaluated based on a small number of cases, over a short period of time and may include the effects of those obstacles

described above, it is difficult to supply a solid base of evidence as to why policy-makers and stakeholders should embrace and invest in telehealth. Evaluations of health systems will identify most benefits when their results are integrated into care practices and into policy. This also implies that evaluation methodologies need to be aligned to the goals of health practices or policy in order to mediate between research and policy to provide useful, evidence-based outcomes. Case example 10 illustrates the evidence and impact gained through evaluation of a national telehealth programme in the United Kingdom.

Case example 10.
Telehealth for chronic disease management

The United Kingdom Department of Health's Whole System Demonstrator programme was launched in May 2008, involving 6191 patients (3030 of whom had chronic conditions) and 238 general practitioner (GP) practices *(85)*. The goal of the programme was to investigate whether using technology for remote care did indeed make a difference, and to offer useful evidence to support eHealth investment decision-making. The trials were evaluated by six universities in five domains (use of services, patient outcomes, cost–effectiveness, participant experiences and the role played by organizational features in the adoption of eHealth services), and the following outcomes were reported *(85)*:

— an 8% reduction in tariff costs;

— a 14% reduction in elective admissions;

— a 14% reduction in bed days;

— a 15% reduction in accident and emergency visits;

— a 45% reduction in mortality rates.

The Renewing Health project started in 2010 and addressed how chronic conditions are managed by shifting a portion of the care from acute clinical settings and into the home *(86)*. The project implemented large-scale, real-life pilots for the validation of an innovative and patient-centred personal health system and telehealth services. Nearly 8000 individuals with type 2 diabetes, chronic obstructive pulmonary disease

(COPD) and/or cardiovascular disease participated in the project's nine European regions.

Expanding on the United Kingdom's Whole System Demonstrator, Renewing Health and other previous projects, the United4Health project aimed at validating and strengthening the evidence on telehealth for chronic disease management *(87)*. Running from 2013 to 2015, United4Health is a European large-scale deployment project that has implemented and assessed the impact of innovative health care services for the remote monitoring of patients with chronic conditions. The project involved 19 service models, covering 14 regions in 10 countries, and put particular focus on the organizational aspects of telehealth, as well as economic aspects and efficiency benefits. The sites deployed telemonitoring focused on managing and supporting approximately 12 000 patients with chronic and noncommunicable conditions including diabetes mellitus, COPD, congestive heart failure or hypertension. The United4Health project involved three different types of telehealth: telemonitoring including teleconsultations, health monitoring and coaching such as through text messaging, and online health monitoring and support. The sites procured any necessary technology, integrated it into their existing health care services and enhanced or redesigned care pathways. Telehealth services were evaluated on their effectiveness, cost–efficiency, transferability of implementation and increase in the use of telehealth in Europe.

Many Member States have indicated the need for more information on the cost and cost–effectiveness of telehealth. More than half of the European Region Member States responding to the 2009 WHO global survey on eHealth reported that they would like more information on cost and clinical uses of telemedicine; 50% reported that they wanted more information on evaluations of telemedicine *(84)*. This indicates that many countries were, at that time, eager to further develop and invest in telehealth services, given that adequate information on implementation and clinical evidence could be provided.

Results of the survey: evaluations

In the 2009 survey, just under 30% of Member States in the European Region reported evaluating telemedicine in

their countries and publishing their results in the past three years; the majority were general overviews *(84)*. In the 2015 survey, 23% (10 countries) report that government-sponsored telehealth programmes have been evaluated. However, 52% (23 countries) report no evaluation and 25% (11 countries) do not know the status of evaluations in their country. This indicates that the evaluation of telehealth programmes is not being systematically performed and governments are recommended to put more focus and funding in support of the evaluation of their implemented services. These findings do not, however, represent other telehealth initiatives that are not government-sponsored and are in fact evaluated, such as research projects. A breakdown of the outcomes from the 10 Member States who did report evaluation of their telehealth programmes

is shown in Fig. 15. The majority of evaluations revealed positive outcomes, except for evidence on initiatives being sustainably incorporated into the Ministry of Health's programmes. This also indicates an area where governments are recommended to increase their focus. Case example 11 demonstrates the application of telehealth for remote patient monitoring in Denmark.

Fig. 15. Outcomes of evaluating government-sponsored telehealth programmes (n=10)
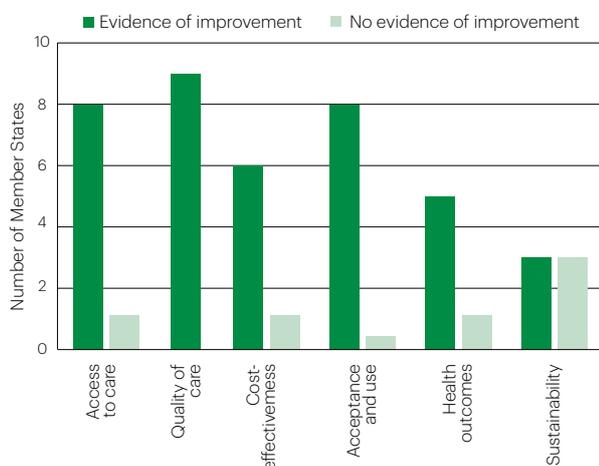
Case example 11.
Monitoring patient health at home in Denmark

Patient@home is a Danish welfare and health technology program focused on rehabilitation and monitoring services to increase the quality of the public health sector *(88)*. The research and innovation program applies user-driven development to promote patient empowerment and support individuals in carrying out treatments in their own homes. Patient@home currently offers over 30 projects, ranging from in-home treatments to optimizing data systems. Patients can utilize the projects before, during and after health treatments; they aim to reduce the duration of stays, as well as the number of admissions in Danish hospitals. Developing services to be used at home not only supports patients but also reduces the financial and human resources required in hospitals and rehabilitation centres. These projects are developed through public–private collaborations between patients, research institutions, private enterprises, health professionals, municipalities and other relevant stakeholders, encouraging further knowledge-sharing, new partnerships and active involvement.

One of the collaboration projects is on monitoring of diabetic foot ulcers. This project used a variety of sensors to measure the temperature, pH, oedema, oxygenation, secretions and biofilm formation of the wounds, as well as a handheld 3D optical scanner that specialized wound care nurses used during their home visits *(89)*. Although the project involved a small number of patients (n=76) and results were not statistically significant, the analysis showed promising clinical, patient-related, organizational and economic benefits. More patients who used the sensors had

healed wounds and less pain after six months, and did not need to travel to the outpatient clinic, which could be exhausting and painful. The majority of patients using this new type of care gained more knowledge about the treatment of their wounds, were very satisfied with their home care and satisfied with the collaboration between their care providers. The nurses improved their collaboration with each other (among those conducting home visits, those at the wound care clinics and those in nursing homes) as well as between themselves and the hospital staff. They also reported improvement in their knowledge about wound treatment and their knowledge of their patients. Again, while not statistically significant, the home treatment reduced costs associated with wound clinic visits and used fewer resources than the control patients. The hospitals also saved several thousand Danish kroner per patient by using home treatments instead of outpatient care at the clinics.

The initiatives are part of broad strategies to advance the Danish education and health and social care system; namely, the larger Danish Strategy for Digital Welfare and the National Strategy for Digitalization of the Danish health care sector. The Strategy for Digital Welfare identified seven focus areas: dissemination of telemedicine throughout Denmark, effective collaboration in the health area, welfare technology in nursing and care, new digital paths in case processing, digital learning and education, digital collaboration in education and preconditions for digital welfare.

The strategy of knowledge-sharing in the Patient@home project not only benefits the technology developers and stakeholders interested in health, but exemplifies that telehealth (and public health overall) works best when information is shared with a larger audience. In health-related terms, this also means that sharing certain data outside of the clinical health sector, such as with social care programmes, will also achieve wider benefits and make strategic organizational steps towards delivering integrated health services.

Results of the survey: barriers to implementing telehealth programmes

In the 2009 survey, the four main barriers to telemedicine in the European Region were lack of legal policies and guidelines (approximately 60%), perceived high costs (50%), organizational cultures that are not familiar with using ICT for remote health services (40%) and lack of standards (just under 40%) *(84)*. In 2015, the main barrier to implementing telehealth programmes is a lack of funding to develop and support them: 71% (30 countries) report it as either very or extremely important. It is interesting to note that while 93% (42 countries) report that public funding by governments is available for eHealth programmes and 69% (31 countries) report that special funding is allocated specifically for the implementation of national eHealth policies or strategies, 71% (30 countries) still report that funding to develop and support telehealth programmes as a significant barrier.

Competing health systems priorities is the next most important barrier in the 2015 survey: 44% (19 countries) rate it as either very or extremely important. This is followed by a lack of legal regulations or legislation on telehealth programmes, with 42% (18 countries) rating it as highly important. The fourth most important barrier is the lack of equipment or connectivity for a suitable infrastructure: 38% (16 countries) report this as very or extremely important.

Member States also report a lack of funding for sustaining telehealth systems, the need for information on what telehealth applications are available and the development of business models by design as very important barriers. One country reports unwillingness to change and lack of innovation in traditional care models as an extremely important barrier. An overview of the 2015 barriers to telehealth implementation is shown in Fig. 16.

Fig. 16. Barriers to implementing telehealth programmes
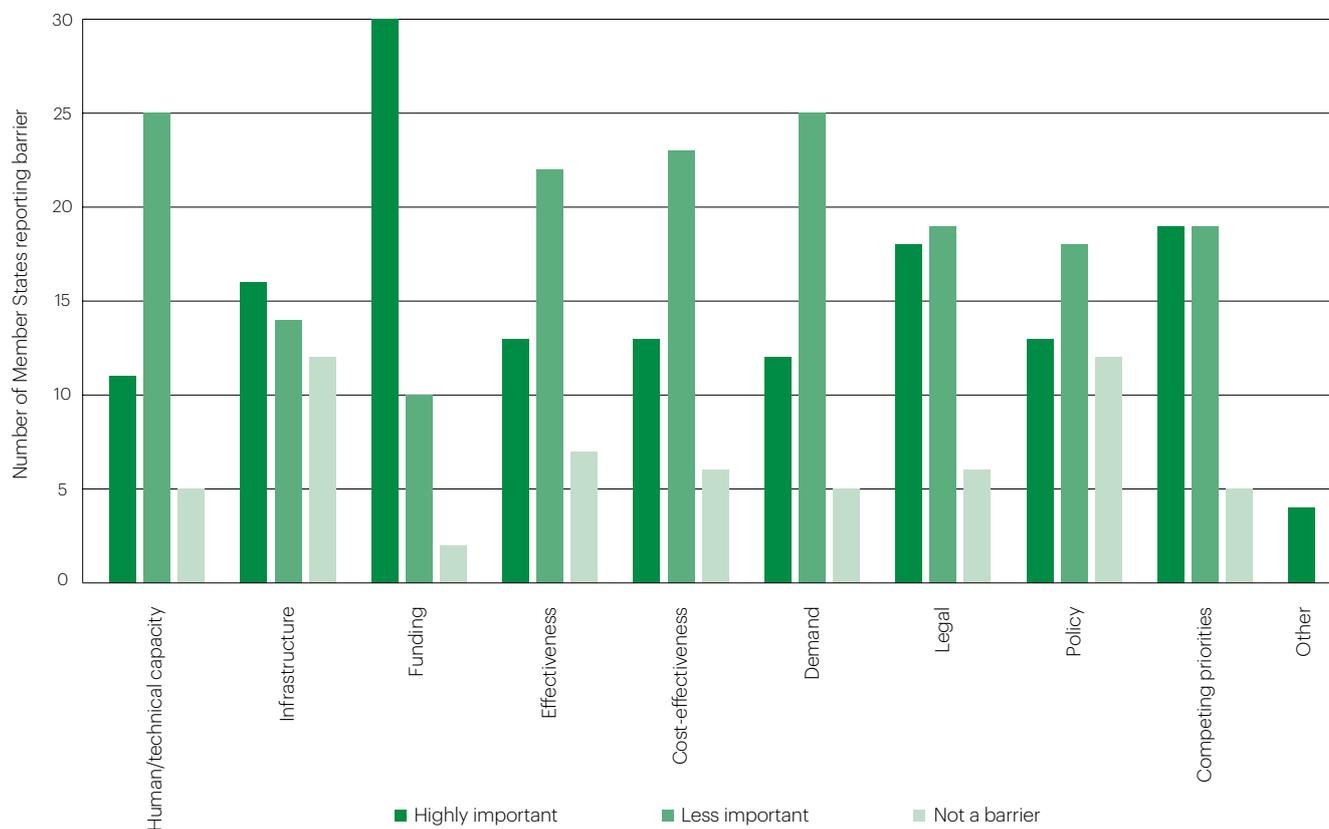
Funding and reimbursement of telehealth

Project-based telehealth programmes have difficulty in securing both long-term employees and funding after the project period ends (30, 90). Grant-based project funding is not a long-term method to establish telehealth services and many initiatives fail to develop and implement business cases during and after their project and become non-viable. Previous research shows that private service providers lack incentives for establishing infrastructures and that many European eHealth infrastructures and applications are funded by their government or quasi-public sources (30). It is difficult for smaller practices to invest a significant amount of money in creating and maintaining an eHealth portal for only their patients; as technology is developing rapidly, the initial investment may be unsustainable. To expand efforts in the direction of integrated care and to include health promotion, reimbursement models for telehealth services need to mature and adopt a perspective of public good (91). That is, models of health care reimbursement must transition from a focus on treating injuries and diseases to including chronic care and the prevention of diseases. Policy-makers

need to make appropriate changes in their views of health economics and use rigorous outcome measures to make this transition. In accordance, stakeholders – such as insurers, employers and health service providers – need to understand the value of the health service they are being asked to reimburse.

Concrete evidence from evaluations on the benefits of telehealth and the cost–effectiveness serve as starting points for establishing funding and reimbursement approaches. Determining who in the care-chain will pay for services is a difficult and ongoing process and identifiable costs and benefits are needed to make necessary decisions. Many of the benefits of telehealth are long-term and it can take several years for investments to be realized (92). Case example 12 illustrates funding and reimbursement models in France and the Netherlands; case example 13 provides a view of eHealth supporting aged care and carers; and case example 14 offers insight into the use of eHealth to improve health care delivery in Azerbaijan.

Case example 12.
Funding and reimbursement for telehealth

National health policy in France has made the development of digital technology an important issue, stimulating innovation, quality of care and health system efficiency. As part of coordinated clinical pathways that integrate medical and social aspects, the increasing use of digital technology in health supports changes that help to ensure equal access to care nationwide, particularly for patients with noncommunicable diseases. Progress attributed to digital technology offers benefits both to patients by empowering them and to health care professionals by allowing them to devote themselves to their core practices.

Taking this into consideration, France's strategic policy directions for eHealth aim to:

— develop uses of ICT by health professionals in both primary and hospital care, as part of urbanized, interoperable and secured information systems;

— foster the organization of innovative work that ensures coordination in continuity of care, supported through the implementation of tools to meet health professionals' needs (such as personal medical files, collaborative tools and tools for computerized processes);

— provide citizens and patients with information for their own health management, helping them to navigate within the system;

— allow regulated open data to be used as a valuable source for research, studies and system management, while respecting the confidentiality of personal information;

— improve access to medical expertise and care, particularly making use of developments in telemedicine.

Generally speaking, the insurance system in France provides reimbursement for a variety of health-related products, services, pharmaceuticals, devices and procedures if they are prescribed by health professionals, in the appropriate medical context, and if they are registered in the relevant positive lists *(93)*. This reimbursement includes preventive, curative, rehabilitative, and palliative care.

Following a 2009 law, a decree on telemedicine enabled fee-splitting to be used for health care payments for the first time, so that medical professionals can now charge other medical professionals for their services *(94)*. In addition, payments can be made for teleconsultations that do not physically take place in the doctor's office. The telemedicine decree also outlines the need for patient consent and authentication of the identities of those providing telemedicine services. Any telemedicine provision should be detailed in a patient's medical notes, including any procedures carried out or medications prescribed.

In this context, at a national level, *la Caisse nationale de l'assurance maladie des travailleurs salariés* – which has a remit for national health and social insurance funds – has laid out what constitutes telemedicine procedures. Information on how such services should be charged has also been provided by France's social security department, which is linked to the Ministry of Social Affairs and Health and the Ministry of Economics and Finance. One specified option is for regional health agencies to integrate these services into multiannual contracts with health care providers. Another option for payments involves the distribution of social health insurance funds by France's regional health agencies. Contracts signed by a regional health agency's director general should reflect regional strategies and national telemedicine policy, and should aim to improve the quality and coordination of health care provision. Health professionals providing telemedicine services should sign agreements that clarify each individual's roles, rights and obligations.

In the Netherlands, the treatment and management of chronic conditions are reimbursed through a fixed budget for treatment established by performance and output criteria. There are specific rules for offering (elective) integrated care to patients aged 18 years and over with a diagnosis of type 2 diabetes, cardiovascular diseases or COPD, and eHealth services are allowed as reimbursable services. This bundled payment system was introduced in 2010 as a way to reduce fragmentation of care and promote integrated care. A care group, typically led by a general practitioner, is responsible for the full spectrum of care-related activities for an individual with a chronic condition *(95)*. The care group negotiates the bundled payment contract with health insurers, which is necessary to qualify for the integrated care reimbursement, and subcontracts a multidisciplinary care team to provide the care. The general practitioner receives their fixed integrated care fee as well as additional fees for consultations not related to the care of the chronic conditions.

Case example 13.
eHealth supporting aged care and carers

Around 80% of care at home is carried out by informal carers, such as relatives or friends *(96)*. This contributes greatly to easing the financial burden of care on the state. Yet many informal carers experience social isolation and struggle to cope with the demands of the role, and may lack key skills required to carry it out.

While ICT-based services could be an effective and efficient way to support such carers, there is a lack of scientific evidence in this area. CARICT: study on ICT-based solutions for caregivers: assessing their impact on the sustainability of long-term care in an ageing Europe (2010–2011) was coordinated and funded by the

European Commission's Joint Research Centre Institute for Prospective Technological Studies and Directorate-General for Information Society & Media. The project analysed how ICT could be used to support informal carers for older people in the community, as well as to support carers paid for and employed by private households. The project documented the extent of ICT services and how such initiatives worked, mapping 52 ICT-based services for informal carers. A cross-analysis of 12 of these services showed that they improved quality of care and positively benefited the quality of life of elderly people and their carers.

As a follow-up project, CARICT-PUBL: publishing and maintaining directory of ICT-enabled services to support carers (2012–2014) created an online directory of ICT-enabled services for informal carers *(96)*. This highlights successful and promising examples of ICT-based solutions and aimed to raise awareness about existing good practices among different stakeholders, including carers and older people. The directory places ICT initiatives within the categories of independent living, information and learning for carers, care coordination and personal support, and social integration.

INNOVAge is a three-year project looking at social innovations that support active and healthy ageing, aligned with the EU Horizon 2020 goal of extending healthy life years. The project will explore the use of ICT to support informal carers as well as smart home technology and the use of mobile phones for preventive health care and the management of chronic conditions. One aspect focuses on developing and implementing a multilingual support platform for information on care activities, coping strategies and communication tools in all EU Member States with both common and national-specific services *(96)*.

Case example 14.
Telemedicine and Electronic Azerbaijan

The Ministry of Health in Azerbaijan has implemented several projects under the State Programme for the Development of Communication and Information Technologies in Azerbaijan (known as "Electronic Azerbaijan"). In 2008 the Clinical Medical Centre was outfitted with a new ICT infrastructure that connected nine buildings and 160 computers. A DICOM printer and picture archiving and communication systems services in the radiology department allow the electronic storage and transfer of images *(97)*. The Centre's training building includes a broadband computer network connected to large screens and advanced cameras to allow for the surgical processes to be observed in classrooms. New treatment-diagnostic centres were also built in order to provide rural areas with medical and diagnostic services, and health personnel were trained to use the new technologies.

The Electronic Azerbaijan programme has an electronic database and electronic health card system used to monitor childhood immunizations; it has had electronic health cards for neonates since 2007 *(98)*. The approach is to initiate the cards with children and scale up to adults. It is also expected that all hospitals, clinics, ambulances and ancillary health service providers will have the equipment to access and enter information on the cards. Azerbaijan also has an electronic observation system of infectious diseases to collect information and to strengthen epidemiological control, including measles, rubella and diphtheria. Computer equipment and connections with the system's central database have been implemented in 77 medical institutions and 140 specialists have been trained in this sanitary-epidemiological service *(99)*.

Like all other eHealth initiatives, telehealth will be most successful when responding to concerns from patients and clinicians. One consistent concern in eHealth is sound legislation regarding privacy and information security – for example, in integrated care – where information may be exchanged between different care providers as well as between different sectors.

In the 2010 WHO policy brief on telehealth in the provision of integrated care, several strategies on deployment and implementation of telehealth are suggested *(100)*. These include the following.

— Multidimensional approaches towards change management and process-led innovation should be pursued to promote and involve multiple aspects of health and social care and help coordinate initiatives in a consistent manner. This requires establishing mechanisms to support collaboration across and among health sectors – for raising awareness, encouraging meaningful discourse and exchanging information between stakeholders.

— Evidence gathered on the benefits and cost–effectiveness of telehealth should be generated and used, paying close attention to ethical issues and guidelines – this is important and will improve telehealth solutions.

— Technical and semantic interoperability should be reinforced to ensure that the health information is effectively transferred and functional in more than one setting or location.

— Various governance frameworks and institutional agreements should be analysed critically to identify opportunities for reform as well as best practices to assist with removing regulatory barriers and expediting the implementation of successful telehealth solutions.

— Telehealth initiatives should be re-evaluated over time as use, supporting technologies and regulations change and adapt.

Comments and lessons learned from Member States

Nine Member States shared lessons learned from the evaluation of telehealth programmes and seven provided additional comments. The importance of business cases for the sustainability of telehealth services was highlighted to show national authorities that the programmes are useful, cost-saving and successfully implemented, and to develop reimbursement models. Such models need to focus on the quality of services rather than the quantity offered. It was also stated that clear frameworks on the functions of telehealth services and their regulation need to be examined before services are established, particularly regarding standards, interoperability and legal aspects such as data protection and liability. Well defined implementation strategies were also highlighted.

> " **The most prevalent telehealth programme in the Region is teleradiology with 38 countries (83%) having adopted it.**

The geographical characteristics of countries will also play a role in the development of telehealth. Mobile telemedicine units can ensure access to quality health services in rural, mountainous and remote regions and smaller countries with a less diverse landscape may focus on different types of telehealth applications more relevant to their needs. To be efficient, effective and sustainable, solutions will need to look at both the horizontal and vertical integration of care through telehealth.

One Member State provided detailed lessons learned from projects on video-based interpretation in health care. These highlight the need for services to be firmly anchored and have the focus and support of management in order to be sustainable after introductory projects are completed. An approved educational programme for interpreters in the health care system is also recommended to facilitate professionalism and professional specificity. Both video and in-person interpretation services can and should be utilized to accommodate health care providers and interpreters. While hospitals used interpretation services during normal working hours, emergency personnel reported the need for acute interpretation and could possibly benefit from tele-interpretation as well.

The use of national networks to facilitate the coordination and development of telehealth was proposed by one Member State as a method to compensate for a lack of funding for research in telehealth. It was pointed out that while continued research is important, it is just as important that projects are aligned to larger goals and that publishing and dissemination of evidence on the best methods to evaluate the effectiveness of telehealth programmes is still needed.

Organizational structure, national coordination of telehealth programmes and the support of management were mentioned several times. Adapting the management policies of existing priorities and workflows is required to advance the way in which services are provided together with a clear vision and strong leadership.

One Member State noted that time is needed to allow progress on patient education and empowerment, specifically mentioning that it affects a change in the roles of individuals and professionals in health care. It also mentioned that encouraging collaborative environments between health and social components enhances the effectiveness and sustainability of care organizations.

Summary

Many telehealth projects are now progressing from pilot projects into a phase of broad-scale implementation. Telehealth services are a means to extend services and reach a broader population; they are an important step towards universal health coverage. Realizing the public demand for telehealth, larger regional telehealth initiatives are emerging. However, careful and detailed planning of telehealth strategies is still needed. As many as 38% of Member States in the WHO European Region do not have a national policy or strategy on telehealth. Yet in absence of specific telehealth strategies or policies at the national level, its use is increasing. In both the 2009 and 2015 WHO global surveys on eHealth, teleradiology is the most prevalent telehealth programme: in 2015 83% of countries report using it, primarily at the national level.

Evaluation of telehealth initiatives is needed to monitor and continue the development of services. The successful integration of telehealth depends not only on the technical components but also on how and why the services are used. Evaluations bring to light the successes and hindrances of services that are important for patients, health workers, investors and other stakeholder groups. In 2015, 10 countries (23%) report that they have evaluated their government-sponsored telehealth programmes. While these evaluations show overall positive results, there is a lack of evidence on successfully and sustainably incorporating telehealth initiatives into the Ministry of Health's programmes. The utilization of evaluations for telehealth programmes has not increased significantly since the 2009 survey, despite a clear increase in adoption – this indicates that it is an area that needs specific focus in order to foster future developments and ensure their success.

> " **Only ten countries (23%) report that government sponsored telehealth programmes have been evaluated.**

Several Member States provided further information and lessons learned regarding telehealth. In particular, business cases are needed for the sustainability of telehealth services, both as a means to evaluate programmes and to develop reimbursement models. The most important barrier to implementing telehealth programmes is a lack of funding to develop and support telehealth programmes, with nearly three quarters of Member States identifying this as the most important barrier. Clearly defined implementation strategies and frameworks for telehealth services are also seen as important elements which need more attention. Organizational goals, national coordination of programmes, strong leadership from management and the education and motivation of health professionals were also cited as significant contributors to the success of telehealth programmes.

Recommendations

— Member States are encouraged to develop national strategies and policies for telehealth to guide its specific contribution to health care service provision and to illustrate modes of intersectoral collaboration between health and social sectors.

— Systematic evaluation of telehealth services should be made to show progress in achieving national health-related objectives and to demonstrate benefits for patients.

— Funding and reimbursement for telehealth should be addressed by Member States to further develop and support national telehealth programmes.

mHealth is the use of mobile technologies to support health information and medical practices. It holds great potential for facilitating the transformation of health services and data delivery by reaching wide geographical areas and in portable forms. mHealth is currently incorporated into health care services such as health call centres or emergency number services, which conventionally depend on existing telephone communication infrastructures, but also includes functions such as lifestyle and well-being apps, health promotion and wearable medical devices or sensors.

Key data from the survey responses

— The use of mHealth for appointment reminders has risen by 21% since the 2009 survey.

— The use of mHealth to access patient records has increased by 25% since the 2009 survey.

— The use of clinical decision support systems (CDSSs) has grown by 27% since the 2009 survey.

— 49% of Member States have government-sponsored mHealth programmes.

— 73% of Member States do not have an entity that is responsible for the regulatory oversight of mHealth apps for quality, safety and reliability.

— Few Member States (7%) report evaluations of government-sponsored mHealth programmes.

Background

mHealth offers several advantages over traditional methods of health care provision by allowing for convenient, real-time and portable access to information and services. mHealth facilitates patients' engagement in their own health care, allows for better coordination of care and is a key enabler for the provision of remote care services and health promotion. When individuals enter information in a health app[4] or use wearable technologies, care providers receive a more holistic and quantified description of patient behaviours and treatment outcomes. As technologies and mobile infrastructures mature, an increasing use of mHealth is being observed

in patient monitoring, decision support in health care settings, integrated care, educating and empowering patients in self-care and raising awareness on key public health issues.

mHealth offers the ability to actively engage individuals in health care in ways that previously have not been possible and facilitates the promotion of health and healthy lifestyles by communicating disease prevention behaviours. Participation extends beyond the consumption of health care services; in many cases, individual users act as valuable contributors to data regarding disease and public health concerns. Public health management also benefits from mHealth as the collection of public health information will be timelier and already digitized. Large amounts of data can be collected through mHealth, which facilitates research and can increase health care effectiveness by examining patterns on a large scale.

Advances in mobile technologies, reduced hardware costs and a maturing market of health-related apps have contributed to a recent increase in mHealth use and its integration into other eHealth services. Many individuals are now able to use their mobile devices to access health information and search for health care services. Clinicians and health professionals use mobile devices and apps to access patient information and other databases and resources. In recent years, mHealth has also rapidly grown in low-resource settings, as the proliferation of mobile phones has allowed countries to leapfrog technology development – bypassing fixed-line solutions and jumping directly into mobile technology infrastructures.

4 mHealth apps involve using programs on mobile devices to collect and deliver health information.

The number of mHealth apps has grown significantly in the past few years. Health and fitness apps are currently the fastest growing category being developed, with over 100 000 mHealth apps available on the market in 2014 *(101)*. By 2017 it is projected that the mHealth app market will largely comprise monitoring services (approximately 65%), with monitoring primarily focused on independent ageing solutions, chronic disease management and post-acute care services *(102)*. Diagnostic services and health system strengthening services are also projected to be key services in the mHealth market. Access to ongoing medical education and training for health professionals will also be expanded with the help of mobile technologies.

Mobile technology integration within the health sector has great potential to promote effective communication in health care settings, supporting health professionals and patients in improving decision-making. Examples of mHealth apps focus on a range of health issues, including malaria, HIV, tobacco and alcohol control, vaccinations, diabetes and maternal health. The evidence emerging from these deployments show that mHealth can be very effective in increasing the coverage of health programmes. Two examples of countries in the WHO European Region that have successfully employed mHealth in this context include the Russian Federation (with programmes aimed at improving prenatal health and care, addressing injection drug users, providing education on and improving the care of people with HIV and AIDS and reducing tobacco use) and the United Kingdom (with programmes addressing tobacco use, wellness and happiness, diabetes management and personalized health care advice).

Within the United Nations, two agencies have come together to form a new global programme focusing on the use of mobile technologies to improve the treatment and prevention of noncommunicable diseases (NCDs). The WHO and ITU initiative on mHealth for NCDs, called "Be He@lthy, Be Mobile", takes a more systemic approach to mHealth by helping governments build their capacity for running large-scale health programmes that use elements of mobile technology as an integrated part of broader health services *(103)*. The programme is a response to the 2011 Moscow Declaration on NCDs (WHA64.11) and the 2011 Political Declaration on NCDs (A/RES/66/2) *(104, 105)* to identify concrete actions to be undertaken by Member States and WHO. It identifies existing mHealth services that have shown successful results and supports their scaling up to reach wider populations. By engaging both WHO and ITU, there is also a dual emphasis on institutionalizing the programmes within health and ICT, engaging ministries of health and communications equally. By 2017, the initiative will have helped implement and strengthen mHealth services in several countries, covering a range of income groups and disease areas: Costa Rica, the Philippines, Tunisia, India (mTobaccoCessation), Senegal and Egypt

(mDiabetes), Zambia (mCervicalCancer), Norway (mCOPD) and the United Kingdom (mHypertension). The aim is for the mHealth services to complement existing health care services *(103)*.

Current mHealth solutions largely consist of text messaging services. The interventions target NCDs through awareness, education, screening, surveillance, treatment and condition management. Norway and the United Kingdom, two of the main partner countries in Be He@lthy, Be Mobile, are joining multiple sectors of society, strengthening connections within eHealth and innovation communities, sharing existing digital assets, and fostering the development of strategies, documents and tools. Be He@lthy, Be Mobile is also developing a global toolkit on how to set up mHealth programmes for different disease areas where there is evidence that mHealth can support disease control. It will also provide technical advice to countries for adapting these global packages to suit the specific needs of each country. The goal is to increase prevention, treatment and enforcement of NCDs, reduce the social and economic effects of NCDs, chronic illnesses and disabilities, and save lives by expanding evidence-based and cost-effective mHealth services to all countries *(106)*. The initiative builds the programmes on the foundation of a strong multisector partnership model.

WHO and ITU are collaborating with the European Commission in discussing the development of an mHealth knowledge and innovation hub to foster collaboration between research and private stakeholders. Ideally, this will bring innovative products and services to the market quicker and improve strategy- and policy-making regarding mHealth.

Results of the survey: policies and strategies guiding mHealth programmes

In the 2015 WHO global survey on eHealth, 49% of respondents (22 countries) in the European Region report having government-sponsored mHealth programmes, with 49% reporting no such programmes. As illustrated in Fig. 17, mHealth programmes in 59% (13 countries) are guided by eHealth policy or strategies, whereas 18% (four countries) report that mHealth is guided by the national telehealth strategy and 27% (six countries) report that no specific policy or strategy guides mHealth. Another 14% (three countries) report that their mHealth programmes are guided by other strategies or policies (digital welfare strategy, strategic plan by the Ministry of Health and a national digital strategy). It should also be noted that three countries report that their mHealth programmes are guided by both eHealth and telehealth policies. No Member State reported having a dedicated national mHealth strategy or policy. This is particularly revealing, as Member States within the WHO European Region are the most active in mHealth globally *(107)*.

Fig. 17. Policies or strategies guiding mHealth programmes (n=22)
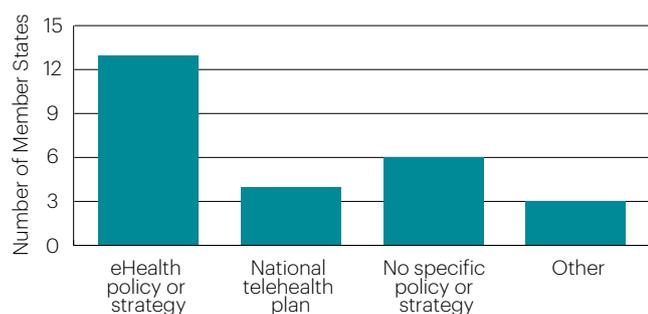
Results of the survey: the role or function of health authorities in developing and adopting mHealth

Member States were asked about the role or function of health authorities in the development and adoption of mHealth (see Fig. 18). Over half of the countries report that their health authorities promote standards and interoperability (56%; 24 countries), provide guidance for privacy and security (56%; 24 countries) and promote the development and adoption of mHealth in the health sector (51%; 22 countries). In 37% (16 countries) the health authorities were reported to provide oversight and enforcement of data ownership. Only about one quarter of countries (26%; 11 countries) report that health authorities regulate mobile devices and software for quality, safety and reliability. Seven Member States (16%) report that health authorities play no role in the development and adoption of mHealth.

Other responses to the role of health authorities in the development and adoption of mHealth as reported by six countries (14%) included coordination and enforcement of EU mHealth guidelines, promoting efficiency in health data capture and exchange, cost–effectiveness analysis when advising about inclusion of mHealth in basic benefit packages, setup of a national roadmap on mHealth and increasing the availability of public health services to the general public.

Fig. 18. Role or function of health authorities in the development and adoption of mHealth (n=43)

Results of the survey: regulatory oversight, incentives and guidance for mHealth

When asked about the existence of a specific national entity with responsibility for the regulatory oversight of mHealth apps for quality, safety and reliability, 22% of respondents (10 countries) report having such an entity; 73% (33 countries) do not have one. Similarly, for the existence of a national entity providing incentives and guidance on the innovation, research and evaluation of health apps, 36% (16 countries) report having such an entity, while 56% (25 countries) do not and four countries report that they do not know. It is interesting to note that 10 of the 16 countries with such an entity also report having government-sponsored mHealth programmes, indicating that when governments sponsor mHealth programmes they are also more likely to provide incentives and guidance on innovation and evaluation, as well as regulation for their use. However, the breakdown of results also exposes the fact that guidance on health apps is not being offered consistently at the national level. With major issues at stake, such as security and privacy, legal and liability challenges and interoperability and international cooperation, stronger leadership to motivate and direct mHealth is needed. As none of the countries report having a dedicated mHealth policy or strategy, this could be an indication that Member States are either not distinguishing between mHealth and other strategic eHealth initiatives or are hesitant in moving forward with mHealth and are looking to European authorities for support and regulation.

Results of the survey: types of mHealth programmes

The 2015 survey asked Member States for an overview of their mHealth programmes, looking for specific information on the types of programme and the levels at which they operate. The frequency of established mHealth programmes greatly outnumbers informal and pilot programmes across the majority of programme types (see Fig. 19). Electronic patient information (access to EHRs) is the most frequent use of mHealth, with the majority of these operating as established programmes at the national level. The results in Fig. 20 show an overview of the operating levels of the mHealth programmes. Overall, mHealth programmes exist most frequently at national and local levels, with a total of only 20 international mHealth programmes in the WHO European Region. These results clearly illustrate that the mainstreaming of mHealth apps is widespread through the Region and is becoming an established form of eHealth.

> " **Only 11 countries (26%) report that health authorities regulate mobile devices and software for quality, safety and reliability.**

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Fig. 19. Types of mHealth programmes

	Informal (n=85)	Pilot (n=103)	Established (n=211)
Health call centre/helpline	7	7	20
Emergency toll-free telephone	3	1	32
Medication adherence	10	14	7
Reminders for appointments	8	7	18
Community mobilization/campaigns	5	8	14
Mobile telehealth	8	10	14
Emergency response and management	3	3	21
Health surveys	9	6	5
Health surveillance	4	6	9
Patient monitoring	5	14	11
Access to information and tools	7	1	21
Clinical decision support systems	6	7	9
Electronic patient information	3	15	20
mLearning	7	4	10

Number of programmes

Fig. 20. Operating level of mHealth programmes

	Local (n=138)	Intermediate (n=64)	National (n=201)	Regional (n=53)	International (n=20)
Health call centre/helpline	12	4	17	5	1
Emergency toll-free telephone	5	4	27	5	3
Medication adherence	15	6	5	2	0
Reminders for appointments	16	4	13	3	0
Community mobilization/campaigns	9	2	19	2	0
Mobile telehealth	13	8	14	7	2
Emergency response and management	2	3	23	4	3
Health surveys	9	5	4	2	1
Health surveillance	4	4	10	2	0
Patient monitoring	15	7	7	6	0
Access to information and tools	10	4	23	5	6
Clinical decision support systems	9	5	10	5	0
Electronic patient information	8	6	20	4	1
mLearning	11	2	9	1	3

Number of programmes

Health call centres/helplines

In the 2015 survey, 70% of respondents (32 countries) report having health call centres or health care telephone helpline programmes, with 59% (20 of these call centres and helplines) functioning as established programmes. The results show an increase in this type of service: each of the comparable mHealth services has grown since the previous survey. The trend in mHealth services in the WHO European Region from 2009 to 2015 is shown in Table 11.

Emergency toll-free telephone services

Thirty-five countries (76%) report having emergency toll-free telephone services, with 89% (32 emergency phone services) operating as established programmes. Some respondents indicate that they have emergency toll-free telephone services, but not their maturity or at which level they operate. Other Member States report that these telephone services are provided by individual health service providers; another group of countries reports that they do not have emergency toll-free telephone services, although such a service is known to exist (for example, 112 is used by the majority of the Member States in the Region).

Medication adherence

Twenty-eight countries (61%) report that they offer medication adherence services via mobile ICT. The majority of these programmes are offered at the local level (54%; 15 countries). Only seven of these programmes are established services; however, it is promising that another 24 informal or pilot services for this type of treatment adherence are reported as this indicates continued development in this area.

Appointment reminders

Non-attendance for health appointments is a known problem in health care services and one area where reminders sent via mobile phones has shown to be beneficial *(108, 109)*. The results from the European Region show that 74% (34 countries) report having mHealth programmes to remind patients about appointments. Of these appointment reminder services 18 operate as established programmes, with another eight operating as informal and seven as pilot services. As with the results on medication adherence via mobile ICT, most of the appointment reminder services are offered at the local level (44%); another 36% are offered at the national level.

Health promotion, awareness-raising and community mobilization

Health promotion campaigns, awareness-raising and community mobilization can also be carried out through mobile ICT. In 2015 61% of respondents (28 countries) report having mHealth services within the category of mobilization and promotion. A total of 27 programmes were reported, 52% (14 programmes) of which are established. Several countries also report having other mHealth programmes in the same category, including recruiting people to donate blood, education campaigns on blood donation, using mHealth for awareness in health emergency situations and campaigns against excessive alcohol consumption.

Mobile telehealth

The 2015 results show that 74% of respondents (34 countries) report the use of mobile telehealth as a method for telehealth consultation between health care professionals or between professionals and patients. The majority of these programmes operate at local or national levels with 44% (14 programmes) established, 31% (10 programmes) in the pilot phase and another 25% (eight programmes) in the informal phase. Based on additional comments from Member States for this question, it appears that some of these services function as extensions of other established telemedicine services.

Emergency response and management

Using mobile ICT for intersectoral communications during emergencies can assist health systems in responding to and managing emergency and disaster situations. Of the respondents, 29 countries (63%) report having mHealth programmes for emergency response and management. The majority of these operate at a national level (66%; 23 programmes) and are established services (78%; 21 programmes). Only a few informal and pilot programmes are reported (six in total). Several Member States indicate that they have separate and dedicated networks for responding to emergency services and that these networks cannot be classified uniquely as mHealth.

Health surveys and surveillance

mHealth is also utilized for health surveys, surveillance and monitoring of health-related information. Use of mobile ICT for the collection, management and reporting of health surveys is made in 59% (27 countries). This occurs at the local level in 43% (nine countries), and 45% of the programmes are categorized as informal, with only five established programmes. The use of mobile ICT for the collection, management and reporting of public health surveillance is slightly more mature: 50% of programmes operate at the national level and 47% of programmes are established. In 2015 19 countries (41%) report using mHealth for surveillance.

Patient monitoring

Capturing and transmitting data to monitor patient conditions via mHealth is a key growth area across Europe. In 2015 70% (32 countries) report using mHealth for patient monitoring. The patient monitoring programmes operate as established (37%), local-level (43%) and pilot programmes (47%).

Access to information and tools

Mobile ICT programmes providing access to information, databases, tools and education for health professionals are also heavily utilized in Europe. Of the 70% (32 countries) reporting these, the majority of programmes are established (72%), with another 24% operating as informal programmes. Almost half (48%) of these programmes operate at the national level; 21% at local levels. Fewer programmes operate at the international level (13%).

CDSSs

CDSSs analyse data and link health observations with health information to support professionals in clinical decision-making. When accessed through mobile ICT, health professionals can make evidence-based decisions regardless of the clinical setting and at the point of care. In the 2015 survey, 52% of respondents (24 countries) in the WHO European Region reported use of mobile decision support, with 41% of programmes operating as established, 32% as pilot and 27% as informal programmes. Most of the CDSS programmes operate at national (35%) and local (31%) levels and none at the international level.

Electronic patient information

mHealth can be used to provide health professionals with mobile, electronic access to patient information, such as EHRs and diagnostic results. In 2015, 72% (33 countries) reported using mHealth for access to patient records. The majority of these programmes are established (53%) and operating at the national level (51%). Another 40% of programmes are pilots, and there are three informal projects. Only one programme in this category operates at the international level.

mLearning

Twenty-three countries (50%) have programmes providing access to online education for professionals through mLearning. These programmes operate on all levels: the majority are local (42%) and national programmes (35%). Established initiatives are more common than informal and pilot initiatives at 48%, 33% and 19%, respectively. This type of mHealth service was not asked about in the 2009 survey.

Table 11. Trends in Member States reporting the use of mHealth services

	2009	2015
Health call centres/helplines	64%	70%
Emergency toll-free telephone services	64%	76%
Treatment adherence	40%	61%
Appointment reminders	53%	74%
Awareness-raising	28%	61%
Mobile telemedicine or telehealth	64%	74%
Emergency response and management	56%	63%
Health surveys	21%	59%
Surveillance	17%	41%
Patient monitoring	47%	70%
Access to information and tools	36%	70%
Access to CDSSs	25%	52%
Access to electronic patient information	47%	72%

Note: for comparison purposes, it is important to note that the 2009 survey differed in that it asked about the use of mobile telemedicine. Telemedicine consists of clinical medical services and information from a distance, whereas telehealth is a broader term including health information and services that can be outside of a purely clinical scope.

Source: 2009 data from the 2011 WHO publication mHealth: new horizons for health through mobile technologies (107).

> **In 2015, 33 countries (72%) reported using mHealth for access to patient records; 32 countries (70%) report using mHealth for patient monitoring; 24 countries (52%) report use of mobile decision support.**

Results of the survey: mHealth in the different geographical subregions

Table 12 shows the results of mHealth programmes for the different geographical subregions in the European Region (see Annex 2 for subregional groupings). These data indicate that the Nordic countries have the highest number of established mHealth programmes as well as a higher total of national projects, reflecting the long and close relationship between the Nordic countries in the field of eHealth. However, it appears that as established mHealth services increase, both EU and Nordic countries seem to decrease pilot and informal initiatives, which can mean that fewer programmes are under development to become new established programmes in the future. The EU has a higher percentage of established mHealth programmes. The CIS countries show a strong commitment to mHealth and have a balanced mix of informal, pilot and established programmes, which has high potential to raise the capacity and quality of their mHealth services. Regional, national and international collaboration is strongest among the CARINFONET countries, indicating their progress in the successful integration of mHealth services. The data in Table 12 show a percentage of the maximum score based on the number of Member States in that subregion and the number of their programmes. Case example 15 illustrates how mHealth is being used to monitor cardiac patients in Georgia.

Table 12. Overview of mHealth programmes, by subregion

	Informal	Pilot	Established	Local	Intermediate	National	Regional	International
EU-28	14%	16%	40%	26%	11%	29%	8%	4%
CIS	20%	24%	25%	22%	18%	37%	15%	4%
CARINFONET	11%	20%	23%	19%	11%	41%	23%	6%
SEEHN	10%	13%	13%	14%	2%	20%	2%	2%
Small countries	4%	5%	26%	4%	0%	27%	0%	2%
Nordic countries	6%	7%	51%	21%	14%	46%	19%	3%

Case example 15. Mobile telemonitoring for cardiac patients in Georgia

The Chapidze Emergency Cardiology Centre in Georgia is pioneering the use of mHealth to monitor cardiac arrhythmias (irregular heartbeats) and hypertension (high blood pressure) in patients. A study carried out by the Centre and Tbilisi State Medical University into mHealth for cardiac patient telemonitoring and integrated care found that when mHealth was used to monitor cardiac arrhythmias it shortened hospital stays and had a positive impact on quality of life, because patients were able to go home sooner *(110)*.

The Chapidze Emergency Cardiology Centre provides patients with a heart-monitoring device that can detect a range of abnormal heart rhythms that could prove fatal. The heart monitor records the electrical activity of the heart (an electrocardiogram or ECG), and sends on information about any abnormal rhythms via Bluetooth to a mobile phone. This information is then sent from the mobile phone to a webserver in Chemnitz (Germany), and the doctor receives an email containing a pdf of the ECG. A series of three beeps also alerts patients if the electrodes on the heart monitor have become detached or if the ECG recorder is running out of battery. The recording device works on a loop system so that old data can be overwritten.

As well as enabling earlier discharge among patients at the Centre, mHealth can also be used to detect arrhythmias in high-risk groups. This includes stroke patients who are at risk of developing atrial fibrillation – a type of irregular heartbeat that can lead to another stroke. These patients can be admitted for treatment to correct their heart rhythms and reduce their risk of having a stroke. The mHealth app can also be used to diagnose arrhythmias in patients who have, for instance, experienced unexplained syncope (fainting). Instead of admitting these patients for continuous ECG monitoring, mHealth enables their heart rhythms to be monitored at home.

In addition to the use of mHealth to help diagnose and improve treatments for heart problems, the Chapidze Emergency Cardiology Centre has used it to monitor blood pressure. As a result of mHealth monitoring, blood pressure fluctuations throughout the day and night that had not previously been recorded were picked up. This enables treatment to be tailored to account for such changes in blood pressure, which relate to the patients' circadian rhythms.

Results of the survey: evaluation of mHealth programmes

In the 2009 WHO global survey on eHealth, 22% of countries in the WHO European Region reported a formal evaluation of mHealth services and subsequent publication of the results *(107)*. The 2015 global survey on eHealth asked Member States specifically about evaluation of government-sponsored mHealth programmes (and not about the publication of results). Only three countries (7%) have evaluated government-sponsored mHealth programmes (though breakdown detail was provided by four countries) while 72% (33 countries) report that no such evaluation had been performed. A further eight countries report that they do not know whether government-sponsored mHealth programmes have been evaluated. While not all mHealth programmes are developed or evaluated by governments, with over 200 established and national programmes in the survey results, a greater degree of programme evaluation could be expected.

Those countries that had evaluated mHealth programmes were asked to provide additional details on their results (see Fig. 21). Case example 16 shows how mHealth is aiding the development of personalized health services for remote clinical monitoring and treatment services.

Fig. 21. Results of the evaluation of government-sponsored mHealth programmes (n=4)
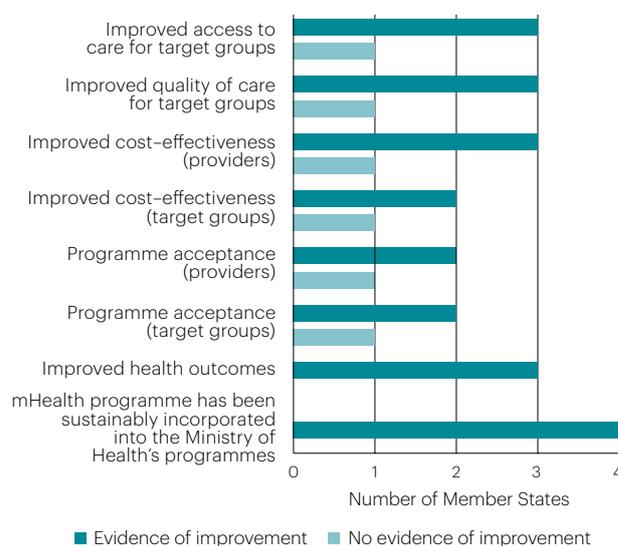
> "Only three countries (7%) have evaluated government-sponsored mHealth programmes while 72% (33 countries) report that no such evaluation had been performed. With over 200 established and national mHealth programmes reported, a greater degree of evaluation could be expected.

Case example 16. Body sensor networks for personalized health monitoring

Researchers have investigated body area network (BAN) technology in remote clinical monitoring and treatment services. The goals include routine chronic disease management and detection of medical emergencies. Building on knowledge gained during a previous project called MobiHealth (2002–2004), the MobiGuide project (2011–2015) *(111, 112)* developed and evaluated a personalized patient guidance system designed to support the daily management of various health conditions.

Different variations of the MobiHealth BAN have been trialled with multiple patient groups since 2002 during several research projects. The system was simple for patients to use and provided direct motivations and health benefits. Older adults who had never previously used a mobile device were easily able to use the system. Further, a remote therapist could provide feedback, which further improves clinical outcomes related to pain and disability. Both professionals and patients found that the advantages of the system and the mobile-based services in remote clinical monitoring were clear and desirable.

The MobiGuide project involves partners from Austria, Israel, Italy, the Netherlands and Spain. The BAN works with a patient wearing sensors on their body and using a mobile device such as a phone. The device receives data from the sensors, runs a local app and acts as a communication gateway by sending data to a remote health care location. Continuous biofeedback through the mobile device enables individuals to adapt their behaviour immediately, resulting in greater awareness patient and positive long-term treatment effects. Patients respond to viewing their biosignals in real-time and can learn to use the biofeedback to improve their immediate states.

Patients receive (evidence-based) feedback and guidance based on data received from body sensors. The clinical data are integrated into a personal health record, which also gathers information from the hospital or care centre's electronic-based records. MobiGuide furthermore has decision support tools that are used to provide actions for the patient to take, pose follow-up questions, recommend lifestyle changes and contact relevant care providers. Although the project focuses on cardiac patients and pregnancy complications, the system and its services can apply to a range of both chronic and acute health conditions. Using real-time data, clinical evidence-based decision-making and best practice guidelines, research on BANs is advancing personalized care services.

Results of the survey: barriers to implementing mHealth programmes

The 2009 WHO global survey on eHealth revealed that, globally, competing health system priorities were the greatest reported barrier to mHealth adoption *(107)*. Within the European Region in 2009, legal issues – including the lack of legislation or regulation for mHealth programmes – lack of knowledge on apps for mHealth[5] and lack of evidence on cost–effectiveness were additional top barriers. Legal issues were the most frequently reported barrier across all segments of eHealth for the Region in 2009.

In 2015 legal issues are overtaken by funding as the most important barrier to mHealth adoption.[6] Lack of evidence on cost–effectiveness, competing health system priorities, lack of legislation or regulations on mHealth and lack of evidence on effectiveness of mHealth programmes are the next most important barriers. Fig. 22 shows the top four barriers to mHealth in the European Region in 2009 and 2015.

All responding Member States indicated to varying degrees that funding is a barrier, with 10 countries reporting it as an extremely important barrier. Lack of demand for mHealth, absence of mHealth in policy and lack of human and/or technical capacity are also reported as moderately important barriers. Infrastructure is the lowest rated barrier: no country rated it as extremely important; it was also the lowest rated barrier in the 2009 WHO global survey on eHealth. Fig. 23 shows the total number of barriers in the Region from the 2015 survey. Additional barriers to mHealth adoption reported by Member States include reimbursement (extremely important); foundations of the funding, cultural traditions, interoperability in connecting to EHR systems, standardization, patient authentication, privacy concerns and lack of leadership (all rated as very important).

Fig. 22. Comparison of the top barriers to implementing mHealth programmes in 2009 and 2015
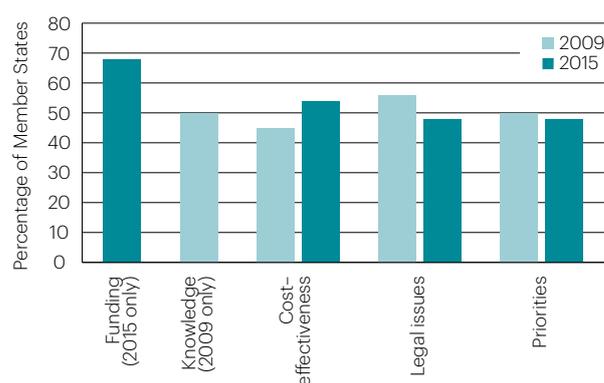
Source: 2009 data from the 2011 WHO publication mHealth: new horizons for health through mobile technologies (107).

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5 Lack of knowledge was not asked about as a barrier in the 2015 survey.

6 Funding was not asked about as a barrier in the 2009 survey, although the GOe report on mHealth did state that "conflicting priorities generally indicate that funding is allocated to other programmes ahead of mHealth".

Fig. 23. Barriers to implementing mHealth programmes in 2015

Legend: ■ Highly important   ■ Less important   ■ Not a barrier

Y-axis: Number of Member States reporting barrier (0–30)

X-axis categories: Capacity, Infrastructure, Funding, Effectiveness, Cost-effectiveness, Demand, Legal, Policy, Competing priorities, Other
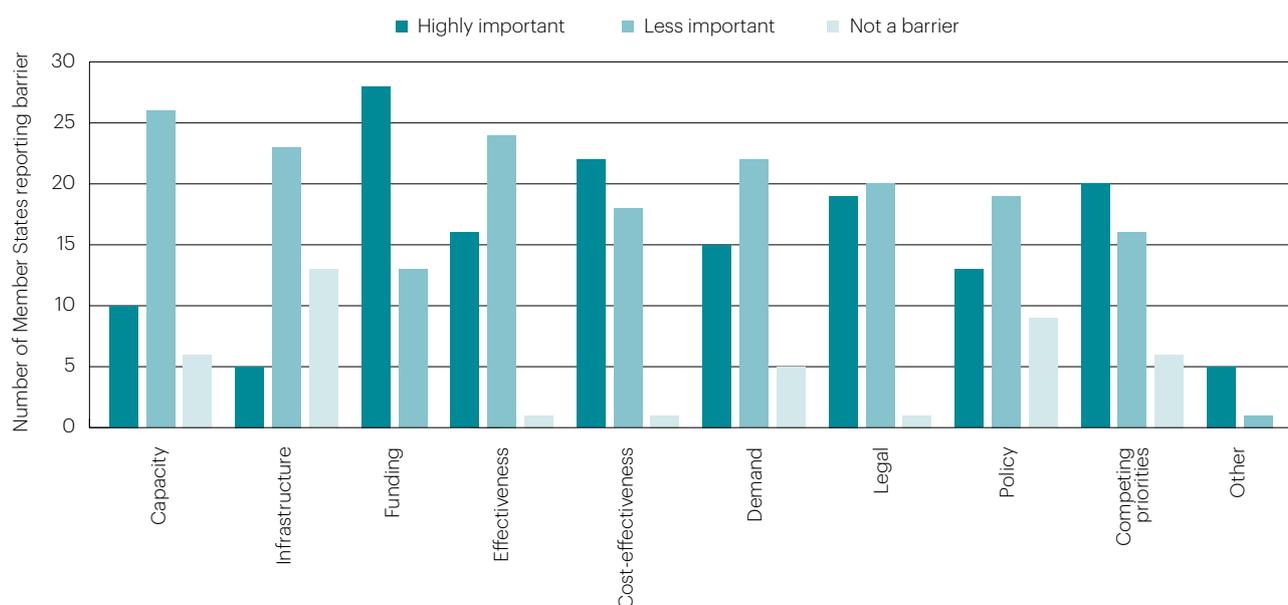
Reimbursement and regulation of health apps in the EU

The European Commission eHealth Action Plan 2012–2020 *(113)* acknowledges the benefits of lifestyle apps, well-being apps[7] and medical devices, and underlines their significant contribution to mHealth. It also notes the need for a distinction between these categories to help guide developers and manufacturers and to provide clear frameworks for legislation on development and safe use. The Medical Devices Directives *(115, 116)* provide guidance to an extent, but do not currently apply to apps, leaving gaps that create confusion and legal issues around the safety of using apps as medical devices, given that they do not adhere to the same rigorous standards as physical devices.

Inadequate reimbursement models are a well-known barrier to the wider use of mHealth solutions and, as such, it is the user who typically pays associated costs directly. Clearer guidance and legislation on mHealth types and uses can also facilitate clearer reimbursement models. Health apps without regulatory approval can be purchased and downloaded; however, apps that are approved may be more likely to be prescribed by professionals, be reimbursed as part of medical care and be trusted by consumers *(117)*. Fortunately, service providers, institutions and national authorities are undergoing the process of examining and including medical and health services delivered via mobile technology. One way to promote reimbursing mHealth services or devices is by including them in the guidelines and terms used to describe health care activities that are reimbursed by insurance agencies, health institutions and national authorities. In this way, mHealth services are more likely to be reimbursed if they

are described in the context of existing therapies or as supporting consultations.

In Spain, AppSaludable Distinctive regulates mHealth apps for safety and reliability, resulting in a seal of guarantee for safe and reliable apps, hosts an app library, as well as offers guidelines on the design, use and evaluation of mHealth apps. The mHealth Competence Centre, also in Spain, provides an easy-to-use catalogue of over 250 apps and additional resources such as research and evidence on the efficacy of mHealth *(118)*.

A stakeholder meeting on mHealth during the 2015 EU eHealth week in Riga, Latvia, addressed key issues on mHealth app development in Europe. The three main topics discussed were privacy and security, safety and transparency, and web entrepreneurs' access to the market. As an outcome of the European Commission's Green Paper on mHealth *(114)*, subsequent consultations *(119)* and eHealth week, the European Commission presented an initiative to draw up a *code of conduct* for mHealth application developers to increase the public's trust in mHealth apps and to promote guidelines and compliance with data protection among mHealth developers. Specifically, the code of conduct will address safety and transparency, regulatory frameworks, evidence and analysis on effectiveness of mHealth apps and interoperability, among other key topics.

Health challenges, lack of staff and expertise and limited budgets all increase the difficulties for decision-makers to choose suitable interventions. Solid evidence from the evaluation of mHealth programmes is necessary for policy-makers to support investment and implementation decisions. It is also crucial for developers and researchers to know which solutions and features should be included. Adequate regulations addressing the problems of health data privacy, accuracy and risk associated with the use of mobile apps are also needed. Safety and security issues

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7 Lifestyle and well-being apps are typically understood to collect and use personal data, which may not necessarily include health data and/or have clinical relevance. The European Commission Green Paper on mobile Health states: "Lifestyle and wellbeing apps primarily include apps intended to directly or indirectly maintain or improve healthy behaviours, quality of life and wellbeing of individuals" *(114)*.

are two of the biggest challenges in the development and adoption of mHealth and solutions should contain suitable security safeguards, such as encryption of data or patient authentication. Policies and laws on mHealth, including liability rules, licensing schemes and informed consent, will become increasingly important as mHealth continues to develop and become a greater part of mainstream health care. Case example 17 describes the use of mobile technology to document adverse drug reactions.

Case example 17.
mHealth and drug safety in the EU

WEB-RADR (Recognizing Adverse Drug Reactions) is a project that uses mobile technology and social media to improve pharmacovigilance, focusing on adverse drug reactions *(120)*. One aspect of the project is investigating how effective and reliable social media data can be to identify potential drug safety issues. As social media is a growing medium where individuals share information and experiences about their health treatments, it has the potential to provide large amounts of information on effective doses and side-effects after medications are licensed and made available to the public. Another aspect of the project is developing a mobile app to report such issues. Through use of reporting forms for medications and their side-effects, mobile devices such as smart phones and tablets can be used to streamline the information so it reaches EU pharmaceutical regulators through an easier and more accurate system. A partner in the project, the United Kingdom's Medicines and Healthcare products Regulatory Agency launched its Yellow Card scheme and app globally in 2015; this collects, organizes and reviews reports of adverse drug reactions on medical and therapeutic devices, homeopathic treatments, herbals and supplements, and both prescribed and over-the-counter medications and vaccines *(121)*.

Comments and lessons learned from Member States

As part of the survey, Member States were invited to provide general comments and share lessons learned through their implementation of mHealth programmes. Some of the key messages expressed are listed below.

— Leadership and coordination are regarded as some of the most important and understated aspects of successful mHealth implementation.

— There is a need for a single national institution or coordinating body to lead the development and integration of mHealth apps; national governments are best positioned to provide the necessary platforms for integration and interoperability.

— Poor coordination of mHealth initiatives at the national level is often seen, and there are difficulties in linking public and private parties with each other for mHealth service delivery.

— Making the distinction between eHealth and mHealth can, in some environments, make matters unnecessarily complicated.

Adequately trained personnel and technical support are also considered as prerequisites for successful mHealth adoption. One country specifically mentioned the benefit of using social networks as a medium to train health care workers and to offer mHealth. Other comments mentioned the basic need for reliable communication systems, software programs and trained human resources.

The need for evaluations was also mentioned and several Member States highlighted that more awareness-raising of the benefits of mHealth in terms of quality, effectiveness and accessibility is required. Other comments drew attention to the fact that, in some countries, there is still an insufficient body of evidence to encourage the use of mHealth. Financing and reimbursement for mHealth services were also mentioned, along with the need for funding for research and further development in mHealth.

One Member State commented that the evaluation of its mHealth programme revealed that there was improved work organization but no discernible time gain in using the programme. It found that satisfaction with the programme increased with use, once the learning curve levelled off, and that adapting functionality as user competency developed is a successful approach. It also reported that mHealth is viewed as adding value for the profession and that business models need to accommodate difficult, socially driven decisions and adapt to the opportunities mHealth is providing to reinvent health services provision.

In this context, it is important to note that cultural challenges encompass far more than linguistic issues, particularly when Member States are addressing working cultures as both barriers and enablers of successful eHealth programmes. Culture is a shared social construction, a dynamic process that is co-created between groups of people (however large or small). In this light, it is important to recognize and address working culture, including leadership and coordination, incentives and organizational processes.

> **Policies and laws on mHealth, including liability rules, licensing schemes and informed consent, will become increasingly important as mHealth continues to develop and become a greater part of mainstream health care.**

Summary

mHealth and health apps have great potential in developing and delivering health information and services. Among the respondents, 20 Member States report that there is some form of national policy or strategy to guide their mHealth programmes, the majority of those being national eHealth policies or strategies. mHealth can be an effective tool in the context of public health and programmes should be viewed as a means to reach the overall goals of health systems rather than as standalone services with narrow goals. The majority of Member States report that health authorities serve some role or function in the development and adoption of mHealth; however, only half of Member States report that there are government-sponsored mHealth programmes currently operating in their country. The results further show that while governments in many Member States are sponsoring programmes and providing guidance, oversight and regulation for the development and adoption of mHealth, there are very few evaluations of government-sponsored mHealth programmes.

Member States report an impressive number of mHealth initiatives in their countries, with many operating as established programmes at the national level. Using mHealth to access electronic patient information is the most common type of mHealth programme, with emergency toll-free telephone services to connect individuals with health services reported as the second most common in the 2015 WHO global survey on eHealth.

Conducting evaluations of mHealth programmes is a crucial element in ensuring that future development of mHealth is sustained. Evidence from the evaluation of mHealth implementations serves as the foundation for stakeholders to make decisions considering mHealth among other alternatives or competing priorities. The evaluations of end users regarding the usability, functionality and meaningfulness of mHealth solutions must also be taken into consideration. Funding and reimbursement models need attention, and effective policies addressing concerns about privacy, security, quality and reliability are required. Continued international cooperation in developing regulations, policies and deployment scenarios will facilitate scaling up the current use of mHealth programmes and align them with larger health goals in the WHO European Region.

Recommendations

— National health authorities are recommended to provide guidance on data ownership, security and data privacy in relation to the development and use of mHealth and should address quality, safety and reliability of mobile devices and software used in health care provision through appropriate national regulation.

— Member States should address liability, licensing and informed consent through policies and legislation regarding mHealth.

— A national entity in each Member State should be identified to promote use of mHealth and raise awareness of best practices for the development and adoption of mHealth.

— National health authorities and the health research community should develop and use a common methodology to evaluate mHealth programmes, particularly government-sponsored initiatives. These evaluations should address usability, functionality and meaningfulness of mHealth solutions for end users. The evidence from evaluations should be actively used to support investment and implementation decisions.

— National health authorities should develop reimbursement models for mHealth tools and services. These should be based on demonstrated benefits of mHealth and support the achievement of national health objectives.

— All major stakeholders should continue international cooperation in developing regulations, policies and best practices on the use of mHealth. This will facilitate continuity in the uptake of mHealth and aid in the development of cross-border programmes.

eLearning refers to the use of electronic technology and media for training and education. It can be used to improve the quality of education and increase access to learning in geographically isolated locations or those with insufficient local training facilities. It can make health sciences education available to a broader audience and make better use of existing educational resources. eLearning can contribute to achieving universal health coverage by improving the knowledge and skills of the health workforce and can increase the number of trained professionals with specialized or general skills.

Key data from the survey responses

— 71% of Member States use eLearning for training health professionals.

— 66% of Member States use eLearning for educating health sciences students.

— 96% of Member States report their main reason for using eLearning for students is to improve access to educational content and to experts; the same applies to the training of professionals in 94% of Member States.

Background

A 2015 report from Imperial College London and WHO found that there is a shortage of 4.3 million health workers globally, and the use of eLearning for training health workers will help increase the number of skilled health workers *(122)*. The World Health Assembly resolutions WHA64.6 (2011) on strengthening health workforces and WHA66.23 (2013) on the transformation of health workforce education in support of universal health coverage advise Member States to scale up their health workforces to address these shortages, which constrain the achievement of international health development goals *(123, 124)*. WHO provides guidelines for this in the 2013 publication *Transforming and scaling up health professionals' education and training (125)*. eLearning is also a valuable medium for patients and individuals to receive education; however, in the context of the 2015 WHO global survey on eHealth and this report, the focus on the use of eLearning is to equip health workers with education and skills.

Several trends in the eLearning sector have emerged in recent years, most of which are related to large-scale increases in Internet speed and accessibility and changes in the ways technology is used. eLearning is available through computers, on mobile devices, such as smart phones and tablets – often referred to as mLearning (mobile learning) – through social media channels and facilitated through open education resources. One example of an open education resource, massive open online courses (MOOCs) offer an innovative new approach for the delivery of higher education. MOOCs are online education that can be freely accessed by everyone via the Internet and are becoming an increasingly popular way of gaining education. Other common sources of online learning include videos and educational materials offered through the websites of health service providers, public–private partnerships and health-related associations and organizations.

In recognizing that digital competence is a fundamental skill for individuals in a knowledge-based society, the European Commission's Digital Agenda for Europe encourages EU Member States to mainstream eLearning in national policies for education and training *(64)*. In addition, the Communication *Opening up education*, also produced by the European Commission, proposes actions to increase ICT in education to support students, teachers, institutions and professional development, and for job creation and workforce strengthening *(126)*. Use of open technologies, open methods and open education resources are encouraged to achieve this and to foster innovation and research. eLearning can also be a valuable tool to enable learning about using technologies and building digital competency, producing new skills and increasing qualifications for those entering the labour market. When health professionals understand

how ICT can be used to support health, they are more capable of teaching and supporting their patients in using technology for their own health care.

Results of the survey: eLearning

The 2015 survey asked Member States about their use of eLearning for students and professionals in health-related fields. Specific sectors of health were examined in their use of eLearning, including public health, medicine, nursing and midwifery, biomedical and life sciences, pharmacy and dentistry. Evaluations of eLearning programmes and barriers to implementing eLearning in Member States were also surveyed.

## Results of the survey: eLearning for students of health sciences

In recent years, education in health informatics and technologies for medical students has increased. Many universities have introduced modules on ICT and eHealth in medical and other clinical programmes, as well as increasing their own use of ICT to facilitate learning. The 2015 survey asked countries to report on training for health science students[8] and working professionals. The results show that 66% (29 countries) use eLearning for students of health sciences. Of responding Member States, 28 report that eLearning is used in educating students of public health and all but one country reports its use for students of medicine. Further, over 70% of respondents report the use of eLearning as part of educational programmes in the fields of nursing and midwifery, biomedical and life sciences research, pharmacy and dentistry. These results are shown in Fig. 24 as a comparison with eLearning adoption for in-service training. An additional nine countries mentioned the use of eLearning in other educational fields, including physiotherapy, occupational therapy, health managers, allied health professions, medical technology, medical physics, rehabilitation, social work, mental health, social sciences, health administration, most health sciences studies and courses for unemployed people looking for a career in health. In addition, 21% (six countries) report that they have universities that offer degrees or certification in health sciences that can be obtained entirely online.

The survey examined the way in which institutions are using eLearning for health sciences education. The majority of institutions are developing eLearning courses for use by their own students (93%; 25 countries) and for teaching pre-clinical and clinical subjects (78%; 21 countries). eLearning courses developed by other institutions are used in 52% (14 countries) and 44% (12 countries) are developing courses for use by other institutions. Finally, 30% (eight countries) are using eLearning for subjects where specialists were not available in the institution, and three countries also provided additional uses of eLearning for postgraduate teaching, delivering series of lectures and certification training.

8 The survey suggested medicine, nursing, midwifery, dentistry, pharmacy, public health, biomedicine and life sciences as examples of health science studies.

Member States were also asked their rationale for the use of eLearning for students of health sciences and could select from a list of up to three primary motivators. The main reason reported by 27 countries (96%) is improved access to educational content and to experts; 57% (16 countries) report reducing costs associated with delivering educational content and 32% (nine countries) report enabling access to education where learning facilities are limited. Overall, 11 countries (39%) marked two reasons and 25% (seven countries) marked all three given reasons. Two countries provided additional motivators as the use of new and blended educational methods to increase learning and activate students, and to increase the consistency of key content while enhancing the flexibility for delivery. The distribution of the reasons for using eLearning for both pre-service students and in-service professionals is shown in Fig. 25. Case example 18 illustrates an example of eLearning in the area of mental health.

Fig. 24. eLearning in health for students and professionals, by field
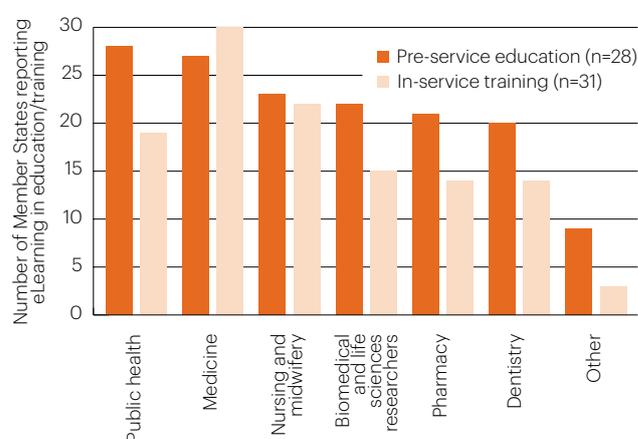
Case example 18.
eMenthe promotes eLearning on mental health

eMenthe is an EU-funded project developing eLearning materials and improving the quality of Master's-level education on mental health *(127)*. As education and mental health practices differ among countries, the project aims to share best practices to ensure that the highest possible quality of education and practice is achieved. The project is a collaboration between universities in Finland, Ireland, the Netherlands, Sweden and the United Kingdom. Associated partners in the project primarily consist of mental health service providers and user organizations; external partners include the WHO Collaborating Centre for Mental Health Promotion, Prevention and Policy, and the Finnish Association for Mental Health *(128)*. eMenthe focuses on first selecting the knowledge, skills and values required by mental health nurses, and then creating learning material for Master's-level students and practitioners in order to create a consistency in the field across Europe. It focuses on three key issues: recovery and social inclusion, mental health promotion and prevention, and working with families and carers. When the eLearning materials are ready, they will be freely available for all to use.

Results of the survey: eLearning for health professionals

A majority of Member States in the WHO European Region use eLearning for in-service training of health professionals (71%; 32 countries) with 61% (19 countries) having eLearning courses that are accredited by continuing medical education or professional licensing bodies. The survey asked which professional groups have adopted eLearning for their in-service training of health professionals. These results are shown in Fig. 24 for both health professionals and health sciences students. The highest rates of eLearning adoption are in medicine (97%; 30 countries) and nursing and midwifery (71%; 22 countries). Three countries also provided other professional fields using eLearning: medical technology, medical physics, allied health professionals, mental health and social sciences. The use of eLearning for in-service training of medical informatics professionals was also examined, with 58% (18 countries) reporting that eLearning is used for this professional group. Table 13 shows the trend in using eLearning based on previous WHO global survey on eHealth results.
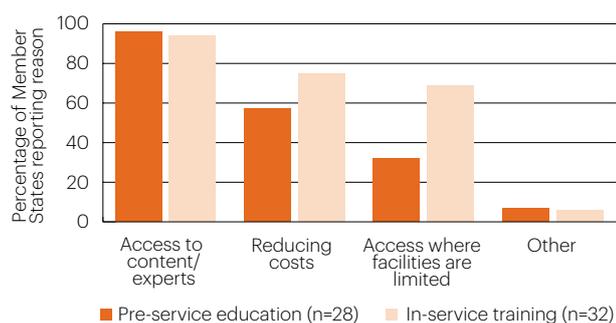
Table 13. Trends in use of eLearning

	2005	2009	2015
eLearning for students of health sciences	N/A	81% (29 countries)	66% (29 countries)
eLearning for health professionals	62% (16 countries)	78% (28 countries)	71% (32 countries)

Sources: 2005 data from the 2008 WHO publication Building foundations for eHealth in Europe (16) (eLearning for students was not asked about in the 2005 GOe survey); 2009 data from the 2011 WHO publication Atlas – eHealth country profiles: based on the findings of the second global survey on eHealth (8).

When asked the rationale for using eLearning as part of in-service training for health professionals, the main reasons are improving access to content and experts (94%; 30 countries), reducing costs associated with delivering educational content (75%; 24 countries) and enabling access to education where learning facilities are limited (69%; 22 countries). Overall, 12 countries (38%) selected two of these reasons and 16 countries (50%) selected all three. Two countries also report additional reasons: facilitating learning, allowing for on-demand courses and improving quality. The results for both pre-service students and in-service professionals are shown in Fig. 25. Case example 19 illustrates the use of eLearning for training of health care professionals in Portugal.

Fig. 25. Reasons for using eLearning for students and professionals

Pre-service education (n=28)   In-service training (n=32)

More than 2600 health care professionals have received teletraining in Portugal's Alentejo region since it implemented the sessions in 2008. The teletraining initiative is part of Alentejo's telemedicine programme, which was introduced in 1998 to address challenges faced in providing health care to a geographically large but sparsely populated area. Only 5% of Portugal's population live in the region, although it covers a third of the country; around 500 000 people live in the region, of which a quarter are over 65 years of age. Barriers to medical access include lower education and income, low population density, poor public transport, limited options for specialist services and a shortage of physicians in a number of specialities.

The telemedicine programme aims for patients to be seen and treated as close as possible to where they live and work, and to ensure that equal care is provided to patients in remote and rural areas. The telemedicine network includes 20 primary care units and five hospitals. As such, telemedicine has had a huge impact on health care provision, with more than 130 000 episodes of telemedicine use carried out between 1998 and 2011, including real-time teleconsultations, teleradiology, teleultrasound and telepathology *(129)*.

As part of the programme, free teletraining sessions are run for health care professionals including doctors, nurses and diagnostic technicians. When the telelearning programme was first established, point-to-point videoconferencing enabled more than 800 health care professionals across 52 locations to participate in remote learning sessions between 2008 and 2010. The introduction of point-to-multipoint teletraining sessions in 2011 meant that the number of health care professionals participating in remote learning sessions could be significantly increased. The first such training session, which looked at bronchitis and asthma, was transmitted from the Hospital of Elvas to medical staff at the Portalegre Hospital, as well as a number of health centres from different municipalities. These teletraining sessions have proved to be cost-effective and time-effective, as health care professionals do not need to travel in order to attend training courses. The experience of the programme has also been drawn upon by a working group, set up by Portugal's Ministry of Health in 2012, to develop a national telemedicine programme.

Evaluation of eLearning programmes

In addition to access to educational content and experts, eLearning offers several other benefits. Through increased and on-demand accessibility to educational content, users can attend courses at their convenience and are able to rewind or repeat particular segments of the topic as required. The creation of online courses can be done more rapidly than classroom courses, which tend to require months of advance scheduling to accommodate both teachers and students. Online courses are also easier to monitor and evaluate, as

the delivery, taking and grading of exams and feedback on the course can be assisted with technology, providing a faster turnaround. eLearning can also be cost-effective as the physical requirements of infrastructure and personnel are reduced or eliminated (booking classrooms, providing electricity, heating and other related facilities management).

Results of the survey: evaluation of eLearning

In the 2015 survey, only three Member States report that their eLearning programmes for pre-service education have been evaluated, and only four report evaluations for their programmes for health professionals. These results, although few, are summarized in Fig. 26. All of the specified evaluation areas have positive or neutral outcomes (two Member States report that there was no evidence of improvement). One Member State commented that eLearning in the health sector is more accessible and presents educational material in a simple and easy to understand manner.

Fig. 26. Evaluations of eLearning for students and professionals (n=4)
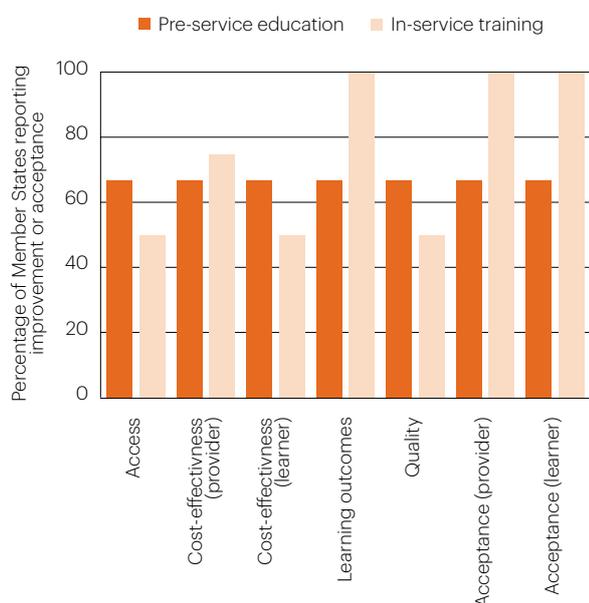
One of the promising areas of eLearning in relation to the health sector is learning via health care simulation, such as via virtual patient simulation. With this technology, doctors interact with the virtual patient as much as possible to simulate a real-life consultation. Virtual patient simulation is particularly useful in cases that are not normally seen on a daily basis, such as rare diseases or diseases/injuries that originate outside of the doctor's country of origin. Case example 20 illustrates the application of virtual patient simulation for medical education.

> " **Twenty-two countries (52%) report that a lack of funding to develop and support eLearning programmes is the most important barrier.**

Case example 20.
Multilingual virtual simulated patient (MVSP)

An MVSP project is aiding medical education across Europe, providing greater flexibility for learning. The project, funded by the Leonardo da Vinci programme, which supports practical vocational education and training, aims to link policy with practice in occupational education and training. The project falls under the European Commission's broader Lifelong Learning Programme and is managed by the Education, Audiovisual and Culture Executive Agency.

The initiative, which includes 11 countries within the WHO European Region, involves the creation of a MVSP that can be used by medical students in different countries with different languages. The MVSP is designed to respond and behave in the same way as a real-life patient being seen in a primary care setting. It is based on a Spanish virtual simulated patient, and has been adapted to incorporate six additional languages: Bulgarian, English, German, Hungarian, Italian and Portuguese. As well as being tailored to simulate patients speaking their mother tongue, the MVSP can also simulate consultations with patients not native to the country, such as migrant populations, who would be speaking in a second language when being seen by a doctor.

The MVSP simulates a clinical interview, with a virtual patient that presents with symptoms of either one or a combination of illnesses. Depending on the course of the interview, it can express different moods, which can be adapted to both the virtual simulated patient's illness and the student's behaviour. The MVSP works along the same principle as actors, who are often used to play the role of patients for teaching medical and health care students. As well as helping students to detect illnesses, the use of such role-play scenarios also aids the teaching of communication skills. However, organizing such role-play scenarios with actors can be time-consuming and costly – an issue the MVSP addresses. It also provides greater flexibility than using actors, as students can log in to practise carrying out clinical interviews at times that suit them. The MVSP can also be used by a large number of students, whereas the need to employ actors limits the number of practice clinical interviews that can take place. While the MVSP has been geared for learning related to primary care settings, it has the potential to be adapted to other learning environments.

Results of the survey: barriers to implementing eLearning programmes

The 2015 WHO global survey on eHealth asked countries to rate their barriers to eLearning implementation in both pre-service education and in-service training. A lack of funding to develop and support eLearning programmes is the most important barrier (52%; 22 countries rated this as very or extremely important) and a lack of suitable eLearning courses available as the second most important barrier (40%; 17 countries rated this as very or extremely important). Interestingly, the third most important barrier

is limitations in gaining a health sciences degree entirely through eLearning, with 40% (16 countries) rating this as very or extremely important. This indicates that there is an interest in gaining online degrees in health sciences but the lack of suitable courses and accredited online degrees is a barrier to further uptake. One Member State further commented that the international recognition

of certificates received through online courses needs attention. Another Member State noted the close proximity of vocational training institutions and no need or demand for online learning as extremely important additional barriers. The results of the barriers are shown in Fig. 27. Case example 21 illustrates the use of eLearning in low-resource environments.

Fig. 27. Barriers to implementing eLearning programmes (n=46)

Legend: ■ Highly important ■ Less important ■ Not a barrier

Y-axis: Number of Member State reporting barrier (0–30)

X-axis categories: Funding; Availability of suitable courses; Limitation to obtain online degree; Lack of demand; Evidence on cost-effectiveness; Competing priorities; Policy support for eLearning; Lack of evidence on effectiveness; Lack of capacity and resources; Insufficient infrastructure; Other

Case example 21.
Aga Khan Development Network (AKDN) eHealth Programme

AKDN has been operating an eHealth programme in southern and central Asia since 2007. The programme uses eHealth to aid the provision of high-quality, low-cost, equitable health care. This encompasses making health care accessible to communities with reduced access to health care services by delivering cost-effective health care through teleconsultations – of particular importance in remote and rural areas. The use of eLearning further builds clinical and management capacities of health care providers, enhances their ability to deliver care and manage services, and ultimately strengthens health care systems. In remote areas, where resources are limited, eLearning can aid continuing professional development when health care professionals are unable to undertake time-consuming and costly travel to attend courses.

In Kyrgyzstan, a link has been established between the Republican Children's Clinical Hospital in Bishek and the Naryn Oblast Hospital and Naryn Oblast Family Medicine Centre in Naryn. The new connection will focus on teleconsultations in paediatrics and eLearning in family medicine. This development marks the first time solely government-owned facilities have been connected under the programme with technical support provided by AKDN.

AKDN's second-longest running programme is in Tajikistan. Since 2012 the programme has established six connections within Tajikistan and from Tajikistan to Afghanistan and Pakistan for teleconsultations and eLearning sessions. AKDN provides eHealth services in the Khorog GornoBadakshan Autonomous Oblast region of Tajikistan, and the Khorog Oblast General Hospital also uses teleradiology services in connection with the Aga Khan Health Board in the United States of America. To date, over 1500 teleconsultations have been provided and nearly 1000 health care professionals have benefited from over 60 eLearning sessions. Tajikistan's eHealth coordinators attended a workshop in Pakistan in 2015 to further their professional development in the provision of eHealth services.

Apart from supporting service delivery, the AKDN eHealth Resource Centre has developed a year-long certificate course aimed at helping health professionals understand core eHealth concepts and address the challenges around eHealth service implementation and delivery. In 2014, the Centre launched an innovation lab aimed at designing and developing eHealth tools and technologies, providing a platform for engineers and developers to collaborate on designing and developing low-cost, innovative eHealth applications and products.

Summary

eLearning is growing in presence and popularity around the globe, providing more people with access to educational content and transforming the way existing educational resources are used. The majority of countries use eLearning to teach health sciences students and for the continued training of health professionals. The results show that eLearning is utilized primarily to improve access to content and experts and to reduce the costs of delivering educational content. These results indicate that Member States realize the benefits of employing eLearning and that the majority are developing and using eLearning in formal health-related educational programmes.

Very few Member States, however, report that a certificate or degree in health sciences can be gained entirely online (six countries), with 19 Member States reporting that eLearning courses are accredited as continuing medical education for professionals. The use of eLearning in health is not utilized in all institutions and evaluations are largely absent. Only three countries report that their eLearning programmes for students and four countries that their eLearning programmes for professionals have been evaluated. eLearning is more than making traditional educational content electronic and requires adjusting strategies and expanding skills in order to organize, present and deliver education in different ways. A lack of funding to develop and support eLearning programmes is the most important barrier in 22 countries. For future adoption, it is important that eLearning incentives and educational advancement goals are incorporated into health strategies.

Recommendations

— Educational institutions and relevant professional organizations should ensure the wider use of eLearning in health sciences education and for health professionals to decrease shortages in skilled health workers.

— Member States are recommended to incorporate eLearning incentives and educational goals into national health strategies.

— Educational authorities should undertake a systematic evaluation of eLearning programmes and re-examine evaluations over time to ensure their continued relevance and development.

" When health professionals understand how ICT can be used to support health, they are more capable of teaching and supporting their patients in using technology for their own health care.

Social media refers to online communication channels that are primarily informal and socially driven. Through social media, health care providers can share information and educate the public, discuss care policy and practice, promote healthy behaviours and increase awareness of their services. Patients can communicate with health care providers and those involved in their care, as well as with other patients.

Key data from the survey responses

— 91% of Member States report that individuals and communities are using social media to learn about health issues.

— 81% of Member States report that health care organizations are using social media to promote health messages as part of health campaigns.

— 14% of Member States have a national policy or strategy on the use of social media in health professions.

Background

As with many aspects of eHealth, the proliferation of social media in health is changing health care by eliminating boundaries, re-engineering work practices and creating new modes of communication. Not only do individuals use the Internet to search for information, they are increasingly using social media to interact with physicians and health professionals. Social media is utilized for casual communication as well as for in-depth and personal discussions about health.

Patients, professionals and health service providers can benefit from using social media for health. Social media is an always-on tool to communicate, interact and inform others around the globe. It is a widely available medium to share information and support health-related decisions. As mentioned in the chapter on eHealth foundations, nearly half of Europeans use the Internet to search for health-related information *(12)*. A 2015 Eurobarometer report further shows that more than half of EU residents use an online social network at least once per week and 34% use it daily *(130)*. Social media networks provide a platform for interested groups of all ages to engage and share knowledge and ideas, and are becoming increasingly popular in the WHO European Region.

Uses of social media for health

Health service providers, organizations, associations and individuals use social media for health-related purposes including networking, education, organization of interest groups, health promotion, communication and support. Individuals and families living with a particular health condition often use social media to find information about how to manage the treatment and to cope with daily life. It is also used to interact with others by searching for patients or doctors treating the same conditions in order to exchange experiences, share clinical information or get emotional support. Patients are empowered in self-monitoring their health by better understanding their health needs, and can interact with other patients to make informed choices.

While there are benefits to people accessing health information online, there is also the danger that incorrect and even harmful information is taken as valid advice. While the risk of finding inaccurate information on the Internet about health conditions cannot be eliminated, patients can and should be encouraged to discuss the information they find and treatments they may want to explore with medical and social care professionals. Fostering open dialogue will increase the patient's involvement in their health care, dispel myths about their treatment and can strengthen the relationship between the team working towards an individual's good health and well-being.

Health and social care professionals are increasingly using social media to network professionally and discuss treatments, research, policy and management issues. Through physician-to-physician collaboration, doctors can build their knowledge and facilitate faster adoption of best clinical practices, which can lead to better patient outcomes. Health professionals' participation in social media can have ethical and political ramifications that are important to understand and address appropriately. For example, issues that can have a serious impact on patients, professionals and health providers include ensuring patient privacy, maintaining respectful behaviour in controversial topics, catering for differences in private and professional opinions, clarifying when an individual is speaking on behalf of an employer or as a private medical professional and declaring conflicts of interest. Having clear guidelines on professionalism in social media use can result in a positive impact in public trust of the health system and medical profession as a whole *(131)*.

Results of the survey: national policies or strategies on the use of social media for health

Of the respondents, 72% in the WHO European Region (31 countries) have no national policy or strategy on the use of social media by government organizations and only 16% (seven countries) report that such a policy or strategy exists. In these seven countries, the year they adopted their national policy or strategy ranges from 2010 to 2013. Further, only one country (the United Kingdom) reports that the national policy or strategy specifically refers to the use of social media in the area of health (see Fig. 28).

Countries were also asked whether or not they have a national policy to govern the use of social media in health professions. Again, the vast majority of respondents (81%; 35 countries) have no such policy and only six countries (14%) report that such a policy exists. Very few Member States have policies or legislation for use of social media in health, particularly considering how many health authorities and health care service providers use and advertise their social media information on their official webpages. Although social media is a relatively new channel of communication, most industry organizations already have appropriate policies in place that govern their use of social media.

Fig. 28. Member States with national policies or strategies on the use of social media
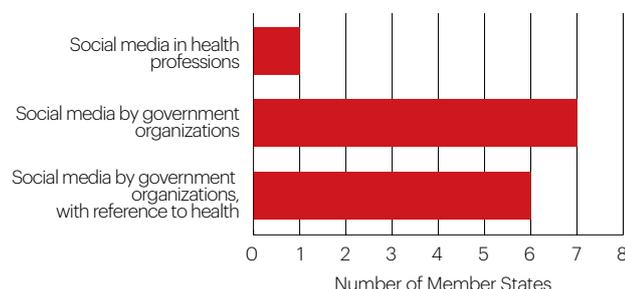

Results of the survey: how individuals and communities use social media

In almost all responses (91%; 40 countries), individuals and communities use social media to learn about health issues. Only two Member States in the WHO European Region report that this is not the case. This shows that Member States are well aware that their populations are using social media to gain information and exchange views. Individuals and communities use social media to help them decide what health services to use in 70% (30 countries); they also use it to provide feedback to health facilities or health professionals in 71% (31 countries), but this is not the case in 11% (five countries). They use social media to run community-based health campaigns in 67% (29 countries); four countries (9%) report no use of social media for this purpose and 23% (10 countries) are unaware of whether individuals and communities in their countries use social

media for this purpose. Lastly, 76% (32 countries) report that individuals and communities use social media to participate in community-based health forums (see Fig. 29).

Fig. 29. Use of social media for health by individuals and communities
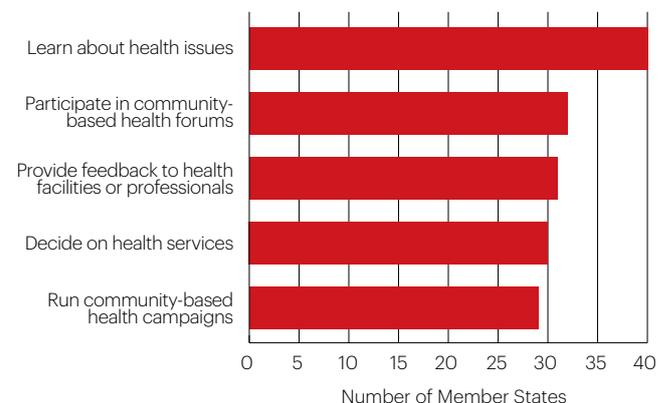
There are a number of good examples from the WHO European Region of how social media is used by patients, clinical professionals and health-focused organizations. One usage that is becoming increasingly popular is virtual health communities. These are Internet-based health communities where members both give and receive support and information on condition-specific and/or health-related issues. Virtual health communities provide a designated space for individuals to share their knowledge and experiences around a topic that connects them. Often, both affected individuals and health professionals participate in virtual communities, creating a unique combination of experienced and highly specific knowledge-sharing. Case example 22 illustrates an example of social media use for patient support.

> " Only 7 countries (16%) report having a national strategy or policy on the use of social media by government organizations and only 6 countries (14%) report having a national policy to govern the use of social media in health professions. However, almost all countries (91%, 40 countries) report that individuals and communities are using social media to learn about health issues.

Case example 22.
Global virtual health communities

RareConnect is a patient-centred community that encourages and facilitates global conversations on health and connects patients, families and those involved in the care of an individual with a rare condition *(132)*. It gives patients the opportunity to share their stories and connect with other people affected by similar conditions through the peer support platform. It is a not-for-profit initiative led by the European Organisation for Rare Diseases (EURORDIS), a nongovernmental and patient-driven alliance of international patient organizations whose main goal is to empower patients and families dealing with rare diseases. RareConnect also promotes research and relationship-building between health professionals and patients across different countries, and offers a translation service at no cost for members.

RareConnect is a patient-led social network that provides a safe, moderated environment (with a network of over 260 volunteer moderators) where people living with rare diseases can seek information, connection and support. It also partners with over 660 disease-specific patient groups around the world to make the link between isolated individuals living with rare diseases and the support offered by patient groups. The platform is available in five languages and includes a translation service, allowing families from different countries to communicate with each other. It has a support staff of seven full-time community managers who support the network in assuring quality of exchange and animating the community with engaging content, often in collaboration with the scientific and clinical community.

A well-known example of a patient-led social networking platform is PatientsLikeMe, which connects hundreds of thousands of individuals with over 2500 conditions *(133)*. It serves as a connection forum for people with conditions that may not be well recognized in the medical community or for which there may be limited treatments, such as seizure disorders, fibromyalgia and post-traumatic stress, so that they can share their experiences and give and find support. The website facilitates users learning from others and exercising greater control of their health by comparing symptoms and courses of treatment with others; it also allows users to track their own health over time by documenting their symptoms, treatments and outcomes.

In a survey of 1323 PatientsLikeMe members, researchers sought to investigate the benefits for patients of using social networks for health *(134)*. Members reported that they found the site helpful (72%) and that the greatest advantage was learning about their symptoms. Other empowering benefits included better understanding their health prognosis (76%), feeling more in control of their condition (72%), having a greater ability to cope with problems (70%), feeling less self-conscious about their health condition (68%) and experiencing improved quality of life (62%).

In terms of clinical benefits, the site has helped members to understand treatment side-effects (57%) and learn about what a specific treatment was like through connections with other members (42%); it has aided them with choices about starting a medication (37%), changing a medication (27%), changing their dosage (25%) and stopping a medication (22%). Furthermore, as a direct result of using PatientsLikeMe, 12% of members changed their physician (21% for individuals with fibromyalgia), 41% of members with HIV reduced risky behaviours, 22% of members with mood disorders found that they required less inpatient care since using the site and 42% were more involved in their treatments. Around one third of members reported printing their treatment and symptom summaries to use during medical appointments and 66% of health providers supported their patients' use of PatientsLikeMe.

Results of the survey: how health care organizations use social media

Health care organizations are realizing that social media can be used to stimulate campaigns and initiatives, improve the public's trust in the health care system and both understand and improve their presence in health promotion. Health care providers can use social media to provide opportunities to serve the public and their employees and for talent recruitment. In addition, there are no geographical boundaries in social media, and providers can reach a large audience within seconds.

Member States in the WHO European Region report that their health care organizations are using social media to promote health messages as part of health campaigns (81%; 35 countries). This illustrates that social media is being used and is already an important channel for communication with the public, despite a lack of legislation or formal guidance (see Fig. 30).

Health organizations are using social media to make general health announcements in 74% of the responding countries (31 countries). The high accessibility of social media suggests that it can have a high adoption rate when compared with other eHealth or ICT tools for health. Patient feedback is a key element of quality development and it is encouraging that 65% (28 countries) report that health care organizations use social media to acquire feedback on services. However, for the feedback to be meaningful, organizations need to take such feedback systematically as a quality measure.

Around half of the responding countries (51%; 22 countries) report that health organizations use social media to make emergency announcements. When compared to the results from other survey questions on social media, this is lower than expected. Social media provides fast channels for spreading important or relevant information; emergency information should be able to reach a high

volume of people in a short period of time. Further, 33% (14 countries) report that health care organizations use social media to help manage patient appointments.

Fig. 30. Uses of social media by health care organizations

Number of Member States
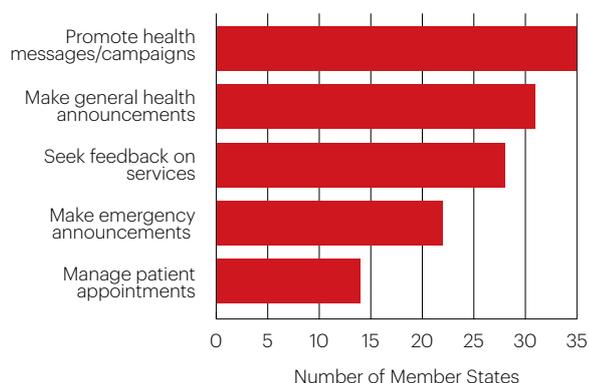
Several Member States also report additional uses of social media, including:

— active use of social media by the ministry of health for promotion campaigns, sharing information with the public and sharing multimedia about the activities of the ministry;

— use of social media by health organizations to connect the generators and subscribers of health content;

— introducing social networks for health workers and consumers of health services;

— use of social media by health organizations to listen and respond to the public.

Through social listening, responsible health ministries are able to form and shape initiatives based on the volume and topics of health conversations in social media. Through social response, they can also contribute to online conversations or questions. Case example 23 provides insight into the use of social media for research and analysis.

> " **Thirty-five countries (81%) report that their healthcare organizations are using social media to promote health messages as part of health campaigns; Twenty-two countries (51%) report that organizations use social media to make emergency announcements.**

Case example 23.
Health care social media analytics

Social media is providing a wealth of information that can be used for health care analytics. By exploring social media data and conversations on health and care, researchers can explore how health is discussed by patients, clinical professionals and other stakeholders. Conversations on social media are open-invitation, which means that the discussions can be diverse and the topics varied. The use of hashtags (#) simplifies terms and makes it easier to sort information by topic, thereby making discussions around health more accessible. The use of hashtags and specific keywords also facilitates conversations and collaboration around common topics.

In research, the use of keywords and hashtags make information easier to discover, organize and analyse. Government offices, health systems, health-related agencies and academic institutions use social media data to analyse global conversations about health and health care. Social media data can be mined for opinions on health topics, to segment news feeds in real-time based on topic or by stakeholder group, to analyse specific stakeholders' presence in social media and to identify trends in health topics. For example, public health campaign creators can see what has (or has not) worked before and how to spread information across the globe quickly and effectively. They can also investigate how well their campaigns are received by the public; identify gaps, trends and opportunities; and map which networks are most connected, active and influential. Such use of social media data has already led to numerous scientific publications, and research into health care social media is a growing field of scientific exploration.

Multiple studies have demonstrated that data from a public social media site could accurately track reported disease levels of influenza-like illnesses and public interest about health-related events *(135, 136)*. Health care social media can also be a source where relevant activities and discussions can enhance the continued professional development for nurses and other health professionals *(137)*, as well as for patient education. One study looked at how social media is used to deliver messages about health literacy by health-related organizations *(138)*. It found that non-profit organizations and community groups offered more information on the topic than government agencies and educational institutions, and suggested more strategic approaches while using simpler language.

Social media is changing the way in which patients, professionals, health care providers and other relevant stakeholders engage with each other, as well as how health-related information is given and received. These are just a few examples of how analysing social media data can deepen the understanding of how health care is contemplated and comprehended in public spheres. Analytics that utilize social media will continue to develop and offer meaningful insight into public engagement and health trends.

Results of the survey: education and training on the use of social media for health

Of the respondents, 18 countries (40%) responded that their universities or colleges teach health sciences students on the use of social media for health. Another 33% (15 countries) report that this education does not exist and 27% (12 countries) are unaware of whether such education exists. Of those 18 countries that do teach students on social media, 13 (72%) offer these courses in less than half of their institutions. Only two countries report offering this in more than half of their institutions and three other countries do not know what proportion of their institutions offer these courses. This shows that few countries are educating their health sciences students on the use of social media for health. Educating students on the current and upcoming trends in health sciences is necessary for capacity-building and awareness of social media use.

Only eight countries report that they have institutions or associations offering in-service training to health professionals on the use of social media for health; 21 countries (48%) report no such training and 15 countries (34%) are unaware of whether this training is offered or not. Of those eight countries that do offer training, it is most available to medicine and public health professionals (88%; seven countries each). The survey did not ask about training on social media for health for professionals in medical informatics; however, two countries did report this profession among other groups receiving such training. The results for the eight Member States who provide training on social media for health are shown in Fig. 31.

Fig. 31. Training for professionals on social media for health
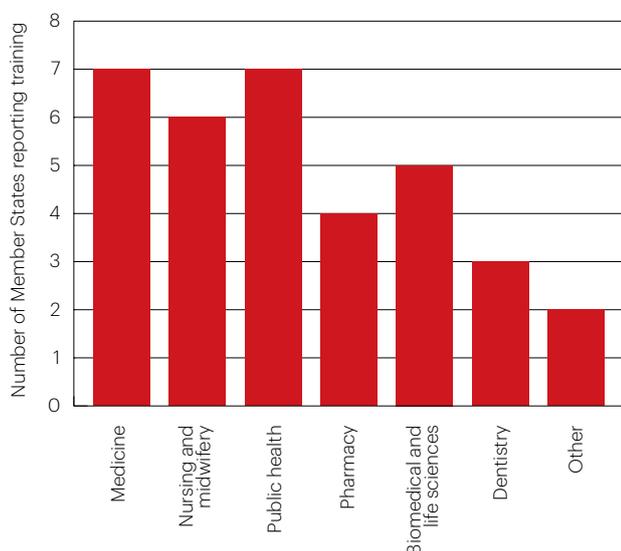
For both students and professionals, the majority of countries do not offer training or guiding policies on the use of social media for health. It is likely that professional or student groups are not utilizing social media as a medium for health to a large extent and are therefore not specifically requesting training on the topic. It is also likely that governments and educational organizations have not yet realized the potential value in using social media for health and have therefore not yet begun to systematically invest in this area of eHealth.

Summary

The 2015 WHO global survey on eHealth results show that health care organizations use social media most often to promote health messages as part of health promotion campaigns. As with any other form of health information dissemination and public engagement, social media strategies should be evidence-based and aligned with overarching policies and goals. The results show that individuals and communities use social media most often to learn about health issues. Measures should be taken to ensure that all segments of the public are offered information and opportunities to engage, including those who are typically less active on social media, so as not to digitally exclude individuals.

The majority of Member States in the WHO European Region do not teach health sciences students or health professionals on the use of social media for health and this low prevalence of regulation and education on using social media for health indicates that social media is not being consistently used across the Region. Public health organizations and health service providers can benefit from promoting meaningful health-related dialogue and initiatives, but need guidance on proper social media engagement.

Very few Member States report having policies to govern the use of social media by government entities, in the health sector and by health professionals. It seems that Member States are largely unsure as to how to use social media effectively past very obvious cases. Training both students and professionals in health-related fields on the appropriate and constructive use of social media for health will help facilitate public education and interaction on health-related topics. Training staff further ensures that they both understand and are able to carry out the policy.

Having a social media policy in place sets clear guidelines that protect against ethical, security and privacy violations. Social media in health is most beneficial when it is incorporated into health communication strategies and supports general communication objectives. A successful social media strategy determines where the use of social media can help to accomplish key health goals and support health strategies. Social media is a tool to connect consumers and providers and structured guidelines are needed to achieve the highest possible benefit of its use.

> " Only eight countries report that they have institutions or associations offering in-service training to health professionals on the use of social media for health.

Recommendations

— Member States should encourage open dialogue between patients and providers regarding health information acquired through social media and on the Internet.

— Educational institutions and relevant professional organizations should train students and professionals in health-related fields on the appropriate and constructive use of social media for health to facilitate public education and interaction on health-related topics.

— Member States are recommended to create clear guidelines on social media use to foster a positive impact in public trust of the health system and medical profession as a whole.

— Public health organizations and health service providers should implement and utilize social media strategies to provide guidance on proper social media engagement in promoting meaningful health-related dialogue and initiatives.

— Social media strategies should be evidence-based and aligned with overarching policies and health goals.

7

Health analytics, in a public health context, is the transformation of data for the purpose of providing insight and evidence for decision- and policy-making. "big data" is a broad term referring to data sets that are much larger and/or more complex than traditional data processing can accommodate. The large and complex data sets will usually require distributed databases and advanced methods of data analysis. These data sets are typically described as big data when the volume of data is large, the type of content varied and the speed of data generation and processing required higher than in a typical system.

Key data from the survey responses

— 13% of Member States have a national policy or strategy regulating the use of big data in the health sector.

— 9% of Member States have a national policy or strategy regulating the use of big data by private companies.

Background

New methods of health analytics are improving health care by identifying trends and correlations in data through the provision of predictive analytics, insight discovery, clinical risk modelling, enhancing personalized medicine and more. When health information is collected and analysed, a wealth of information can be drawn from it and used again to further enhance services and provide an evidence-base for policy. The data may be taken from clinical records and disease registers, but can also originate from many other sources as the proliferation of sensors, cameras, social media content, mobile phones, pictures and videos uploaded to the Internet and similar are more frequently used. The term "big data" refers to this immense scope and quantity of data; while all these types of information have not necessarily been used in health and social care previously, they have the potential to become indicators of the well-being of a person, community or larger population (139).

There are several common analytical approaches to using big data, which can be applied to clinical intelligence in the same way as they are applied to business intelligence. Prescriptive analyses can model next steps to take, such as prioritizing actions during the management of multimorbidities. Predictive analyses identify patterns and reveal likely scenarios and outcomes – for instance,

to identify patients likely for re-admission to hospitals and alternative approaches for effective care. Diagnostic analytics can examine past information to determine causation for outcomes – for example, to aid in finding an underlying cause for a patient with multiple complex symptoms. Descriptive analyses can provide detailed analytics on current and incoming data, even in real-time, such as information on vaccinations or patients with blood pressure issues following a procedure.

From improved cost control for national health systems to more detailed and available information for health care professionals and data-driven decision-making tools, new methods of data analytics can offer many advantages. Using complex analytics from large amounts of data can introduce valuable innovative products, increase the efficiency of processes and provide readily accessible information to optimize management procedures.

Medical professionals and health care managers are familiar with reports that provide retrospective analyses (140). While these are important aspects of research and evaluation, lengthy static reports can obscure critical insights. In contrast, dynamic and real-time data can provide professionals with timely access to information relevant to their current clinical situation. In short, smarter analytics deliver actionable information.

As the use of big data in health is relatively new and still beyond the scope of many national health strategies, the questions in this section of the 2015 WHO global survey on eHealth were limited to regulation and barriers in the use of big data. Additional information on recent trends in health analytics and data sharing accompanies this

chapter to illustrate the vast potential of newer methods in data analysis to support and enhance health care. Case example 24 provides an example of the use of big data in the context of developing personalized medicine.

Case example 24.
Personalized medicine project in the EU

The "p-medicine" (personalized medicine) project aimed to develop and promote the use of technology to personalize medicine and meet societal needs *(141)*. In recognizing that health care is undergoing a transition to include more preventive measures, the project consortium focused on personalizing integrated care by using innovative technological approaches such as disease modelling, computational tools and visualization technologies. The project ran for four and a half years and included more than 20 partners in the EU and Japan. Its work is continued through the development of a new centre of excellence.

By emphasizing an open, modular framework, the intention is that tools and services can be adopted over time to scale up health system functioning. Virtual physiological human models and decision support services for individualized therapies are two key aspects of p-medicine. The project also addressed interoperability and data integration with HISs, biobanks, genetic databases and medical imaging systems. Large amounts of different types of data on individual patients are analysed to create personalized treatments *(142)*. The p-medicine project focused on demonstrating the clinical benefits of the system in cancer research to develop reusable, multiscale cancer models for clinical trials. The work further included establishing a service framework, developing eLearning tools and empowering patients.

A secure p-medicine portal was developed for clinicians, patients and researchers to use and interact, including subportals and communities and access to a data warehouse. Ethical and legal issues were addressed, including data security, privacy and empowering patients to determine what type of research can be done with which aspects of their data and biomaterials. Before the p-medicine project ended, the Study, Trial and Research Centre (STaRC), based in the Saarland, Germany, was developed to continue the work of p-medicine in supporting clinical trials in cancer research *(143)*. The next step is to utilize the large amount of information in the data warehouse to design computational models to create virtual models of diseases and to test therapies within these models.

National policies and strategies on big data in the health sector

Within the EU, Directive 2003/98/EC (known as the "Public Sector Information (PSI) Directive"), which was revised by Directive 2013/37/EU, provides a common legislative framework for how public sector bodies should make information available for reuse *(144)*. As a result of the PSI Directive, a European Commission initiative created the ePSI Platform portal *(145)* to promote open data and PSI reuse. The portal includes digitized books, statistics and geographical information, as well as research, legal, economic, financial and meteorological data for reuse; this is organized under several themes, such as health, safety and social welfare, science and technology, and business and trade.

Similarly, the EU's European Data Portal *(146)* hosts metadata on PSI that is available from national, regional, local, or domain-specific public data portals across 34 countries from the EU and European Economic Area, countries involved in the EU's neighbourhood policy and Switzerland. In addition to metadata categories including health, regions and cities, population and society, and environment, the Portal also includes metadata from geospatial portals, eLearning on Open Data and the results from their study on the economic impact of reusing public and open data. In 2015, the European Data Portal published a study on open data readiness, policies and maturity in the 28 countries belonging to the EU after July 2013 (EU-28) plus Albania, Bosnia and Herzegovina, Iceland, Kosovo (in accordance with Security Council resolution 1244 (1999)), Liechtenstein, Montenegro, Norway, Serbia, Switzerland and Turkey *(147)*. This study found that 27 countries have a national open data portal and 71% of the countries have an open data policy, frequently under digital strategies or eGovernance programmes.

Results of the survey: national policies and strategies on big data for health

Member States were asked to provide information on the existence of national policies or strategies addressing big data; specifically, the survey asked about regulation of the use of big data. Six countries (13%) report having a national policy or strategy regulating the use of big data in the health sector. Four countries (9%) have a national policy or strategy regulating the use of big data by private companies. The year these Member States adopted their national policy or strategy to regulate big data ranges from 1991 (in Lithuania) to 2015 (in Iceland). With the enormous attention given to the potential of big data and advanced data analytics, as well as the legal, ethical and privacy issues emerging from this field, the absence of national strategies or policies governing its use within health indicates this area is still in its relative infancy in Europe. Case example 25 explores the use of big data in dementia research.

" **Only six countries (13%) have a national policy or strategy regulating the use of big data in the health sector and four countries (9%) have a national policy or strategy regulating the use of big data by private companies.**

Case example 25.
Big data in dementia research

Currently, there are no therapies that effectively cure or alter the course of Alzheimer's disease and other progressive dementias. Improving the sensitivity and specificity of diagnostics and exploring disease-modifying therapies involves substantial investments in time and financial resources. Recent innovation in science and technology has developed new research strategies to understand dementia syndromes. New systems and structures of collaborative research partnerships, with the help of advanced data analytics, are offering solutions to more efficiently address Alzheimer's disease and other dementias.

OECD, in collaboration with notable international partners in the field of dementia research and development, is promoting public policy for open and global data sharing to improve research and development for the treatment of dementia *(148)*. In particular, open science solutions are providing unprecedented volumes of both individual (deep data) and population-level data (broad data) that can be aggregated and analysed. Large quantities of open-source data from local areas are linked through a network of data resources between 11 international partners. In addition, sharing population-level data from up to 2 million individuals, ranging from basic health data to genomics and imaging, will allow for the analysis of complex datasets.

OECD revised its widely influential guidelines on the protection and privacy and transborder flows of personal data in 2013; this serves as a cornerstone for the open sharing of data in their initiatives to address dementia. By connecting and sharing large amounts of data from research studies, routinely collected data in medical records and other sources of big data, it is hoped that significant advancements in the understanding and treatment of Alzheimer's disease and other dementias will result in methods to prevent, halt or cure these neurodegenerative conditions. To accomplish this, public policy recommendations are given to create a research environment with the necessary frameworks and regulations to address data governance, proper consent and protection of data, the means for linking and sharing data, sustainable financing for innovation and research in dementia, and open data strategies to advance innovation *(149, 150)*.

A 2014 report by the Warsaw Institute for Economic Studies states that big data and open data have the potential to improve gross domestic product by nearly 2% in the EU by 2020, a percentage equivalent to one year of economic growth *(151)*. The concept of open data supports the realization of big data's potential through the reuse of valuable information. Open data sharing takes the view that rather than defining what can be available and shared, information should be viewed as open by default, with restrictions placed only on the data that should

be closed. Providing easier access to a variety of data encourages experimentation and innovation, provides new insights, increases transparency and reliability and fosters the growth of networks, as more data can be connected and examined across sectors. Addressing limits on the use of personal data and data privacy regulation can actually foster the appropriate use of big data. Data propagation can be mitigated through clear rules for deleting or closing data and when data should not be opened. These and other issues require legal frameworks for the potentials of open health analytics and big data to be achieved. Case example 26 describes how big data techniques are being utilized to develop active clinical monitoring systems in the United Kingdom.

Case example 26. Monitoring for early warning of patient deterioration

Researchers at the University of Oxford's Institute of Biomedical Engineering in the United Kingdom, along with clinicians from Oxford University Hospitals NHS Trust, have applied information from large data sets on the monitoring of vital signs – such as heart rate, blood pressure, temperature and oxygen saturation – to improve patient outcomes. Each year, around 40 000 inpatients in the United Kingdom deteriorate sufficiently to require admission to an intensive care unit, of which 10 000 patients subsequently die. Early warning score systems are used in hospitals across the United Kingdom to alert staff to deterioration among patients. However, big data (in this case, large data sets of patients' vital signs) is now being used, with the aim of improving the identification of patients at risk of deterioration. In general wards, patients' vital signs are monitored at regular intervals by staff; acutely and critically ill patients, such as those in emergency rooms and intensive care units, have their vitals monitored constantly by machines.

An Oxford study involved looking at 64 000 hours of vital sign data from previous clinical trials that had been run in the United Kingdom and United States. The data were assimilated into a statistical model so that an abnormality score could be created, based on a patient's vitals, to highlight triggers calling for action. The research resulted in track and trigger charts being implemented at Oxford's John Radcliffe Hospital in 2011. The charts are now in use in all adult wards in the Oxford University Hospitals NHS Trust, which recorded a 10% decrease in cardiac arrests among patients the first year after their introduction.

Paper charts are often used to record vital signs, and another project in Oxford has looked at how recording information on computer tablets can calculate an early warning score instantaneously to help identify patients at risk of deterioration. The System for Electronic Notes Documentation project, which is being rolled out across Oxford University Hospitals NHS Trust, also enables data to be shared with relevant clinicians across hospital sites. It addresses issues such as

poor legibility of paper charts, as well as errors when calculating early warning scores, which can occur due to staff incorrectly weighing the importance of certain vital signs.

The Hospital Alerting via Electronic Noticeboard project is also looking at improving risk assessment in patients, and alerting staff when intervention may be required. Large-scale data acquired from the Oxford University Hospitals and Portsmouth NHS Trusts is being used to produce a hospital-wide alerting system that continuously makes risk assessments on patients. The initiative, funded by the Wellcome Trust and Department of Health under the Health Innovation Challenge Fund, aims to assimilate the wide range of electronic information about patients – such as age, previous admissions, vital signs and blood tests – to help clinicians identify and rank at-risk patients and initiate treatments quickly.

Results of the survey: barriers to adopting big data for health

As the name big data suggests, huge amounts of highly complex and interacting data need to be stored and then analysed by high-level computers running complex algorithms. Some of the commonly known barriers to big data analytics in health include legal issues regarding personal data, the complexity of the data itself, the difficulty of collecting and storing voluminous amounts

of personal health data and the safety and confidentiality concerns raised by such an endeavour. Further, collecting and storing the data can be a challenge, especially for health-related data that may contain personal information.

When the survey asked Member States about barriers to adopting big data for health, the top three most important barriers (rated as very or extremely important) are a lack of data privacy and security laws, limited integration between different health services and other systems collecting data and a lack of support for new analytical methods. These top three barriers are all related to a lack of data governance. Data governance involves a set of processes to manage the use of data, including access, usability, quality and security of information, as well as consequences for the misuse of data. Addressing data governance at the national level (through leadership and collaboration with health ministries, justice ministries and data privacy regulators) is likely to lessen the importance of these barriers to implementing big data in health. Countries that have a data governance framework enabling the use of privacy-protected information will be able to stimulate quality, efficiency and performance in their health systems, become more attractive for medical research and increase their opportunities to build public–private partnerships *(152)*. The survey results on barriers to implementing big data for health are presented in Fig. 32. Since big data for health is a relatively new area, it is not surprising that barriers to implementing big data are generally rated as more important when compared to other thematic areas of the survey.

Fig. 32. Barriers to implementing big data for health (n=44)
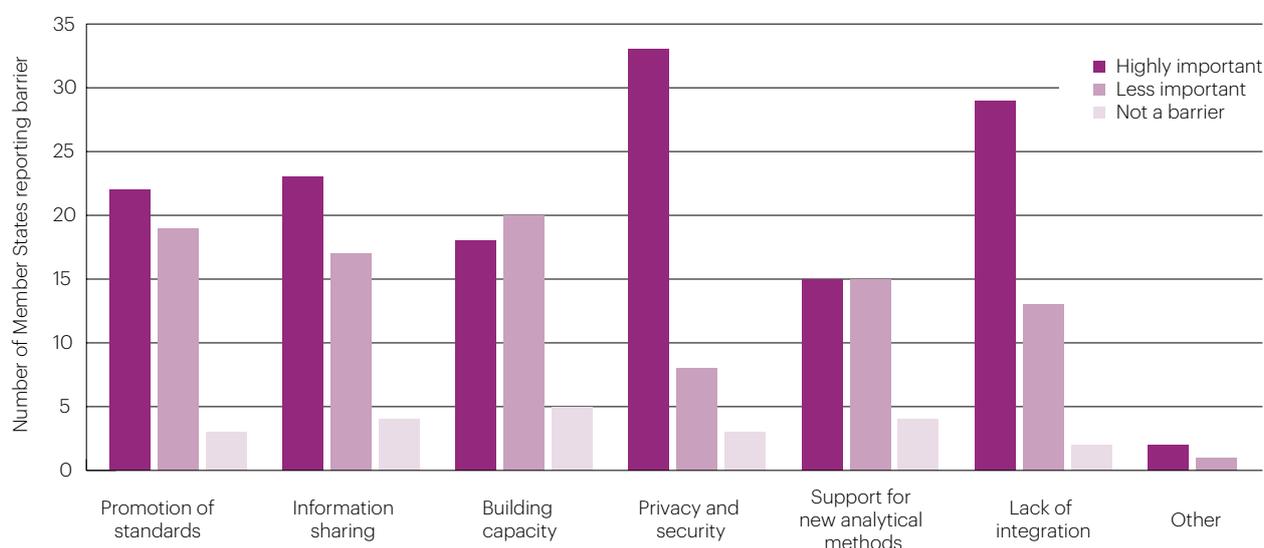
Member States could also note additional barriers to their adoption of big data for health. Two countries raised other issues as being very important barriers, including:

— the difficulty of assessing the merits of investing in big data, being a relatively new science and developing rapidly;

— the difficulties associated to pseudo-anonymization of data;

— the large amounts of data already being gathered by private companies;

— consideration of the quality of data for diagnostic assistance.

Further, the lack of skilled human resources, coupled with the fast development of new data management solutions, is a bottleneck for future developments in big data and health analytics. Insufficient resources, insufficient funding and difficulties in finding and/or training data experts with the right talent are very real barriers to implementing big data for health *(153)*. Although the respondents did not rate capacity-building – such as the need to provide training – as one of the most significant barriers, hiring and training more and competent staff members is essential for governments to use public and health data in new ways.

Comments and lessons learned from Member States

Four Member States provided additional comments about the use of big data for health. One commented that a variety of regulations and processes on the use of data already exist in its national environment, which cover big data in the public and private sectors without explicitly naming it. Another comment was that national regulations on big data in health are being drafted in accordance with OECD guidelines. One Member State mentioned the need to integrate information resources into an analytical framework, such as EHRs, as well as databases that may not be specific to health, such as environmental databases.

One specific comment from the Member State with a national strategy on big data in health was in relation to ongoing work to demonstrate the feasibility of integrating information. Its opinion is that some of its programmes, such as care of the elderly, require disparate data sources to better understand specific cohorts or patient conditions and that not having a single approach to the adoption of information technology has been limiting. Local engagement and sensitivity to local circumstances can help programmes to be successful. This Member State reports that it recently published a new framework for using data and technology to support sustainable and high-quality health care. In addressing the public opinion of data protection and the use of health data, it has established a national data guardian to ensure that data is appropriately collected and used and to ensure that personal data is protected. The national data guardian is intended to build trust, represent the views and interests of the public and fulfil the functions of independently advising and challenging the way information is collected and shared. Case example 27 illustrates the use of data analytics in developing a real-time view of the development of influenza-like illness in Europe.

> " A lack of data privacy and security laws is considered to be the top barrier to adopting big data for health.

Case example 27.
Internet-based epidemiology

The residents of the EU are aiding influenza-like illness surveillance with an initiative that aims to help predict flu epidemics by shedding light on outbreaks and how viruses spread. Influenzanet *(154)* is based on the online surveillance and communication project *De Grote GriepMeting* [The Great Influenza Survey] *(155)*, and has been operational since 2003. Unlike traditional surveillance methods, Influenzanet uses information provided directly by members of the population, without the need for data to be provided by doctors or hospitals.

Around 35 000 volunteers in Europe are taking part in Influenzanet, which operates in 10 countries: Belgium, Denmark, France, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. Any resident, whether a European national or not, can take part. All information is anonymous (participants subscribe to the site with an email address and do not need to provide their real name). Once registered, participants are asked to fill in a brief questionnaire including their age, where they live and work, the make-up of their household, any allergies they may have and whether or not they have had the flu vaccine.

Data are analysed to give a real-time picture of influenza-like illnesses. Research is focused on the role of age, demand for health care, impact of vaccinations, spread of disease and risk factors. Incidences from Influenzanet correlate well with European Centre for Disease Prevention and Control data over multiple seasons, and in many of the countries involved, government surveillance websites publish the data weekly in connection with their official data.

Summary

At present, very few Member States have policies regulating the use of big data in the health sector or by private entities. The most important barriers to adopting big data for health are related to a lack of data governance and include the need for laws on privacy and data protection, insufficient integration between health services and other systems collecting data, and not enough support for the research and development of new analytical methods.

Health analytics and big data have great potential to support higher-quality treatment for patients and better research data for scientists, and to reduce costs for health care. However, this potential is missed when countries cannot yet see applicable uses of big data in health. The use of data analytics in health care can also provide incentives to medical professionals when they can observe the benefits and usefulness of information mined from EHRs.

Recommendations

— Member States should create and implement policies regulating the use of big data in the health sector and by private entities.

— Member States should address data governance at the national level, particularly on privacy and data protection, through leadership and collaboration

with health ministries, justice ministries and data privacy regulators.

— Public health organizations and health service providers should increase education and training for staff on how to use public data and health data analytics.

— Member States and funders of health research should support research and development into new analytical methods.

Robust legal frameworks for health, whether delivered in person or through the use of ICT, play an important role in the delivery of quality health services. The benefits of eHealth are based on the overall acceptance of users. Legislation, therefore, needs to focus on issues such as privacy, confidentiality, data quality, integrity, access, ownership and sharing so that patients are better informed about the use and role of their data in care. Standards regarding interoperability and functionality also require legal guidance in order to advance eHealth services, tools and technologies.

Key data from the survey responses

— 80% of Member States have legislation to protect the privacy of an individual's health-related data in electronic format in EHRs – an increase of nearly 30% since the 2009 survey.

— 53% of Member States do not have legislation that allows individuals electronic access to their own health data in their EHRs.

— 50% of Member States report that individuals have the right to specify which health-related information in their EHR can be shared with health professionals of their choice.

— 43% of Member States have policies or legislation that defines medical jurisdiction, liability or reimbursement of eHealth services.

Background

Legal frameworks for eHealth lay the foundation for the effective use of and patient trust in eHealth; they are a key factor in the successful implementation of eHealth tools. Frameworks for patient safety, data protection and security and ethical issues related to the collection and use (and reuse) of patient information are needed to create legal clarity and certainty in the relationship between care providers and recipients of care. These also provide the option of exchanging information between health professionals about patients, diseases and scientific research, with the certainty of accurate information and data protection. Legal frameworks are also needed to build trust across all users of eHealth services. However, they must adapt to current needs in order to work efficiently and continue to evolve as their use by technology and society evolves.

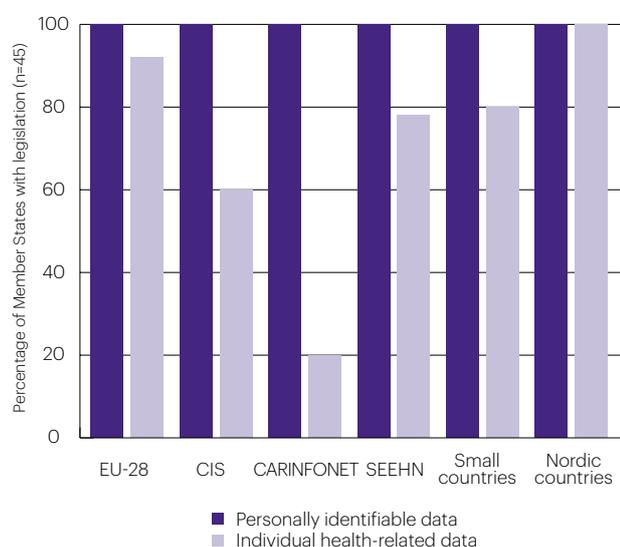## Results of the survey: protection of data

The 2015 WHO global survey on eHealth asked Member States about their national legislation on digital health services and health-related data. This section of the survey sought to investigate the degree of protection and sharing of patient data in digital forms. As such, the majority of the questions focused on EHRs.

All the responding Member States report having legislation to protect the privacy of personally identifiable data, such as addresses or fingerprints, regardless of whether they are in paper or electronic format. The survey question on data protection addresses concepts of privacy in human rights law and whether privacy protection is an established legal concept in the national environment. It is an indicator of the advancement of human rights law in Europe that 100% of respondents in the WHO European Region have such legislation in place.

Of the respondents, 36 countries (80%) report having legislation to protect the privacy of an individual's health-related data in electronic format in EHRs. This is important for the use and continued development of eHealth, as the fundamental rights of individuals need to be appropriately defined and supported. The countries that do not have specific legislation on the protection of privacy are likely to face greater difficulties in building confidence in their national eHealth programmes. Fig. 33 shows the presence of national legislation to protect the privacy of data by subregion (see Annex 2 for subregional groupings). CARINFONET and CIS countries show lower adoption levels of legislation to protect the privacy of an individual's health-related data in EHRs. These two subregions also have the lowest rates of legislation on their EHRs in the

European Region (see Fig. 6 in Chapter 2), indicating that stronger focus on legislation regarding health-related data is needed in these countries in order to keep pace with their eHealth adoption. Case example 28 describes the implementation of eHealth legislation in Austria.

Fig. 33. Member States' national legislation to protect the privacy of data, by subregion (n=45)

Results of the survey: sharing of data

The survey asked whether Member States have legislation governing the sharing of digital information through EHRs between health professionals in other health services in their country, such as insurers, health care providers or pharmaceutical companies. The 2015 results show some advancement in this area as 60% (27 countries) responded that they have legislation on sharing digital data through EHRs within their country. However, 38% (17 countries) do not have such legislation.

The results of the 2015 survey also show that 61% (27 countries) report having legislation allowing the sharing of personal and health data between research entities, while 34% (15 countries) do not.

When countries were asked if they have legislation governing the sharing of digital data through EHRs between health professionals in health services in other countries, only 38% (17 countries) report having such legislation while the majority (56%, 25 countries) report that it does not exist. While this shows some progress in the European Region from the 2009 survey, the continued lack of national legislation on the sharing of digital information between countries will remain a barrier to cross-border health care. Fig. 34 shows the proportion of Member States with legislation on sharing data by subregion

Case example 28.
Austrian EHR File Act

Austria's national EHR system, *elektronische Gesundheitsakte (ELGA),* will link up care providers such as hospitals, private medical practices, nursing homes and pharmacies. The EHR File Act – *ELGA-Gesetz* – from which it takes its name was passed in Austria in 2012 and underpins its legal basis. At the end of 2015 ELGA was implemented in public hospitals in the provinces of Styria and Vienna, before being rolled out nationwide. If successful, it will be one of Europe's first nationwide EHR systems integrating all health care providers.
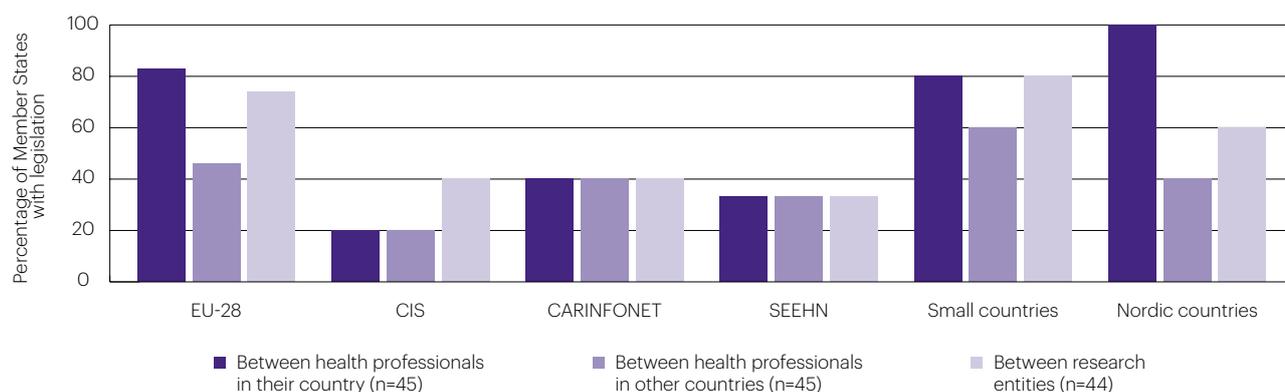
The system will enable health care providers to share a range of medical documents, with legislation to ensure that such health data is restricted to the provision of medical treatment. In addition, patients' rights over how this data is used are key components of *ELGA-Gesetz* and patients have control of their data via a centralized access control centre. This will enable them to see who has accessed their data and decide whether to expand or shorten access times, deny access to certain documents or declare that certain data should not be included. They can also decide whether to opt out of ELGA entirely or only participate in particular applications, such as ePrescription services.

As part of the Act, certain medical reports – including radiology, lab and discharge summaries – are required to be structured in a standardized electronic architectural format. This will enable the reports to be exchanged over the ELGA platform. All reports will also need to adhere to a strict content format, which will enable physicians to navigate more easily around the reports to find the information that they require. Care providers will need to adapt their local ICT systems to use ELGA-compatible reports.

As well as an access control centre, centralized components of the system will include a health care provider index, patient index, logging system and Internet portal. Document registries and repositories will be decentralized. The document registries will only be a database of links, thereby enhancing data security. Only technical information about the documents, such as addresses and identification of document repositories, will be included. ELGA will benefit health care providers by providing them with more comprehensive patient histories. Through the adaptation of regulations, infrastructure can be shared more appropriately, enabling wider eHealth initiatives to be supported.

> **Thirty-six countries (80%) report having legislation to protect the privacy of an individual's health-related data in EHRs.**

Fig. 34. National legislation on the sharing of data, by subregion

Legend:
- Between health professionals in their country (n=45)
- Between health professionals in other countries (n=45)
- Between research entities (n=44)

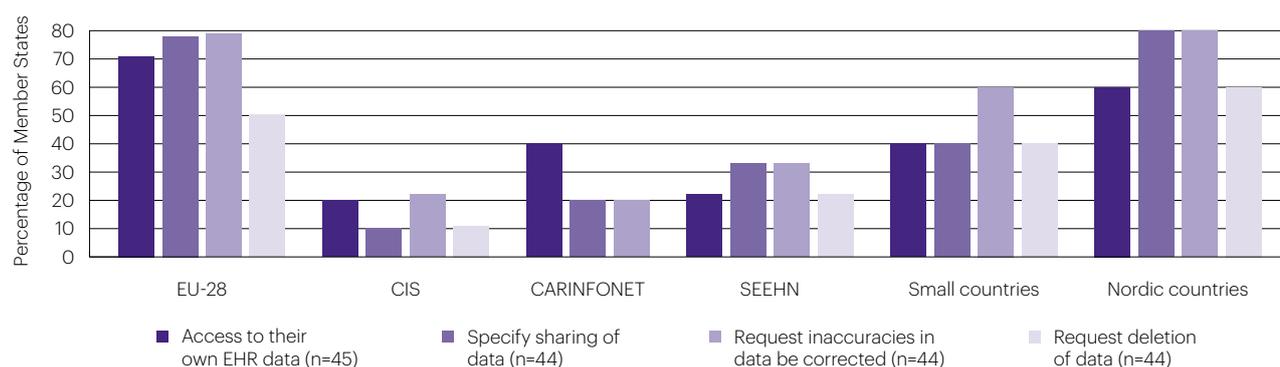## Results of the survey: patient access to and control of data

With regards to patient access and control of data stored electronically, 47% (21 countries) have legislation allowing individuals electronic access to their own health data in their EHRs, but a majority of countries (53%, 24 countries) do not. This proportion represents the total number of respondents to this survey question and not just those who report having a national EHR (which is 59% of respondents; 27 countries). Compared to the 2009 survey, where 20 countries in the WHO European Region (56% of respondents) reported that they have legislation that permits individuals the right to access their EHRs *(156)*, there has been little discernible progress in the area of legislation governing patient rights in relation to access and control of data stored electronically.

Exactly half of respondents (22 countries) report that individuals have the legal right to specify which health-related information in their EHRs can be shared with health professionals of their choice. Results of the 2015 survey also show that 52% (23 countries) have legislation to allow individuals to request that data inaccuracies in their EHRs be corrected, while 41% (18 countries) do not. The results further reveal that while 34% (15 countries) report having legislation to allow individuals to request that information be deleted from their EHR, the majority of responding countries (61%; 27 countries) do not. These results are shown in Fig. 35, by subregion.

Many EHRs do not actually delete erroneous data without a trace of the deletion, but add a comment stating that these have been found to be incorrect and are void of value. Individuals' right to demand deletion of health-related data from their EHRs is a complex matter. As patient data is an important element in patient safety when a person is receiving treatment, this is not an easy topic with clear answers. While the issue of individuals' right to access their own personal and health information is one aspect to consider, another concerns control of the information; both bring up discussions on legal ownership of the information. In several countries, these rights are given to health professionals or the health care system as the legal owners of the EHR, but this is not the case in all countries in the European Region. Further, countries were asked whether there were policies or legislation defining medical jurisdiction, liability or reimbursement of eHealth services: 43% (19 countries) have such policies or legislation while 50% (22 countries) do not.

As more digital health information is collected and used, and as individuals are becoming more digitally literate in terms of understanding which information is collected, how it is collected, how it is subsequently used and by whom, there is a need for clear legislation regarding patient access and control of information and the professional use of that information. For example, allowing patients to adjust or even conceal information in their health records and specify who has access to the information can affect the completeness and quality of the data that health professionals can use, which can in turn affect the quality of care.

Fig. 35. Legislation on patient access to and control of data, by subregion

Legend:
- Access to their own EHR data (n=45)
- Specify sharing of data (n=44)
- Request inaccuracies in data be corrected (n=44)
- Request deletion of data (n=44)

When countries were asked whether they have policies or legislation to address patient safety and quality of care based on data quality, transmission standards or clinical competency criteria, 58% (26 countries) report that they have such policies or legislation and 31% (14 countries) do not. Table 14 shows the trend in legislation on data in the European Region based on several measures of information from the 2009 WHO global survey on eHealth. Case example 29 explores legislation for electronic health data protection in Poland.

Table 14. Trends on the protection of individuals' data

	2009	2015
Protection of health-related data in digital format	~52%	80%
Protection of personally identifiable data	94%	100%
Legislation allowing sharing health-related data (EHR) between health professionals in other health services in their country	~39%	60%
Legislation on sharing health-related data (EHR) with health care facilities on other countries	~19%	38%
Legislation allowing sharing of personally identifiable health data for research purposes	N/A	61%
Legislation granting individuals the right to access their EHR	56%	47%
Legislation allowing individuals to request inaccuracies of their health-related data be corrected within an EHR	~33%	52%
Legislation allowing individuals the right to request deletion of data from their EHR	33%	34%
Legislation allowing individuals the right to specify with which health provider(s) to share their EHR	N/A	50%

Source: 2009 data from the 2012 WHO publication Legal frameworks for eHealth (156).

> **"** As more digital health information is collected and used, and as individuals are becoming more digitally literate in terms of understanding the use of health information and by whom, there is a need for clear legislation regarding patient access and control of information and the professional use of that information.

Case example 29. Poland's Law on the Information System in Health Care

In Poland, the Law on the Information System in Health Care (2011) makes it obligatory for health records to be stored in an electronic format. The Law addresses issues relating to the storage, processing, transfer of and access to such health data. This includes ensuring that health care providers make records stored in their ICT systems available to authorized institutions and individuals to facilitate continuing treatment or diagnostic procedures.

The introduction of EHRs will not only aid medical treatment but also facilitate reimbursement for medical care. The aim is to have electronic data that moves with the patient and provides up-to-date information to health care providers. A medical information system is being developed so that EHRs can be easily exchanged between relevant health care providers. In addition to information contained in health records, the medical information system should be able to process data such as health care entitlements, insurance numbers and insurance details. Legislation incorporates rules on the identification and authorization processes related to the exchange of such data. The system will also enable the use of ePrescriptions.

Data protection is achieved by limiting access to the data, as opposed to limiting the scope of information stored. Patients do not need to provide consent for their details to be stored electronically, but failure to ensure confidentiality of health data is a penal offence. The Act on the Rights of Patients lays down criteria for health care providers to protect personal data, as well as ensure that that health records are created and updated immediately following the provision of health care. The Patients' Rights Ombudsman has authorization to oversee whether health care providers are abiding by the Law.

Health records are legally available for secondary users, such as public authorities, in order for them to carry out their work – particularly in relation to control and oversight. Information can also be provided to higher education or research institutions as long as it does not involve disclosure of personal data. The use of such ICT solutions aligns with the European Commission's eHealth Action Plan 2012–2020 (113) to provide smarter, safer and patient-centred health services.

Privacy and data protection

Within the EU, directives on personal data protection (Directive 95/46/EC) and the protection of privacy in electronic communications (Directive 2002/58/EC) were transposed into national and regional laws of EU Member States, but each country has the freedom to transpose differences in the outcomes of these directives (156).

The differences in legislation, therefore, represent a potential barrier for the Member States of the EU.

Other important issues regarding differences between Member States in the broader WHO European Region include the cultural contexts, linguistic challenges and translation barriers in relation to the specific laws in each country. Disparities between national laws need to be identified and examined in order to develop a unified model of legal frameworks in the Region.

It is imperative to keep in mind that the context of health provision and related information-gathering is changing constantly. One way to address privacy is by building it into the design of the technological devices, services and networks from the start. Privacy by Design (PbD) is a technical framework that embeds privacy directly into the system design, thus addressing the ICT, related business practices, physical design of the device and networked infrastructures *(157)*. It has been adopted as an international privacy standard by the International Data Protection and Privacy Commissioners and the European Commission is integrating PbD into a unified data protection law – the General Data Protection Regulation (COM(2012) 11) *(158, 159)*.

Another innovative method to address privacy and data protection is SmartData. This is an Internet-based autonomous agent that acts as a virtual proxy for individuals, securely storing their personal information and then intelligently releasing certain information based on the individual's instructions and the context of the data request *(160)*. The SmartData virtual health proxy is allowed to disclose (some of) an individual's data. However, before something like SmartData could be used, there needs to be policy in place to address which information is gathered and how it is to be used.

A third way to address privacy protection is by defining the contexts in which personal and health information is appropriate to use. Instead of viewing the right to privacy as being focused on the control of information, it is viewed as the right to the appropriate flow of information, which varies based on the context – referred to as "contextual integrity" *(161)*. An example of this is how information given in a private setting and pertaining to an individual, such as in EHRs, is given under the assumption that it will remain within that context and not flow into a public setting. The contextual integrity framework can be incorporated into eHealth policy in order to determine or justify whether a device, system or practice is ethically or legally legitimate.

> " **Twenty-six countries (58%) have policies or legislation addressing patient safety and quality of care based on data quality, transmission standards or clinical competency criteria.**

Cross-border sharing of health information

Although legislation on the sharing of digital information across borders was not a main focus of the 2015 survey, it deserves further reflection. One explanation for why the majority of countries do not have specific legislation on the sharing of digital data through EHRs between countries could be that they are focusing available resources on the development of their own internal EHR systems. Another explanation could be that countries consider the cross-border transfer of EHR information as a topic to be addressed at the regional or European level and are not prioritizing it as part of their national development strategies, or are hesitant to develop cross-border agreements, which are complex by nature and may not be aligned with future European action *(162)*. EU Directive 2011/24/EU on patients' rights in cross-border health care provides a general framework to clarify patients' rights in seeking health care (and its reimbursement) in another EU country *(24)*. It establishes a foundation for cross-border exchange of health data; gives guidelines for ensuring the safety, quality and efficiency of health care across borders; and promotes cooperation between EU Member States regarding health care.

Comments and lessons learned from Member States

Several Member States report that they are working on legal frameworks for the protection and sharing of personal and health data. Some countries have general guidelines in place and will finalize the adoption of laws and regulations after electronic health systems are implemented. A number of countries report that they have common laws on the right to privacy, data protection and to cover actions within electronic health even if they are not designed specifically for EHRs or digital information. Other countries have broad regulations prohibiting the use of personal health data for purposes other than direct health purposes and the continuity of care, unless otherwise authorized by a legal authority. One country identified that patients' rights to their data or control of their data depends on the purpose for which the data is to be shared. Some countries commented on legislation regarding EHRs, noting the need to modify regulations on patient's consent and access. A few countries mentioned their efforts to protect privacy and information in the reuse of medical data for research and policy-making, with some comments on the use of unique identifiers.

Summary

All the responding Member States report that they have legislation to protect the privacy of personally identifiable data and 80% report legislation to protect the privacy of health-related data held in electronic formats. Privacy protection is a fundamental right, and while the great majority of countries have specific legislation to protect the privacy of patients and their information, improvements are still needed. Member States report that 58% have policies or legislation to address data quality, transmission standards or clinical

competency and resulting patient safety and quality of care, while 43% have policies or legislation that define medical jurisdiction, liability or reimbursement of eHealth services.

While the majority of Member States have legislation that allows for the sharing of personal and health data between research entities and on sharing data with health professionals in their own countries, only 38% have legislation on sharing data with professionals in other countries. Most EHRs are national, and international sharing of health records can be a complex issue to solve due to differences in language, culture, financial mechanisms, technical standards and how health services are organized. However, there are also important trust, ethical and privacy questions that should be addressed and protected by some form of cross-border regulation. The increasing flow of labour across national boundaries builds a demand for solving some of the practical and legal issues regarding the flow of health data.

The survey results indicate that while countries are focusing on legislation for sharing health-related data with professionals, individual patients' rights to access and alter their health-related data is not as well developed. Currently, 47% of Member States have legislation allowing individuals to electronically access their own health-related data, 52% have legislation allowing individuals to demand incorrect health-related data to be amended, 34% have legislation allowing individuals to demand the

deletion of data from their EHR and 50% have legislation that grants individuals the legal right to specify which health-related data can be shared with particular health professionals. National legal frameworks need to be revisited regularly in order for them to keep pace with technological change, societal values and the changes in the health information landscape.

Recommendations

— Member States are recommended to have national legislation that protects the privacy of health-related data held in electronic formats and addresses the individual rights of patients and their interaction with EHRs. In particular, appropriate national legislation should, as a minimum, address access and ownership of patient data stored in an EHR, define who can access it, allow patients to restrict access if they wish, address amendments and deletions of data and ensure that patients are informed about the related risks.

— Member States are recommended to develop and adopt policies or legislation to address data quality and transmission standards in support of eHealth, in addition to defining medical jurisdiction, liability and reimbursement for eHealth services.

— Member States are recommended to periodically revisit and revise national legal frameworks pertinent to eHealth to accommodate technological change and changes in the health information landscape.

CONCLUDING REMARKS

Analysis of the results of the 2015 WHO global survey on eHealth shows an increasing appetite for eHealth in the European Region, with Member States actively building upon their national eHealth foundations to provide a mainstreamed portfolio of health care services delivered through the use of eHealth.

The results illustrate the positive effect when action is taken by governments to utilize eHealth in the reform of national health care and health information environments. However, progress in adopting eHealth is not uniform across all countries in the Region and a concerted effort is needed in several Member States for accelerated action and increased political commitment. Such commitment is manifested in strengthened eHealth governance, practical eHealth strategies and sustainable, long-term funding mechanisms. Most importantly, success in national eHealth adoption is often influenced by a range of factors that extend beyond the obvious requirements of skills and funding for technology and it is here that intersectoral engagement of stakeholders, led by the health ministry, is a key catalyst for success.

With over half of the Member States in the Region focusing on constructing and refining national EHRs, only a portion of these countries have sufficient legislation supporting their use. This is despite a growing trend of EHRs being used in primary, secondary and tertiary care settings. In several cases, when national legislation applicable to the electronic storage of health data exists, key issues surrounding patient and provider access rights, the modification of information in a patient record and data ownership are weak or not addressed. EHRs are also increasingly being linked with laboratory and pharmacy information systems, among others, indicating the increasing importance of EHRs as the primary hub of health information and its exchange.

Many telehealth projects in the European Region are now progressing from pilot projects to broad-scale implementation. Realizing the public demand for telehealth, larger regional telehealth initiatives are emerging. Member States reported many examples of telehealth programmes, which is indicative of its growth in Europe. Teleradiology, telepathology and remote patient monitoring were cited as

the most commonly established telehealth programmes, with telecardiology also mentioned as a service of importance. The continued development of organizational goals, clear strategies for services and national coordination of programmes will further support the European Region's progress in telehealth.

The survey results on mHealth adoption in the WHO European Region were particularly revealing and show increases in both uptake and maturity. One illustrative example is the increase in the use of mHealth for CDSSs, access to patient records and appointment reminders (by 27%, 25% and 21%, respectively) in the European Region since 2009. The majority of other mHealth programmes are established and operating at local and national levels, indicating that mHealth services are becoming more common and widely used. In contrast, mHealth is neither well regulated nor guided by dedicated national strategies. Nearly half of the Member States in the European Region report government-sponsored mHealth programmes. Around half of these fall under the guidance of eHealth policies, and none of the Member States report having a dedicated mHealth policy or strategy. The majority of countries also report that there is no national entity responsible for the regulatory oversight of mHealth apps for quality, safety and reliability, or for providing incentives and guidance on innovation, research and evaluation of mHealth apps.

It is crucial that Member States systematically address digital and health literacy in both health professionals and the public in order to ensure eHealth services are successfully adopted and that health inequalities are reduced with the digitization of services. eLearning is one channel to address digital and health literacy education, and the majority of countries acknowledge its importance for improving access to educational content and experts in formal education

settings. While most countries are providing pre-service education in ICT and eHealth for students of health sciences, this education is not yet widespread within countries. eLearning in health is also utilized to a limited extent in the majority of Member States, but more often for students than for the continued training of health professionals.

In terms of future areas of growth, the use of social media in health was briefly examined. Nearly all Member States in the WHO European Region acknowledge the use of social media by individuals and communities to learn about health issues, and the majority of countries also report that health care organizations use social media to promote health messages as part of health campaigns. These results indicate that the use of social media for health is widely used by the public and by health care organizations. However, there is an enormous underlying potential in the use of social media that is still to be explored. Fewer than half of Member States actively educate students of health sciences on the use of social media for health and even fewer train medical professionals on its use. Furthermore, one country reported having a national policy or strategy on the use of social media in health and seven countries have a policy or strategy on the use of social media by government organizations.

Big data and health analytics were also identified as having the potential to affect public health and health services on a broad scale. As an indication of the relative infancy of these technologies, few Member States reported having national policies or strategies regulating the use of big data in the health sector or national regulations on the use of big data by private companies. Given that the most important barrier to big data adoption was reported to be a lack of appropriate data privacy and security laws, the absence of applicable national regulation is an area demanding increased focus. While the growth and maturity of advanced analytics in the context of health care and public health will undoubtedly take time, there is clear evidence of its importance and potential for supporting public and population health. Member States in the WHO European Region should therefore ensure that national policy to support this growth is appropriately defined and adopted.

An examination of progress in national legislation governing eHealth highlighted the need for increased focus on the individual rights of the patient in interacting with data stored in EHRs. The importance of the development of legislation in accordance with technological and social developments is a crucial factor for the success of national eHealth implementation and further focus is needed to harmonize legislation in the Region in support of cross-border health information exchange.

The future of eHealth in the European Region

Incorporating ICT into health care adds value to the services and to the skills of the professionals using them. Although significant progress is being made towards person-centred care models in Europe, critical gaps in the design and delivery of health care services remain. It is important to involve all stakeholders in future national reform processes for health and crucial that countries view health information and its accessibility as key factors for the redesign and standardization of health care systems. All potential consumers and contributors of health information need to be identified to improve the way health and social care will be delivered. Most importantly, effective national health reform needs to adopt the perspective of the patient in order to understand how eHealth tools and services can be used to facilitate better care and to ensure populations are more proactively involved in their own health and well-being.

The WHO European Region is particularly active in adopting eHealth and there are significant indications that the future pace of adoption of eHealth will continue to increase. A greater focus should, however, be placed on eHealth standards adoption and the systematic measurement and evaluation of eHealth as a component of strategic programmes. Decision-makers need complete and timely evidence drawn from their own national environments to make effective decisions about the health of their populations. It is vitally important for countries to work towards integrating systems and information flows that facilitate the use of this evidence for the definition of national health policy.

WHO and the role of Health 2020 in developing the future eHealth landscape in Europe

As the role of eHealth in the WHO European Region transitions towards becoming a key strategic asset for reforming health systems and achieving universal health coverage, the importance of adopting a transparent, intersectoral approach to policy development and implementation becomes more critical. It is here that the value of the WHO health policy framework for Europe, Health 2020, becomes apparent as a blueprint for Member States to develop an inclusive and multidisciplinary governance mechanism for eHealth. Health 2020 provides a strategic guide to achieving intersectoral whole-of-government and whole-of-society approaches for addressing health inequalities and improving health; it is important that the implementation of eHealth is viewed in this context. Use of technological innovations such as those described in this report has been shown to play a significant role in improving the quality and cost–effectiveness of care, extending the services of the health system and providing new roles for health information in facilitating health care delivery. In line with the objectives of Health 2020 for strengthening people-centred health systems and public health capacity, eHealth brings together services and information when and where they are needed to enable more nuanced and accurate treatment and to increase patient participation and empowerment. As the development of eHealth continues to gain momentum across Europe, WHO's role in supporting Member States will increasingly focus on engaging with international partners to strengthen eHealth foundations, further the adoption of standards and interoperability and reform national HISs as a part of the EHII.

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ANNEX 1.
Definitions used in the report

WHO defines *capacity-building* as "the development of knowledge, skills, commitment, structures, systems and leadership to enable effective health promotion. It involves actions to improve health at three levels: the advancement of knowledge and skills among practitioners; the expansion of support and infrastructure for health promotion in organizations, and; the development of cohesiveness and partnerships for health in communities".

WHO defines *empowerment* as "a process through which people gain greater control over decisions and actions affecting their health. To achieve this, individuals and communities need to develop skills, have access to information and resources, and opportunities to have a voice and influence the factors affecting their health and well-being".

WHO defines *governance for health* as "the attempts of governments and other actors to steer communities, countries or groups of countries in the pursuit of health as integral to well-being through both whole-of-government and whole-of-society approaches".

WHO defines *Health for All* as "a policy goal consisting in the attainment by all the people of the world of a level of health that will permit them to lead a socially and economically productive life".

WHO defines *health inequality* as "a difference in health status between individuals or groups, as measured by, for example, life expectancy, mortality or disease. Health inequalities are the differences, variations and disparities in the health achievements of individuals and groups of people. Some differences are due to biological or other unavoidable factors such as age; others, however, are avoidable".

WHO defines *health literacy* as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health," and states: "by improving people's access to health information, and their capacity to use it effectively, health literacy is critical to empowerment".

WHO defines *health systems* as "The ensemble of all public and private organizations, institutions and resources mandated to improve, maintain or restore health. Health systems encompass both personal and population services, as well as activities to influence the policies and actions of other sectors to address the social, environmental and economic determinants of health".

WHO defines *intersectoral action* as referring to "efforts by the health sector to work collaboratively with other sectors of society to achieve improved health outcomes".

WHO defines *public health* as "the science and art of preventing disease, prolonging life and promoting health through the organized efforts of society".

WHO defines *public health capacity* as "the resources (natural, financial, human or other) required to undertake the delivery of essential public health operations".

WHO defines *public health services* as "the services involved in delivery of the essential public health operations. These services can be provided within the health system or in other sectors (beyond the strict boundaries of the health system) with health generating activities".

WHO defines *well-being* as both subjective and objective and comprising "an individual's experience of his or her life, and a comparison of life circumstances with social norms and values".

WHO defines *whole-of-government* as referring to "the diffusion of governance vertically across levels of government and arenas of governance and horizontally throughout sectors. Whole-of-government activities are multilevel, encompassing government activities and actors from local to global levels, and increasingly also involving groups outside government".

WHO defines *whole-of-society* as referring to "an approach that aims to extend the whole-of-government approach by placing additional emphasis on the roles of the private sector and civil society, as well as of political decision-makers such as parliamentarians".

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ANNEX 2.
Subregional groupings of Member States in the WHO European Region

The 28 countries belonging to the European Union after July 2013 (EU-28) are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom. * France, Germany and Slovakia are not included in this analysis.

The Commonwealth of Independent States (CIS) includes Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, the Republic of Moldova, the Russian Federation, Tajikistan and Uzbekistan; Turkmenistan and Ukraine are included as Associate States. * Belarus is not included in this analysis.

The Central Asian Republics Health Information Network (CARINFONET) consists of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

South-eastern Europe Health Network (SEEHN) consists of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Israel, Montenegro, the Republic of Moldova, Romania, Serbia and the former Yugoslav Republic of Macedonia. * The former Yugoslav Republic of Macedonia is not included in this analysis.

Small countries consist of Andorra, Cyprus, Luxembourg, Iceland, Malta, Monaco, Montenegro and San Marino. * Andorra and Monaco are not included in this analysis.

The Nordic countries are Denmark, Finland, Iceland, Norway and Sweden.

ANNEX 3.
World Bank gross national income per capita groupings of Member States in the WHO European Region

Member State	Gross national income per capita classification
Albania *	Upper-middle
Andorra	High-income
Armenia *	Lower-middle
Austria *	High-income
Azerbaijan *	Upper-middle
Belarus	Upper-middle
Belgium *	High-income
Bosnia and Herzegovina *	Upper-middle
Bulgaria *	Upper-middle
Croatia *	High-income
Cyprus *	High-income
Czech Republic *	High-income
Denmark *	High-income
Estonia *	High-income
Finland *	High-income
France	High-income
Georgia *	Lower-middle
Germany	High-income
Greece *	High-income
Hungary *	High-income
Iceland *	High-income
Ireland *	High-income
Israel *	High-income
Italy *	High-income
Kazakhstan *	Upper-middle
Kyrgyzstan *	Lower-middle
Latvia *	High-income
Lithuania *	High-income
Luxembourg *	High-income
Malta *	High-income
Monaco	High-income
Montenegro *	Upper-middle
Netherlands *	High-income
Norway *	High-income
Poland *	High-income
Portugal *	High-income
Republic of Moldova *	Lower-middle
Romania *	Upper-middle
Russian Federation *	High-income

Member State	Gross national income per capita classification
San Marino *	High-income
Serbia *	Upper-middle
Slovakia	High-income
Slovenia *	High-income
Spain *	High-income
Sweden *	High-income
Switzerland *	High-income
Tajikistan *	Lower-middle
The former Yugoslav Republic of Macedonia	Upper-middle
Turkey *	Upper-middle
Turkmenistan *	Upper-middle
Ukraine *	Lower-middle
The United Kingdom of Great Britain and Northern Ireland *	High-income
Uzbekistan *	Lower-middle
TOTALS	
High-income	34
Upper-middle	12
Lower-middle	7

Notes: Countries included in this report's analysis are marked with *. All income groupings in this report are based on the World Bank gross national income per capita groupings at the time of analysis in the autumn of 2015.

Source: Country and lending groups. In: The World Bank [website]. Washington, DC: World Bank Group; 2015 (http://data.worldbank.org/about/country-and-lending-groups, accessed 17 December 2015).

The WHO global surveys on eHealth and related publications are available online at the Global Observatory for eHealth webpage.[9]

Interactive results for the 2015 WHO global survey on eHealth from the European Region can be found on the European Health Information Gateway.[10]

Further information on eHealth from the WHO Regional Office for Europe and on the eHealth report is available at[11]

9   http://www.who.int/goe/en/
10 http://portal.euro.who.int/en/data-sources/ehealth-survey-2015/
11 http://www.euro.who.int/en/ehealth

FROM INNOVATION TO IMPLEMENTATION

eHealth in the WHO European Region

This report describes the development of and emerging trends in electronic health (eHealth) in the WHO European Region in 2016. Its content and key messages are based on data collected from the 2015 WHO Global eHealth Survey and the assistance of a number of key practitioners in the field. The report gives case examples to illustrate success stories in countries and the practical application of eHealth in various settings. The key outcomes given provide evidence of an increasing appetite for eHealth and indicate tangible progress in the mainstreaming of technology solutions across the European Region to improve public health and health-service delivery.

Together, the findings and analysis provided in this report offer a detailed insight into the development of eHealth in Europe. Through the recommendations and proposed actions, WHO echoes its commitment to supporting Member States in developing their national eHealth environments as a strategic component in the achievement of universal health coverage and the policy objectives of Health 2020 in the European Region.

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