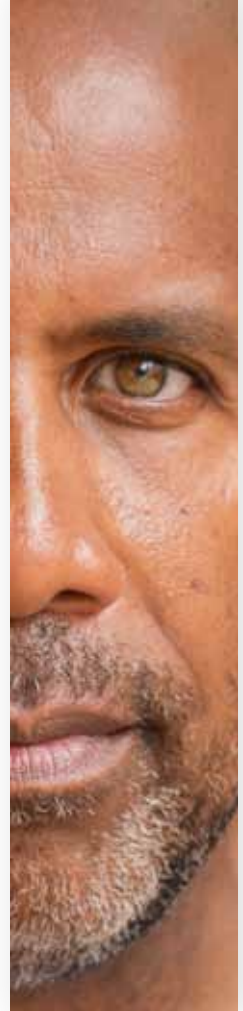# Global diffusion of eHealth:

Making universal health coverage achievable

Report of the third global survey on eHealth

Global Observatory for eHealth

World Health Organization

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2016

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Acronyms and abbreviations

AKDN	Aga Khan Development Network
AKU	Aga Khan University
ANM	Auxiliary nurse midwife
ASHA	Accredited social health activist
AWW	Anganwadi worker
CME	Continuing medical education
CSO	Civil-society organization
DOTS	Directly observed treatment, short-course
EHR	Electronic health record
EIR	Electronic immunization registry
EMR	Electronic medical record
ESA	European Space Agency
FOSS	Free open source software
GOe	Global Observatory for eHealth
HIS	Health information system
ICT	Information communication technologies
MCTS	Mother and Child Tracking System
MOOC	Massive open online courses
NGO	Nongovernmental organization
OECD	Organisation for Economic Co-Operation and Development
OER	Open educational resources
PACS	Picture archiving and communications
R&D	Research and development
TB	Tuberculosis
UHC	Universal health coverage
UN	United Nations
WHO	World Health Organization

Executive summary

The aim of the third global survey on eHealth was to explore developments in eHealth since the last survey in 2010 and the role it plays in achieving universal health coverage (UHC). It has become increasingly clear that UHC cannot be achieved without the support of eHealth. The impetus for the global surveys on eHealth came from the increasing use of information and communication technologies (ICTs) in support of health services in both developed and developing countries since the early 2000s. This was acknowledged by the World Health Assembly in resolution WHA58.28 (2005): "eHealth is the cost-effective and secure use of ICT in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research." Managed by the World Health Organization (WHO) Global Observatory for eHealth (GOe), the most recent survey had the highest response rate by WHO Member States (125) to date, which reflects growing interest by countries in this issue and eHealth's increasingly ubiquitous role in health care.

UHC is part of the "post-2015" agenda geared to meeting the Sustainable Development Goals (SDGs) adopted by the UN General Assembly in September 2015. Goal 3 is to "Ensure healthy lives and promote well-being for all at all ages" and its target 8 is to "Achieve universal health coverage", so that all people receive the high-quality health services they need without suffering financial hardship. This presents an opportunity for eHealth to support a comprehensive and coherent approach to health and support integrated, people-centred health services.

Impressive progress

More than half of WHO Member States now have an eHealth strategy, and 90% of eHealth strategies reference the objectives of UHC or its key elements. It is becoming mainstream for countries to have policies for managing information. When well articulated, eHealth strategies should enable the interoperability needed to support people-centred health services for everyone, and the move from disease silos to resilient health systems which can deliver UHC.

A large number of countries reported at least one mHealth initiative (83%). mHealth continues to be a dynamic area; the number of established programmes reaching maturity has increased since the 2010 GOe survey. Despite the rapid growth, however, very few Member States reported evaluations of government-sponsored mHealth programmes, thereby limiting knowledge of what works well and what mistakes to avoid.

The use of telehealth continues to grow, and teleradiology is the most widespread (77%). Other services, such as telepathology, remote patient monitoring and teledermatology, are also in use in nearly half of countries. By offering care at a distance telehealth services enable greater equity in health coverage.

eLearning is used for medical students' and doctors' education in over 84% of countries. UHC needs staff with the right skills, and eLearning has the potential to play a significant part in addressing the skills gap.

National electronic health record (EHR) systems are now reported in 47% of countries. While implementing EHR programmes is complex and costly, EHRs have the potential to provide clinical decision-makers with complete and accessible information for every patient at point of care, thereby improving the quality and timeliness of care, and, in aggregate, providing better data on effectiveness and coverage of interventions. Key international standards are being implemented for interoperability.

In total 78% of countries reported legislation protecting the privacy of personal information, and 54% reported legislation to protect the privacy of electronically held patient data. For eHealth to play its full role in helping health systems achieve UHC a sound legal framework is required. There has been slow but steady development of a general eHealth regulatory environment, with good advances in the adoption of health data privacy legislation.

Nearly 80% of countries reported that health care organizations use social media for the promotion of health messages. Social media supports both advocacy of UHC, and the promotion of health messages. Individuals and communities use social media primarily to learn about health issues. The potential of social media to support UHC has not yet been fully explored.

"Big data" was investigated for the first time in this survey: 17% of countries already report having a national policy or strategy regulating its use in the health sector. Using new analytical tools on big stores of digital data offer health care advocates the potential to explore individual, group and national level analyses of health coverage in support of UHC.

Overcoming barriers and moving forward

Improvements in information systems to support health and health care face many barriers. Some are reflected in the findings of the survey, such as the need for a trained workforce skilled in using eHealth solutions, the need for proper governance, funding, etc. But fundamental to overcoming these barriers is the understanding that in the 21st century the delivery of health care and improvements of health systems must consider the contribution of ICT as an essential and central component, not an add-on. eHealth is now an integral part of delivering improvements in health.

At present in many countries there are extensive data requirements for different "silo" solutions. This often places unreasonable data collection burdens on staff, the net result being that data quality is poor. The data required for UHC needs to be developed as part of a country-driven, integrated approach to information management. Country-driven eHealth strategies must determine how eHealth solutions best reflect the needs of health professionals and citizens for information as well as management's requirements (whether local, national or international).

Over the past decade or so, the impetus to strengthen health systems with better information and ICT has driven significant progress. The early pioneers of eHealth have seen their work taken up, replicated and developed. There has been a substantial increase in the number and range of solutions, particularly with the advent of mHealth. However, the process of embedding eHealth everywhere still has a long way to go, both in terms of coverage and functionality. The picture now is quite mixed, with progress reflecting different national or local priorities. Nevertheless, implementing eHealth remains the direction of travel. And its pace is being accelerated by the push to attain UHC, particularly since some of the key requirements of UHC are best met with health data on individuals. Creating the enabling environment (legal, skills, standards and technical infrastructures, together with monitoring and evaluation) for this is fundamental to national eHealth strategies.

The survey touched on some developments that can be expected to have significant impact in the next 5–10 years, such as social media and big data. But there are other developments that may also prove of great significance. For example, the potential over the next 10 years for low-cost smartphones to enable virtually everyone everywhere to have access to audio-visual examples of best (global and local) practices for improving health behaviours and supporting UHC could represent a paradigm shift in health care. As silo-based solutions are replaced with those that are more people-centred, the potential contributions of eHealth and UHC to achieving the SDGs (e.g. the development of sustainable cities and communities, goal 11) may become more evident. But progress will depend on learning, vision, sharing and comparing experiences. The results of this survey are a contribution to that process.

Introduction

All World Health Organization (WHO) Member States made the commitment to strive for universal health coverage (UHC) in 2005. This represented a collective expression of the belief that all people should have access to the health services they need without risk of financial ruin or impoverishment. Working towards UHC is a powerful mechanism for achieving better health and well-being, and for promoting human development.

This report documents the results of the third global survey on eHealth conducted by the WHO Global Observatory for eHealth (GOe), which had a special focus – the use of eHealth in support of universal health coverage. eHealth plays a pivotal role in promoting UHC. For instance, it helps provide services to remote populations and underserved communities through telehealth and mHealth. It facilitates the training of the health workforce through the use of eLearning, and makes education more widely accessible especially for those who are isolated. It enhances patient diagnosis and treatment by providing accurate and timely patient information through electronic health records (EHRs). And through the strategic use of information and communication technologies (ICT) it improves the operations and financial efficiency of health care systems.

The GOe 2015 survey was divided into eight thematic subjects, each offering its own perspective on the contribution of eHealth to UHC:

- » **eHealth foundations**
- » **mHealth**
- » **Telehealth**
- » **eLearning in health sciences**
- » **Electronic health records**
- » **Legal frameworks for eHealth**
- » **Social media**
- » **Big data**

Each of these themes is discussed in the report and also explored in case studies that highlight examples of successful eHealth programmes, while Annex 1 contains the methodology and limitations of the survey. The report is complemented by its sister publication, the *Atlas of eHealth country profiles 2015: the use of eHealth in support of universal health coverage*[1], which shows the uptake of multiple eHealth metrics by country.

The results of the survey clearly demonstrate that there has been impressive growth in almost all areas studied since the last global survey in 2010, reflecting country attitudes to eHealth now being considered fundamental to health system strengthening and innovation. Further, it is evident that eHealth and UHC are inexorably linked and that UHC will not be achieved without eHealth.

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1   http://www.who.int/goe/publications/atlas_2015/en/

1. eHealth foundations

Key findings:

- **An impressive 58% of responding Member States now have an eHealth strategy, and in approximately 90% of these strategies there is reference to the objectives of universal health coverage (UHT) or its key elements.**

- **Ninety percent of countries with an eHealth strategy report that they have special funding available for it.**

- **Approximately half of countries have government-supported health internet sites that offer information in multiple languages.**

- **Three quarters of countries have institutions that offer pre-service training or continuing education training on information communication technologies (ICT) for health for health sciences professionals; 25% of countries offer in-service training on social media for health.**

Introduction

eHealth has been a priority for the World Health Organization (WHO) since 2005, when the World Health Assembly resolution WHA58.28 was adopted: "eHealth is the cost-effective and secure use of information communication technologies (ICT) in support of health and health-related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research" *(1)*. The same Health Assembly adopted another resolution promoting universal health coverage (UHC) (WHA58.33). Since that time the growth in both UHC and eHealth has been accelerating.

The programmes to deliver eHealth need to be built on firm foundations. These include ensuring there is a national strategy for eHealth. The fundamentals for eHealth strategy development have been described elsewhere *(2)*, but essentially they need to set out, in the context of the health priorities of the country, a vision, a plan of action for delivering the vision and arrangements for monitoring and evaluation. This requires the engagement of a wide range of stakeholders, developing appropriate governance arrangements, addressing the required components (such as standards, legislation, appropriate technical and service delivery solutions) as well as ensuring there are the financial and human resources to deliver them. eHealth fundamentals also need to deliver what citizens value and understand.

To help achieve overarching health priorities such as UHC, eHealth strategies are needed which can support resilient health systems *(3)*. While sources of funding may vary, countries should lead the orchestration of them to deliver eHealth where it is needed. This ranges from provision of information to keep citizens healthy, to support for public health in communities, care and support systems in health facilities, and from all the above the data needed to inform management and policy-makers. And, as the requirements for equity in supporting health for all *(4)* become better articulated, so will the need for providing multilingual knowledge support, to both health staff and citizens. None of this can be delivered if students and health professionals are not able to use information and communication technologies (ICT) and (increasingly) social media.

Together with the other chapters, this report unpacks some ways eHealth can support UHC. It does so at a time when the paradigm is shifting away from silo-based, vertical approaches "to broader, cross-cutting approaches coordinated around and aligned with countries' needs and priorities" *(5)* to support the Sustainable Development Goals (SDGs). In supporting health systems with ICT, eHealth helps provide the foundations for the future.

Results and analysis

National policies or strategies

The findings from the Global Observatory for eHealth (GOe) 2015 survey show that supporting the development and delivery of health systems with good information systems is now becoming mainstream. All 194 WHO Member States were surveyed to determine whether they had national policies in place related to eHealth. Results from the 125 responses show that having an eHealth strategy is now becoming the norm; well over half of countries (n=73; 58%) now report having an eHealth strategy in place. Almost all of these strategies (n=64; 91%) have policy or strategy objectives that address how eHealth can contribute to UHC.

An even higher proportion of countries reported having a health information system (HIS) policy –two thirds of countries (n=82; 66%) had adopted a national HIS policy or strategy. Given that a national HIS policy or strategy lays out the vision and objectives for a national system to meet the health information needs of its citizens, it is not surprising that more countries reported having a HIS policy that concerns more than just the use of ICT. Some countries (n=21; 17%) stated they did not have a separate policy for HIS, as it was included in their national eHealth policy or strategy. Only relatively few countries (n=17; 14%) stated they had no national HIS policy or strategy.

Nearly a quarter of countries (n=27; 22%) stated they had a national policy for telehealth. An additional third of countries (n=43; 34%) reported that while they did not have a separate telehealth policy their national eHealth policy refers to telehealth. Among these countries, nearly three quarters (n=51; 73%) indicated that the policy or strategy objectives address how telehealth can contribute to UHC. These findings are summarized in Table 1.1.

Table 1.1. Comparison of country adoption of national policies or strategies for eHealth, HIS and telehealth

Survey question	eHealth		HIS		Telehealth	
	No. re-sponses	%	No. re-sponses	%	No. re-sponses	%
National adoption of a policy/strategy	73	58	82	66	27	22
No separate national policy, but topic included in eHealth policy or strategy	NA	NA	21	17	43	34
The policy/strategy refers to how ICT, eHealth, or telehealth can support UHC	64	91	NA	NA	51	73

The survey also asked if there was a national UHC policy or strategy. Three quarters of countries (n=94; 75%) reported adoption of a national policy or strategy for UHC. Two thirds (n=63; 67%) reported that their strategy refers to the use of ICT. But there was no examination of exactly how detailed that reference was – and some countries did not know (n=6; 6%). Of particular concern, however, was the number of responses to the question about the use of ICT to support UHC; a quarter of countries (n=25; 27%) stated there was no reference to the use of ICT to support UHC. Are the eHealth foundations weak in those countries? Or is it simply that eHealth policy development is not yet at a stage where it is fully integrated as part of the overall strategy for health, but viewed as a separate support function? Nevertheless, it would seem that the need to use ICT to underpin the information systems to deliver on UHC is becoming widely recognized.

The 2015 survey also asked about the year of adoption of policies on UHC, eHealth, HIS and telehealth. Although not all countries with a national policy reported its year of adoption, nevertheless the data does allow the current state of adoption to be put into an historical context.

Given a starting point of 1990, it is in the past decade that the number of countries adopting UHC, eHealth, HIS and telehealth policies has increased substantially. The 2005 World Health Assembly resolutions perhaps mark the starting point of the acceleration in the number of countries adopting each type of national policy or strategy. The lower rates for telehealth may be explained by the fact that many eHealth policies also include reference to it. Fig. 1.1 presents a side-by-side comparison of the cumulative rate of increase for each policy type by year of adoption.

Fig. 1.1. Number of countries with UHC, eHealth, HIS, and telehealth policies or strategies, cumulatively by year of adoption (1990–2015)
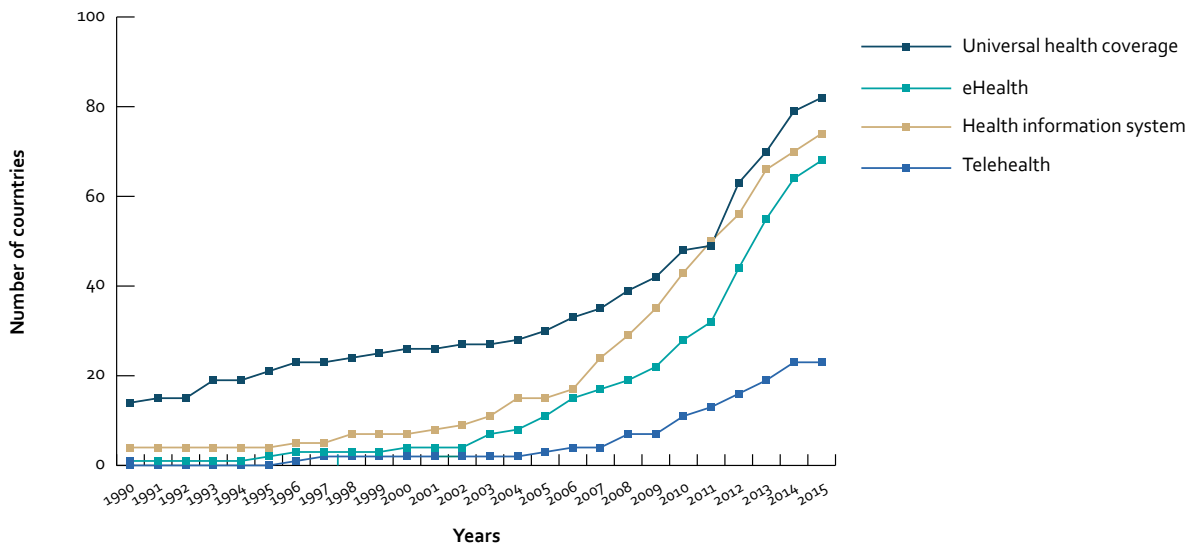
Evidently there is a close association between the increase in UHC, HIS and eHealth, though cumulative totals mask the challenge of keeping policies up to date.

Not only has there been an increase in the number of countries with eHealth strategies, but it is also occurring worldwide. Fig. 1.2 shows the increase in numbers each year, and also the adoption of eHealth strategies in countries both large and small, developed and developing.

Fig. 1.2. Timeline of country adoption of eHealth policies or strategies, 1990–2015
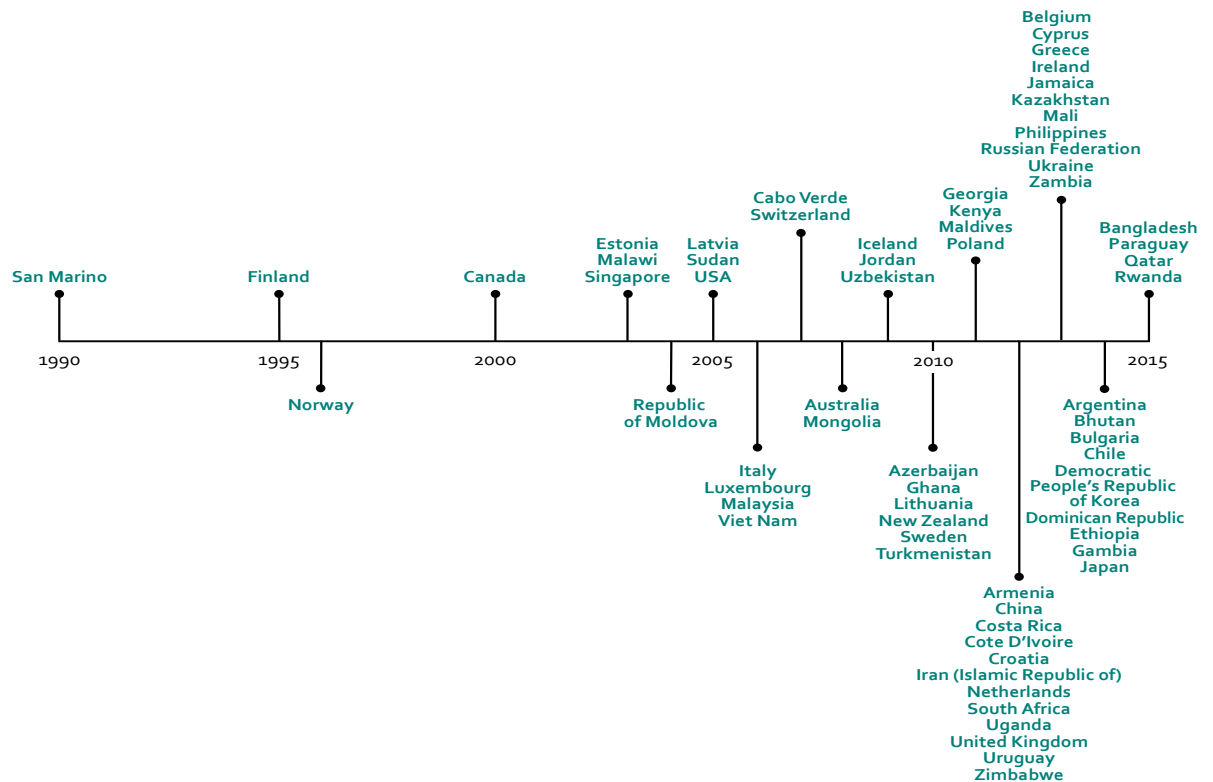
Note: Of the 73 reporting countries, 68 are shown (5 did not report the year of eHealth adoption and were omitted).

Funding

This section looks at funding and investment in eHealth and the types of funding sources used. The 2015 survey indicated that funding could come from any combination of sources, including public, private, donor/non-public or public-private partnerships. The figures shown in Table 1.2 therefore are not mutually exclusive, and the mix varies between WHO regions, as Fig. 1.3 suggests.

Table 1.2. Funding sources[a] (non-exclusive) for eHealth programmes

Funding source	No. responses	%
Public	96	77
Donor or non-public development	79	63
Public-private partnerships	52	42
Private or commercial	50	40

a   Public funding was defined as financial support provided by government and can come from national, regional or district levels; donor/non-public support is financial or in-kind support provided by development agencies, banks, foundations or other non-public funding bodies; public-private partnerships are joint ventures between public organisations and private sector companies, and private or commercial funding is financial or in-kind support provided by the private or public sector.

An informative perspective is to look at the funding sources for eHealth programmes by the World Bank income group[1] of each country. In high- and upper-middle-income countries, public sources of funding for eHealth programmes were dominant (Fig. 1.3). In low- and lower-middle-income countries donor funding predominated, while for upper-middle-income countries both public and donor funding were equally dominant. There were no clear trends in public-private partnership funding and private funding by World Bank income group. In high-income countries, where the tax revenues are relatively high, it is not surprising that public funding predominates. Of the 32 upper-middle-income countries, 72% (n=23) had donor funding; this was proportionately slightly higher than 20 low-income countries, where there were 70% (n=14) reporting donor funding. Small numbers may be relevant here, but this near equivalence was an unexpected finding.

Figure 1.3.   Funding sources for eHealth programmes, by World Bank income group
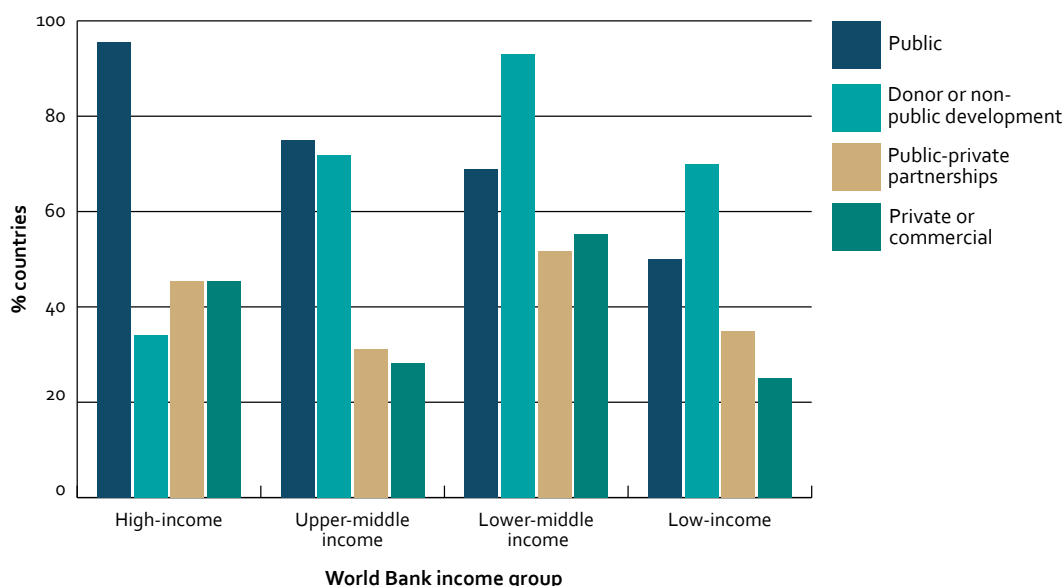
1   World Bank country classification is available at: http://data.worldbank.org/about/country-and-lending-groups.

The survey then asked whether there was special funding allocated for the implementation of the eHealth policy or strategy of each country. Encouragingly, of the 73 countries with an eHealth strategy, 69 (94%) reported that they had special funding.

Multilingualism

In many countries more than one language is spoken, and it is becoming widely recognized that information about health and health services needs to be provided to citizens in the language they speak. This also helps deliver on the equity agenda that underpins UHC. A national multilingualism policy or strategy promotes linguistic diversity and cultural identity, and reflects a government's commitment to inclusion of linguistic minorities in the country. The ability of ICT-enabled media to support these policies is indicated by the provision of government-supported health internet sites that provide information in multiple languages. The survey's findings are shown in Tables 1.3 and 1.4.

Table 1.3. Country response to having a policy or strategy on multilingualism

Response	No. responses	%
Yes	35	29
No	54	45
Not applicable due to language situation in country	17	14
Don't know	14	11
Total	**120**	
Non-responding	5	

Table 1.4. Do government-supported health internet sites in your county provide information in multiple languages?

Response	No. responses	%
Yes	60	51
No	45	38
Not applicable due to language situation in country	9	8
Don't know	4	3
Total	**118**	
Non-responding	7	

In the GOe survey in 2005 *(6)* it was reported that only 25% of countries were actively working on stimulating the development of multilingual eHealth content. But by 2015 the provision of information in multiple languages has improved, with 51% of countries indicating this was the case, as Table 1.4 shows.

As capabilities of mobile technologies to handle audio-visual media increase and become affordable, text-based delivery of information can be supplemented with more engaging media. And as connectivity improves, so do the opportunities for providing multilingual support for all.

Capacity building

The training and continuing professional development of students and health professionals (whether they are working in communities or health facilities) is essential for providing high-quality eHealth services and UHC. Indicators of eHealth capacity building help assess whether students or professionals are receiving training in preparation for using eHealth in clinical settings. As Chapter 7 on social media shows, approximately 80% of countries reported health care organizations used social media for promotion of health messages. Given this, there is likely to be an increasing requirement for training on social media for health.

The findings in the survey (Table 1.5) showed that roughly three quarters of countries have institutions that offer pre-service training (n=93; 74%) or continuing education training (n=96; 77%) on ICT for health for health sciences professionals. Conversely, only one third of countries (n=41; 33%) have institutions that offer pre-service training on social media for health and only a quarter of countries (n=30; 24%) offer in-service training on social media for health.

Table 1.5 Number and percentage of countries with eHealth training opportunities for health sciences students and professionals, globally

Type of eHealth training	No. responses	%
Pre-service training on ICT for health	93	74
In-service training on ICT for health	96	77
Pre-service training on social media for health	41	33
In-service training on social media for health	30	24

Though more needs to be done, it is encouraging that three quarters of countries are now offering training in ICT for health. Much of this training typically is focused on improving the management of information within the health system. Unsurprisingly, training in the use of social media, a much more recent phenomena, is less advanced. An exploratory question concerning whether there was a national policy to govern the use of social media in the health professions revealed that the vast majority of countries (n=99; 83%) do not have such a policy.

When viewed by WHO region (Fig. 1.4) it is perhaps expected that the highest percentages of countries offering pre-service ICT training for health are in the Region of the Americas and the European Region (at 83% and 87% respectively) but it is noteworthy that for in-service ICT training the Western Pacific Region (at 92%) has the highest percentages (and indeed scores relatively well on all 4 indicators). It should be remembered though that the number of countries responding to the survey in the Western Pacific and South-East Asia Regions is relatively low (12 and 5 respectively). Nevertheless, they both have a high proportion of countries offering in-service training in social media for health (Western Pacific Region at 58% and South-East Asia Region at 40%). Other than for in-service social media training, the African Region has the lowest percentages across each of the other three categories.

Fig. 1.4.　Percentage of countries with eHealth training opportunities for health sciences students and professionals, by WHO region
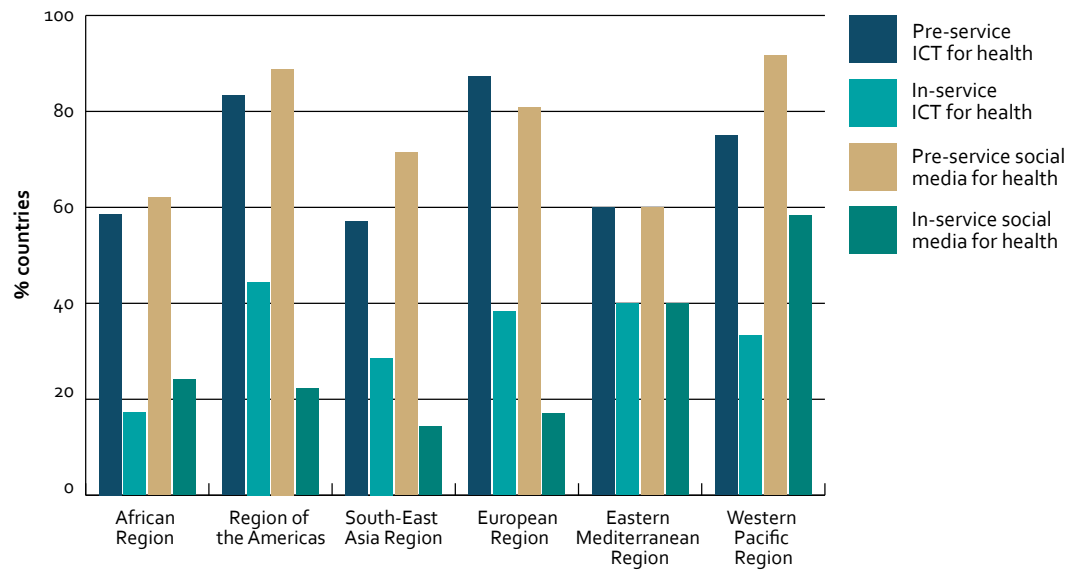
Examination of eHealth training opportunities by World Bank income group (Fig. 1.5) suggests a clear decreasing trend in eHealth training opportunities for ICT and social media moving from high-income to low-income countries. In-service training on social media is the intriguing exception, in that irrespective of World Bank income group, roughly 20% of countries reported training opportunities.

Fig. 1.5.　Percentage of countries with eHealth training opportunities for health sciences students and professionals, by World Bank income group
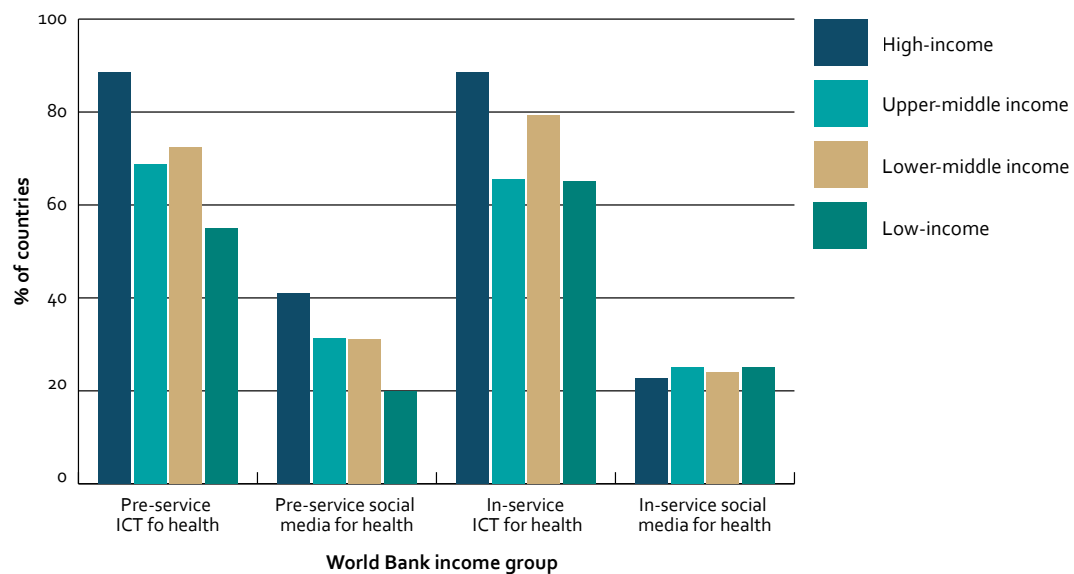
When the provision of in-service training on ICT and social media for health is examined by the seven types of professional groups, it is evident that medical, nursing/midwifery, and public health professionals were the groups with the best access to in-service training on ICT for health and social media for health (Fig. 1.6). Dentists and biomedical researchers had lower access to in-service eHealth training opportunities.

Fig. 1.6. The percentage of health professions receiving in-service training on ICT and social media for health
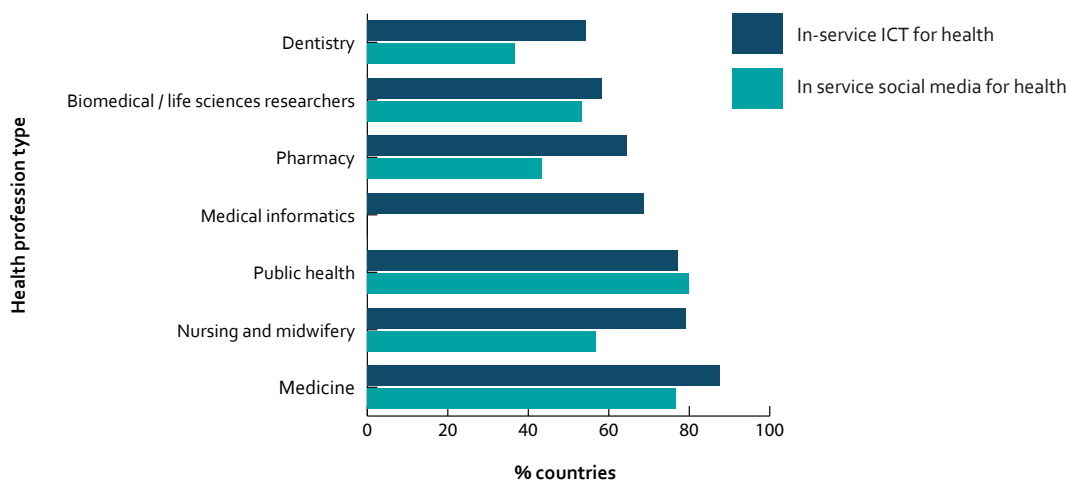
The finding that in-service training in the use of ICT for health is now being offered to support the continuing education of the doctors, nurses and midwives in over 75% of responding countries is encouraging. With its use becoming more widespread, including use by the nursing profession *(7)*, social media has proved useful in managing outbreaks e.g. Ebola *(8)*, and the need for training in its use by health professions is likely to grow. How social media can best be used to support UHC remains a major challenge and opportunity.

Discussion

The findings in this chapter reflect the encouraging upward trend in the adoption of eHealth. Since 2005 this trend has been accelerating and now there is 58% of countries with an eHealth strategy. Given the range of issues that an eHealth strategy has to address it is helpful that almost all of these strategies have special funding to support them. It is also encouraging that 75% of countries have institutions that offer pre-service training or continuing education training on ICT for health for health sciences professionals and 25% of countries offer in-service training on social media for health. Indeed, without a workforce comfortable with the use of ICT to support their work the potential benefits of eHealth will remain unrealized. Training in the use of social media to engage with citizens, and the provision of government-supported health internet sites that offer information in multiple languages in 50% of countries are indicators that the potential of ICT to help improve the health knowledge and behaviours of all citizens is beginning to be demonstrated. Given that the goal of UHC is "to ensure that all people obtain the health services they need without suffering financial hardship when paying for them" *(9)*, there is clearly an important role in the use of ICT-enabled media to convey these messages to everyone.

It remains an open question as to whether policies explicitly supporting multilingualism are really only found in 29% of countries. Similarly, it is not clear how best to interpret the significantly slower uptake in telehealth policies. And the nature of the relationship between countries with and without UHC and eHealth strategies needs further exploration. Though the levels of pre- and in-service

training in ICT for health are high, what is happening in the 25% of countries where they are not offered? It may also be helpful to track what proportion of the training that is offered is actually taken up, and how that varies between region and income group. Two high-level indexes have been proposed for UHC which require significant amounts of data to be captured, either by administrative systems or surveys *(10)*. At present, however, the use of ICT to improve data and real-time systems to underpin UHC is not referred to in the UHC policies of 27% of the countries responding to this survey. In addition, the data collection load on health workers to meet many different data requirements has been acknowledged but not sufficiently analysed *(11)*.

While the relationship between eHealth and UHC remains a key issue, so too is the relationship between UHC and the SDGs, where Goal 3 in part aims to "achieve UHC, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all" (Target 3.8) *(12)*. This presents "an opportunity to promote a comprehensive and coherent approach to health, beyond the control of specific diseases, to focus on how the health system delivers integrated, people-centred health services" *(13)*. How best to grasp the opportunity to work in a cross-sector way to monitor and manage the broader determinants of health remains to be explored. And making progress is challenging when "relatively few global health actors are involved in cross-sectoral advocacy. This issue area could become more important in the post-2015 era, with an increasingly interconnected global community and what are likely to be interdependent development goals that connect different fields" *(14)*. In addition to supporting the growing information needs of clinicians and management working within or from health facilities, as communities become better supported with ICT so eHealth can also help them. In doing so, it should explore how a people-centred health service can be supported by cross-sector work, and thereby lay the eHealth foundations for the future.

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Case study
eHealth foundations

Electronic immunization registries,
Latin America

Latin America is home to some of the oldest computerized immunization registers in the world. Since the late 1980s Uruguay's immunization records have been detailed in a register. Since then, many countries in Latin America have been working toward implementing electronic immunization registries (EIRs), an important component of foundational eHealth systems. The driver behind the development of these registries was to improve immunization data quality and facilitate better data availability at all levels of the immunization programme. At least 14 countries in Latin America have implemented or are in the process of implementing nationwide EIRs. Other countries have regional or provincial EIRs or use them for certain providers *(1)*.

Uruguay and Mexico were the first countries in Latin America to use computerized national immunization registries in 1987 and 1991 respectively. Panama followed in 2007. In 2013 Chile began transitioning to using an EIR at the national level. As of 2014 and 2015, Argentina, Brazil, Belize, Colombia, Costa Rica, Guatemala, Paraguay and Honduras were implementing or piloting national EIRs. The Dominican Republic is progressing EIR development. El Salvador is including vaccines doses administered at birth in its electronic birth records and Venezuela had begun the process with a platform to track yellow fever vaccinations *(2)*.

EIRs are computerized, population-based information systems that contain data on vaccine doses administered. EIRs are not to be confused with immunization information systems that are those generating information used to manage and monitor an immunization programme; EIRs can be part of or integrated with other immunization information systems. Benefits of an EIR include coverage monitoring by cohort or "dynamic denominator" instead of relying on annual goals. More precise monitoring may assist with vaccine and supply stock forecasting and management. It also allows for detailed analysis of unvaccinated or undervaccinated persons or groups to enable tailored vaccination strategies. EIRs can also facilitate timely vaccinations, individualized follow-up and can provide data by provider, vaccine, dose, age, geographical area or other identified target group, such as population at risk for a given vaccine-preventable disease.

An "ideal" EIR has been described as comprising:

- enrolment at birth
- an unique and unequivocal identifier or id
- information on vaccination provider, vaccine dose and date
- mechanisms for aggregating data at different geographical levels
- individualized follow-up of vaccination schedules to allow for automated recall/reminders
- data security and protection of patient confidentiality
- data entry as close to vaccination as possible (time and place) *(2)*.

Experiences from different settings suggest that improving the monitoring of immunization practices results in better coverage *(3)*. EIRs can improve coverage monitoring in terms of individual follow-up, timeliness and accuracy *(2)*. In recent years the rapid advancement of electronic health record (EHR) systems, the related adoption of standards and the increased availability of computers and internet access all contribute to shorten the lag time between vaccine administration and

data entry, which is a significant advantage of an electronic versus paper system. Data entry at the point of delivery can streamline the overall workflow. Essentially, EIRs provide opportunities for better understanding of coverage gaps, enable more targeted vaccination delivery, enhanced communication and improved advocacy strategies *(2)*.

Despite the success of the EIRs, most countries that use them still collect the vaccination data on paper. Maximizing the potential of the systems occurs when data are entered close to the delivery time and place of the service. For example, in Costa Rica, the EIR is available on computers in the facilities where nurses administer the vaccines *(2)*.

EIRs benefit four main groups: parents, health workers, public health officials and researchers. Some of the features of EIRs that make the systems in Latin America unique include the fact that the EIRs are mostly country-owned (and predominantly used in middle-income and lower-middle-income countries) and are very important to the respective ministries of health.

Uruguay has been able to move from monitoring childhood vaccination coverage based on an annual fixed target to the more precise method of coverage rates by birth cohort *(4)*. Nationwide EIRs can also facilitate the tracking of countries' transient or nomadic populations, making it easier to retrieve vaccination history, particularly in cases where the vaccination card (home-based record) has been misplaced or lost *(2)*.

Technology platforms for EIRs in Latin America range from proprietary software to open source. Many countries use a mix of both. Initially the EIRs were stand-alone applications used exclusively for immunization programmes. Currently EIRs are usually modules of larger health information systems (HIS), however, the EIRs are often the catalyst for such systems *(2)*.

mHealth initiatives related to immunization are being pilot tested too. Examples include using mHealth for mobile collection of immunization data and sending reminders via SMS. Mexico is working on vaccination SMS reminders as well as adding a near-field communication chip to the current paper-based national vaccination card, which is also supported by a mobile and web-based app.

The Improving Data Quality for Immunization Project in Latin America exists to help countries decide whether, when and how to introduce and/or expand EIRs. Workshops are regularly held on the topic and best practices identified from various countries include the following.

- Objectives and the scope of the EIR should be clearly established before development.
- Implementation of the EIR should be monitored in order to address problems as soon as possible.
- Data flow and processes should be clearly identified at the start of the project.
- An unique identifier should be used or created, as well as capturing the entire target population.
- EIRs need to be flexible enough to accommodate new vaccines, new schedules, etc.
- EIRs require investments in time and financial commitments during their entire life cycle *(2)*.

> *"Experience in the Americas has indicated that it is critical to have a complete picture of the final system from the beginning and keeping in mind that the data to be collected needs to fulfil specific actions including strategic decisions, operational decisions and managerial decisions. In order to facilitate the sharing of experiences, case studies may prove useful."*
>
> – Marcela Contreras, PAHO/WHO

The Strategy for Universal Access to Health and Universal Health Coverage includes strategies to reach vulnerable populations and thus reduce inequities in vaccination. In order to ensure equitable access to vaccines, it is essential to have adequate and timely information on the target population. Therefore, EIRs help to support strategies to systematize the analysis and use of immunization data, assess its quality, with a view to promoting timely vaccination and improving coverage in an equitable manner. These registries can be linked to mobile technologies in order to improve the efficiency of the registration processes and use of the information.

The Latin American Regional Immunization Action Plan for the 2016-2020 period recognizes the progress made in the elimination and control of vaccine-preventable diseases and that work must still be done so that access to vaccination helps bring health services to all through a comprehensive approach that considers the social determinants of health and universal coverage. It also recognizes EIRs as useful tools to achieve these goals.

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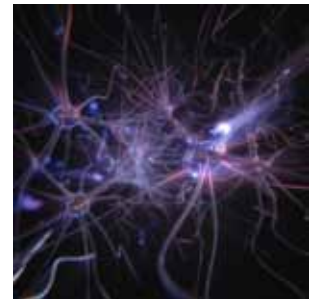
Key findings

- A vast majority (87%; n=109) of responding countries reported at least one mHealth programme in their country.

- A total of 80% of the responding low-income countries (n=16) reported at least one mHealth programme as compared with 91% of high-income countries (n=40).

- The number of programmes reported as being established (ongoing for at least two years and with funding for at least two more) has increased since 2010.

- Despite this rapid growth, only 14% (n=16) of countries reported an evaluation of a government-sponsored mHealth programmes.

Introduction

In the GOe 2015 survey, mHealth (also known as mobile health) was defined as the use of mobile devices – such as mobile phones, patient monitoring devices, personal digital assistants (PDAs) and wireless devices – for medical and public health practice. Examples of mHealth applications provided in the survey covered a broad spectrum from telephone helplines and text message appointment reminders, to mobile telehealth and mobile access to electronic patient information (the full list is shown in Table 2.1).

mHealth can contribute to achieving universal health coverage (UHC) through making services available to remote populations and underserved communities and providing mechanisms for data exchange on patients and services. It can be used to increase access to and provision of health services in areas where there is little infrastructure to support the internet (or other technologies) or traditional health services, but where mobile communications technology infrastructure has been prioritized. Supplying the technology for mobile communications is cheaper than providing in-person services. At the same time, mobile devices and technologies may be contributing to increasing quality of life through other initiatives such as finance, small business and agriculture.

The use of mobile devices has been increasing exponentially internationally – from 2.2 billion global mobile phone subscriptions (82 per 100 inhabitants) in 2005 to more than 7 billion (>120/100) by the end of 2015. The increase has been greatest in the developing world from 1.2 billion to over 5.5 billion mobile phone subscriptions or nearly 92 per 100 inhabitants in 2015. Active mobile broadband subscriptions have also been increasing rapidly to cover 86% of inhabitants in developed countries and 39% in the developing countries – surpassing global fixed broadband subscriptions in 2008 and fixed telephone lines in 2012, since which time fixed telephone subscriptions have been declining globally*(1)*. This rapid adoption of technology globally brings with it the opportunity for mHealth to have a different impact than traditional health services, and on a greater scale.

Many low- and middle-income countries have mobile phone subscription rates similar to those in high-income countries, alongside much lower access to traditional fixed telephone lines or "land lines". In some low- and middle-income countries subscriptions might not reflect actual user numbers where an individual phone may be used by a family or a village. These subscription rates reflect that access to basic mobile phone technology is quickly becoming ubiquitous, however, there are still barriers to accessing smartphones and the internet. These include the cost of different plans/functionality, lack of network infrastructure, digital literacy, lack of appropriate and relevant content and cultural or social acceptance (e.g. for women) *(2)*. Although, at least in the United States of America, those classified as low income or of low educational attainment are more likely to rely on their phone for internet access – that is, they have few other options for getting online other than a smartphone *(3)*. As the cost of smartphones and data plans continue to fall, it is becoming more likely that the developing world will leapfrog the technology development steps of the developed world, adopting mobile internet access (among other features) wholeheartedly. mHealth will, no doubt, follow.

Results and analysis

Types of mHealth programmes

In order to determine the breadth of mHealth programmes currently in place, respondents were asked to report on the presence of 14 types of mHealth programmes in their country, as described in Table 2.1. These cover a broad spectrum from relatively simple programmes, such as telephone helplines and text message reminders, to more complex and integrated programmes, such as access to electronic patient information and clinical decision support via mobile devices.

Table 2.1. Types of mHealth programmes included in the survey

Communication between individuals and health services	
Health call centres/ health care telephone helplines	Health care advice and triage provided by trained personnel and pre-recorded messages; accessible on mobile phones or fixed lines.
Emergency toll-free telephone services	Free telephone hotlines for health emergencies provided by trained personnel and pre-recorded messages and linked to response systems; accessible on mobile phones or fixed lines.
Communication between health services and individuals	
Treatment adherence	Reminder messages provided by health services to patients aimed at achieving medication adherence using mobile ICT[a]; messages can be text, voice or multimedia.
Reminder to attend appointments	Reminder messages provided by health services to patients to make or attend an appointment using mobile ICT; message can be text, voice or multimedia.
Community mobilization/health promotion campaigns	Health promotion campaigns conducted using mobile ICT to raise the awareness of target groups. Messages conveying information can be text, voice or multimedia.
Consultation between health care professionals	
Mobile telehealth	Consultation between health care practitioners or between practitioners and patients using mobile ICT.
Intersectoral communication in emergencies	
Emergency management systems	Response to and management of emergency and disaster situations using mobile ICT.
Heath monitoring and surveillance	
Health surveys	Data collection, management and reporting of health surveys using mobile ICT. May involve any combination of networked mobile devices.
Surveillance	Routine, emergency and targeted data collection, management, and reporting for public health surveillance using mobile ICT. May involve any combination of networked mobile devices.
Patient monitoring	Data capture and transmission for monitoring a variety of conditions in a range of settings using mobile ICT.
Access to information and education for health care professionals	
Access to information, resources, databases and tools	Access to health sciences literature, resources and databases using mobile ICT.
Clinical decision support systems	Access to decision support systems using mobile ICT.
Electronic patient information	Access to electronic patient information (such as EHR/EMR, laboratory results, X-rays, etc.) using mobile ICT.
mLearning	Access to online educational resources using mobile ICT.

a   Mobile ICT refers to mobile devices or hand-held computers such as mobile phones, laptops, tablets or PDAs, which can be used for text, voice or image communication, and can collect, process and report data.

According to Member State responses, emergency toll-free telephone services (75%) and health call centres (72%), both accessible by mobile or fixed-line phones, were the most commonly reported type of programme, followed by appointment reminders (69%) using mobile ICT (text, voice or multimedia) (see Table 2.2 and Fig. 2.1).

Table 2.2. Number and percentage of countries that reported employing an mHealth programme, by type

mHealth programme	No. responses	%
Toll-free emergency	94	75
Health call centres	90	72
Appointment reminders	86	69
Community mobilization	80	64
Information	79	63
Mobile telehealth	77	62
Emergency management systems	75	60
Patient records	72	58
mLearning	66	53
Patient monitoring	65	52
Health surveys	64	51
Treatment adherence	60	48
Surveillance	60	48
Decision support systems	60	48

All three of these most commonly implemented programmes may be seen as some of the most apparent and feasible uses of mHealth – extension of current services using a new mode of delivery. Toll-free emergency phone services and health call centres have been around for years in many developed countries. As mobile communications are widely deployed, people expect these and other government services to be available and accessible via mobile phones. These more common programmes are also using the most basic and ubiquitous mobile phone functions – voice and text messaging. The pervasiveness of these tools provides massive potential for extending existing services, although adding a mobile dimension is often rolled out without a full understanding of the implications on service delivery.

Text message appointment reminders have been shown to be effective in reducing non-attended appointments in many studies *(4)*. Also seen across many other industries, this programme has been spreading rapidly since the mid-2000s.

Fig. 2.1. Number and percentage of countries that reported employing an mHealth programme, by type
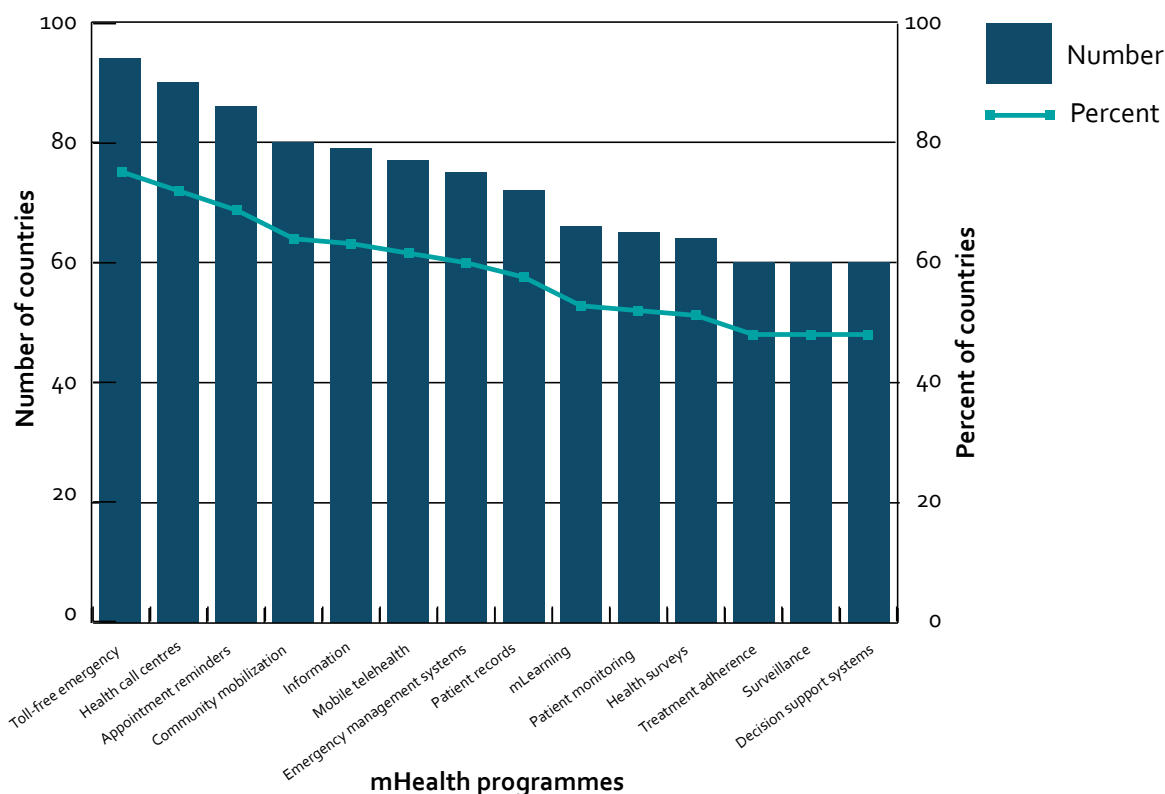
Fig. 2.1 shows that the next most common group of programmes include community mobilization/ health promotion campaigns, access to health information and databases, mobile telehealth consultations, emergency and disaster response and management, access to patient records, mLearning online education resources, data capture and transmission for patient monitoring, and data collection for health surveys. Anywhere from one half to two thirds of respondents reported the existence of these programmes in their countries.

Many of these types of programmes concern adding another channel for existing services to be delivered – a channel that is potentially transformative due to the ubiquitous nature of the technology. These would include health promotion campaigns, providing health information or learning/education resources and data collection for health surveys. The benefits of this are seen particularly where mobile communications technology has greater reach into priority populations than that of health services, the internet, and fixed telephone lines. Even in developed countries, people are discontinuing fixed phone and internet connections in favour of mobile ones *(5)*. In developing countries mobile communications technologies are leapfrogging several stages of technology development into remote areas that may never have infrastructure for sufficient fixed telephone lines or computers. The development of mobile communications emergency response programmes, for example, makes perfect sense in these contexts.

Just under half of the countries (48%; n=60) reported programmes for medication adherence reminder messages (using text, voice or multimedia), any sort of surveillance using mobile ICT, or access to clinical decision support systems using mobile ICT. Several studies have now proven the

effectiveness of mHealth adherence programmes to antiretroviral therapy in HIV across different settings in low- and middle-income countries *(6–8)*. In other areas governments may be waiting for greater evidence of their effectiveness or for practical solutions to implementation issues, such as secure access and integration with patient health records for clinical decision support programmes.

All categories of programmes showed increases since the previous GOe survey *(9)*. Among the countries responding to both surveys (n=84), there was tremendous growth in the proportion of countries reporting programmes geared toward providing health care professionals with mobile access to information at the point of care. The number of countries that reported programmes for access to health information increased by 39%, decision support systems increased by 29% and electronic patient records increased by 27%. Programmes for health monitoring and surveillance also increased by nearly 30%, which includes patient monitoring, health surveys and general surveillance (Table 2.3 and Fig. 2.2).

Table 2.3. Number and percentage of countries that reported an mHealth programme by type, 2010 and 2015

mHealth programme	2010		2015		Difference	
	No. responses	%	No. responses	%	No. responses	%
Communication between individuals and health services						
Toll-free emergency	48	57	67	80	19	23
Health call centres	52	62	66	79	14	17
Communication between health services and individuals						
Appointment reminders	41	49	64	76	23	27
Treatment adherence	33	39	44	52	11	13
Community mobilization	33	39	55	65	22	26
Awareness raising[a]	21	25	–	–	–	–
Consultation between health care professionals						
Mobile telehealth	45	54	59	70	14	17
Intersectoral communication in emergencies						
Emergency management systems	46	55	54	64	8	10
Health monitoring and surveillance						
Patient monitoring	27	32	51	61	24	29
Health surveys	23	27	46	55	23	27
Surveillance	21	25	45	54	24	29
Access to information for health care professionals at point-of-care						
Information	26	31	59	70	33	39
Electronic patient records	30	36	53	63	23	27
mLearning[b]	–	–	48	57	–	–
Decision support systems	18	21	42	50	24	29
Total countries	**84**		**84**			

a   raising awareness about health-related topics was only asked about in the 2010 survey, not in that from 2015.

b   mLearning was only asked about in the 2015 survey, not in that from 2010.

Fig. 2.2. Number of countries that reported an mHealth programme by type, 2010 and 2015, globally
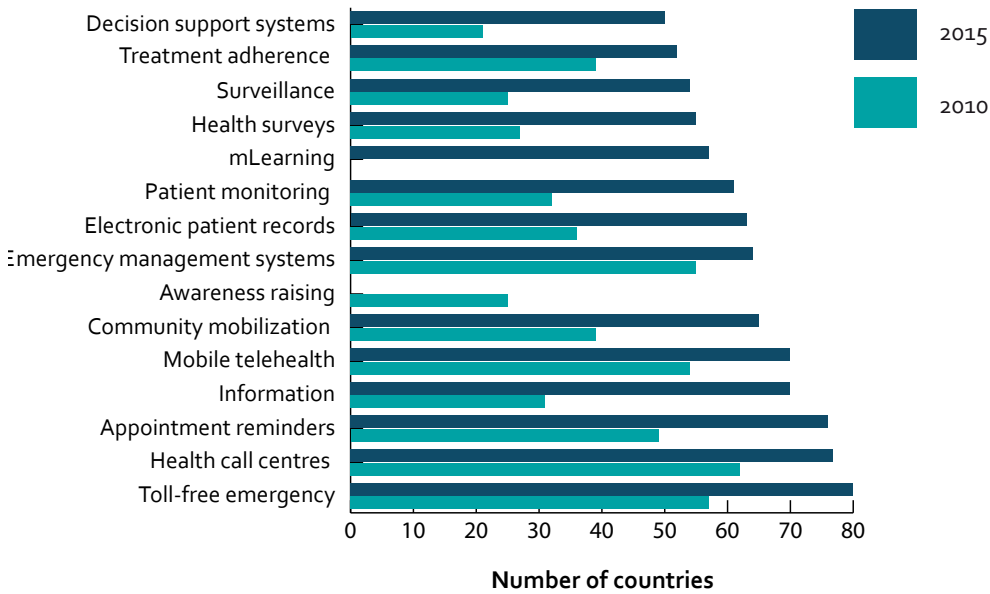
A more in-depth analysis of where the 14 common types of mHealth programmes are occurring by WHO region may help to identify leaders, enablers and future opportunities for growth. This analysis has been organized into three overarching categories based on the purpose of the programme:

1) Accessing/providing health services – health call centres; toll-free emergency calls; treatment adherence; appointment reminders; mobile telehealth; and emergencies.

2) Accessing/providing health information – community mobilization; access to info, resources, databases and tools; decision support systems; electronic patient information/records; and mLearning.

3) Collecting health information – health surveys; surveillance; and patient monitoring.

Countries reporting at least one type of mHealth programme for collecting health information (74%), accessing/providing health information (81%) or accessing/providing health services (87%) were examined by WHO region (Fig. 2.3). Across each of the three main programme categories, the Region of the Americas reported the highest percentage of countries with at least one mHealth programme in each category, whereas the South-East Asia Region reported the lowest percentage.

Fig. 2.3. Percentage of countries that reported at least one type of mHealth programme within the three main programme categories, by WHO region
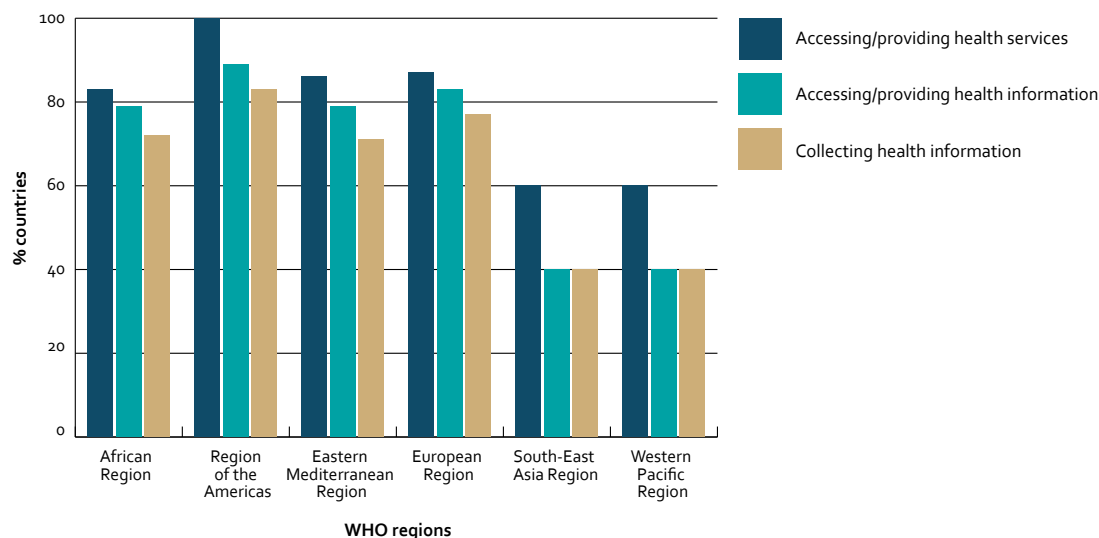
In Fig. 2.4, within the category of mHealth programmes for accessing/providing health services, toll-free emergency calls (dark blue bar) and health call centres (teal bar) were the most prevalent types of mHealth programmes globally as well as within each of the regions. The Western Pacific Region figures are high – 67% of countries with mobile telehealth, 50% with treatment adherence reminder systems, 75% with access to patient records, 42% with decision support systems, 58% with patient monitoring. Treatment adherence programmes appear to be the lowest across all regions (although vary from 20–29% in the South-East Asia[1] and Eastern Mediterranean Regions to 56% in the Region of the Americas). There is potentially a lot of opportunity for growth in adherence programmes, as there is considerable evidence showing improved health outcomes with mAdherence *(10)*.

While use of emergency programmes is relatively high worldwide, 40% of countries (50% within the Eastern Mediterranean Region) do not have emergency response and management programmes available that leverage mobile ICT. It may be important to enable and assist countries to learn from each other in establishing such programmes.

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1   Data from the South-East Asia Region should be viewed with caution due to the low number of responding countries.

Fig. 2.4. Percentage of countries reporting mHealth programmes for accessing/providing health services, by WHO region
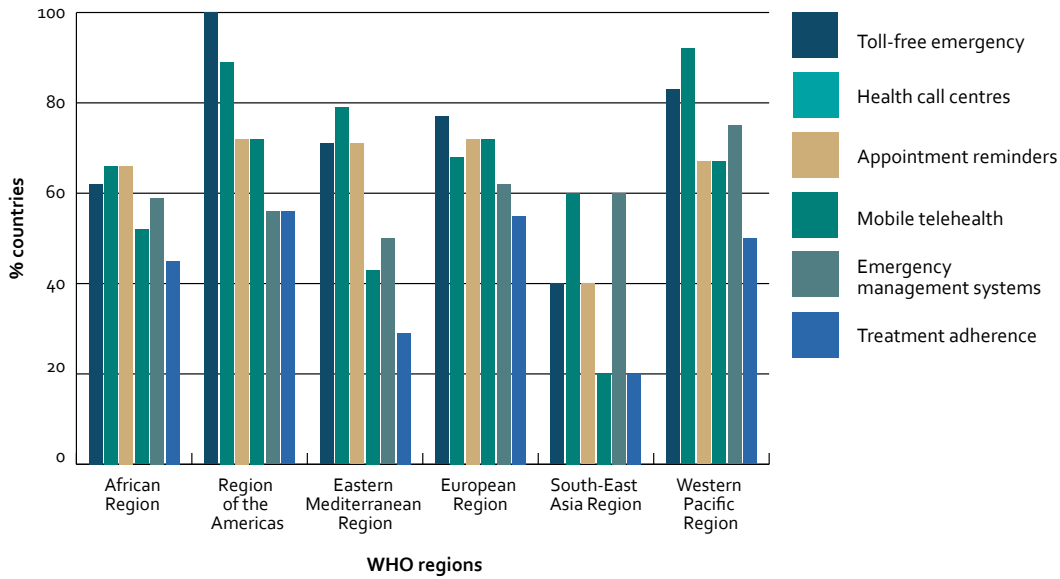
In terms of mHealth programmes for accessing and providing health information (Fig. 2.5), community mobilization/health promotion campaigns were commonly reported across four of the six WHO regions. The European and Western Pacific Regions appear to have the greatest proportion of countries with programmes enabling patient record access. Whereas access to information/resources/databases was most commonly reported within the Regions of the Americas and Europe, and decision support systems appear to be more prevalent in the Region of the Americas than elsewhere. This highlights the need for some regions to learn from others where programmes are more prevalent.

Fig. 2.5. Percentage of countries reporting mHealth programmes for accessing/providing health information, by WHO region
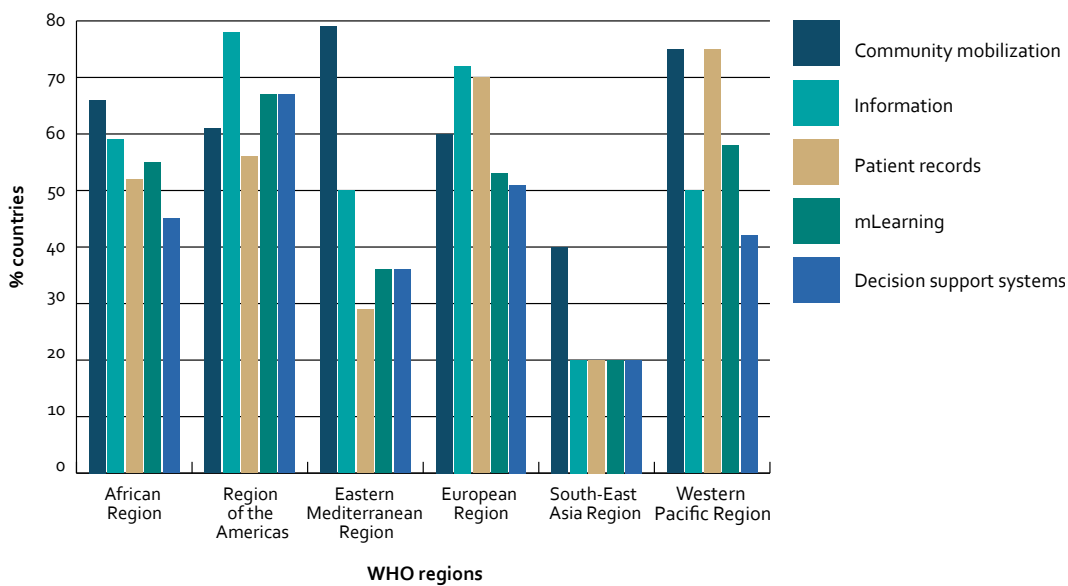
With respect to mHealth programmes for collecting health information (Fig. 2.6), the use of mobile technologies to conduct health surveys were reasonably similar across regions. Patient monitoring appears to be more common in the European Region, which may reflect a systematic focus on policy and research funding across Europe by the European Commission *(11)*.

Fig. 2.6. Percentage of countries reporting mHealth programmes for collecting health information, by WHO region
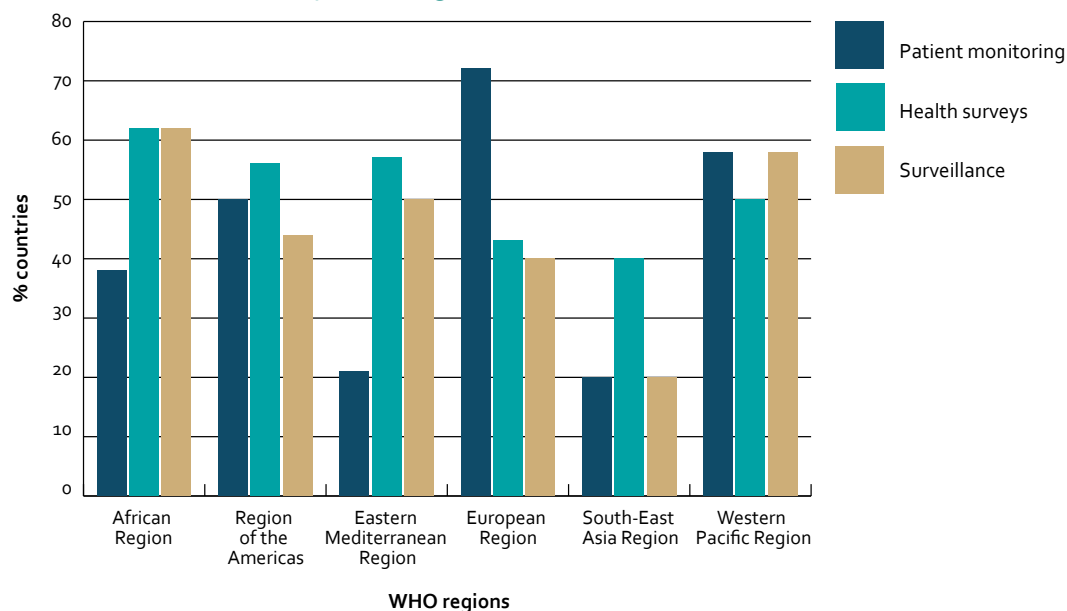
When examined by World Bank income group, high-income countries reported the largest percentage of countries with at least one mHealth programme in each of the three major categories, whereas the low-income group reported the lowest percentage of countries with at least one mHealth programme in each of the three categories (Table 2.4).

Table 2.4. Number and percentage of countries that reported at least one type of mHealth programme within the three main programme categories, by World Bank income group

mHealth programmes	World Bank income group				Total
	High	Upper-middle	Lower-middle	Low	
Accessing/providing health services	40 (91%)	28 (88%)	25 (86%)	16 (80%)	109 (87%)
Accessing/providing health information	38 (86%)	25 (78%)	23 (79%)	15 (75%)	101 (81%)
Collecting health information	35 (80%)	22(69%)	23 (76%)	13 (65%)	92 (74%)
Total countries	**44**	**32**	**29**	**20**	**125**

The proportion of low-income countries with at least one mHealth programme in each category is still reasonably high (from 65% collecting health information to 80% accessing or providing health services). Literature on the implementation of mHealth programmes in low-income countries continues to be scarce *(12–15)*. Implementation of mHealth programmes in low-income settings may face different challenges and require different solutions than in higher-income countries. It is

therefore important that the lessons learned in such settings can be shared with other low-income countries. For example, in small low-income nations the capacity to develop and maintain the technology required to implement mHealth programmes is often insufficient *(16)*; these countries therefore require assistance from other countries or multinational mobile network operators for implementation. The use of "please call me" messages have been used to address cost issues in Africa as they are free to send and can be sent from phones with no credit on them *(12)*.

One area that was not specifically asked about is mHealth interventions to support healthy behaviour change. Text messaging programmes to help people to stop smoking have been proven to be effective *(17)* and are being implemented on a large scale by governments, such as in India *(18)*.

Level of adoption of mHealth programmes

mHealth programmes may be adopted at a variety of levels from local to international. Generally smaller, local initiatives might be pilots for an eventual larger scale or national roll out. However this will not always be the case, as in some instances local administration of programmes may be the most appropriate. In this question, countries were asked to report the level of adoption of each type of mHealth programme as international (health entities in other countries in the world), regional (in countries in the same geographic region), national (across hospitals, laboratories, health centres, mainly public but also private), intermediate (covering district or provincial facilities) or local/peripheral (health posts or centres providing basic care). Table 2.5 displays how many countries reported having a programme in each category and the percentage of programmes operating at the national and local levels.

Table 2.5. Number of countries reporting each type of mHealth programme, and percentage of mHealth programmes by level of the health system[a]

mHealth programme	No. responses	National (%)	Local (%)
Health call centres	92	50	24
Toll-free emergency	90	60	14
Treatment adherence	85	19	43
Appointment reminders	78	36	36
Community mobilization	78	56	23
Mobile telehealth	75	29	30
Emergency management systems	73	63	13
Health surveys	71	50	24
Surveillance	65	52	17
Patient monitoring	64	26	42
Information	62	44	18
Decision support systems	59	37	32
Patient records	59	47	24
mLearning	58	39	29

a   Countries could report the programme operating at multiple levels of the health system.

The majority of mHealth programmes were reported to be operating at the national or local levels of the health system. Relatively few programmes operated at the international level. Issues with delivering programmes internationally cover the spectrum from technical issues due to different mobile network operator environments, boundaries of accountabilities of governments and different health service contexts. Some programmes sit comfortably at a national level, such as emergency response management and help lines, while others may be more transferable across borders and contexts such as health information, mLearning and possibly surveillance – which do not need to be replicated separately in each country.

The proportion of programmes at a national level is encouraging. Historically, the mHealth sector has been dominated by pilot projects and there were concerns expressed that scale was not achievable. Reasons included limited government ownership, multiple barriers around prioritizing funding, overall cost and acceptance by health authorities and populations.

Some programmes might be more suited to sitting within a health system or service, rather than at a broader level. For example, the majority of appointment reminders, patient monitoring and mobile telehealth programmes are reported as being at the intermediate or local levels. Most treatment adherence programmes are also reported as local or intermediate, however, where treatment guidelines are national such adherence programmes could also become national as the programme matures. To test this further, countries were also asked to report the level of adoption of their mHealth programmes according to whether they considered them to be established (ongoing for at least two years and with funding for at least two more), pilot (testing and evaluating in a given situation) or informal (early adoption in the absence of formal processes and policies).

Toll-free emergency (60%), health call centres (49%), information (42%) and emergency (42%) polled the highest among responding countries with established mHealth programmes. Treatment adherence (26%), appointment reminders (21%) and mobile telehealth (9%) polled the highest among countries with programmes in the pilot phase (Table 2.6, Fig. 2.7). Less than 20% of all programme types were categorized as informal.

Table 2.6. The percentage of mHealth programmes in the established, pilot or informal phase

mHealth programme	No. coun-tries (denomina-tor)[a]	Established		Pilot		Informal		Total	
		No. responses	%	No. responses	%	No. responses	%	No. responses	%
Toll-free emergency	123	74	60	10	8	7	6	91	74
Health call centres	120	59	49	19	16	10	8	88	73
Appointment reminders	122	37	30	25	21	19	16	81	66
Community mobilization	124	41	33	18	15	20	16	79	64
Emergency management systems	124	52	42	10	8	11	9	73	59
Mobile telehealth	121	27	22	23	19	21	17	71	59
Information	123	52	42	6	5	14	11	72	59
Patient records	117	34	29	19	16	9	8	62	53
Patient monitoring	123	24	20	21	17	18	15	63	51
mLearning	122	33	27	8	7	19	16	60	49
Health surveys	121	26	22	21	17	12	10	59	49
Treatment adherence	120	11	9	31	26	16	13	58	48
Decision support systems	124	27	22	15	12	17	14	59	48
Surveillance	124	31	25	14	11	13	11	58	47

a   A denominator less than 125 indicates where countries selecting multiple types of programmes were removed.

Fig. 2.7. Percentage of countries with each mHealth programme type by established, pilot or informal phase
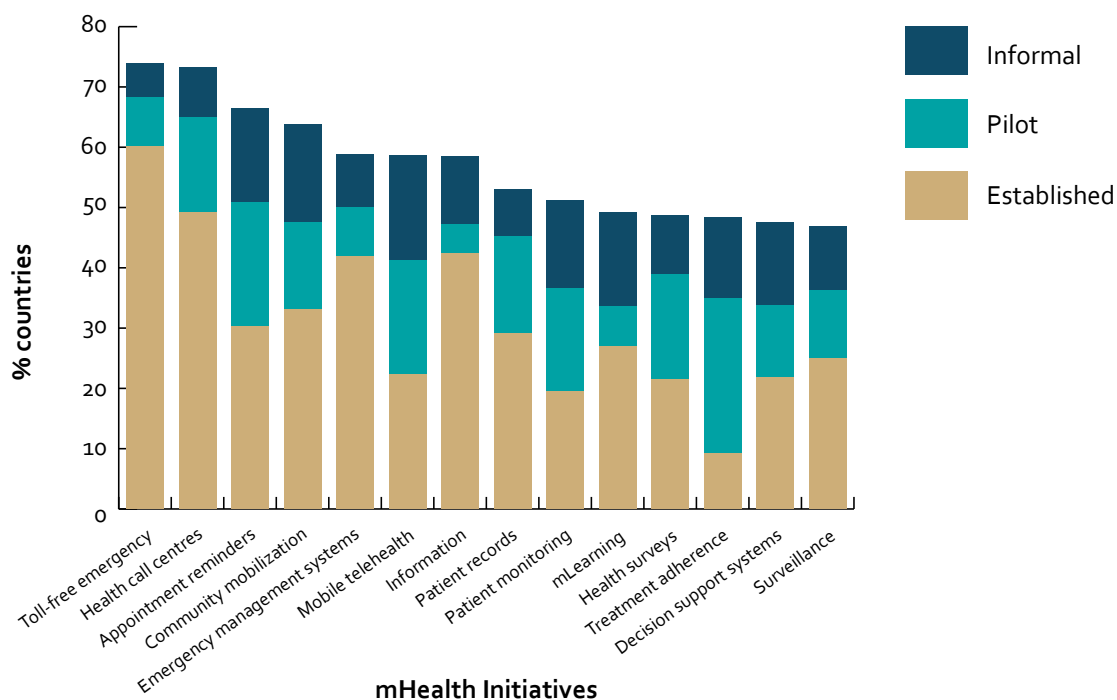
Since the 2010 GOe survey, countries have reported an increased proportion of programmes as established in every category except for treatment adherence. Pilot programmes also appear to have increased across the board. Certain mHealth programmes have matured since the previous GOe survey, particularly health call centres, toll-free emergency lines and emergency management systems were the most established types of mHealth programmes in the 2010 survey, which progressed notably in the 2015 survey (Fig. 2.8a). In Fig. 2.8b, the most notable increase in established programmes was for access to information for health care professionals; however health monitoring, surveys and surveillance programmes also appeared to have matured over time with a greater proportion of programmes classified as established.

Fig. 2.8a. Comparison of the maturity of mHealth programmes related to communication between individuals and health services, and during emergencies
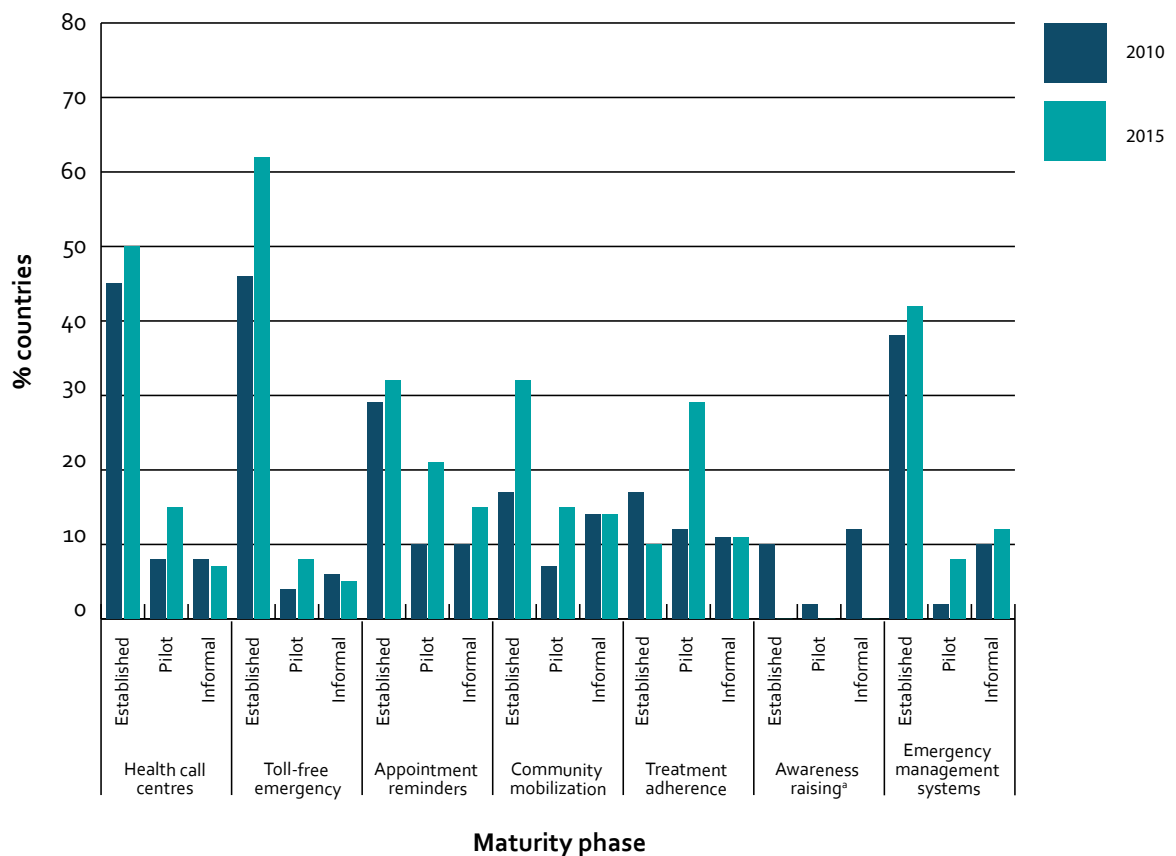
a Raising awareness about health-related topics was only asked about in the 2010 survey, and not in 2015.

Note: For some mHealth programmes, the number of countries that answered the phase maturity question may be smaller than the totals reported in Table 2.6 for one of two reasons: either countries reported they had a particular type of mHealth programme but did not answer the question about maturity phase, or countries selected multiple responses for established, pilot or informal. In both of these cases the response was excluded since the phase of the maturity could not be determined.

Fig. 2.8b. Comparison of the maturity of mHealth programmes related to health surveillance and monitoring, as well as access to information and education for health care professionals
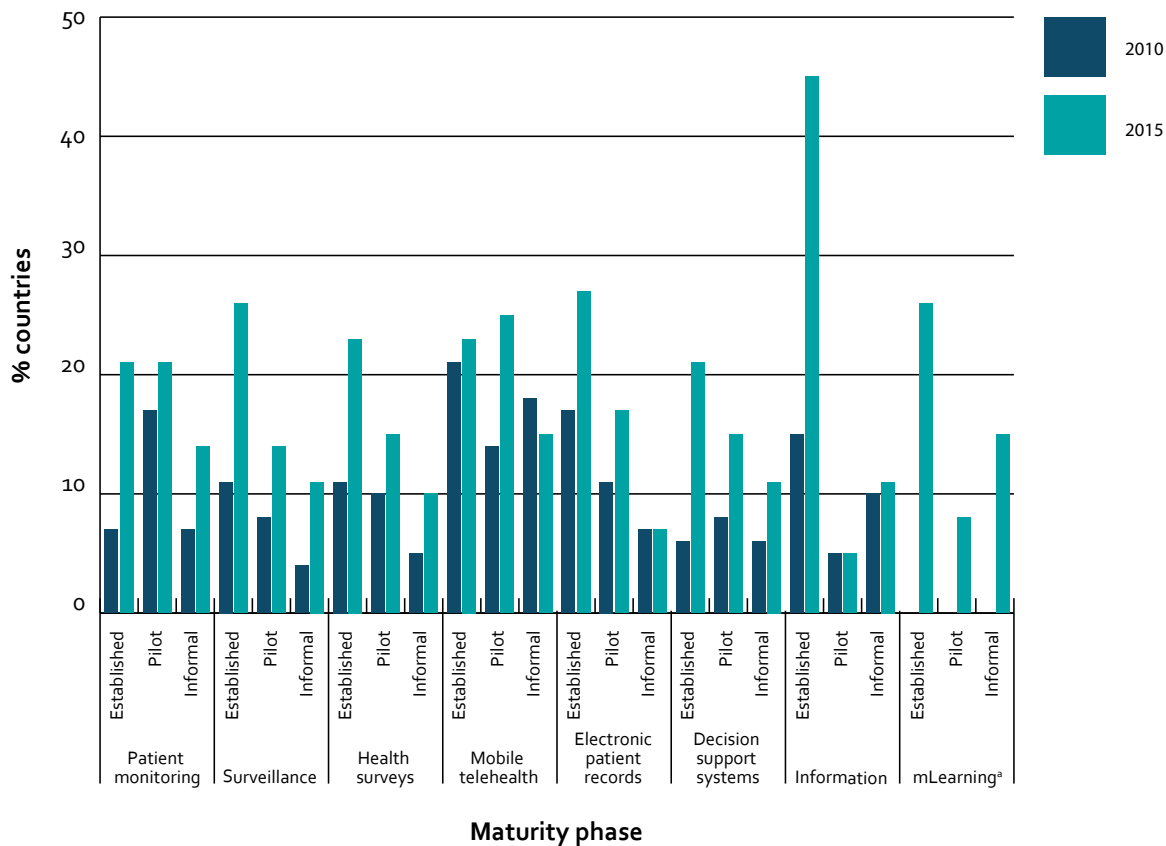
a mLearning was only asked about in the 2015 survey, and not in 2010.

Role of national health authorities in mHealth

mHealth work is increasingly being guided by eHealth, and sometimes specifically mHealth, policies. Many governments are recognizing their role and responsibility in governing this domain. Countries were asked whether they have government-sponsored mHealth programmes being implemented in their countries and 69 countries (57%) responded affirmatively. These 69 countries were then asked about the type of policies or strategies that guide their programmes (Table 2.7).

Table 2.7. The type of policy or strategy that guides mHealth programmes in countries where such programmes exist

Type of policy/strategy to guide mHealth programmes	No. responses	%
National eHealth policy or strategy	32	46
No specific guidance available	19	28
National telehealth policy or strategy	9	13
National mHealth policy or strategy	4	6
Don't know	1	1
Countries with government-sponsored mHealth programmes	65	
Non-responding	4	

Almost two thirds (65%) reported that national eHealth/telehealth/mHealth policies or strategies were used to guide these programmes. The previous 2010 GOe survey reported a preponderance of small pilot projects and few large-scale implementations (9). The development of national policies could be a step towards more strategic implementations of large-scale programmes. However, there were still 28% of countries that responded they had no specific national level guidance available for government-sponsored mHealth programmes.

Other roles for national health authorities were also explored. Promoting the development and adoption of mHealth in the health sector was the most commonly reported role for health authorities with respect to the development and adoption of mHealth (58%). Roughly half of countries reported that promoting standards and interoperability (52%), providing guidance for privacy and security (52%) and providing oversight and enforcement of data ownership (44%) were roles played by health authorities in country (Table 2.8). Regardless of the type of government, these would appear to be reasonable domains for authorities to have oversight or provide guidance (19). An example of the systematic consideration of these factors can be seen in the Nigerian programme Information Communication Technologies for Saving One Million Lives (ICT4SOML) (20).

Table 2.8. Role of national health authorities in the development and adoption of mHealth

Role of health authorities in development/adoption of mHealth	No. responses	%
Promoting the development/adoption of mHealth in health sector	72	58
Promoting standards and interoperability	65	52
Providing guidance for privacy and security	65	52
Providing oversight and enforcement of data ownership	55	44
Regulating mobile devices	38	30
No role	17	14
Don't know	3	2
Total countries	**125**	

Despite the marked increase in the availability of health-related mobile applications, only 25 countries (21%) reported having an entity responsible for regulatory oversight of mobile applications in terms of their quality, safety and reliability. This is likely leaving a gap in the provision of credible advice for citizens to help them select effective, evidence-based health applications that adhere to national guidelines. This has proved to be a particularly challenging task for both government and industry agencies that have attempted it, due to the scale, scope of evaluation and important security concerns (19,21,22). However, there are indications that governments are taking the development of health-related applications seriously, as 47 countries (39%) did report having an entity providing incentives and guidance for innovation, research and evaluation of health apps.

Evaluation of mHealth programmes

Only 14% of countries (n=16) reported an evaluation of a government-sponsored mHealth programme (Fig. 2.9). When examined by WHO region, the Eastern Mediterranean Region and South-East Asia Region had the highest percentages of countries having evaluated a government-sponsored health programme (Table 2.9a).

Fig. 2.9. Percentage of countries reporting evaluation of government-sponsored mHealth programmes, globally
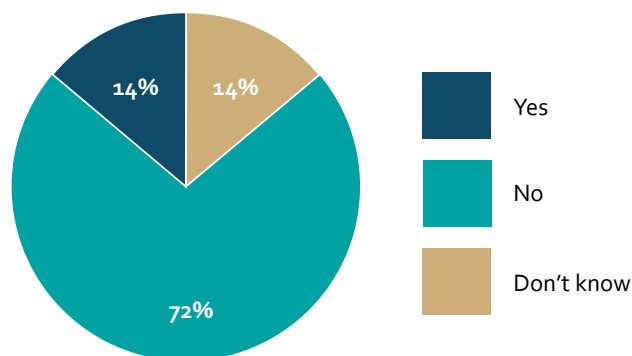
Table 2.9a. Number and percentage of countries reporting an evaluation of government-sponsored mHealth programmes, by WHO region

Response	Total		African		Americas		Eastern Mediter-ranean		European		South-East Asia		Western Pacific	
	No. responses	%	No. responses	%	No. responses	%	No. responses	%	No. responses	%	No. responses	%	No. responses	%
Yes	17	14	3	11	2	11	3	23	4	9	2	40	3	27
No	87	72	24	86	15	83	6	46	34	74	3	60	5	46
Don't know	17	14	1	4	1	6	4	31	8	17	0	0	3	27
Total	121		28		18		13		46		5		11	
Non-responding	4													

Responses to this question have not changed a great deal since the previous survey in 2010, where 12% of countries reported an evaluation. This is of great concern given the previous section showed that large numbers of programmes are moving to established programmes at scale, indicating that many could lack sufficient evidence of impact. Governments might require evaluations to provide them with confidence that their investment is providing value. More published evaluations would be useful to highlight issues in implementation that others can learn from in order to prevent making the same mistakes. When examined by World Bank income group, the high-income countries reported the highest percentage of countries (18%) conducting evaluations (Table 2.9b).

Table 2.9b. Number and percentage of countries reporting evaluation of government-sponsored mHealth programmes, by World Bank income group

Response	Total		High		Upper-middle		Lower-middle		Lower	
	No. responses	%	No. responses	%	No. responsess	%	No. responses	%	No. responses	%
Yes	17	14	8	18	3	10	3	11	3	15
No	87	72	31	70	20	67	21	78	15	75
Don't know	17	14	5	11	7	23	3	11	2	10
Total	121		44		30		27		20	
Non-responding	4									

Among the 16 countries that reported an evaluation of government-sponsored mHealth programmes, acceptance (from the perspective of both providers, 88%, and target groups, 81%) and access (75%) were the most commonly reported criteria of evaluation (Fig. 2.10). Quality (69%), cost-effectiveness (69% – provider perspective), health outcomes (69%) and sustainability (67%) were criteria also reported by roughly two thirds of respondents.

Fig. 2.10. Percentage of countries that reported criteria for evaluation of government-sponsored mHealth programmes
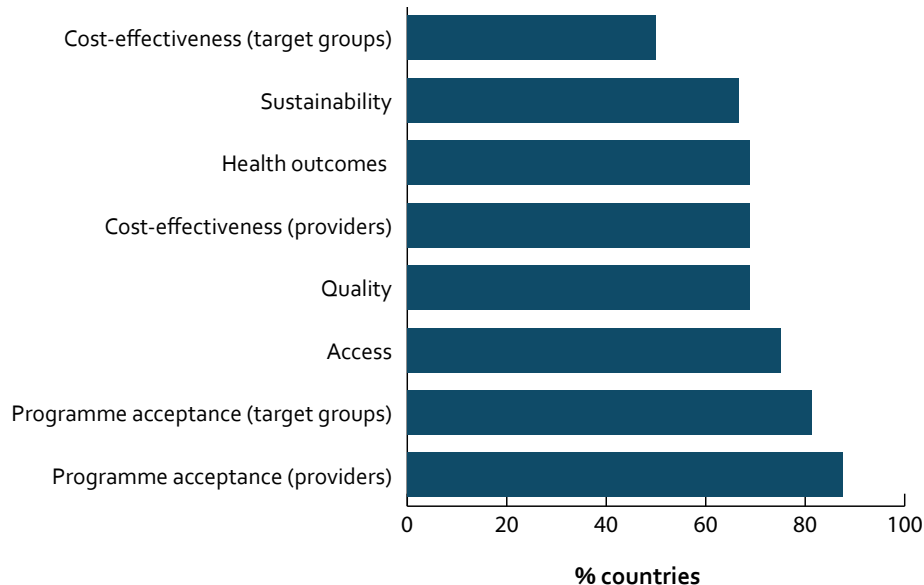
Note: Non-responding = 1 (17 countries reported an evaluation; only 16 filled in questions 49–56).

Barriers to implementing mHealth programmes

There are important barriers to implementing mHealth programmes, particularly for low- and middle-income countries. In this survey, countries were asked to rate common barriers to implementation of mHealth programmes by order of importance, particularly in respect to supporting UHC. Lack of funding (32%; n=37 countries) and lack of legal regulation covering

mHealth programmes (28%; n=32) were the top two barriers rated as extremely important. Policy (25%; n=29), demand (20%; n=23) and infrastructure (20%; n=23) were most frequently reported as not being barriers to programme implementation.

Fig. 2.11 shows the original five categories of answer choices collapsed into three categories, i.e. slightly/moderately were merged and very/extremely were merged. The majority (71%; n=82) of countries rated lack of funding as a very or extremely important barrier. Roughly half of countries considered lack of legislation or regulations covering mHealth programmes (51%; n=59), lack of prioritization (51%; n=59) and lack of evidence of cost-effectiveness (44%; n=51) of mHealth programmes as a very or extremely important barrier.

Fig. 2.11. Barriers to implementing mHealth programmes to support UHC, rated by level of importance (3 categories)
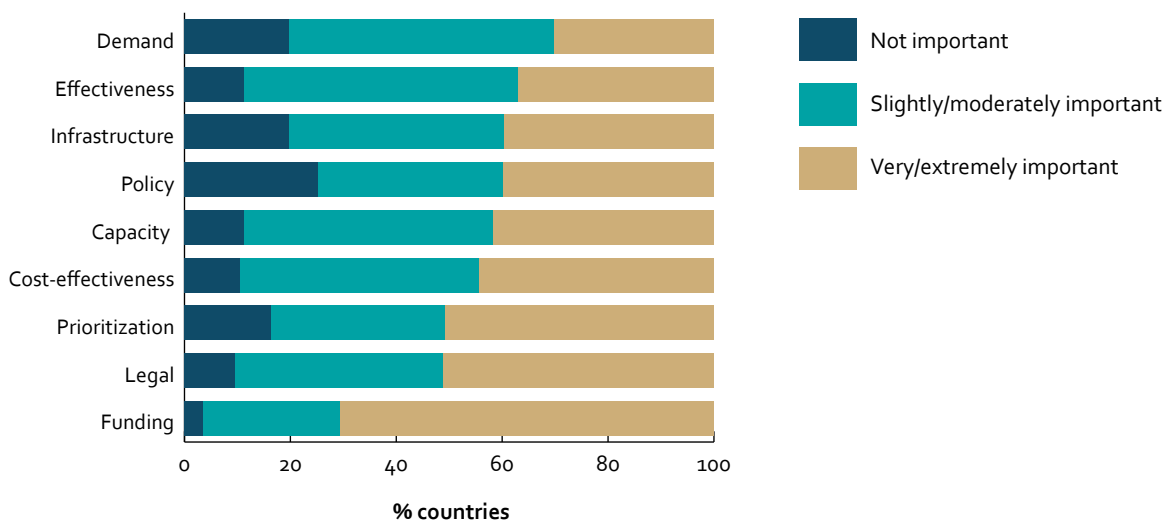
mHealth programmes can require substantial upfront investment in order to set up systems and processes, plus evaluation and ongoing operational costs. However many of the initiatives that are well suited to mHealth are those that will take some time to show net benefits or socioeconomic return for the government – often in the form of prevention, education and long-term condition management. Particularly in the developing world, mHealth can increase access to services that people would otherwise not have. While this will benefit society in the long term, it could contribute to increased costs in the short to medium term – due to service provision for populations that were not previously receiving them. Issues around funding, prioritizing mHealth programmes over other health services, and lack of evidence of cost-effectiveness, are therefore all important barriers that may be difficult to address in resource-constrained environments. The implementation and ongoing support for mHealth programmes can sometimes require extra health workers or integration into other eHealth programmes, potentially raising other barriers as well.

Regulations on mobile communications vary across regions. For example, some countries allow spam advertising to mobile phones. This in itself may interfere with the ability of mHealth programmes using similar channels to have an impact. Security regulations around mobile communications technology may also impede the development of mHealth programmes that wish to share or access

personal health information. The requirements for smartphone apps to have privacy policies and what is acceptable in those privacy policies may also vary from country to country. Differences between countries will have an impact on the international scalability of mHealth programmes.

It is recognized that other barriers facing countries may not have been captured here, depending on how they were interpreted by the respondents. These could include digital literacy of the population and sociocultural aspects in the use of mobile phones.

Discussion

Where previous GOe reports have described a dominance of small pilot programmes in mHealth, it is promising that a large proportion of countries in this survey report having government-sponsored programmes that are guided by national strategies, are scaled to national delivery and have been established for at least two years (with funding for a further two years). These appear to be widespread, with all WHO regions of the globe reporting mHealth programmes. There is also reasonably high uptake of at least one mHealth programme in low-income countries. It should be noted that this survey only asked about government programmes and may not include others developed by nongovernmental organizations (NGOs), industry, start-ups and application developers.

It is exciting to see this level of activity in low-income countries, since ICT are often less expensive and more ubiquitous in remote parts of the developing world than many other forms of technology or health service infrastructure. Increasing universal access to health services that populations may otherwise miss out on must be one of the greatest potential benefits of mHealth, and developed countries are just as likely to learn from developing countries as vice versa *(23)*.

The findings of this report reveal a lot of activity in the area of mHealth across the globe, beyond what is published via journals and other similar sources. While this is encouraging, it leaves an open question around the level of evidence of effectiveness driving these developments. Similarly, while barriers may exist across countries, solutions may vary widely depending on the context, and all can learn from innovative approaches that may be adapted to their own environment. Sharing information is the first step. And this should be encouraged.

It should be also noted that this survey did not seek to determine the quality of mHealth programmes, which due to methodological constraints, was never the intention. Concerns have been raised about the accuracy, reliability and effectiveness of smartphone applications in particular *(24–26)*. For the sake of international consistency in these important areas, it could be interesting to look in more detail at the different national approaches to mHealth guidelines and related regulations. Perhaps in future, as more established programmes are evaluated, respondents to this survey could also provide information on user acceptance and adoption of programmes.

Governments need to ensure their sponsored or guided programmes are evaluated in some form and publicly disseminated. Funding bodies should also play a part by making evaluation an integral part of the programme cycle. Only by building on what others have done, and learning from successes

and failures in fields and contexts possibly outside our experience, will society speed up the roll out of successfully implemented programmes globally. These evaluations should report on the benefits that are important to governments and funders – there is no need to continue to start from scratch or to require a randomized controlled trial with every new implementation or environment.

In summary, there has never been such rapid uptake of any technology as the global spread of mobile communications technology, which has disrupted many established norms. This presents a huge opportunity for this burgeoning field as it grows to shape, and be shaped by, important current and emerging global health issues. As shown in the findings of this survey, governments and national agencies can play an important part in governing, stimulating and regulating the spread of mHealth programmes. Particular areas of focus for the near future could include the following points.

- International mHealth efforts would benefit from countries/governments actively evaluating the process of implementation and programme outcomes. Public dissemination of lessons learned and benefits gained from implementing mHealth programmes would be particularly useful as other countries seek to develop and launch similar programmes.

- Given the large potential value of countries learning from each other, it may be useful to develop regional and global networks to facilitate the sharing of mHealth knowledge.

- It may also be useful for international efforts to focus on determining the best areas for government interventions and regulations in order to assist mHealth adoption and promote local innovation.

- Researchers, health authorities and global organizations should be promoting indicators of increased access for priority populations (e.g. marginalized) to be assessed in all mHealth programmes.

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Case study
mHealth

mSehat, Uttar Pradesh, India

mSehat[1] is an integrated, Android and web-based, multimedia-enabled mobile health platform for frontline health workers, which includes accredited social health activists (ASHAs), Anganwadi workers (AWWs) auxiliary nurse midwives (ANMs) and health programme managers. mSehat was named after the Hindi word for health, "sehat", and assists these workers via an integrated service-delivery platform accessible via smartphones, tablets and web-based dashboard reporting.

Since October 2015 mSehat has been implemented in five districts of Uttar Pradesh (Bareilly, Faizabad, Kannauj, Mirzapur and Sitapur), chosen because they were among the 25 identified high-priority districts in the state. There are approximately 12 000 ASHAs and ANMs within the five districts, serving a predominantly rural population of 12.5 million. The goal of the programme is to accelerate the reduction of maternal, neonatal, child mortality and total fertility rate in Uttar Pradesh. To that end smartphones and tablets were provided to 12 000 workers in the five districts. The content of the mSehat app is visual, including voice and text messages in local languages, which is intuitive to use.

Uttar Pradesh, the fourth largest state in India with a population of approximately 200 million, has 75 districts, 820 blocks and 107 776 villages. The infant mortality rate and maternal mortality rate are among the highest in the country, well above the national average and remain much higher than the target set as part of the MDGs. Uttar Pradesh alone accounts for 9% of the neonatal and 5% of maternal deaths globally.

Uttar Pradesh has a large number of frontline health workers. There are 30 000 ANMs and 150 000 ASHAs (women mostly educated to the 8–10 grade level) who are a critical interface between the community and the public health system. These workers help improve the reach and utilization of reproductive, maternal, neonatal, child and adolescent health services in the state.

There is growing evidence that community-based approaches to pregnancy and child tracking, particularly those focusing on antenatal care and immunizations via antenatal and postnatal home visits have a positive impact on maternal and neonatal outcomes. For example, in December 2009 the Indian Ministry of Health and Family Welfare launched an e-governance initiative called Mother and Child Tracking System (MCTS). MCTS allows name-based tracking of beneficiaries from pregnancy until the child turns five. It was rolled out across Uttar Pradesh to provide frontline health workers, health programme managers and policy-makers with timely data for programme monitoring and planning.

However, there were a number of gaps that needed to be addressed to realize the full potential of the MCTS system, including:

- lack of an efficient data entry system resulting in a duplication of efforts to collect and record data;
- suboptimal pace of data entry;
- burdensome level of data collection, such as multiple paper-based records (registers weighing in access of 1kg).

These gaps led to delays in updating data, which made workplans incomplete and prevented accurate monitoring and decision-making.

1   http://www.msehat.in

Meanwhile the demands on frontline health workers was increasing: while workers were provided with some job-aids, the lack of refresher training, field supervision and support led to challenges keeping skills updated, completing reports and planning work effectively. In addition, ASHAs lacked access to a health care information repository, standardized tools for counselling and other job-aids to effectively complete their work. They also faced difficulties in getting incentives due to delays in payment and a lack of clarity and transparency in the payment process, which affected their morale.

Many mHealth pilot projects in the state have illustrated that mobile phone-based applications improved the performance of frontline health workers through automated management of beneficiaries, use of audio-visual self-learning and counselling tools. They also considerably reduced the need to complete complex forms. For these reasons the Government of Uttar Pradesh decided to embed technology into the workflow of frontline health workers by implementing mSehat – currently the largest mHealth implementation in the world in terms of population served – under a public-private partnership model.

However, there was no precedent or prior programme information to leverage, either locally or internationally, as no programmes have previously worked with such large volumes of government data or catered to as many users. One of the staff members involved in mSehat reported that the real challenge was implementing it in the "heat and dust" of India.

mSehat uses a mobile platform to:

- provide on-demand training and information to frontline health workers using multimedia enabled content;
- provide a multimedia job-aid to frontline health workers for registration, tracking, counselling, reporting, screening and referral;
- facilitate monitoring of demand, supply and consumption of medicine stocks;
- create an incentive monitoring system for ASHAs, so they can be rewarded for their work;
- strengthen MCTS through real-time updating of workplans, and service delivery information.

The mSehat app replicates the physical registers the frontline workers are required to carry. The register has not been completely removed as yet, but there has already been a large increase in the amount of data coming from the field. Literacy levels do not seem to be a barrier when using technology to enter the data as the fields are intuitive and make sense to the user.

Owning a mobile phone is a status symbol in India, so there has been a real sense of empowerment among the workers and their families. There have been some challenges, such as dealing with cases of theft of the phones and tablets and only having electricity for 10 hours per day on average. To overcome this the vendor agreed to replace lost or stolen devices within 15 days, and service centres were set-up in each district.

"There was a time when we used to give tablets (medicines) to help people and now the time has come when we are given tablets (mobile devices) and they are helping us all."

– Phoolan Kushwaha, ANM of 25 years

The main benefits for ASHAs include their ability to better counsel, persuade and manage beneficiaries using vernacular, multimedia enabled, intelligent (uses individual service delivery data to guide health information delivery) job-aids. For ANMs it is their ability to produce automated service delivery reports and reminders. Block programme managers find the most benefit in their ability to track high-risk pregnant women and newborns, and health worker performance using the real-time dashboard. And of course, the beneficiaries have responded they appreciate receiving services alerts and health information as SMS and voice calls in their local language, which has meant improved health indicators of mothers, babies and families.

Not all components of the programme have been implemented at this stage. Early analysis, however, shows promising results (as shown in the table below).

mSehat enrolment (Oct 15–Apr 16)	Annual target population	Population served (%)
ASHAs using mSehat	10 250	9 951 (97%)
ANMs using mSehat	1 700	1 540 (91%)
Eligible couples	21 23 300	17 69 493 (83%)
Pregnant women	279 773	125 163 (45%)
Children (0–5 years)	1 623 700	431 190 (27%)
Adolescents (10–19 years)	2 410 570	2 547 950 (105%)
Total population	12.49 million	11.15 million (89%)

Source: mSehat and mobile device management server, accessed 16 April 2016.

Based on the findings and evaluation of the current pilot project in the five districts (which will be conducted after the programme finishes in 2018), mSehat has the potential to be scaled up to the other seventy districts in Uttar Pradesh.

3. Telehealth

Key findings:

- More than half of responding Member States (57%; n=70) said that there was a specific national telehealth policy in their country or that there was a reference to telehealth within their national eHealth policy.

- Approximately three quarters of responding countries having a teleradiology programme, and roughly half reported a telepathology programme, a remote patient monitoring programme and a teledermatology programme; about one third of responding countries reported a telepsychiatry programme; these values are all higher than in the 2010 survey.

- Most of the telehealth programmes were operated at national level or below, i.e. relatively few were being operated internationally; 60% of the teleradiology programmes were said to be established (again a higher figure than in 2010), while other programmes were said to be mainly at the pilot or informal stage.

- Almost one quarter of responding countries reported that there had been an evaluation of a government-sponsored telehealth programme in their country; the most common criteria used in the countries in which an evaluation had been performed (22 out of 29) were programme acceptance (to service providers and clients), quality, access and cost-effectiveness.

- The main barriers to the implementation of telehealth were said to be a lack of funding to develop and support telehealth programmes, a lack of infrastructure (equipment and/or connectivity), competing health system priorities and a lack of legislation or regulations covering telehealth programmes.

Introduction

Telehealth – the practice of medicine at a distance – has a long history, but it was the arrival of digital communications and low-cost computers in the late 1980s that made it more feasible to expand and become more mainstream *(1)*. Since then there has been a lot of experimentation, which has encompassed most areas of medicine. Unfortunately, only relatively few pilot projects are ever adopted into routine service.

Telehealth involves an interaction between a health care provider and a patient when the two are separated by distance. That interaction may take place in real time (synchronously), for example by telephone or by use of a video link. But it may also take place asynchronously (store-and-forward), when a query is submitted and an answer provided later; (secure) email is an example of this technique.

There is reasonable evidence that telehealth is practical (i.e. it is feasible and acceptable to users, including health care providers) and is cost-effective in some areas of clinical use, such as teleradiology, teledermatology and telepsychiatry *(2)*. On the whole, asynchronous telehealth is easier to organize and requires less-costly infrastructure than synchronous telehealth (e.g. real-time video).

The primary benefit of telehealth is that it improves access to health care, i.e. it increases the speed of access and/or reduces the cost. There may also be other benefits, such as increased uniformity of practice (higher quality of care) and better support for rural health workers. More rapid access to appropriate specialist expertise or the avoidance of travel on the part of the patient or health care provider are often major benefits in the delivery of health care to rural populations, although telehealth also has a place in urban areas *(3)*. In a low-resource setting, telehealth is likely to be particularly valuable for allowing the possibility of equitable access to health care, i.e. no matter where the patient is located, the same access can be given to health care providers. Telehealth can therefore be a key component of providing universal health coverage (UHC). As has been observed before, the developing world contains far more people, with relatively fewer health care resources, and should represent an environment that is ripe for improvement by telehealth *(4)*.

There have been relatively few attempts to obtain information about the use of telehealth at a national level. Even less is known about the use of telehealth globally. The WHO surveys of 2005, 2010 and 2015 therefore represent a unique and valuable resource *(5,6)*.

Telehealth is known by a number of synonyms, including telemedicine. In the present survey, telehealth was defined as

> the delivery of health care services, where patients and providers are separated by distance. Telehealth uses ICT for the exchange of information for the diagnosis and treatment of diseases and injuries, research and evaluation, and for the continuing education of health professionals. Telehealth can contribute to achieving universal health coverage by improving access for patients to quality, cost-effective, health services wherever they may be. It is particularly valuable for those in remote areas, vulnerable groups and ageing populations.

The survey contained questions about a national telehealth policy or strategy, requests for details of any national telehealth programmes and their evaluation, and questions about barriers to telehealth. In accordance with good practice, the main terms referred to in the survey were defined on the questionnaire to minimize the possibility of misunderstanding by the responder *(7)*.

Results and analysis

A total of 122 responses were received to the question about whether the country had a dedicated national telehealth policy or strategy. This represents 98% of the participants in the survey. However, there was no information from the 72 countries which did not participate in the survey so the analysis below assumes that the survey responses, which were from approximately two thirds of Member States, were representative of the whole.

National telehealth policies

There has been a substantial increase in the numbers of countries with policies and strategies that refer to telehealth. Approximately one quarter of the responding countries said that there was an explicit national telehealth policy or strategy in their country (Table 3.1). Conversely, 42% of responding countries said that there was no national telehealth policy and there was no reference to telehealth within their national eHealth policy. Thus in more than half of the countries (57%), telehealth was identified at a national policy level, something that is likely to be useful in promoting its adoption (8,9).

Table 3.1. Number and percentage of countries with a dedicated national telehealth policy or strategy

Response	No. responses	%
Yes	27	22
No – but telehealth is referred to in the national eHealth policy or strategy	43	35
No	51	42
Don't know	1	1
Total	122	
Non-responding	3	

The survey also asked whether the policy or strategy included objectives that addressed how telehealth could contribute to UHC (such as by making a second medical opinion available, or improving access to cost-effective health care). Among countries with either national telehealth policies or strategies, or eHealth policies that mentioned telehealth, the majority (n=51; 73%) included objectives related to how telehealth can contribute to UHC.

Types of telehealth

The survey requested information about five specific telehealth disciplines, and provided the following definitions.

- Teleradiology is a field of telehealth using ICT to transmit digital radiological images for diagnosis or consultation.
- Teledermatology is a field of telehealth using ICT to transmit medical information concerning skin conditions for the purpose of diagnosis or consultation.
- Telepathology is a field of telehealth using ICT to transmit digitized pathological results, such as microscopic images of cells, for the purpose of diagnosis or consultation.
- Telepsychiatry is a field of telehealth using ICT to provide mental health services.
- Remote patient monitoring is an increasingly important field of telehealth where patients, often at home, transmit information about their condition from sensors and monitoring equipment to external monitoring centres.

From these five types of telehealth, the 125 responding countries reported a total of 375 telehealth programmes. On average, each country reported 3.7 telehealth programmes of the five mentioned above. There was some variation between WHO regions, with the European Region reporting relatively more and the African Region reporting relatively less telehealth, Fig. 3.1.

Fig. 3.1.   Number of telehealth programmes reported in each WHO region[a]
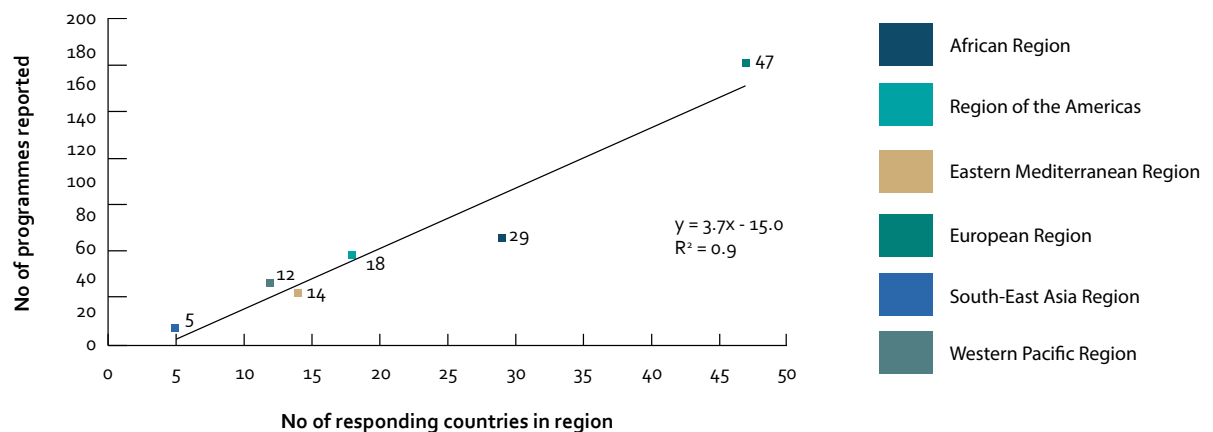
a The solid line is the linear regression.

Numbers of telehealth programmes

Approximately three quarters of responding countries reported having a teleradiology programme in their country (Table 3.2). Roughly half reported a telepathology programme, a remote patient monitoring programme and a teledermatology programme; about one third reported a telepsychiatry programme in their country (Table 3.2).

Table 3.2. Number of countries that reported a telehealth programme

Telehealth programme	No. responses	%
Teleradiology	96	77
Telepathology	65	52
Remote patient monitoring	59	47
Teledermatology	57	46
Telepsychiatry	43	34
Other type of telehealth initiative	55	44
Total no. countries	125	

The frequency of reporting of teleradiology programmes in the present survey is consistent with the view that teleradiology represents the most widely-diffused technique in telehealth. Teleradiology is so widely used in fact that it is nowadays regarded as a component of normal working practice in radiology. In a recent survey of radiologists in Europe – from a total of 44 mainly European countries – two thirds of responding countries reported that teleradiology was in use by their organization (10). It was being used both for "insourcing" (transferring images between sites to enable the radiologist to work offsite or report images from remote locations, with employment arrangements unaffected and radiologists being paid by one of the institutions involved) and "outsourcing" (where reporting of images was outsourced to teleradiology companies, which employed the radiologists separately) (10).

Note that the survey data cannot reveal information about activity (numbers of teleradiology cases) or anything more than general information about numbers of teleradiology programmes (because the data are right censored[1]). With respect to teleradiology, for example, country A with a single programme and country B with 10 programmes would both produce the same survey response. What can be concluded from the data, however, is that most countries have at least one telehealth programme in each of the five disciplines listed.

Comparison with previous survey

There were 84 countries which participated in both the present survey and in its predecessor in 2010. The number of countries reporting telehealth programmes increased for all five disciplines (Fig. 3.2). In teleradiology, for example, 56% of countries reported a teleradiology programme in 2010; this increased to 83% in the 2015 survey. This parallels the reported growth of teleradiology in Japan, for example, where the number of hospitals using teleradiology increased by 70% in six years *(3)*.

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1   That is, data points which are above a certain value but it is unknown by how much.

Fig. 3.2. Number of countries reporting a telehealth programme in the 2010 and 2015 surveys[a]
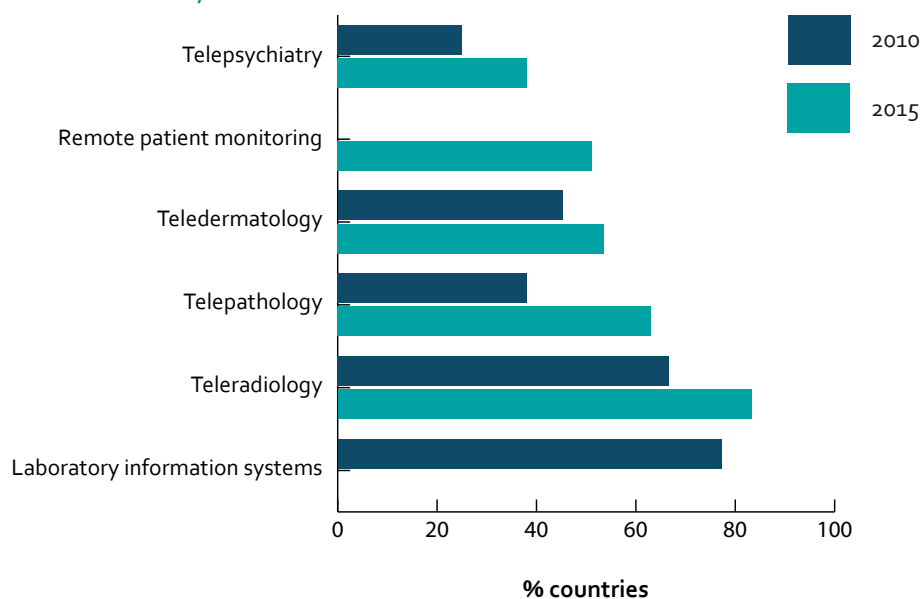
% countries

a   Note: There was no question about remote patient monitoring in the 2010 survey.

The survey data relate to the presence of at least one of the five types of telehealth in the countries which responded. More countries in the second survey reported at least one type of telehealth. However, the actual number of telehealth programmes in each country is not known, which makes the comparison between surveys difficult. For example, a change from five pilot programmes in a country to a single national programme would be reported in exactly the same way in the two surveys; but this should not be interpreted as static growth, nor indeed a failure in the adoption of telehealth.

In comparison with the previous survey, the proportion of countries with at least one telehealth programme in each discipline has increased. This suggests, though does not prove, that diffusion is occurring, i.e. that more telehealth programmes are being implemented (because the answer that "my country has at least one programme in teleradiology" does not reveal whether there are more teleradiology programmes than in the previous survey). Nonetheless, the results from the present survey strongly suggest that more countries are implementing more kinds of telehealth programmes.

Regional differences in telehealth

Overall, teleradiology was reported most often and telepsychiatry least often in the survey. There was some regional variation in this. For example, teleradiology (widely regarded as the most mature form of telehealth around the world) was reported most often in the Region of the Americas and least often in the South-East Asia Region[2] (see Fig. 3.3).

2   Note that the South-East Asia Region contains the fewest countries of all the WHO regions, which means there will be larger uncertainties in the responses from this region.

Fig. 3.3. Countries reporting telehealth initiatives[a]

Fig. 3.3. Countries reporting telehealth initiatives[a]
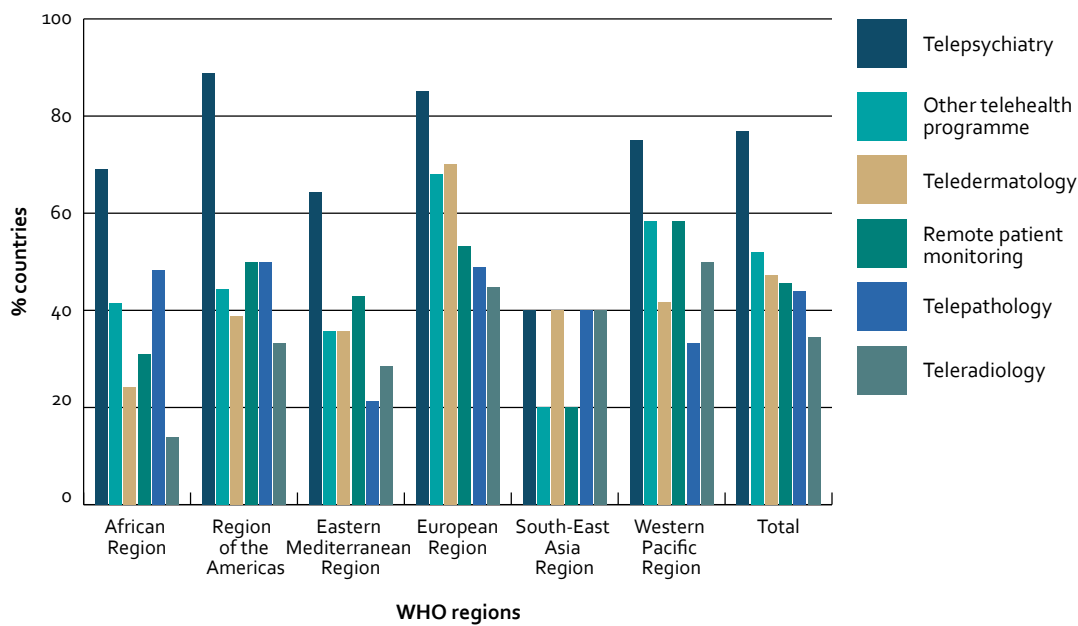
a   The bars represent the reported programmes (e.g. teleradiology, shown in blue) in a WHO region, expressed as a percentage of the countries in that region which reported any kind of telehealth programme.

It is noteworthy that telepsychiatry, one of the longest-established forms of telemedicine *(11,12)*, was reported least frequently in the survey. One reason for the apparent underuse of telepsychiatry may be that it normally depends on the use of video technology to facilitate real-time face-to-face links between psychiatrist and patient. As such, the programme is more difficult and costly to implement in routine health care than those which can be conducted asynchronously, such as teleradiology and teledermatology.

Level of operation

Respondents were asked about the level at which telehealth services were being operated. Five levels were defined, as follows.

1. International level: health entities in other countries in the world.

2. Regional level: health entities in countries in the same geographic region.

3. National level: referral hospitals, laboratories and health institutes (mainly public, but also private).

4. Intermediate level (covering district or provincial facilities): public, private profit-making and private non-profit-making (e.g. religious) hospitals and health centres.

5. Local or peripheral level: health posts, health centres providing basic level of care.

Most of the telehealth programmes were said to operate at national level or below, i.e. relatively few were being operated internationally (Fig. 3.4). This is to be expected, given the complexities of conducting telehealth work internationally *(12)*. For example, international telepsychiatry has been proposed as a mean of lightening the global mental health burden, but so far has been little used *(13)*.

Fig. 3.4.

Fig. 3.4. Proportion of telehealth programmes operated at each level of the health system, globally[a]
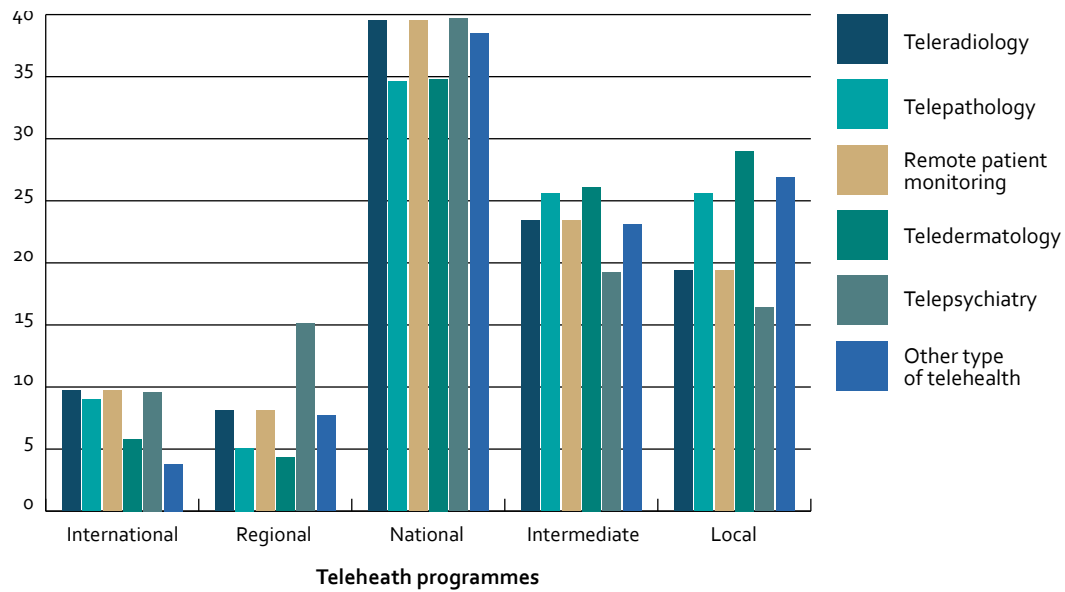
a   The bars show the proportions as a percentage of the number of countries reporting each type of telehealth programme.

Maturity of telehealth programmes

Responding countries were asked to rate the maturity of their telehealth programmes, which was defined as follows.

- Established – an ongoing programme using telehealth that has been conducted for a minimum of two years and is planned, and has allocated funding, to continue for at least two more.
- Pilot – testing and evaluating the use of telehealth in a given situation.
- Informal – early adoption of telehealth in the absence of formal processes and policies.

As might be expected, teleradiology was the most mature discipline: 60% of the responding countries said that their teleradiology programme was mature (Fig. 3.5). In contrast, only 22% of responding countries said that their remote patient-monitoring programme was mature.

Fig. 3.5. Proportion of countries with each type of telehealth programme, and their reported maturity
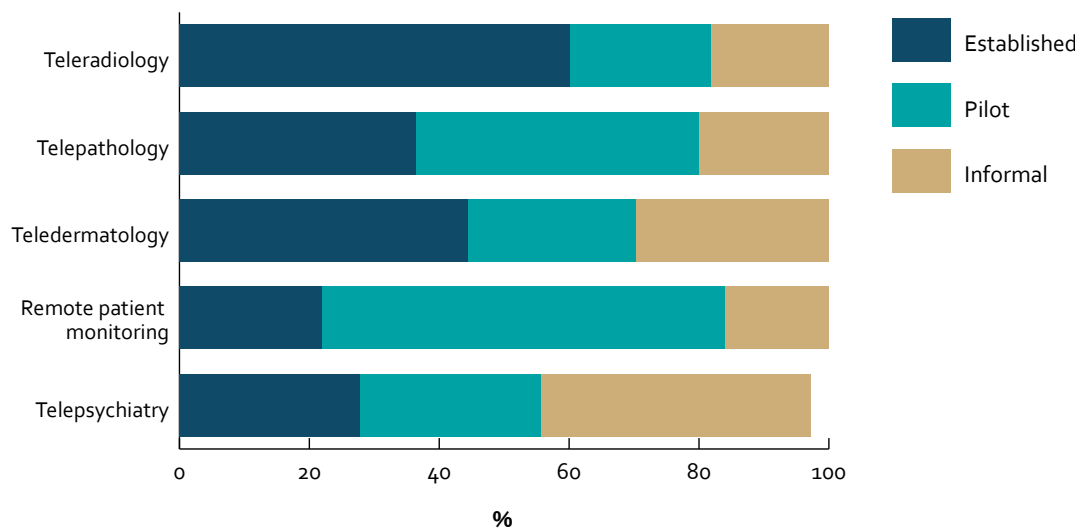
In comparison with the previous survey, there was an increase in the numbers of all telehealth programmes reported (138 in 2005 and 206 in 2010, for the 84 countries which participated in both surveys), Fig. 3.6.

Fig. 3.6. Number of reported telehealth programmes in each of five categories, in 2010 and 2015[a]
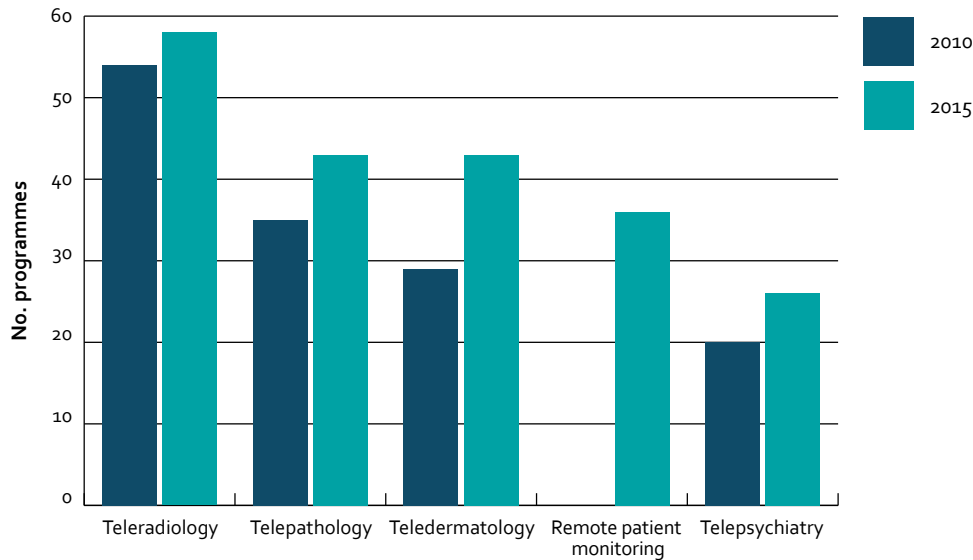
a Note: There was no question about remote patient monitoring in the 2010 survey.

To facilitate comparison, the relative maturity of the five reported telehealth programmes was scored on a three-point scale (Table 3.3).

Table 3.3. Maturity[a] of the telehealth programmes in 2015

Programme	No. responses	Mean score
Teleradiology	83	2.42
Telepathology	55	2.16
Teledermatology	54	2.15
Remote patient monitoring	50	2.06
Telepsychiatry	36	1.81

a 1=informal; 2=pilot; 3=established

The average maturity of the programmes does not seem to have increased in comparison with the results from the previous survey (Fig. 3.7). However, this is consistent with the continued diffusion of telehealth, since new programmes as they are started are likely to begin in pilot form. For example, suppose in the 2010 survey a region containing 10 countries, had established teleradiology programmes operating in six countries. Then the number of countries reporting teleradiology would be six, and the average maturity of those programmes would be three (on the scale used in the survey). If in the subsequent survey another two countries had begun an informal teleradiology programme, then the number of countries reporting teleradiology would rise to eight. But the average maturity of those programmes would decrease (to 2.5).

Fig. 3.7. Maturity[a] of the five reported telehealth services in 2010 and 2015[b]
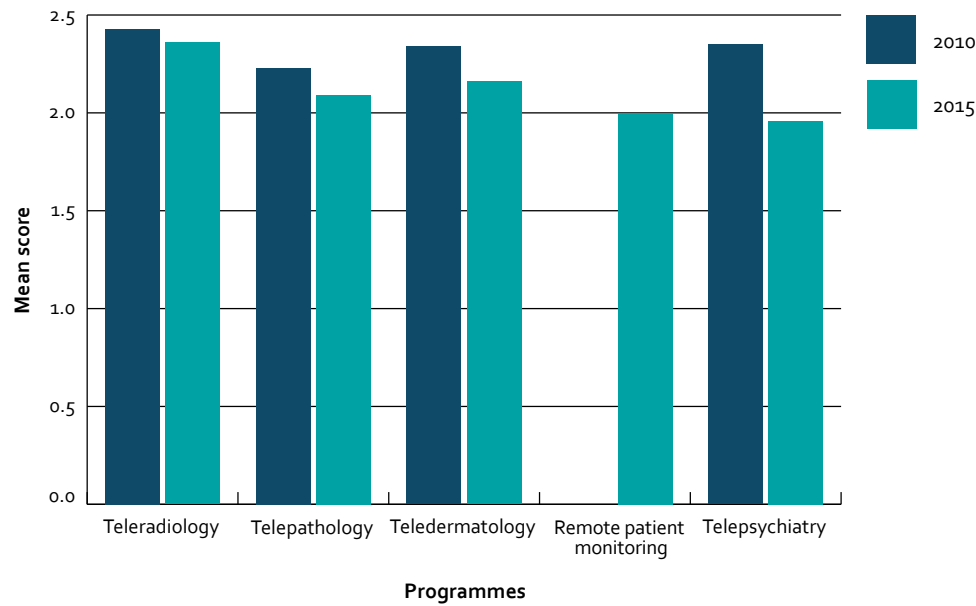
a   Scored on a three-point scale: 1=informal; 2=pilot; 3=established.

b   Note: There was no question about remote patient monitoring in the 2010 survey.

Evaluation of telehealth

Globally, almost one quarter of responding countries (n=120) reported that there had been an evaluation of a government-sponsored telehealth programme in their country (Fig. 3.8).

Fig. 3.8. Proportion of countries reporting an evaluation of a government-sponsored telehealth programme
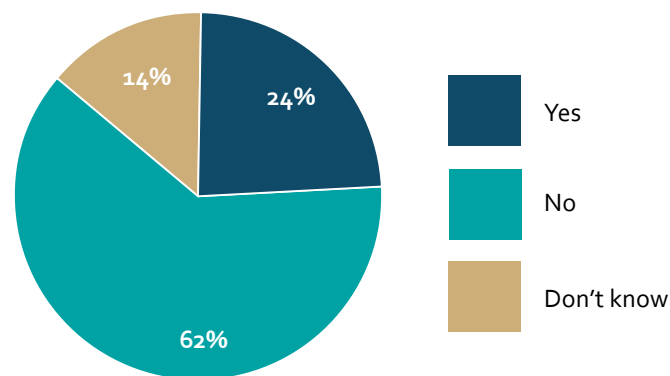
Is this value high or low? One matter to consider is what level of evaluation might be possible. In the survey, 77% of responding countries reported one or more teleradiology programmes. If only three quarters of the responding countries have any teleradiology (the most common form of telehealth) and of those only 60% are established programmes, then it would be unreasonable to expect that evaluation would be possible in more than 45% of those countries. In this context, evaluating one quarter of the teleradiology programmes would seem entirely reasonable.

In the early days of telehealth, a frequently-cited barrier to its adoption was the paucity of evidence for cost-effectiveness. At that time, evaluation of any telehealth programme was important for the health service operating it, and also important in terms of building an evidence base. That evidence base is now stronger – though by no means perfect *(14)* – so the imperative of performing evaluations is perhaps less. Nonetheless, evaluation data are likely to be helpful in operationalizing a pilot telehealth service. Use of an evaluation framework which links policy and health service performance to health outcomes will assist health services to improve performance as part of a continuous quality improvement cycle *(15)*.

In those countries where an evaluation was reported, responding countries were asked to provide details of one evaluation that had been conducted on a self-selected programme. The most common criteria used in the evaluation (22 of 29 responses) were programme acceptance (to service providers and clients), quality, access and cost-effectiveness (Table 3.4). Measuring cost-effectiveness and acceptance to users is central to the evaluation of telehealth.

Table 3.4. Criteria used to evaluate government-sponsored telehealth programmes

Evaluation criterion	No. responses	%
Programme acceptance (providers)	16	73
Quality	16	73
Access	15	68
Programme acceptance (target groups)	14	64
Cost-effectiveness (providers)	12	55
Sustainability	12	55
Health outcome	11	50
Cost-effectiveness (target groups)	10	46
Total no. countries	22[a]	

a   Non-responding = 7 (29 countries reported a government-sponsored telehealth evaluation, but only 22 answered questions 83–90)

Barriers to the implementation of telehealth

Respondents were offered a list of nine common barriers to the adoption of telehealth, and asked to rate each of them (in three categories) according to its importance as an impediment to UHC. The biggest obstacles were said to be a lack of funding to develop and support telehealth programmes, a lack of infrastructure (equipment and/or connectivity), competing health system priorities and a lack of legislation or regulations covering telehealth programmes (Fig. 3.9). The responses seem very similar to the barriers identified in other reviews *(16)*.

Fig. 3.9.   Barriers to implementing telehealth programmes to support UHC, rated by level of importance
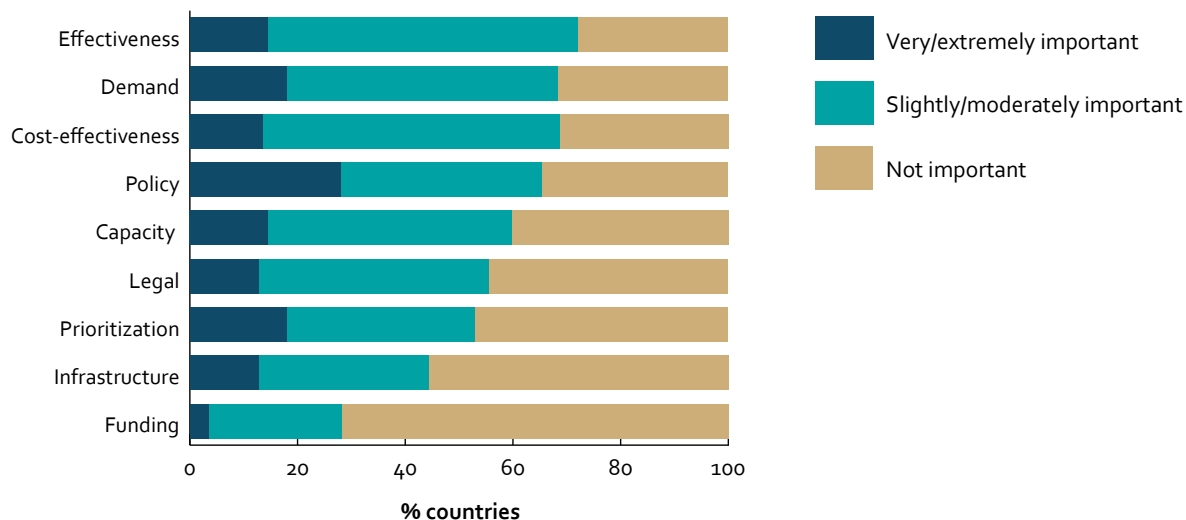
Discussion

The present survey shows that more countries are reporting telehealth programmes, and that many of these programmes are well established. Although the average level of maturity of these programmes has fallen slightly since the previous survey, this may simply reflect the steady adoption of telehealth. There is almost no published data on the international adoption of telehealth, making the quinquennial WHO survey a highly valued resource. There are limited data about telehealth adoption within countries, e.g. the longitudinal Norwegian surveys of Zanaboni & Wootton *(17)*, which are consistent with the GOe survey data of 2010 and 2015 – indicating the steady adoption of telehealth around the world.

In the present survey one quarter of respondents reported that a government-sponsored telehealth programme in their country had been evaluated. Based on the survey results, the way that the evaluations are being done (i.e. the criteria used) seems to accord with good practice.

A big gap in the knowledge of telehealth uptake relates to numbers of telehealth programmes (adoption) and the numbers of cases (activity). Both are difficult to measure on a national scale and almost impossible to measure on an international scale. Thus the results from the present survey provide an impression of the global telehealth landscape at the highest level, but are not able to provide any further level of detail without a change to the survey method.

Implicit in suggesting the way forward is the assumption that telehealth is a societal good, i.e. that one would like to see it used more often and more widely to support health care. As has been observed before, the developing world contains far more people, with relatively fewer health care resources than the industrialized world, and should represent an environment that is ripe for improvement by telehealth *(4)*. However, implementing telehealth is not easy. Successful implementation requires an holistic approach, which includes the technology, organizational structures, change management, economic feasibility, societal impacts, perceptions, user-friendliness, evaluation and evidence,

legislation, policy and governance *(18)*. In low-resource settings and elsewhere, the context (resources, infrastructure and funding), the needs of key stakeholders and their expectations are all important *(19)*.

Nowadays the use of telehealth in radiology could be considered an integral part of the practice of radiology, i.e. it is a purely routine activity. So it would be reasonable to expect that all countries – whether well- or poorly-resourced – would report the use of teleradiology, not 77% as in the present survey. Perhaps, therefore, countries not reporting the use of teleradiology should consider its use. Note that "teleradiology" encompasses a very broad range of techniques to improve access to radiology. At the expensive end are things like a national picture archiving and communication system (PACS) infrastructure. But at the opposite end of the spectrum are techniques like low-cost internet transmission of digital camera images. A recommendation to consider the use of teleradiology says nothing about which techniques might be appropriate in a particular country. Something similar could be said about telepathology, but its value in low-resource settings has not been well documented yet.

Teleradiology is worth considering for widespread use because it is the most mature form of telehealth. Teledermatology might form the subject of a second recommendation, partly because there is reasonable evidence for its cost-effectiveness, and partly because it can be performed without the need for an expensive (video) infrastructure. In contrast, telepsychiatry – well established in some parts of the world, and with a long history and something of an evidence base *(2)* – tends to depend on real-time video. This probably makes the widespread (global) use of telepsychiatry unlikely, even though it is an excellent way of improving access to specialist resources.

How should future telehealth networks be developed, especially in resource-limited settings? Ways forward have been discussed *(4)*. Particular focus should be on programmes with a strong evidence base and modest infrastructure requirements – such as teleradiology and teledermatology mentioned above. Because of the lack of specialist resources, such networks need to have international links, at least at the beginning. Such links, however, should not replace country ownership of these networks, and their growth.

WHO has provided examples of interventions that, if implemented properly, can substantially reduce the burden of disease, especially among the poor, and do so at a reasonable cost. These interventions include the treatment of tuberculosis (TB), maternal health and safe motherhood interventions, tobacco control, etc. *(20)*. What is striking is how little telehealth has yet been applied in these areas. Taking directly observed treatment schedules, short-course (DOTS) for TB as an example, the need is clear. Furthermore, supervision via low-cost video links (running over the ordinary telephone network) was demonstrated nearly two decades ago *(21)*. Yet this, and most of the other interventions suggested by WHO, remain unadapted to telehealth.

In other words, the way forward should be to use telehealth strategically to address global health priorities, rather than – as widely perceived – using telehealth tactically to address local problems. This will require planners to take a different perspective, as traditionally telehealth is assumed to be driven by the technology enthusiasts rather than the health professionals.

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Case study telemedicine

Peek Vision, Kenya

The Portable Eye Examination Kit (Peek[1]) is a unique smartphone-based system that can be used for comprehensive eye testing anywhere in the world. Peek Acuity, the app used to test eyesight easily and affordably using a smartphone, is as accurate as traditional Snellen charts *(1)*. The Peek Retina adapter slips neatly over the built-in camera on a smartphone. Used in conjunction with the Peek app, users hold the phone close to someone's eye and it will auto-focus to show the retina on screen. It gives high-resolution images of the eye at a fraction of the cost of traditional ophthalmic equipment, which can be difficult and time-consuming to use.

The high image quality means cataracts can be viewed clearly for treatment classification. In addition, features of glaucoma, macular degeneration, diabetic and malarial retinopathy and signs of nerve disease can be detected. Other health problems such as hypertensive eye disease can also be identified with a good view of the retina.

The Peek Vision team includes ophthalmologists, doctors, business development managers and product designers. The Peek team is focused on ensuring every test performed with the Peek tools are proven and rigorously validated through clinical trials and field tests. They are designed for use in children and adults and are independent of language.

The Peek Acuity app has already been assessed in a number of studies compared with traditional acuity measurement including retro-illuminated charts or card-based modalities. Mobile platforms (such as Peek) bring the potential to improve both portability and objectivity *(1)*. The results from the app tests carried out on 233 people in their own homes were repeated in eye clinics based in Kenya. The study showed the app was as reliable as standard paper-based charts and illuminated vision boxes in an eye clinic *(1)*.

Another study showed that Peek provides a low-cost alternative to the direct ophthalmoscope in the form of a simple optical adapter for a smartphone. It can overcome many of the technical challenges of fundoscopy, providing a high-resolution view of the retina through a dilated pupil. This can be used in locations with limited diagnostic resources to detect conditions such as glaucomatous optic neuropathy.

Comparison of optic nerve images from commercial retinal screening cameras with the smartphone optical adapter demonstrates strong evidence for no difference in performance in glaucomatous disc grading. The grades of an experienced retinal photographer were compared with those of a lay photographer (with no health care experience before the study), and no observable difference in image acquisition quality was found. Therefore, the potential for task shifting and the detection of avoidable causes of blindness in the most at-risk communities makes this an attractive public health intervention *(2,3)*.

> *"More people in Kenya, and in sub-Saharan Africa, have access to a mobile phone than clean running water. So we said, could we harness the power of mobile technology to deliver eye care in a new way? And so we developed Peek, a smartphone [system] that enables community health care workers and empowers them to deliver eye care everywhere."*
>
> – Dr Andrew Bastawrous, co-founder of Peek

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1   http://www.peekvision.org

Most of the 285 million people worldwide who are visually impaired live in low-income countries and have limited access to specialist clinics. If all people with eye or vision problems had immediate access to diagnosis and prompt care, 80% of the world's blindness could be eliminated. One of the reasons more people do not receive timely care is the challenge involved in connecting patients (predominantly rural) with health care providers (predominantly urban), which includes expensive and time-consuming transport of expensive, fragile equipment to remote areas, where no facilities exist, to perform eye exams.

Peek co-founder Andrew Bastawrous says developing the Peek tools and systems was never about the technology, it was about trying to fill a gap, which he himself had experienced while trying to provide care in remote communities. He points out that the act of screening individuals is only one part of the challenge, and at Peek they do not measure their impact according to how many people have been screened using their tools, but rather, how many patients have received the care and intervention required. Rolling out a programme involves capacity building, training, service availability and integration of Peek. There is little usefulness in screening someone if they cannot be appropriately treated or supported. The Peek team is therefore working with partners to help distribute Peek at low cost in Kenya, Botswana, Mali, Malawi, the United Republic of Tanzania and India.

> *"Our ultimate hope is that the accuracy and easy-to-use features of Peek will lead to more people receiving timely and appropriate treatment and being given the chance to see clearly again."*
>
> – Dr Andrew Bastawrous, co-founder of Peek

As part of a validation trial, the Peek Schools Screening programme screened 21 000 children in 50 schools over nine days in Kenya. During the trial 900 children with visual impairment were identified and were almost three times as likely to adhere to a referral for treatment than the control group. The programme will be rolled out to the whole county, which will involve a further 350 schools and 300 000 children. This model does not need a health care professional to be a screener and in this programme the teachers were able to perform the eye screening. Peek screening is objective because the tester responds to gestures the patient gives in response to the Peek Acuity test, without needing to know if the patient is giving the correct response – as the software provides the intelligence and output.

The app vision test is designed to be used in patients unfamiliar with symbols or letters used in the English language. It is also not dependent on electricity because users can power and back-up their mobile phone using a solar-powered backpack. The test features a "tumbling E" on screen, showing the letter E displayed in one of four orientations. The patient points in the direction they perceive the arms of the E to be pointing and the tester uses the touch screen to swipe accordingly. This translates the gestures from the patient to the phone, as the image gets smaller.

Development of the Peek model includes the following.

- Observe – define the barriers and needs.
- Innovate – create low cost solutions.
- Validate – prototype, clinical trials, iterate, prove.
- Scale – implement through partnerships.

With ubiquitous use of mobile phones around the world by health care workers and patients, it is not hard to imagine the Peek app and retina attachment propelling us toward achieving the 2013 World Health Assembly resolution of "universal access to comprehensive eye care services" and the global target of "reduction in prevalence of avoidable visual impairment by 25% by 2019". Learn more about the programme at http://www.ted.com/talks/andrew_bastawrous_get_your_next_ eye_exam_on_a_smartphone#t-377763.

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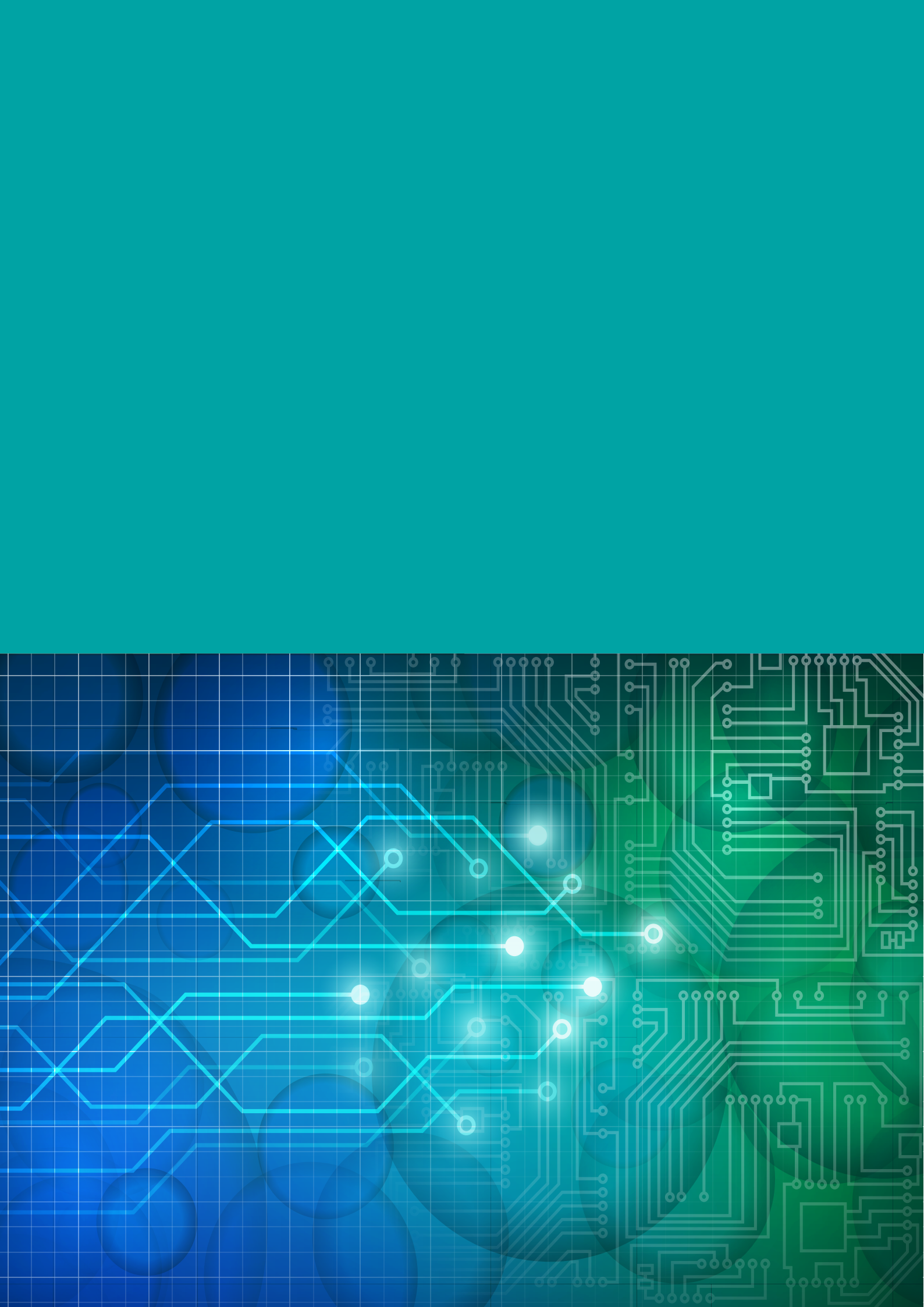
4.

eLearning
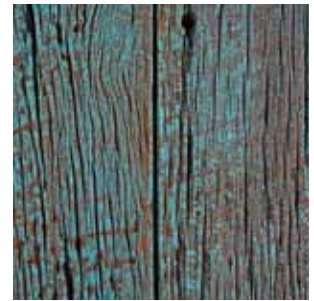
Key findings:

- At least two thirds of responding Member States use eLearning for health science education – for both pre-service education and in-service training. Countries in the African Region (48%; n=14) and the South-East Asia Region[a] (20%; n=1) reported the lowest adoption of eLearning for pre-service health science education.

- eLearning is mostly used for education of medical students (91%; n=72) and doctors (84%; n=73), followed by pre-service (80%; n=63) and in-service public health education (68%; n=59).

- Countries reported low rates of evaluation of both pre-service and in-service eLearning programmes (around 10%; n=8). Half of the countries reported accreditation of in-service eLearning programmes by professional bodies.

- More than 90% of countries reported enabling access to experts and content as the reason for eLearning adoption for both pre-service (n=73) and in-service (n=81) health science education.

- The key barriers to wider implementation of eLearning programmes supporting universal health coverage (UHC) were lack of capacity, availability of suitable eLearning courses, human resources, funding and evidence on cost-effectiveness of eLearning.

a Data from the South-East Asia Region should be viewed with caution due to the low number of responding countries

Introduction

A health workforce is essential to attaining the universal health coverage (UHC) epitomized by the third UN Sustainable Development Goal (i.e. ensuring health and wellbeing for everyone) *(1,2)*. Yet, health care systems worldwide face a severe health workforce shortage of about 10.3 million health workers globally, which is expected to rise to 12.9 million in 2035 *(1)*. Scaling-up of the health workforce is contingent on high-quality, relevant and up-to-date health science education, aimed at building the knowledge, skills, attitudes, behaviours and core values of health workers. However, health science education is faced with a number of important challenges, including a widespread deficiency of faculty, educators, administrators, infrastructure and resources *(3)*.

The shortage of competent health care workers globally and health science education-related issues call for a paradigm shift and innovative solutions in health workforce development *(4)*. eLearning, i.e. the use of ICT for education, is increasingly recognized as one of the key strategies for health workforce training *(5)*. Its potential and value in addressing educational needs of health professionals, especially in developing countries, has been acknowledged by both the United Nations (UN) and WHO *(4,6)*. eLearning enables access to learning for geographically isolated people or those who have poor local training facilities, and can improve the quality of education. It conveys health sciences education to a broader audience, and promotes collaboration and better use of existing educational resources *(5)*. eLearning also allows health professionals to update their knowledge and skills in a flexible, efficient and personalized manner, often without having to leave their workplace *(6)*. eLearning could enable training and education necessary to provide communities with the full spectrum of essential and people-centred health services as part of UHC, including health promotion, prevention, treatment, rehabilitation and palliative care. Furthermore, eLearning can support health systems reforms by facilitating increased training and effective dissemination of information needed for redesign of health professionals' responsibilities and roles.

The widespread adoption of the internet, wireless and mobile technologies in the past 20 years has resulted in expansion of learning technology, better access to education and novel learning experiences *(7)*. The evidence shows that using eLearning for health professionals' education is as effective or more effective than the traditional teaching approach *(8–13)*. eLearning differs from traditional learning (i.e. face-to-face, classroom-based, teacher-led learning) in terms of the medium by which learning is delivered as well as the teaching and the learning approaches it employs. It encompasses a variety of interventions in terms of tools, content, learning objectives, pedagogical approaches and setting of delivery. It can take the form of a purely eLearning approach, which is entirely driven by technology, or blended learning, i.e. a mix of the traditional and fully ICT-based approaches. However, implementation of eLearning is associated with a number of challenges. Development and delivery of eLearning requires significant human and financial resources. At the same time, the existing evidence on cost-effectiveness of eLearning is still scarce (14, 15,16). This is coupled with a lack of robust and comprehensive health science eLearning evaluation standards leading to haphazard evaluation and accreditation of eLearning programmes *(12)*.

The results of the GOe 2015 survey provide important insights into the current state of eLearning for health sciences education among Member States – the extent of adoption, the variety of applications and the barriers to its use.

Results and analysis

The use of eLearning in pre-service and in-service health sciences education

This part of the survey focused on the use of eLearning for both pre-service health sciences education and in-service health sciences training. The pre-service health sciences education dimension represents undergraduate, health sciences-related university degrees, or a basic health-related vocational training programme that is recognized by the relevant governmental or professional bodies and entitles the qualification-holder to apply for entry level positions in the health care workforce. In-service health sciences training represents any type of study after a qualification which is recognized by the relevant governmental or professional bodies and entitles the qualification holder to work in the health care workforce in a more independent or senior role.

One hundred and twenty-five Member States responded to the 2015 global survey on eHealth. Almost two thirds (65%; n=79) reported that eLearning is being used to help teach health sciences students in pre-service education in their countries. Conversely, one quarter of countries (26%; n=32) reported no use of eLearning for pre-service health sciences education (Fig. 4.1a). Seventy-two per cent (n=87) of responding countries reported the use of eLearning for in-service health sciences training for health professionals (Fig. 4.1b).

It is encouraging to see that most Member States employ eLearning for health sciences education at both pre- and in-service levels. However, a quarter of countries with no use of eLearning at all for health sciences education demonstrates a considerable untapped potential, particularly given the abundance of available, free and relevant online educational resources. With the emphasis in the research literature being predominantly on the use of eLearning for health sciences students, it is surprising to note that a higher proportion of countries reported the use of eLearning for in-service training compared to pre-service education.

Fig. 4.1a. Percentage of countries that use eLearning for pre-service education of health sciences students
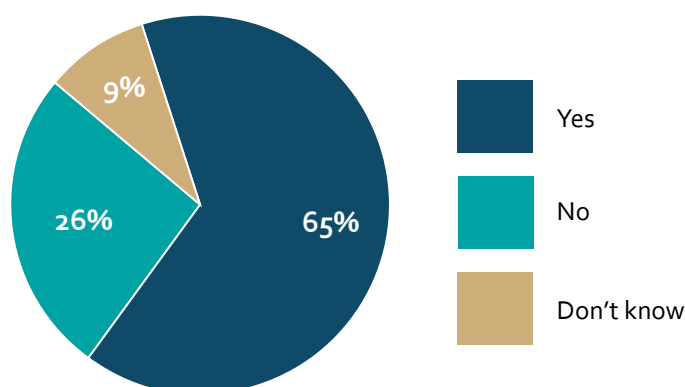
Fig. 4.1b. Percentage of countries that use eLearning for in-service education of health professionals

- Yes — 72%
- No — 17%
- Don't know — 11%
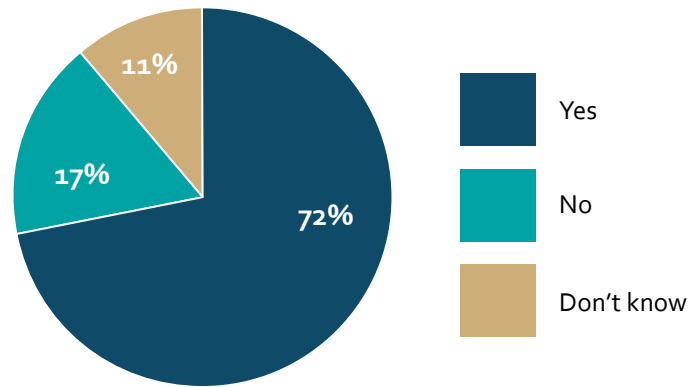
The extent of use of eLearning for pre-service and in-service education was relatively similar across three WHO regions (the Eastern Mediterranean, European, and Western Pacific Regions) where it varied between 60% and 75% per region. In the African and South-East Asia Regions, the use of in-service eLearning use was reported by approximately 60% of countries. But notably, use of eLearning for pre-service education in the African Region was lower (48%). The use of eLearning was, in general, less commonly reported for pre-service than in-service education across all six WHO regions (Fig. 4.2a).

The World Bank income group classification showed a slightly decreasing trend (from high- to low-income countries) for the use of eLearning for pre-service and in-service health sciences education (Fig. 4.2b). These findings are not surprising as many developing countries still grapple with a shortage of eLearning essentials such as high-speed internet access, affordable bandwidth, trained ICT personnel and even stable electrical power *(3,6)*.

Fig. 4.2a. Percentage of countries that reported eLearning for pre-service and in-service education, by WHO region
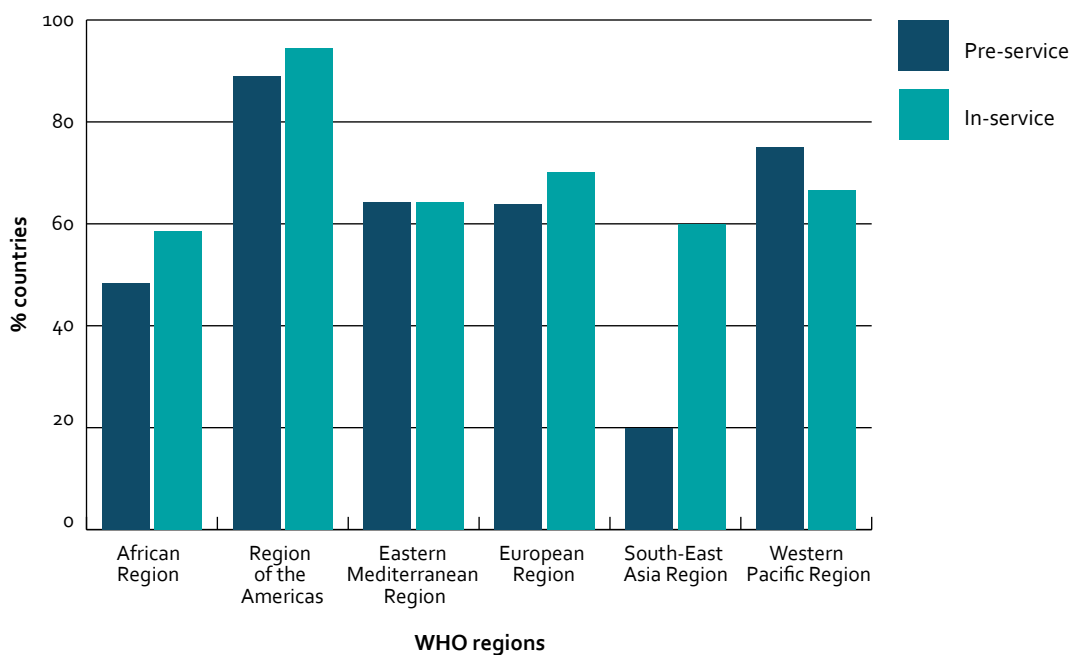
Fig. 4.2b. Percentage of countries that use eLearning for pre-service and in-service education of health sciences students, by World Bank income group
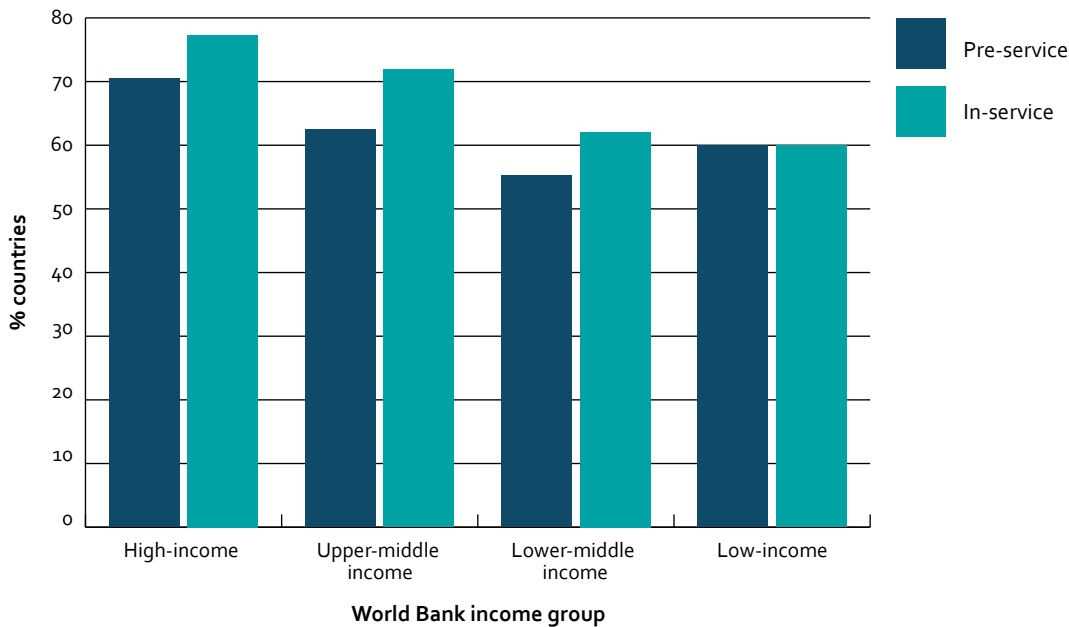
When comparing the use of eLearning within different WHO regions, the African Region stands out with much lower rates of eLearning adoption for pre-service education. This demonstrates a considerable missed opportunity in terms of health sciences education, particularly given the abundance of available, free and relevant online educational resources. However, these online resources are often inaccessible by learners in developing countries and content may not be suitably tailored for the context of use.

The extent of integration of eLearning in health sciences education for both pre- and in-service education is remarkable in the Region of the Americas (around 90%). The Western Pacific, Eastern Mediterranean Region and European Regions, are lagging behind the Americas in terms of eLearning use by 15–20%. The EU member countries' reluctance to adopt eLearning was also noted in a report to the European Commission on modernization in higher education *(16)*. There may be a number of barriers that contribute to this gap such as hesitancy to leave behind conventional teaching methods and restructure education; lack of appropriate expertise, teaching capacity and infrastructure; or paucity of customized materials specific to various contexts and in different languages.

Having access only to the basic infrastructure has been identified in the literature as a major impediment to the implementation of technology-enhanced teaching in developing countries *(6)*. For online eLearning, learners need access to a personal computer or mobile device (tablet or mobile phone) and access to the internet or cellular networks. Mobile learning, i.e. mobile-device-enabled learning, is gaining recognition as another pertinent approach for health workforce education in resource-limited settings. In areas with lacking, slow or costly internet and cellular network access health science education can be provided via offline eLearning, i.e. a partial or complete delivery of educational materials via portable storage devices (such as USB flash drives, DVDs and external hard drives) *(8)*.

The main reasons for use of eLearning in health sciences education

The survey asked about the main reasons for using eLearning in pre-service education and in-service training. Based on the data from the responding countries, improving access to content (93%; n=73) and experts (93%; n=81) were reported as the main reasons for use. The second most common reason for using eLearning in pre-service health sciences education, reported by approximately 60% of countries (n=47), was enabling access to education where learning facilities are limited. The third most common reason for using eLearning for in-service health sciences training, reported by approximately three quarters of countries (n=66), was reducing the cost associated with delivering educational content (Fig. 4.3).

Fig. 4.3.   Main reasons for using eLearning for pre-service and in-service health sciences education, globally
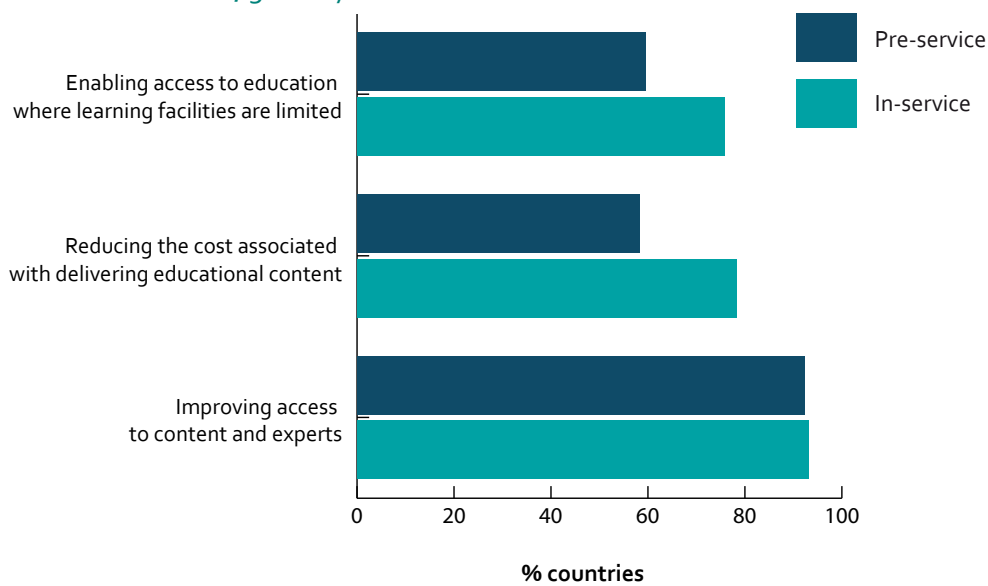
It is interesting to note that access to content and experts was considered the main reason for the use of eLearning for both target groups rather than the reduction of cost. The reduction of cost was considered more important in relation to in-service training (ranked second) than to pre-service education. This corresponds to the findings from the literature showing that eLearning is mainly used to address faculty shortages and to supplement faculty instruction at institutions *(14)*. Access to experts, especially as part of the pre-service education, can be achieved through the use of various eLearning resources e.g. free and accessible massive open online courses (MOOCs) developed by leading institutions, initiatives such as open educational resources (OER) and free open source software (FOSS), and offline eLearning materials in areas with poor connectivity.

The groups adopting eLearning for pre-service and in-service health education

Based on the response from countries that reported the use of eLearning for pre-service education (n=79) (Fig. 4.1a), eLearning is most commonly used for medical students' education (91%; n=72)

and the in-service training of medical practitioners (84%; n=73), followed by both pre-service (80%; n=63) and in-service training (68%; n=59) in public health education. Both pre-service and in-service adoption of eLearning for medical, public health and nursing/midwifery education was reported by over 60% of countries. Across all types of student and professional groups, eLearning adoption was often reported (more than 40% of countries), but pre-service eLearning was more commonly reported than in-service eLearning.

The gap between the use of eLearning for pharmacy or dentistry and medical education or nursing/midwifery revealed in the survey is surprising, as many subjects among these four specializations are similar or overlapping (Fig. 4.4). These findings, however, correspond to other research on the use of eLearning in health sciences education in developing countries, showing that most of the available resources are intended for medical education *(14)*. Medical informatics training was offered as a question in the survey only in relation to in-service training. The availability of this type of training, both in-service and pre-service, is still largely confined to high-income countries, despite a pressing and worldwide need for professionals who are both skilled in the use and management of ICT and knowledgeable in the field of health care *(15,17)*.

Fig. 4.4.   Percentage of countries with student or professional groups that have adopted eLearning approaches for pre-service or in-service education
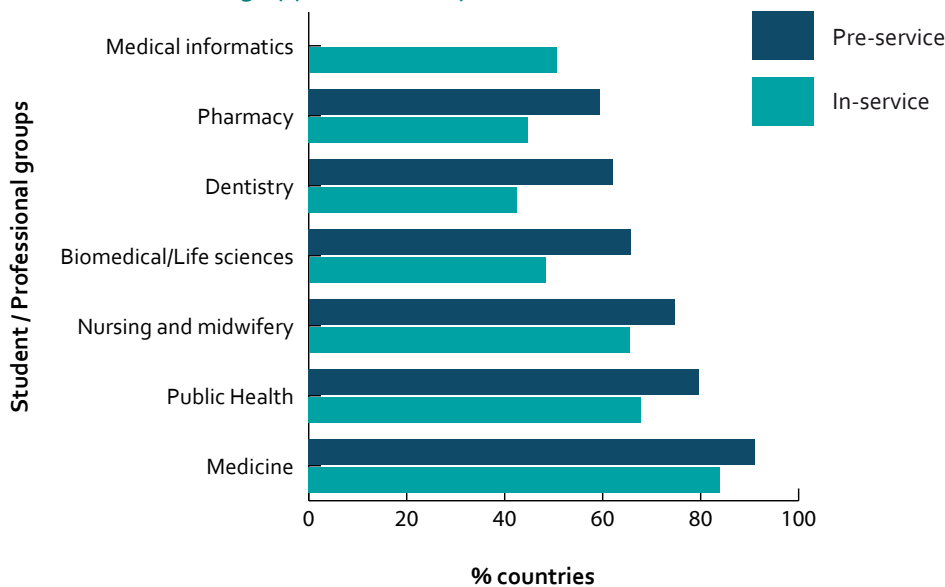
The survey asked about the way health sciences teaching institutions were using eLearning, listing six categories.

- Developing courses for use by their own students.
- Using courses developed by other institutions.
- Teaching pre-clinical subjects.
- Teaching clinical subjects.
- Developing courses for use by other institutions.
- Teaching subjects where specialists are unavailable at the institution.

Of the countries reporting the use of eLearning for pre-service education (n=79) (Fig. 4.1.a), nearly 80%

(n=63), reported that their health sciences teaching institutions used eLearning for developing courses for use by their own students. About 65% (n=51) of countries reported use of courses developed by other institutions. eLearning was used in most countries for pre-clinical pre-service education (73%; n=58). This was closely followed by the use of eLearning for clinical subjects (67%; n=53). Almost half of the countries, 46% (n=36) reported developing courses for use by other institutions (Fig. 4.5).

Fig. 4.5. Percentage of countries that reported common uses of eLearning for pre-service education by health sciences training institutions
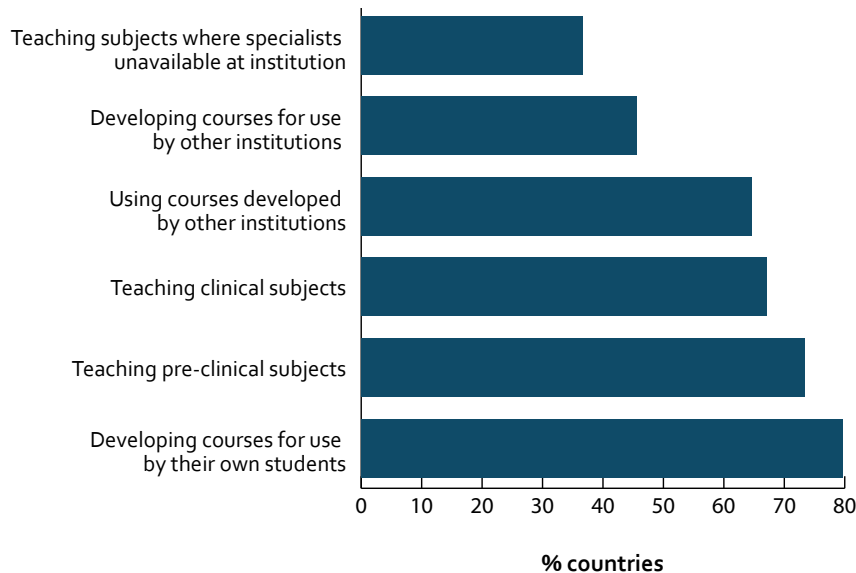
% countries

When asked about fully online delivered eLearning programmes, approximately 16% (n=12) of the countries with pre-service eLearning (n=79) (Fig. 4.1a) reported that their universities offered health sciences degrees that can be obtained entirely online. Furthermore, approximately 23% (n=18) of countries with pre-service eLearning offer certification in specific health sciences subjects that can be obtained entirely online.

Evaluation and accreditation

Among countries with pre-service eLearning (n=76), only 11% (n=8) reported that some eLearning programmes for pre-service health sciences education had been evaluated (Fig. 4.6a). Among countries with in-service eLearning (n=84), roughly 50% (n=41) reported courses were accredited by continuous medical education (CME) or professional licensing bodies (Fig. 4.7). Roughly 10% (n=8) reported that any eLearning programmes for in-service training of health professionals had been evaluated (Fig. 4.6b). Nearly half of countries (48%; n=41) had no evaluations of in-service eLearning.

Fig. 4.6a. Percentage of countries with an evaluation of any eLearning programme for pre-service health sciences education

Legend:
- Yes
- No
- Don't know

Values: 11%, 42%, 47%
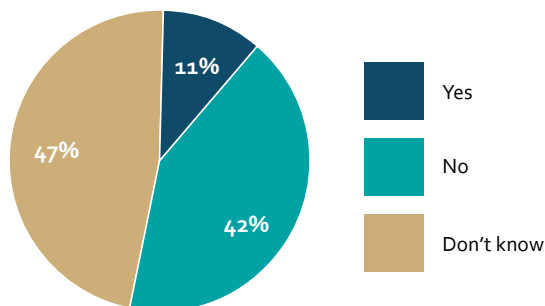
Fig. 4.6b. Percentage of countries with an evaluation of any eLearning programme for in-service training of health professionals

Legend:
- Yes
- No
- Don't know

Values: 10%, 48%, 42%
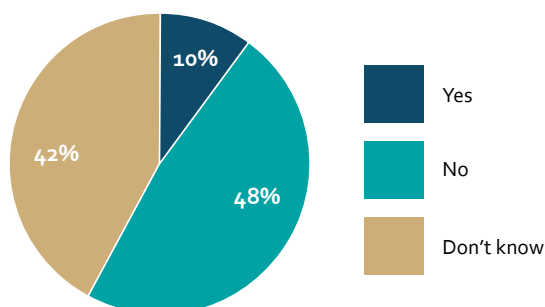
Fig. 4.7. Percentage of countries with accreditation of in-service eLearning programmes by continuing medical education or professional licensing bodies

Legend:
- Yes
- No
- Don't know

Values: 49%, 31%, 20%
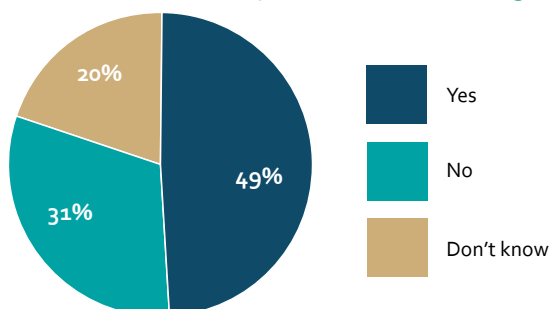
These findings show a clear and a widespread need for evaluation of pre- and in-service eLearning programmes. Considering the prevalent use of eLearning courses developed by other institutions, the rates of eLearning evaluation and accreditations should increase. Another major issue is the limited scope of existing evaluations as they are typically restricted to learners' enjoyment and satisfaction with the courses *(5)*. Evaluation of eLearning programmes should entail both learners' and providers' standpoints and focus on a range of elements such as cost-effectiveness, acceptance, access, achievement of learning outcomes, quality of the programme, etc.

Barriers to implementation

Countries were asked to rate common barriers to implementation of eLearning programmes by order of their importance with regards to supporting UHC (Fig. 4.8). A majority of countries (58%; n= 68) rated lack of capacity (i.e. trained human resources and/or technical support to develop or administer eLearning) as a very or extremely important barrier. Lack of availability of suitable eLearning courses (47%; n=54), lack of evidence on cost-effectiveness (42%; n=49) and lack of funding (41%; n=49) were also rated as a very or extremely important barrier to eLearning implementation by more than 40% of countries.

Fig. 4.8.   Barriers to implementing eLearning programmes for UHC, rated by level of importance (3 categories)
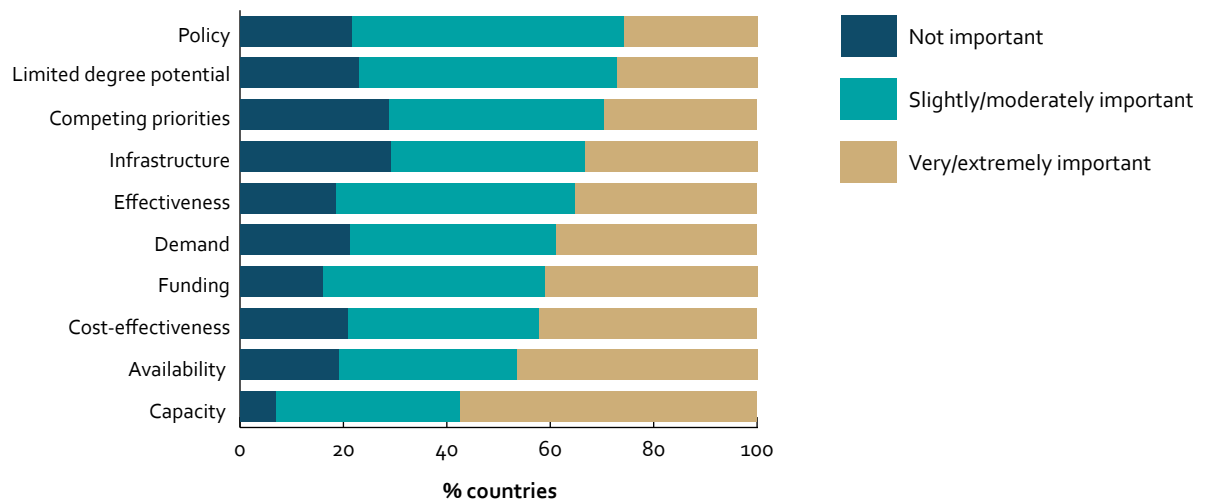
Discussion

This survey demonstrated a widespread recognition of the value of eLearning for health sciences education as most Member States reported its use for pre- and in-service health sciences education. However, a significant gap was also revealed – a quarter of countries do not use eLearning in pre-service education, with the largest shortfalls in the Americas and South-East Asia Regions. eLearning is predominantly employed to enable access to content and experts and mostly for medical, public health and nursing education while its use for dentistry, pharmacy and life/biological sciences education lags behind. A very low rate and narrow scope of evaluation as well as infrequent accreditation of eLearning programmes was noted globally. While most Member States reported that the main use of eLearning by their institutions was to develop courses for their own students, the use of eLearning programmes developed by other institution was also prevalent.

According to most Member States, the use of eLearning in health sciences education is hindered by a shortage of capacity, funding and availability of suitable courses. While a lack of evidence on the cost-effectiveness of eLearning was identified as another prevalent barrier, eLearning was also seen by many respondents as reducing the cost of education, especially for in-service health science education. As the traditional form of education is often at odds with health care provision, eLearning,

due to its flexibility and convenience, may seem a more cost-effective option for in-service health sciences education. In contrast, the classroom-based approach still predominates in pre-service education and the cost-effectiveness of eLearning may not be so obvious. Although eLearning, in the long run, may result in budgetary and time-saving benefits, it can only reduce costs once a large investment has been made into its design and delivery. The lack of evidence of eLearning's cost-effectiveness is important, therefore, as limited human and financial resources necessitate evidence-informed decisions, especially in developing countries.

The findings from this survey call for a paradigm shift in how eLearning is perceived, implemented and evaluated. To address the main identified barriers to eLearning (i.e. lack of suitable courses, funding and capacity), various alternative strategies for eLearning adoption could be explored and evaluated such as twinning, adoption of free eLearning resources and the use of blended learning with mentoring. Twinning, i.e. collaboration and partnerships with academic institutions in high-income countries can support capacity building in developing countries (18). In addition, the abundance of accessible, peer-reviewed and shareable eLearning materials offered via MOOCs or OER and FOSS initiatives could be further leveraged in health sciences education. International organizations such as the World Bank and WHO also offer free online, offline and blended eLearning courses. However, adopting eLearning solutions for health sciences education is neither simple nor free: available resources must be mapped, evaluated and aligned with the local health care, culture and customs while preserving idiomatic meaning in different languages. Another pertinent strategy, in line with the nature of health sciences education, is a combination of blended eLearning and face-to-face mentoring to support development of clinical skills, especially in countries with a capacity shortage (19). To ensure delivery of high quality, embedded and pertinent eLearning programmes there is a need for a standardized, comprehensive and sweeping approach to its evaluation and accreditation.

Finally, a worldwide collaboration, commitment and dialogue among all the relevant health sciences education stakeholders (e.g. ministries of education, health and finance, public and private training institutions, professional bodies and research organizations) is essential to ensure eLearning in health sciences education is optimized to ensure the development of global health workforce and progress towards universal health coverage.

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Case study eLearning

eLearning programme in Afghanistan and Pakistan

The Aga Khan Development Network (AKDN) set up an eLearning programme[1] in Afghanistan in 2010, which expanded to Tajikistan in 2013, Pakistan in 2015 and Kyrgyzstan in 2015. In 2011 the AKDN eHealth Resource Centre (eHRC)[2] was established to provide strategic eHealth support to the AKDN health agencies and their partner health institutions with managing eHealth operations, such as the eLearning programme.

The eLearning programme facilitates professional development and capacity building via ICTs. The aim is to increase knowledge, enhance clinical and managerial skills and enable health professionals to deliver improved quality of care to patients. As part of eLearning, CME sessions ensure health care providers receive up-to-date training and skills. eLearning enables health professionals to undertake learning at a distance and helps to develop knowledge about eHealth which can assist them to become comfortable with using eHealth tools. It also reduces professional isolation, often a consequence of working in remote areas.

The AKDN eHealth programme found that health care professionals working in these regions felt isolated and cut off from their colleagues. They also found it difficult to participate in or access ongoing education opportunities. After rolling out a successful teleconsultation programme at a number of sites, AKDN implemented the same "hub and spoke" model in the form of eLearning opportunities. A "hub" is the central location or facility that provides the professor or teacher and learning materials. The "spokes" are the facilities where the health professionals attend and participate in the courses. The AKDN eHRC has a number of hub and spoke locations fitted with the required technology in order to run these sessions.

A rapid eHealth assessment tool is used to determine the need for eLearning services. Stakeholders are interviewed to ascertain the eHealth readiness of the site (from eHealth literacy to eHealth infrastructure readiness) and which courses should be offered to health care providers. To determine hub sites, the AKDN eHRC identifies locations with sociocultural and language similarities and those which have the capacity to offer eLearning services to the spoke sites.

> "When I was moving from a very well-renowned teaching hospital to the hardship and relatively less developed area of Gilgit, I was excited about the opportunity to contribute, but also very concerned about my continuous learning and professional development. To my happiness and surprise, an eHealth link was established here at Aga Khan Medical Centre, Gilgit, for eLearning sessions from the Aga Khan University."
>
> – Dr Nasreen Muhammad Saleem, Internal
> Medicine Specialist, Aga Khan Medical Centre, Gilgit

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1   http://akdnehrc.com/moodle/course/index.php?categoryid=18
2   http://www.akdn.org/ehrc_ehealth_programme.asp

The eLearning programme began in Afghanistan by offering eLearning sessions from the French Medical Institute for Children to medical health care professionals and nursing staff at the Bamyan Provincial Hospital in 2010. eLearning services were then extended to Faizabad Provincial Hospital in 2011 and Mirwais Regional Hospital in 2013.

In 2015, Faizabad Provincial Hospital began acting as a hub site providing eLearning sessions to Baharak District Hospital and three Comprehensive Health Centres – Bashore, Ishkashim and Nusai. eLearning services were extended to multiple sites in Tajikistan in 2013 followed by Kyrgyzstan and Pakistan in 2015. Medical and nursing eLearning topics are available, and to date over 5000 health care professionals have been trained through eLearning sessions offered in these countries.

In Pakistan, the Aga Khan University (AKU) in Karachi provides eLearning sessions to health care providers at Aga Khan Booni Medical Centre, Gilgit Medical Centre and Singal Medical Centre and to facilities in Afghanistan. Two types of sessions are offered: CME courses and Grand Rounds, which are structured online conferences designed to enhance medical knowledge and skills. The AKU offers credit hours for CME courses attended by participants, allowing them to receive credit for attending the courses remotely. In 2016, AKU began offering eLearning sessions three times a week in neurophysiology to health care providers at the French Medical Institute for Children.

Local physicians or health care professionals who have particular skills or knowledge to share determine the schedule of courses. Topics covered in the eLearning courses range from internal medicine, nutrition, blood transfusion, CPR and cannulation to infectious diseases. Sessions are also offered on topics such as applying evidence from a research paper to clinical practice, which helps to build health care providers' knowledge beyond general medical and nursing skills.

> "*I have been working at Bamyan Provincial Hospital since 2003. Before the eLearning programme became available in 2010, accessing professional development courses was very difficult. I had to travel either to Kabul (3 hours away) or to Takhar province (6 hours away) from Bamyan to avail the sessions. Even then, not all staff could go together as some had to stay behind to attend to patients. Only a few staff could go at a time. This was expensive and very time-consuming. Now, with the eLearning courses being broadcast directly from Kabul, we can attend the sessions right here without leaving the hospital. I attend two sessions a month now compared to one session a year when I had to travel to Kabul or to Takhar province.*"
>
> – Chaman Ali, Nurse in-Charge, Bamyan Provincial Hospital, Afghanistan

An impact evaluation research study is currently under way evaluating the efficacy of the eLearning intervention on improving maternal, neonatal and child health knowledge and practices at all sites in Afghanistan and the Khorog Oblast General Hospital in Tajikistan. The strengths and weaknesses of the eLearning approach and factors that lead to the success or failure of such interventions in health care settings of low- and middle-income countries will also be identified. The research study is projected to be completed by early 2017.

Future plans include analysing and evaluating lessons learned from the eLearning programme in central Asia with a view to implementing a similar eLearning programme in Kenya.

5. Electronic health records

Key findings

- There has been steady growth in the adoption of national EHR systems over the past 15 years – and a 46% global increase in the past five years.

- Over 50% of upper-middle- and high-income countries (n=23) have adopted national EHR systems.

- Adoption rates are much lower in the lower-middle (35%; n=10) and low-income countries (15%; n=3)

- The majority of Member States with national EHR systems report integration of EHR systems with laboratory (77%; n=44) and pharmacy (72%; n=41) information systems, followed by picture archiving and communications systems (PACS) (56%; n=32).

- The most frequently cited barriers to the implementation of EHRs were lack of funding, infrastructure, capacity and legal frameworks.

Introduction

This chapter reports on the global status of national electronic health record (EHR) systems. It considers the adoption of national EHR systems and their integration with other types of health information systems (HIS). Finally, barriers to implementation of national EHR systems are discussed.

For the purpose of this survey, electronic health records (EHRs) were defined as:

> "real-time, patient-centred records that provide immediate and secure information to authorized users. EHRs typically contain a patient's medical history, diagnoses and treatment, medications, allergies, immunizations, as well as radiology images and laboratory results. A National Electronic Health Records system is 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."

It is important to emphasize that the survey looked at national EHR systems, which are driven by national governments and publicly funded. Some Member States reported that their EHR systems did not fit fully within the definition and therefore were unable to have their EHR implementations recorded in the survey. Therefore the number of implementations may be underreported.

To streamline questions and promote consistency, the survey used the terms electronic health records (EHRs) and electronic medical records (EMRs) interchangeably although this is not strictly correct. EMRs are in-house electronic versions of the traditional paper charts that collect, store and display patient information and 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 health professionals (1).

EHR systems are an important component of the provision of UHC, where all people have access to the promotional, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship (2). UHC is a major priority for health reform in many countries as well as for WHO (1,3). A well-functioning EHR system improves the quality, accuracy and timeliness of patient information at point of care. EHR systems can play a pivotal role in UHC by providing insight into health care costs, utilization and outcomes, promoting quality of care, reducing costs, supporting patient mobility, increasing reliability of information and providing access to patient information to multiple health care providers (4–6). Data from EHR systems, in combination with other HIS data, can highlight areas of concern and health services delivery, public health and social determinants (7).

Results and analysis

Implementation of national EHR systems

This section of the survey focused on whether a country had a national EHR system, and if so, when it was introduced. It aimed to see if there were any identifiable trends in their implementation.

Almost half of the responding Member States (n=57; 47%) reported having introduced a national EHR system (Fig. 5.1a). Countries that answered "no" to this question may still have some form of EHR system used in local or regional facilities, but the coverage is not national. Alternatively they could be privately funded and supported by health insurance companies, for example.

Fig. 5.1a. Percentage of responding countries with a national EHR system

- Yes
- No
- Don't know
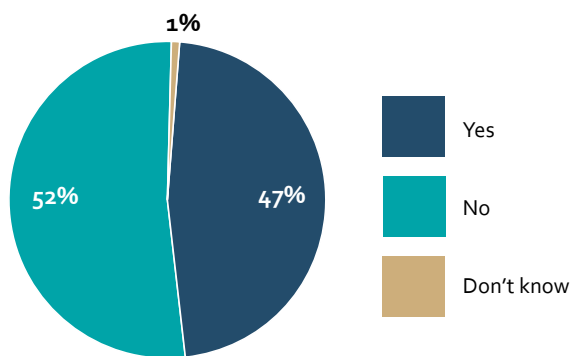
When analysed by World Bank income group, the implementation of EHR systems is highest in wealthier countries with two thirds (66%; n=21) in the upper-middle income group and roughly half of high-income countries (52%; n=23) having introduced them, while a third of lower-middle-income countries (35%; n=10), and 15% of low-income countries (n=3) reported having implemented them (Fig. 5.1b).

A national EHR system is implemented under the responsibility and guidance of the country's national health authority and will therefore be a public sector service supported by public funds *(8)*. The difference between the countries in the four income groups reflects the health systems in which they operate. Countries in the upper-middle-income group are more likely to be developing EHR systems supported by public funds. The numbers for the lower-middle and low-income countries are low with only three low-income countries reporting they have a national EHR system (Fig. 5.1b). A major reason for the slow uptake of EHRs in poorer countries is likely to be funding – which has also been identified as a major barrier in the survey. However, poorer countries are also more likely to have less developed infrastructure and health ICT to support EHR systems as well as be lacking in capacity and human resources required to develop and maintain such complex systems *(9,10)*.

Fig. 5.1b. Percentage of countries with a national EHR system, by World Bank income group
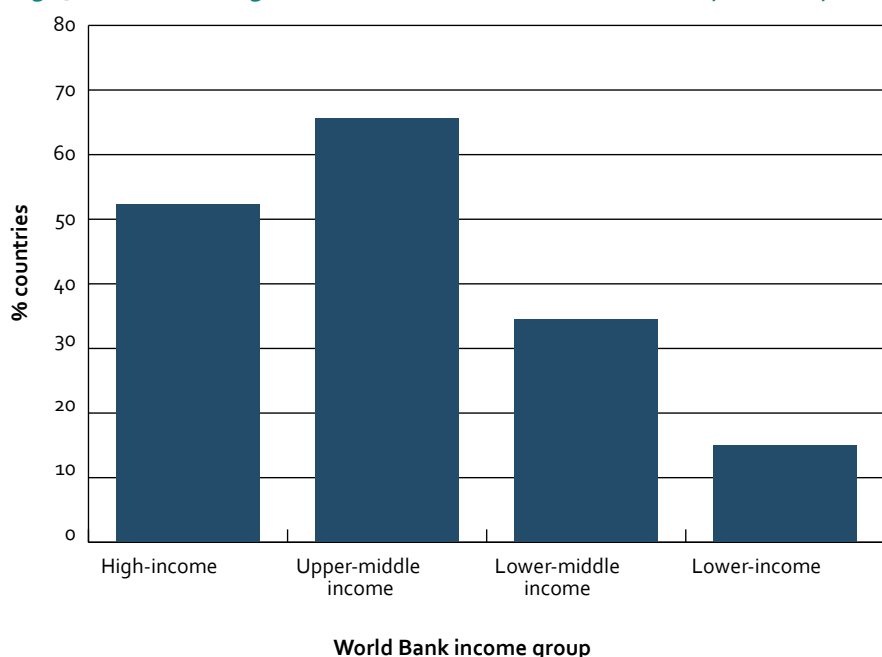
There has been a steady increase in the past 15 years in the adoption of national EHR systems (Fig. 5.2) with a 46% increase in the past five years (2010–2015). Not all countries reported their year of adoption, as the survey was not clear if "year of adoption" referred to the year the EHR system was launched or completed.
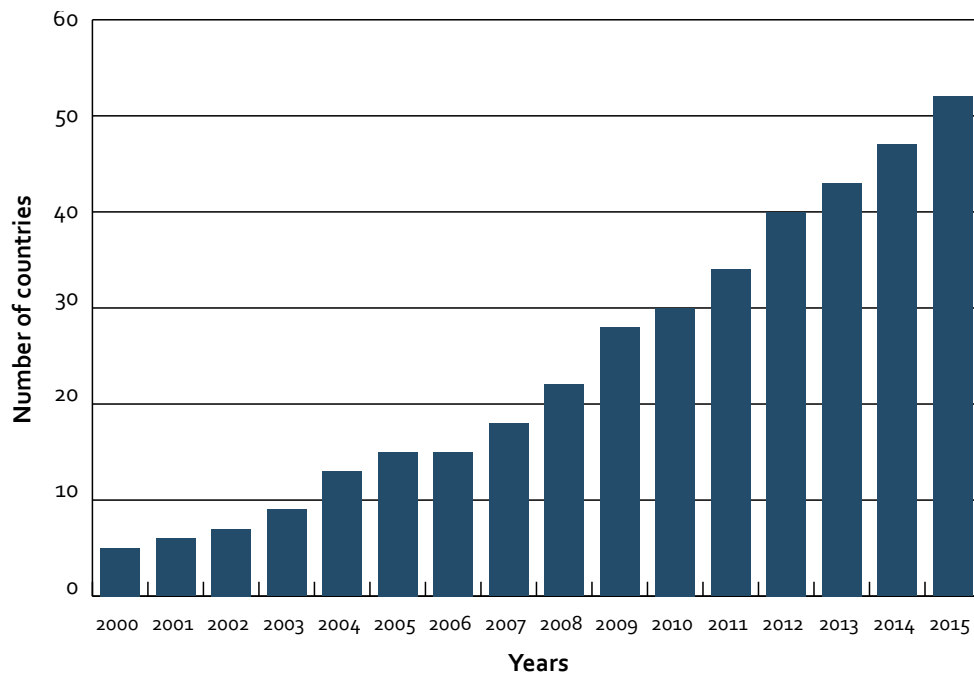
a   **Note:** This figure does not show the complete picture, as not all countries reported their year of adoption.

Specific legislation concerning EHR systems

The survey asked if countries had introduced legislation to govern the use of national EHR systems. Although there is reasonable progress in this area with 56% of countries (n=31) responding positively, there are still a large proportion of countries without appropriate legislation (Table 5.1). These findings are consistent with other studies *(11)*. Chapter 6 explores this central and complex issue in greater detail, addressing such areas as patient privacy and confidentiality, the sharing of data with other health professionals, as well as control over personal health data.

Table 5.1 Countries with legislation to govern the use of national EHR systems

Response	Total	
	No. responses	%
Yes	31	56
No	24	43
Total	55	
Non-responding	2	

Availability across the health system

The survey also explored the extent to which EHR systems are available across the health system in primary, secondary and tertiary health care facilities[1] as well as the level of uptake according to four measurements: low (less than 25% of facilities using EHR systems), medium (25–49%), high (50–74%) and very high (more than 75%).

The results show that of the 57 countries reporting having national EHR systems, the level of use across all three strata of health care facilities is high (all over 80%; see Table 5.2). Examining the degree of use of the systems across facility types reveals some interesting patterns. Use is either high or very high in 39% of primary care facilities as well as tertiary care, and is the case with secondary care facilities (36%). This shows that there is a relatively-uniform high level of use across all three levels.

Table 5.2. Countries with a national EHR system by facility type and measurement of uptake

Operational level	No. countries	Low (< 25%)		Medium (25–49%)		High (50–74%)		Very high (> 75%)		Total (%)
		No. facilities	%	No. facilities	%	No. facilities	%	No. facilities	%	
Primary care facilities	57	14	24	14	24	9	15	13	22	88
Secondary care facilities	57	17	29	13	22	5	8	16	28	89
Tertiary care facilities	57	20	35	6	10	9	15	13	22	84

Integration with other types of HIS

The survey went on to explore how national EHR systems were integrated with other HIS. To keep the results focused, the survey instrument offered the choice of the most common possibilities in the collection and maintenance of integrated patient data. These are pathology information systems, picture archiving and communications (PACS), pharmacy information systems and laboratory information systems (Fig. 5.3). By far the most frequent linkage is with laboratory information systems (77%; n=44). This is followed by pharmacy information systems (72%; n=41) and PACS (56%; n=32). These results are expected, as diagnostics constitute a central component of curative care services in the continuum of care. There are numerous additional linkages being explored or already being implemented. For example, countries link their EHR systems with other relevant sectors such as social services with the aim of providing a person-centred integrated approach to care.

As EHR systems mature and expand, there will inevitably be a gradual transition away from and/or integration of legacy, stand-alone systems (e.g. HIV databases, maternal and child health information) with national EHR systems.

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1   Primary care facilities include clinics and health care centres; secondary care facilities include hospitals and emergency care; tertiary care facilities include specialized care, and referral from primary/secondary care.

Fig 5.3. Linkages between national EHR system and other types of health information systems, globally
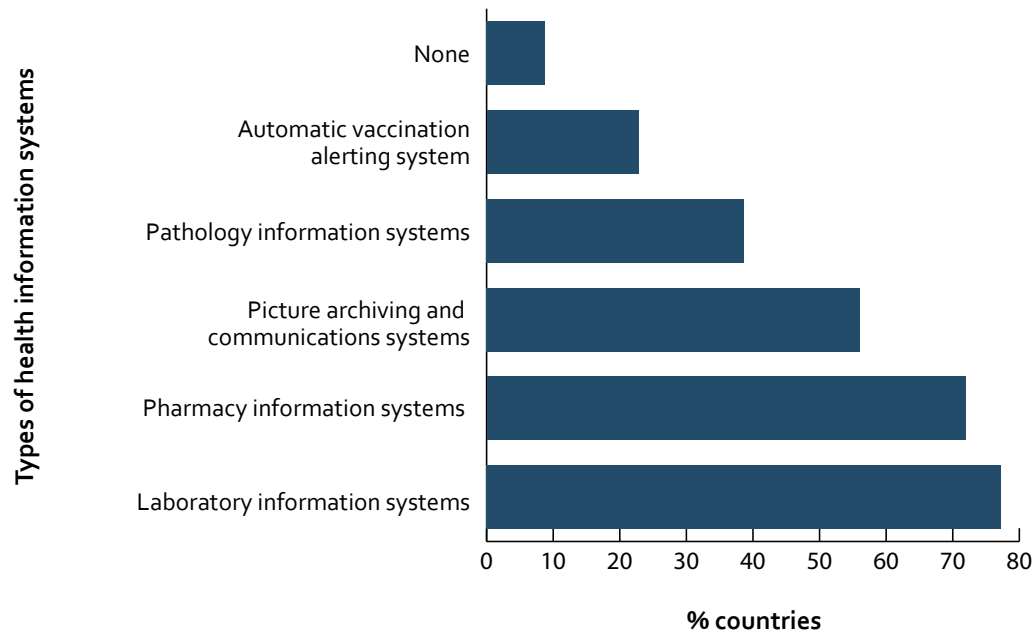
Barriers to implementing national EHR systems

Identifying and understanding the factors that can hinder implementation of EHR systems in countries can be valuable for strategic planning and implementation. Countries were asked to rate 10 possible barriers according to five values: not a barrier, slightly important, moderately important, very important and extremely important. For the purpose of reporting the data these scores were grouped into three values (see Fig. 5.4)

Fig 5.4. Barriers to implementing national EHR systems, globally
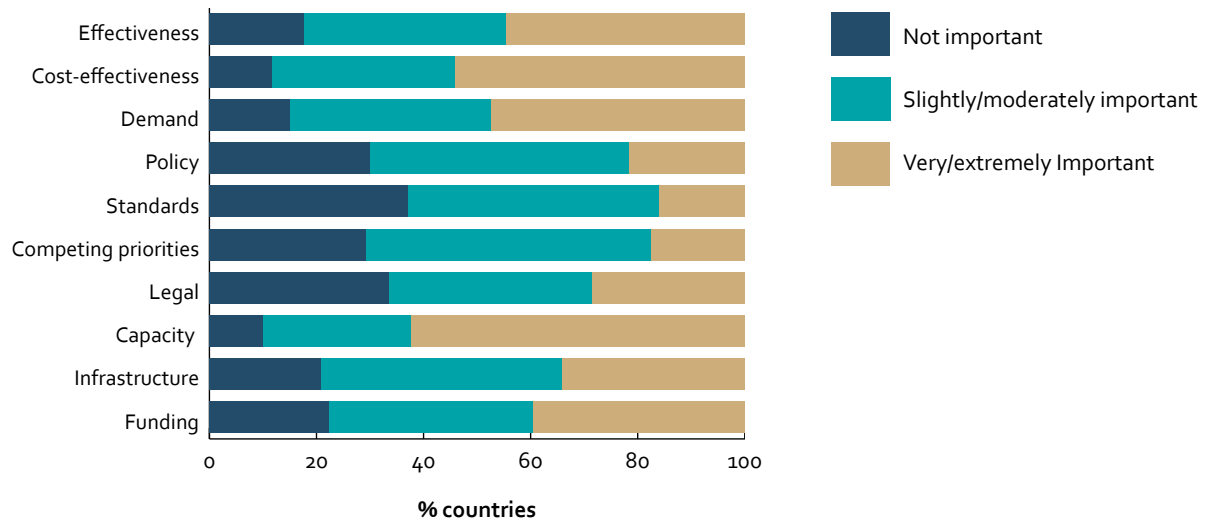
Given the high cost and complexity of national EHR system implementation, it is unsurprising to find that funding was identified as a major barrier. Sixty-three per cent of responding countries (n=75) rated funding as a very/extremely important barrier. National EHR systems require a considerable initial investment as well as an ongoing and long-term commitment on behalf of government. A national EHR system implementation may be the first point of entry into the eHealth domain for countries and probably the most ambitious HIS undertaking they will make.

Infrastructure was identified as a key barrier by over half of the responding countries (54%; n=65). Fortunately the momentum of improving infrastructure across other public sectors is already driving change in the health sector as well. It is anticipated that with increasing technological innovation – broadband access to the internet becoming more readily available, the cost of internet connectivity decreasing and the emergence of cloud storage – infrastructure will become a less significant barrier in the coming years.

Capacity was identified by almost half of responding countries (48%; n=57) as another important barrier. National EHR systems are complex and labour intensive to implement and require specialized skills for their development, upkeep and integration with other systems. Building HR capacity in health ICT is becoming increasingly important for the sector.

Legal issues were also considered to be a significant barrier (44%; n=53). Protecting the privacy and security of patients' health data must be a high priority for all countries. Chapter 6 reports that just over half of the responding countries (n=68; 55%) have legislation to protect the privacy of individuals' health-related data in EHRs; this indicates that a large proportion of countries have still not taken action. However, it is encouraging to note that during the years 2010–2015 there was a sharp global increase in legislation governing privacy protection of EHRs, which grew from 31% (n=26) to 55% (n=46). It should be noted that specific legislation covering data in electronic form may not be required if countries already have general data protection legislation with wide reach.

Discussion

The results of this survey showed that the implementation of EHR systems has increased impressively over the past five years, and that the higher-income countries are more likely to be further advanced in the adoption and utilization of EHR systems than lower-income countries. This is unsurprising since the adoption of EHR systems at the national level is linked to the availability of human resources, good infrastructure, supporting legal frameworks and adequate funding.

The effectiveness of national EHR systems and their contribution to achieving UHC is related to their uptake across the health sector. The survey found that there was a high level of diffusion across all three levels of the health system. However, there is variation in their use within the facilities with the highest being in primary care facilities, less in secondary care facilities, and the least in tertiary facilities.

An important and unique benefit of EHR system integration with other systems is to obtain a complete overview of care of the individual at any given time. It is encouraging to note that a high proportion of countries are already linking to related systems; and as EHR systems evolve this trend is expected to continue.

Understanding the barriers to EHR system implementation is the first step to overcoming them and moving forward. Countries most frequently identified funding, lack of capacity, infrastructure and legal aspects as the main barriers to the introduction of national EHR systems. While funding is likely to be an ongoing issue worldwide, capacity, infrastructure and legal frameworks are steadily being addressed and are likely to diminish in importance in the future.

The adoption of EHR technology in health care systems is increasing steadily; in time, EHRs will become the basic building block of eHealth in countries. The effective implementation of national EHR systems will empower health professionals as well as patients through the use of comprehensive and timely patient information resulting in more accessible and better health care – a prerequisite in the journey toward universal health coverage.

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Case study
EHR

My eHealth Record, Northern Territory, Australia

The My eHealth Record (MeHR), an electronic shared record service, was established to address the fragmentation of health information for a predominantly Indigenous and mobile population with multiple health concerns. It has been operating since 2005 in the Northern Territory as well as in surrounding regions of Central Australia.

Aboriginal and Torres Strait Islander Australians comprise 30% of the population in the Northern Territory (approximately 70 000 people), the highest proportion of any state or territory *(1)*. The proportion of Indigenous people in other Australian states is 5% or less *(1)*.

Compared with non-Indigenous Australians, Indigenous Australians are more likely to have certain medical conditions and a higher incidence of certain diseases that are now virtually unreported in the non-Indigenous population, e.g. rheumatic heart disease *(2)*. Despite Australia's high-quality universal health system, death rates for the Australian Indigenous population are much higher than the non-Indigenous population across all age groups and for all major causes of death *(3)*.

The largely mobile nature of Aboriginal and Torres Strait Islander people means there was no central place to access their health information in order to provide integrated and continuous care. The MeHR service helps to overcome this challenge in providing care to this population in this region.

Aspects of Aboriginal culture require unique and specialized care which the MeHR service was designed to be able to support. For example, the mobility of the population means that the record is predominantly used when health providers do not have timely access to existing patient information. Additionally, English is not a first language for many patients and Western "clinical talk" can be perceived as a foreign language *(4)*. The MeHR service empowers patients to state "the information is in my record" and therefore they do no need to tell or retell their clinical story.

The Indigenous sense of identity is unique which can make identifying individuals at the point of care challenging. The service has search, alias and other familial details that assist with patient identification. Likewise, the record allows recording of gender-related health issues, which eases the burden on patients to revisit and retell sensitive health histories. In some circumstances, cultural nuances call for prompt care. For example, some patients will not wait for a provider, and instead manually source information from other providers or organizations to "fill in the gaps". In these cases, the record provides immediate access to the required information.

The MeHR service has proven to be an invaluable resource. The main benefits have been outlined in the evaluation report *(5)*, which states that the MeHR service:

- increases access to health information
- reduces time spent sourcing information
- supports clinical decision-making
- increases provider and consumer confidence
- improves continuity of care
- increases capacity to deliver population-based primary health care.

> *"There was an Indigenous lady who moved into the community, because her family were living there. She's got dementia and she had a stroke. She came in from [community omitted] so she had nothing; no record. I went into her eHealth record and that's where I found everything I needed."*
>
> - Aboriginal and Torres Strait Islander Health Practitioner

Health care providers in these regions are also unique and the environment is usually quite different to that found elsewhere in Australia. This presents a number of challenges and opportunities; for example, the remuneration model is based on capitation not fee-for-service, which was a key enabler of the programme. However, there is a high staff turnover and the complexities of service delivery in Indigenous communities require a high level of teamwork, communication and collaboration. The complex care needs of this population result in complex clinical documentation. The MeHR service has become a bridge between providers, as they are able to access information contained in the MeHR service regardless of clinical information system interconnectivity or interoperability. The service has enabled vast flows of information across and within different sectors of the health system, for example, from the Aboriginal community-controlled primary care sector to the government-operated acute sector *(5)*. In fact, the less interconnectivity between systems there is, the more valuable the MeHR service becomes as a source of information and the more frequently it is accessed.

The record is predominantly used by providers in four main scenarios:

1) for investigative purposes (Who is this patient? What medications are they on?);
2) opportunistically (a trigger or prompt during consultation may cause the provider to look for more information);
3) targeted (to find a specific piece of information);
4) to supplement local clinical records.

The record also offers a means to provide proactive population-based health care, which was an unexpected outcome. It is used in the preparation of clinics and to track the whereabouts of a patient by identifying recent locations of care delivery, in instances where they may require follow-up care.

In terms of overall use of the system, the MeHR evaluation showed that consumer registration took 5.5 years to reach 50% of the target population, with provider registration and participation continuing to increase over time. Interestingly, clinical content generation preceded viewing, which is an important learning outcome for others implementing an EHR as it demonstrates the need for patience, as there was a gradual evolution toward a "critical mass" of useful clinical information.

The MeHR service has been able to realize its value because the service has become embedded into routine workflow, particularly at points of handover. The reasons for this successful implementation and use by clinicians can be attributed to three main factors: automated document generation with default-to-send settings which minimizes the impact on providers; an effective clinical advisory committee which drove clinical usability enhancements and helped foster participation and trust; and an intuitive user interface design which meant minimal training was required *(5)*.

Consider Charlie Tjami, a 41-year-old father of two who lives in remote community Amoonguna, 15 km south-east of Alice Springs. He is experiencing shortness of breath and a tight chest. His general practitioner at the local Aboriginal community health centre refers him to Alice Springs hospital where he has an electrocardiogram. He is then referred to Royal Adelaide Hospital for further tests and undergoes a multiple coronary artery bypass and mitral value surgery. After 10 days he is discharged home to his community. Throughout this clinical event he has travelled over 8000 km, across two states, and has been treated by many providers. During this time his health care providers were able to rely on the information in his MeHR service, predominantly at the critical points of clinical handover.

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6. Legal frameworks for eHealth

Key findings

- **Slow but steady development of a general eHealth regulation: 33% of responding Member States (n=39) have policies or legislation to define medical jurisdiction, liability or reimbursement of eHealth services, while 47% (n=58) have legislation to promote safety, quality and standards of health related data.**

- **Good advances in adoption of health data privacy legislation: 78% of responding countries (n=98) reported having legislation to protect privacy of personal information, and 55% (n=68) legislation to protect the privacy of electronically held patient data is a good indicator. These numbers have risen from 73% and 31% respectively since the 2010 survey.**

- **Slow adoption of legislation to facilitate international sharing of electronic health record (EHR) data for patient care: 34% (n=43) reported having legislation to covering sharing of health related patient data between health care professionals within the same country, and but only 22% (n=28) have legislation which addresses sharing such data internationally.**

- **Slow but steady development of patients' rights with respect to electronically held health data: 29% of countries (n=36) reported that legislation had been adopted to ensure patients can access EHRs, and almost the same number (28%) reported that legislation gives patients the right to define who may access the record. Thirty-two per cent reported that a patient may demand to have an error in an EHR corrected, but only 18% provide for the deletion of an entry in a record.**

Note: the survey questions focused particularly on the regulatory aspects of the use of electronic health data and EHRs. While electronic data and EHRs are only one element of a well-functioning eHealth system, it may be argued that they are the basis of eHealth systems, and as such the maturity of regulation of electronic health data and EHRs may be taken as a good indicator of maturity of the general eHealth regulatory framework. The fact that the focus of the questions was significantly on EHRs implies, however, that countries which do not use electronic records are not covered in detail in this review.

Introduction

eHealth is an important tool to help countries establish safe, efficient and sustainable health care delivery systems. Other parts of this report have already explored the extent to which eHealth can extend the reach of health professionals to patients who, for reasons of the physical distance, may experience considerable problems in reaching both basic and specialist care. Its potential in enhancing safety of care through online education and decision support have also been explored, and its role in extending capacity of care providers through remote monitoring and telemedicine has also been considered.

However, in order for eHealth to play its full role in helping health systems achieve the targets of universal health care (UHC) and to be truly integrated into daily health care services, a number of political and policy changes will have to be made in many health care systems. Alongside the many other needs that have been discussed in the preceding chapters, a change in the legal context for health care provision is also necessary to enable the full potential of eHealth to be realized.

A comprehensive legal framework for eHealth will need to address the transfer and use of information between health care workers and patients. In addressing such transfers the issues of privacy and confidentiality of patient data and rules on access rights and sharing rights for data are paramount. However a good legal framework should also address data quality and integrity as a basis for clinical and patient decision-making, and provide for the adaptation of professional liability rules to accommodate care provided remotely or virtually. Alongside traditional legal issues such as privacy and liability it is important to ensure that legislation addresses procurement of eHealth tools such as electronic health records (EHRs), telemedicine systems, monitoring systems and that medical devices include provisions to ensure system interoperability. This will include harmonizing adoption of standards and clearly specified requirements for compliance with standards in procurement notices *(1)*.

However, the full legal framework outlined in the paragraph above, stretching from simple data privacy rules to full technical interoperability, was considered to be too wide for the GOe surveys. Rather than asking very detailed questions on all legal aspects, it was decided that the surveys would focus on legal provisions linked to the use of EHRs and sharing the data held in such records. This does not seek to imply that EHRs are synonymous with eHealth, but rather uses EHRs as a parameter of the maturity of thinking on the legal frameworks needed for eHealth. Accordingly, the questions asked in the 2010 and 2015 GOe surveys focused mainly on the legal framework for EHRs, looking at the existence of a general framework for their use, and then focusing on issues of privacy, creation and access, and sharing. The maintenance of the particular focus on privacy in the 2015 survey, which was the sole focus of survey questions on legal issues, was based to some extent on the finding of the 2013 study of the Organisation for Economic Co-operation and Development (OECD) *(2)*, which looked at the challenges facing the world's most advanced countries in improving health care efficiency. The OECD report stressed the need for new legal frameworks which allow for sharing of health-related information between health care professions

within and across health care organizations, as well as across organizational and geographical boundaries. The report noted that very few countries in the OECD had addressed these challenges comprehensively, and argued that generalized uncertainty on how existing legal frameworks apply to health ICT systems impedes uptake of otherwise mature solutions. The OECD report underlined specifically that privacy concerns constitute some of the most difficult barriers to overcome if widespread implementation of eHealth is to be achieved.

Concerns with privacy in eHealth are not, however, the preserve of the richer countries alone. Studies of the International Development Research Centre in 2010 *(3)* and Privacy International in 2012 *(4)*, argued that the processing of information, ranging from simple communication between patients and medical staff to complex sharing of data between care institutions, is a core requirement of good health care. The results of these projects established that many developing countries are poorly equipped to ensure the levels of patient privacy that such processing of health information demands. This finding was further underlined in a subsequent study which noted that "as the systems and practices [for eHealth] in a developing country are being overhauled, little work is being done to establish new policy frameworks for the protection of privacy and security. Capacity-building in these countries focuses mostly on deploying new systems, at great cost"*(5)*.

Many challenges to patient privacy in developing countries may exist because of financial constraints, which make it hard to use sophisticated health information security tools or to invest significantly in training health care professionals on how to uphold the ethical principles demanded by the use of new communication and digital technologies in health care. However, experience in stigmatized diseases such as HIV has shown that unless privacy is addressed very clearly by public authorities, patients are often unwilling to seek treatment.

A valuable assessment of the wider challenges of legal frameworks for eHealth in developing countries is contained in a report conducted under the auspices of the European Space Agency (ESA) on regulatory aspects of satellite-enhanced telemedicine and e-health *(6)*. ESA supported the publication of four linked studies whose objective it was to explore the challenges and opportunities of a satellite-enhanced e-health and telemedicine infrastructure for sub-Saharan Africa. The four separate studies analysing the potential of telemedicine in Africa, cover regulation, governance, interoperability and sustainability. The study identified the following list of key regulatory issues relevant for eHealth in Sub-Saharan Africa:

- access to and ownership of data
- security and access to clinical information systems by patients and care provider
- privacy and confidentiality
- informed consent for data use
- data ownership
- access rights to patient data
- integrity of data
- patient safety

- secure transmission of patient data
- electronic and physical security
- reliability of electronic portable medical devices used with ehealth
- accuracy and reliability of online information for patients
- sustainability of accuracy and integrity of electronic patient medical records
- validity and reliability of clinical decision support systems
- quality of care using ehealth processes
- availability of efficient and effective communication systems for transferring patient data
- reliability and dependability of telemedicine and telemonitoring.

The study authors concluded, however, that these are too numerous for many less-developed countries to pursue simultaneously. They argued therefore that on a pragmatic basis, regulatory priorities for eHealth development should include privacy, confidentiality, security and standards.

Following a similar line of argument on prioritization, the GOe surveys of both 2010 and 2015 sought to examine the extent to which privacy rights had been addressed in legislation relevant to the practice of eHealth. The results discussed below will highlight that despite the fact that privacy of health data is a relatively well understood concept, there is still some way to go in ensuring that respect for such privacy is well translated into regulation of eHealth across both developed and less developed regions of the world.

Results and analysis

The legal issues section of the 2015 survey asked respondents to reply to a series of questions, which began with questions about the existence of legislation on eHealth and electronic health data privacy. It then moved on to look at the issue of electronic health data quality, exchange and usage; and finally looked at patients' rights with respect to access, correction and control of data held in EHRs. The responses in this section complemented those asked in the sections on telehealth, mobile health and EHRs, in which respondents were asked if legal and legislative issues were barriers to adoption of those initiatives.

The legal baseline

The first question sought to establish the baseline for the legislative framework for eHealth, asking if legislation or policy to define jurisdiction over eHealth acts, as well as liability and reimbursement for eHealth, had been adopted. The survey results establish that one third (n=39; 33%) of the responding countries have policies or legislation in place to define medical jurisdiction, liability, or reimbursement for eHealth (Fig. 6.1).

The results show a notable regional variation, with the Region of the Americas and the Western Pacific Region reporting 50% and 55% respectively and the European Region reporting 42% (Fig. 6.1a). Looking at the responses by World Bank income group (Fig. 6.1b), there was a clear decreasing trend moving from high- to low-income groups: 55% of countries in the high-income group versus 5% of countries in the low-income group reported policies or legislation addressing eHealth jurisdiction, liability, or reimbursement.

Fig. 6.1.   Countries with policies or legislation to define medical jurisdiction, liability or reimbursement of eHealth
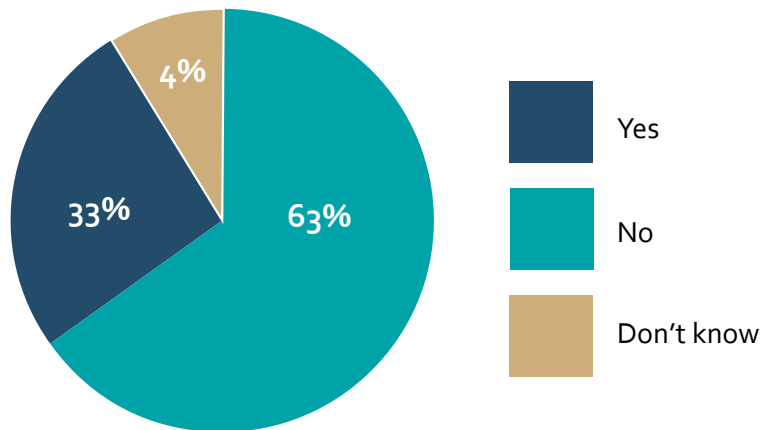
Fig. 6.1a. Percentage of countries with policies or legislation to define medical jurisdiction, liability or reimbursement of eHealth, by WHO region
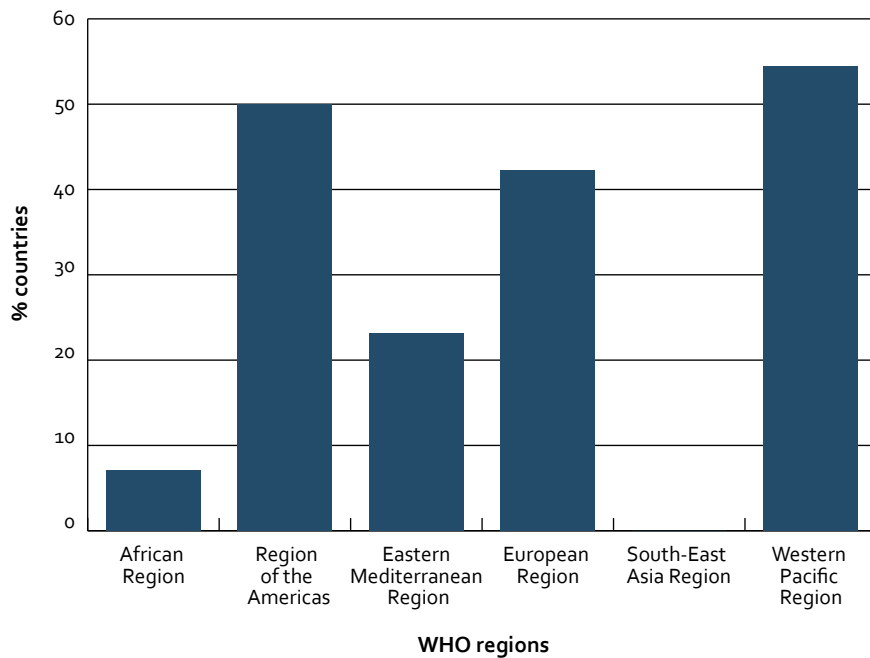
Fig. 6.1b. Percentage of countries with policies or legislation to define medical jurisdiction, liability or reimbursement of eHealth, by World Bank income group
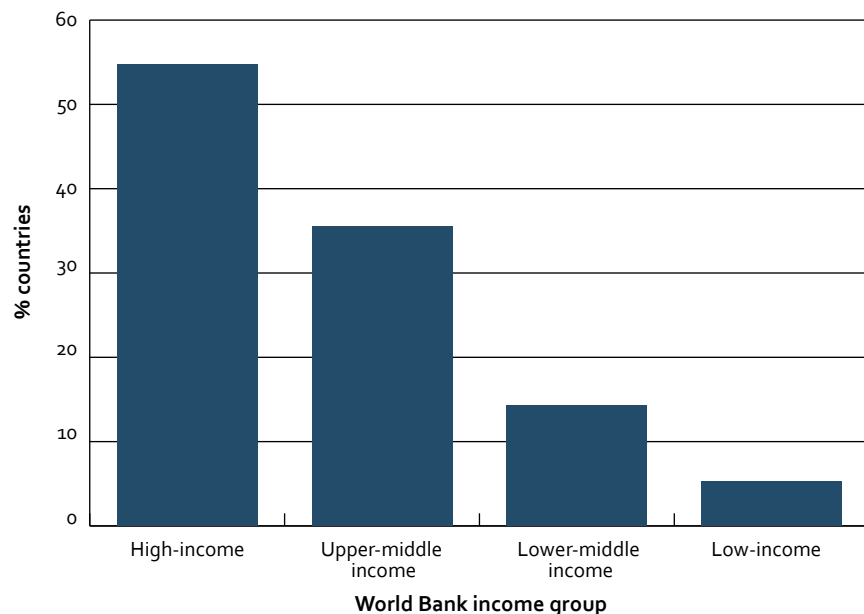
The baseline picture is further clarified by the second question, which asked if legislation has been adopted to address patient safety and quality of care based on data quality, data transmission standards or clinical competency criteria. Nearly half of countries (n=58; 47%) reported having such legislation (Fig. 6.2). Here there was also a variation by WHO region (Fig. 6.2a) and World Bank income group (Fig. 6.2b). Legislation of this type was higher among countries in the Region of the Americas (n=14; 78%), the European Region (n=26; 57%) and Western Pacific Region (n=6; 50%). Among the Eastern Mediterranean, South-East Asia and African Regions, fewer than a third of countries reported legislation on data quality and transmission. Similarly, richer countries reported a greater incidence of such legislation than poorer countries.

Fig. 6.2.   Countries with policies or legislation to address patient safety and quality of care
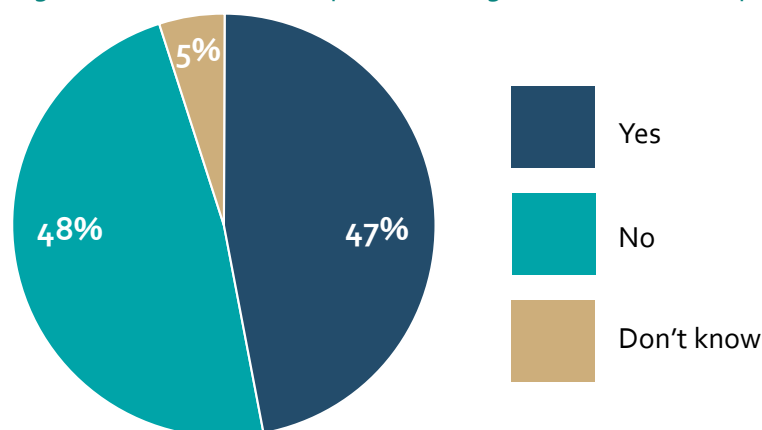
Fig. 6.2a. Percentage of countries with policies or legislation to address patient safety and quality of care, by WHO region

(bar chart, y-axis: % countries, 0–80; x-axis: WHO regions)

- African Region: ~24
- Region of the Americas: ~78
- Eastern Mediterranean Region: ~30
- European Region: ~56
- South-East Asia Region: ~19
- Western Pacific Region: ~50

WHO regions
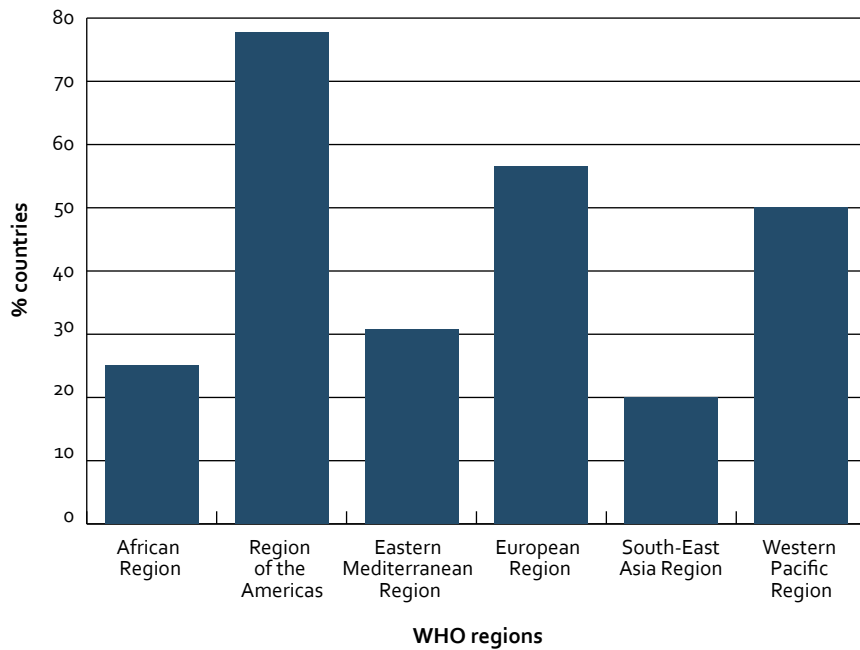
Fig. 6.2b. Percentage of countries with policies or legislation to address patient safety and quality of care, by World Bank income group

(bar chart, y-axis: % countries, 0–80; x-axis: World Bank income group)

- High-income: ~79
- Upper-middle income: ~51
- Lower-middle income: ~17
- Low-income: ~15

World Bank income group
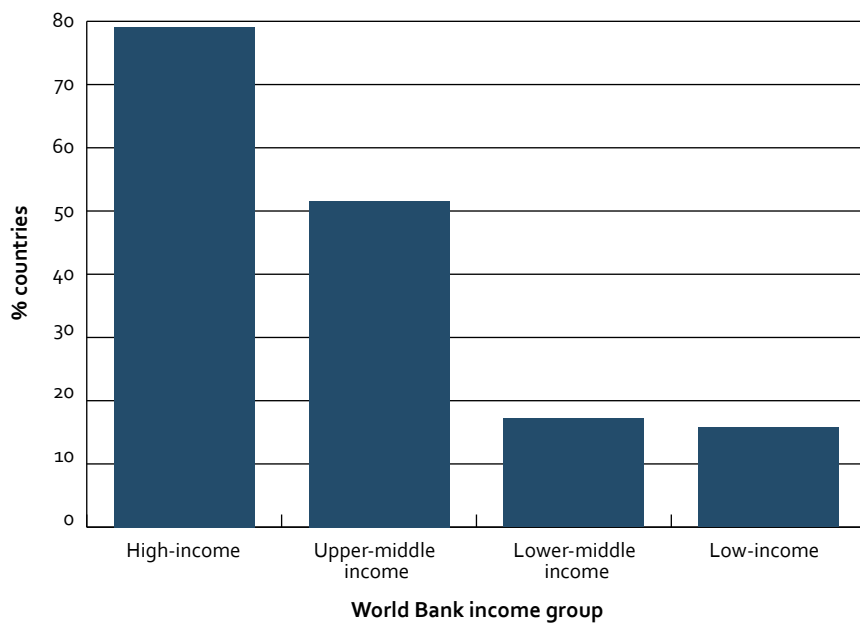
These baseline data provide an important background, which was not examined in the 2010 survey. They show that while an appreciation of the importance of a good legal basis is emerging, the demands have not yet been comprehensively addressed. The variations across the World Bank income groups are indicative not only of the place of eHealth in these health systems, but perhaps also of law as a tool for governing health systems.

Privacy for patient data and patient data held in electronic form

After establishing the baseline of the legal framework for eHealth, respondents were asked to consider the issue of privacy of health-related data in general (whether held in paper or electronic format) and then to comment on privacy of data in EHRs.

The survey guidelines defined personally identifiable data as information which can specifically identify an individual. This can include, but is not limited to, names, date of birth, addresses, telephone numbers, occupations, photographs, fingerprints – regardless of the format or medium in which it is held. Health-related data was defined as information recorded about an individual including their illnesses and prescribed treatments. It was noted that this generally includes details of prescribed medication and any medical or surgical procedures undertaken as well as treatments received from other health care providers.

Over three quarters of countries reported general privacy legislation to protect personally identifiable information (n=98; 78%), with higher rates among countries in the European Region (n=46; 98%) and Region of the Americas (n=17; 94%) than in the other four regions (Fig. 6.3a). There was also a noticeable difference between high-income countries (n=40; 91%), upper-middle-income (n=26; 81%) and lower-middle-income (n=23; 79%) compared to low-income countries where fewer than half of countries (n=9; 45%) reported general privacy legislation (Fig. 6.3b).

With respect to specific protection of the privacy of individuals' health-related data in EHRs, just over half of countries (n=68; 55%) reported having such legislation. Significant regional trends were observed for privacy of EHR data, with the European Region (n=36; 77%) and Region of the Americas (n=12; 67%) leading among WHO regions (Fig. 6.3a). In terms of World Bank income group, over 80% of high-income countries reported legislation to protect EHR data, whereas only about half of upper-middle-income countries (n=17; 53%) and about a third of lower-middle-income (n=8; 28%) and low-income countries (n=6; 30%) had legislation in place for protection of EHR privacy (Fig. 6.3b).

Fig. 6.3a.   Country legislation for protection of personal information and eHealth data, by WHO region
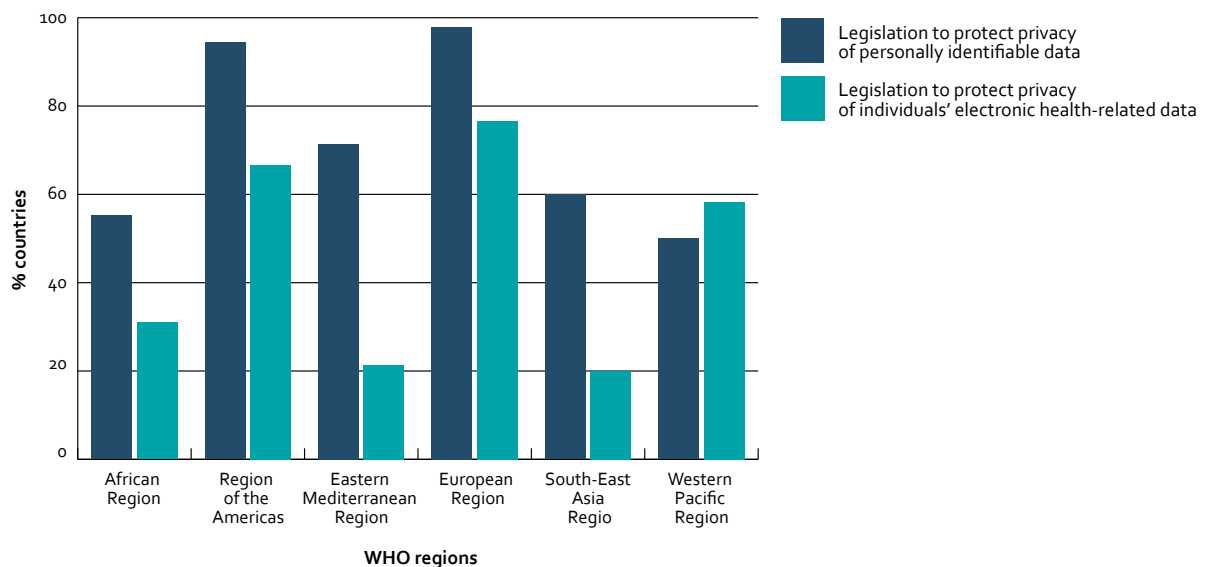
Fig. 6.3b. Country legislation for protection of personal information and eHealth data, by World Bank income group
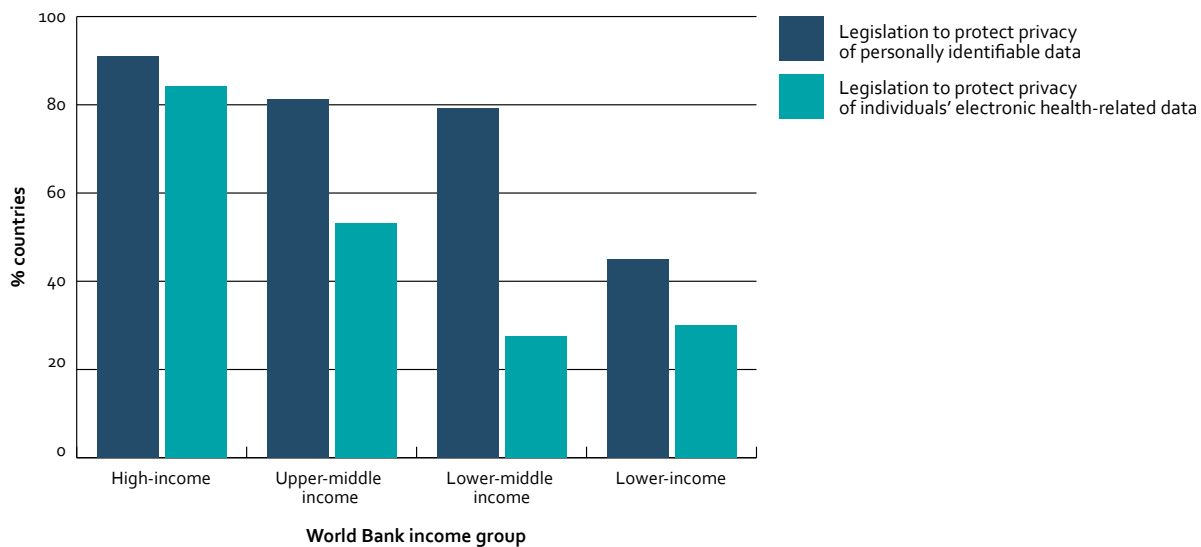
These questions were asked in both the 2010 and 2015 survey, allowing a comparison to be made. For both types of legislation, there was growth over time. In 2010, 73% (n=61) of countries had legislation to protect the privacy of personally identifiable information, but by 2015 this had grown to 81% (n=68). There was a sharper increase in legislation governing privacy protection of EHRs, which grew from 31% (n=26) in 2010 to 55% by 2015 (n=46).

It is important to interpret these data recognizing that specific legislation covering electronically held data may not be required if the general data protection legislation is drafted with wide reach. This may be the case particularly in countries of the European Union, where the data protection legislation is a transposition into national legislation of Directive 95/45/EC on data protection. The Directive provides in Article 3 that it applies to any form of data processing whether "wholly or partly by automatic means, or processing otherwise than by automatic means which form part of a filing system or are intended to form part of a filing system". Based on this definition, many European Union countries have updated their general data protection legislation in such a way that specific EHR privacy legislation would not be strictly necessary in order to protect patients.

Sharing and use of health related data

Much of the power of eHealth, whether it is supporting direct patient care through EHRs, telehealth, mobile health or driving research through big data applications, relies upon the capacity of eHealth tools to collect and process patient data and generate reliable data to share with the patient, health care providers and researchers. Recognizing that shareable patient-specific data is in many ways the "fuel" of eHealth based health care, without which the tools have only a limited capacity, the survey asked a series of questions about the extent to which legislation facilitates the sharing of health related data (Fig. 6.4).

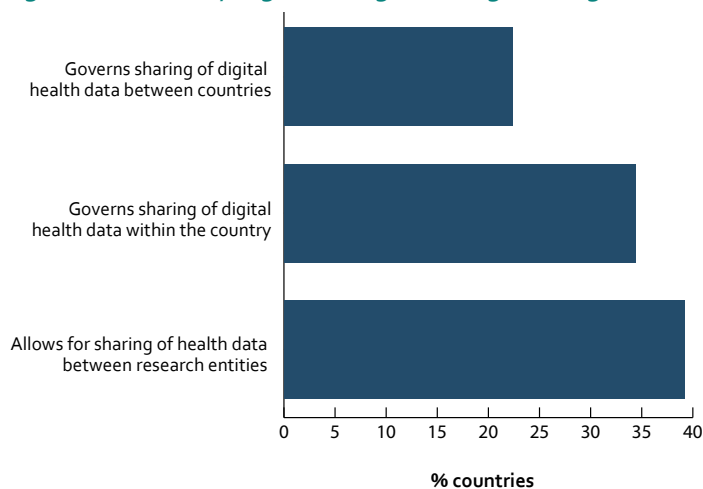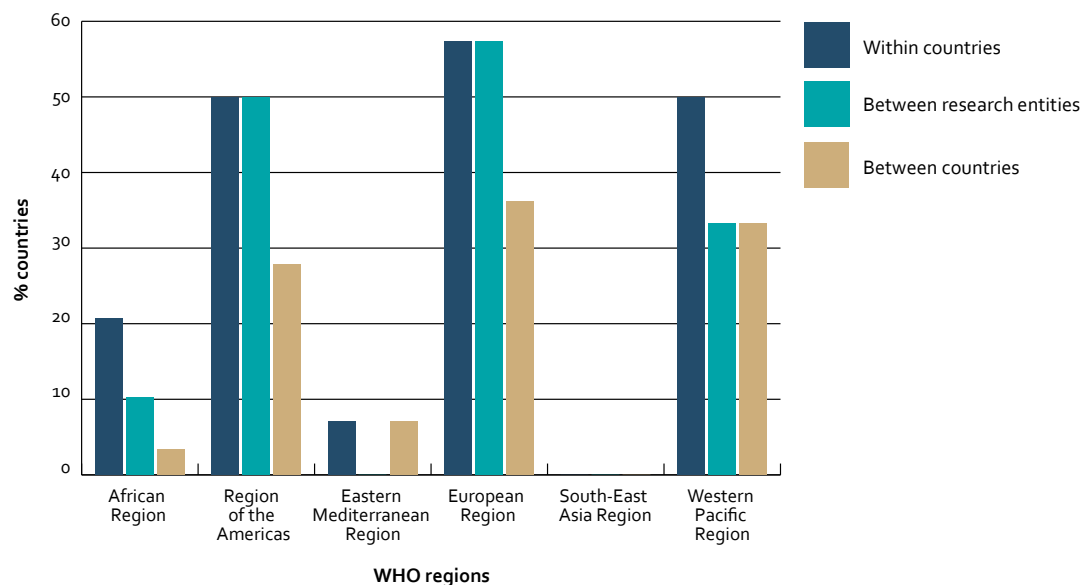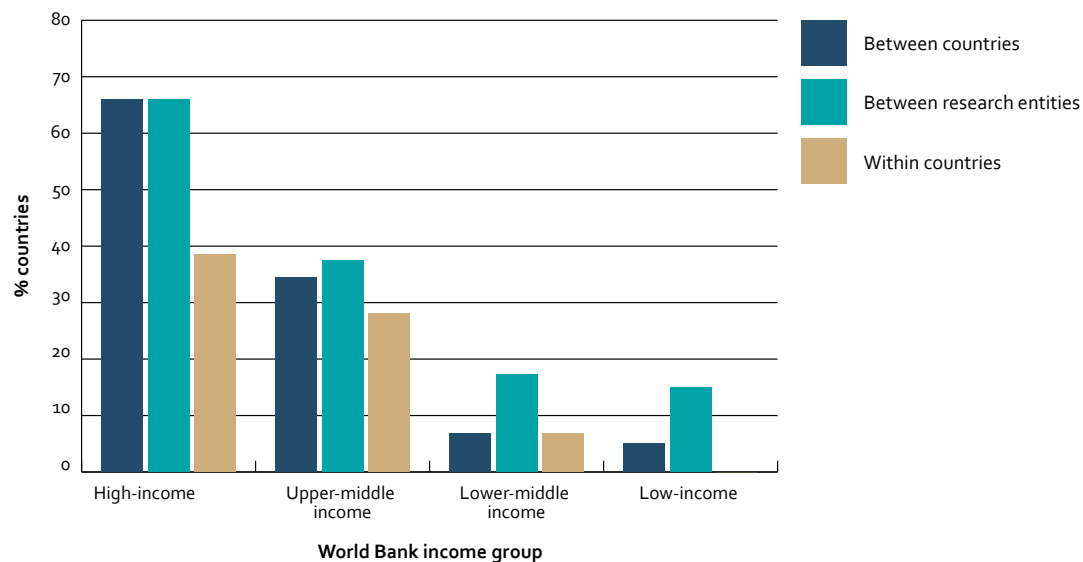### Fig. 6.4. Country legislation governing sharing of health-related data, globally

Fig. 6.4a. Country legislation governing sharing of health-related data, by WHO region

Note: None of the Member States in the South-East Asia Region responded to this question.

Fig. 6.4b. Country legislation governing sharing of health-related data, by World Bank income group

Sharing data between health care professionals in-country

Looking at sharing data for care purposes, the first of the group of questions on data sharing asked respondents to state if their country had legislation governing the sharing of digital data between health professionals in other health services within their country. Roughly 34% of countries had such legislation in place.

The regional variation here was stark, with 57% of countries in the European Region responding that such legislation existed, 50% in the Region of the Americas, and 33% in the Western Pacific Region. In the African Region, however, only 10% of countries reported such legislation, while in the Eastern Mediterranean Region very little was reported, and in the South-East Asia Region, none (Fig. 6.4a). The same data distributed by World Bank income group show a similar pattern (Fig. 6.4b). It therefore appears that most countries have recognized the power of a legislative framework to underpin the sharing of EHR data between health care professionals in their country – even if they have not yet enacted such legislation.

The data therefore beg the question: If just over one third of countries (n=43; 34%) have laws to regulate the sharing of electronic health data between health care professionals working in the same country, and under half (n=57; 47%) have EHR systems, is the lack of a legal framework for using EHRs slowing their adoption of EHR systems? The fact that 44% reported that they thought the lack of a legal framework was a very or extremely important barrier to EHR adoption would suggest that in many countries the governance tools to regulate the use of EHRs are not keeping pace with demand.

Sharing data between health care professionals internationally

The power of eHealth in addressing the SDG objectives of safe and affordable care lies however not only at national level, but also in the extent to which it can empower nations to share health expertise across borders to support citizens in countries where the requisite medical expertise may not exist. For this reason the survey asked also about the existence of legislation to facilitate sharing of electronic health data with health professionals in other countries.

Here the responses showed a low provision of such laws, with 36% (n=17) of countries in the European Region reporting such legislation and 28% in the Region of the Americas (n=5) (Fig. 6.4a); zero countries in the South-East Asia Region had such laws and only two countries in the African Region did so. The relatively higher number in the European Region may be accounted for to some extent by the fact the European Union adopted legislation on cross-border care,[1] which was transposed into national legislation by late 2013.

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1   Directive 2011/24/EU of the European Parliament, and of the Council of 9 March 2011 on the application of patients' rights in cross-border healthcare.

Sharing data for research purposes

Shareable data, however, drive not only quality, accessibility and affordability of direct patient care, but also research and innovation in health care between research entities. Accordingly, the survey also sought to establish if legislation provided for the sharing of data between research entities.

Legislation for data sharing for research was comparatively more established among countries in the European Region (n=27; 57%), the Americas Region (n=9; 50%) and the Western Pacific Region (n=6; 50%). The data show that in the former two regions the numbers for sharing data between health care professionals in the country and researchers were exactly the same, allowing an assumption that the same piece of legislation covers both types of sharing.

Notwithstanding the relatively low percentage of countries globally reporting adoption of legislation for data sharing, whether for care or research purposes, growth in the adoption of such legislation can be seen between 2010 and 2015. Among the 84 countries that responded to both the 2010 and 2015 GOe survey, over a quarter (n=23; 27%) reported having legislation to govern sharing of digital health data within the country in 2010, compared to over 40% with this type of legislation by 2015 (n=35; 41%). In both 2010 and 2015, fewer countries reported such legislation to govern sharing of digital health data between countries, but there was still significant growth over time from 13% (n=11) to 27% in 2015 (n=23). It is not possible to draw a comparison between the percentage of countries enacting legislation to facilitate EHR data sharing for research from the 2010 and 2015 surveys; in the former the question on sharing data for research purposes focused specifically on international research, whereas in the latter the questions asked about research in general.

Growth of patient rights

Until relatively recently in most parts of the world patient information was treated as confidential, but in the sole control of the doctor. To a large extent this was because when records were held only in a paper format, written by hand by a doctor on paper owned by a doctor, there was a strong sense that the record was in fact owned by the doctor. The duty of secrecy was based on duties relative to good conduct by the doctor, rather than concepts of patients' rights. With the advent of EHRs where the ownership of the medium on which the record is captured is less important and the record itself is composed of a range of data items originating from a wide variety of sources, the concept of record ownership is less helpful. In order to establish how far the global health community has adopted ideas of patients' rights to access and control their health care records, a series of questions about such rights was asked in both the 2010 and 2015 surveys. Figs. 6.5 and 6.5a show responses to the question in the survey and by WHO region, respectively.

Fig. 6.5. Countries with legislation that governs individual rights related to EHRs, globally
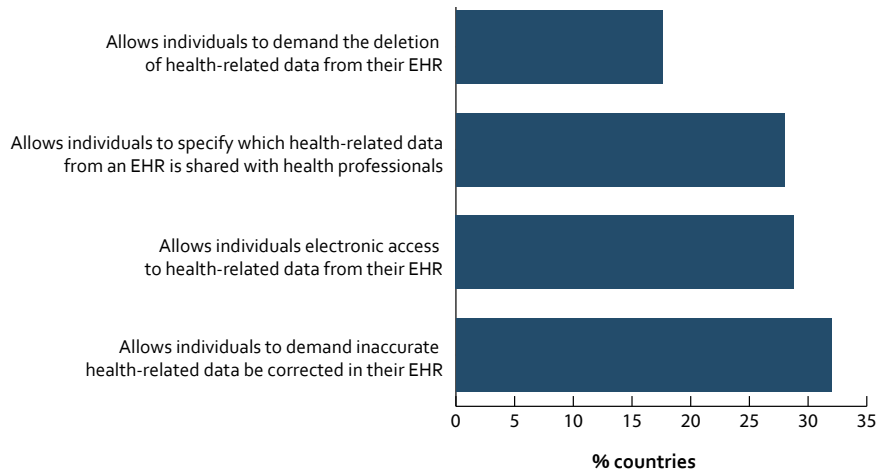
Fig. 6.5a. Countries with legislation that governs individual rights related to EHRs, by WHO region
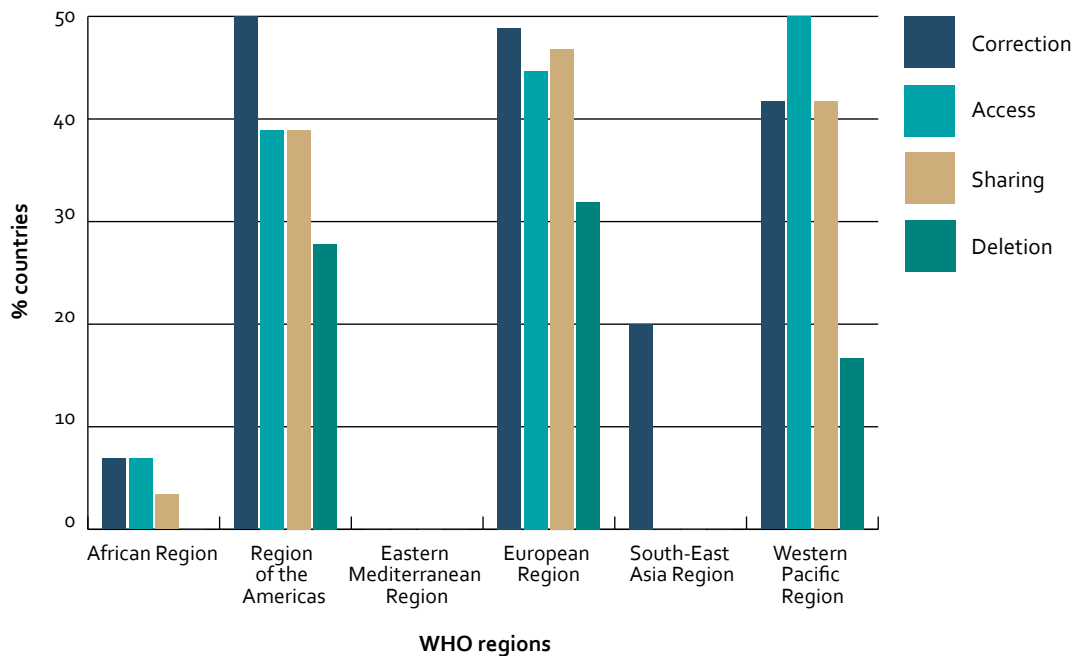
Electronic access

The figures show that globally only 29% of countries have legislation that allows individuals to electronically access health-related data from their EHR (n=36). Countries with this type of legislation were clustered in the Regions of the Western Pacific (n=6; 50%), Europe (n=21; 45%) and the Americas (n=7; 39%), whereas only two countries in the African Region (7%) and zero countries in the Eastern Mediterranean or South-East Asia Regions reported this type of legislation around individual access. By World Bank income group, countries with legislation around individual access to EHRs were largely found in the high- (n=25; 57%) or upper-middle-income groups (n=9; 28%).

These data are somewhat concerning when read in conjunction with the data on sharing of data for research or care purposes discussed above. With respect to sharing data for research it was noted that over 57% and 50% of the countries in the European and Americas Regions, respectively,

provided for sharing data for research or care purposes, whereas the same regions reported 45% and 39%, respectively, when granting patients access to data concerning themselves. It would seem therefore that while in the higher-income countries of the world a greater rhetoric around patient-centred care and patient empowerment exists, this has not yet translated into legislation facilitating easy access to EHR data by the patient him or herself.

It should be noted that in the 2015 survey the questions asked if patients had electronic access to their data, rather than access per se, which was the wording of the question in 2010. The fact that in 2015 the focus was on electronic access makes it hard to compare the figures, but does account for the reported 28% of countries globally that granted patients access to EHR data in the 2010 survey.

The difference between access per se and electronic access is underlined particularly in the results for the European Region, where in 2010 a positive response rate of 55% was reported, compared to 45% in 2015. This variation in the European Region can be accounted for largely by European Union Member States that have interpreted the duty contained in Article 12 of the Data Protection Directive to mean that patients should have access to their records, but not necessarily in electronic format. The Directive requires only that Member States shall guarantee every data subject (patient) the right to obtain in "an intelligible form" the data concerning him or her which is undergoing processing. Should the survey be conducted again post 2018, it will be interesting to see the impact of a change in wording in the European legislation, which through Article 15*(3)* of the General Data Protection Regulation 2016 requires that by 2018 patients are granted access in a commonly used electronic form, unless they request otherwise.

Correction

The distinction between electronic access and access per se is strongly underlined by the responses to the second question in this series, which asked if patients had a right to demand correction of inaccurate health-related data in the EHR. Here the survey found that 32% of countries reported having legislation allowing individuals to demand inaccurate health-related data be corrected in their EHR, again largely clustered in the Region of the Americas (n=9; 50%), the European Region (n=23; 49%) and the Western Pacific Region (n=5; 42%). Results by World Bank income group reflect the same statistics; the majority of positive responses came from countries in high-income (n=27; 61%) and upper-middle-income (n=10; 31%) groups.

The fact that somewhat more countries in the European and Americas Regions reported having legislation to allow a patient to demand correction, than allowing the patients to demand electronic access, suggests that other forms of access are likely to be provided for in those regions. It is surprising that, notwithstanding an allowance made for a difference between electronic access and other forms of access, the patient is not deemed an appropriate party to correct data, even though he or she is likely to be best informed about it. However, the trend demonstrated between the 2010 and 2015 surveys is positive, showing an increase of eight countries reporting having legislation to allow patients to demand correction between the two surveys.

Deletion

The concept of deletion of data is closely related to that of correction, yet in health care it poses many more challenges. This arises because the fact of an event recorded in a medical record is not only data about the patient, but implicitly also about the health care professional who treated the patient, and potentially also about the patient's direct relatives for whom the medical history of a close relative might also be a marker for their future health. For this reason countries which have recognized a "right to be forgotten" for certain types of data (European Union, USA, Argentina, India and others) have not extended that right as a matter of principle to medical records.

It is not surprising therefore that the survey found that globally, comparatively few countries have legislation which allows individuals to demand deletion of health-related data from their EHR (n=22; 18%). It should be noted that where such a right exits, it is likely to be a potential rather than absolute right. European law for example provides a possibility for such deletion, but does not make it a right. This flexibility was included particularly to address the issue of medical records created in the context of research where the demand of an individual to withdraw from a study should not fundamentally undermine the study. It does, however, imply that EHRs should be constructed and maintained in such a way that it would be possible to erase any personal data upon request.

Access control

The final question in this section relating to patients' rights asked if legislation had been enacted that allows patients to specify which health care professionals may access all or part of the data in their EHR. This question was asked to establish the extent of the sophistication of the EHR legislation in seeking to balance patient rights with the needs of the health care system.

Globally, 28% of countries reported having legislation that allows individuals to specify which health-related data from their EHR may be shared with health professionals. Similar to the trends in other types of legislation governing individual access, correction and deletion of data in EHRs, countries with legislation allowing individuals to specify which health-related data is shared were found in the European Region (n=22; 47%), the Western Pacific Region (n=5; 42%), and the Region of the Americas (n=7; 39%). The pattern is the same with respect to World Bank income group: positive responses came from high-income (n=22; 50%) or upper-middle-income (n=10; 31%) countries.

In line with the other indicators, here too a trend of gentle increase in legislation giving more control to patients was seen between the 2010 survey data and the 2015 survey data. Globally in 2010 only 18% of countries reported having such legislation, while in 2015 this figure had risen to 28%. The growth had occurred, however, exclusively in the European, Americas and the Western Pacific Regions. In 2010 and 2015 no legislation of this type was reported in the Eastern Mediterranean or South-East Asia Regions, and in the African Region one country alone reported this type of patient right.

Discussion

The fact that some 33% of countries have adopted legislation providing a basic framework for eHealth in terms of jurisdiction, liability and reimbursement for health services provided through eHealth, is a strong and positive indicator of the development of eHealth. In addition, the survey showed 48% of countries having legislation which addresses issues of patient safety and data quality in the context of eHealth, as well as a good level of adoption of legislation to address issues such as data sharing, patient record access or use of EHRs for research purposes. The generally high incidence of legislation to safeguard the privacy of patient-identifiable data is also very positive, as is the strong growth in this type of legislation shown between 2010 and 2015 – 24% growth in the number of countries reporting special privacy legislation for EHRs.

The data show a significant difference between the number of countries developing specific eHealth legislation and those including eHealth into other more general health care regulation. This may be accounted for in two ways. First, some legal systems, such as the English legal system, have a case-based development of jurisprudence, in which an "eHealth Law" is less likely to be adopted than a series of legal measures which address generic health care issues and allow for their interpretation to cover eHealth. Second, a more piecemeal approach to legislation on eHealth may be seen as more appropriate in a field with a fast pace of technological change in which overarching laws may be seen as too cumbersome. While the relatively lower percentage of countries reporting a specific eHealth law (33%) compared to those adopting more a generic health care law approach (48%), may have a sound basis in the jurisprudence of a country, it can have a negative impact on achieving a good return-on-investment in eHealth solutions.

Responses provided by Member States in the section on EHRs showed that of the 57 countries that reported that a national EHR system had been implemented, only 31 reported that specific legislation on EHRs had been enacted. Lack of such specific eHealth legislation may be undermining patient confidence in providing data for an EHR, and thus limiting its potential. Research has shown that when patients are not content with the levels of privacy protection in place they lose faith in eHealth systems – a fact that occurs in both highly-developed health systems, such as Germany *(7)*, as well as systems in less-developed economies *(8)*.

Despite the still relatively low level of eHealth law, the need for a good level of legislation to drive confidence in the adoption of eHealth solutions into everyday health care is underlined by the responses provided in the survey sections on mHealth and telehealth. In these sections more than half of the respondents (n=59; 51%) stated that they believe the lack of legislation on mHealth was a very or extremely important barrier to the adoption of eHealth, while 44% (n=52) believed the lack of a legal framework was very or extremely important in holding back the roll-out of telehealth.

The data also suggest that there may be a lack of coherence between adoption of technical solutions and the adaptation of the legal framework within which they must be operated. For example, the South-East Asia and Eastern Mediterranean Regions reported having no legal framework for sharing data between health care professionals. Yet five countries in the South-East Asia Region reported

using telemedicine as did 14 in the Eastern Mediterranean Region. This would suggest that a legal framework has not kept pace with other advances, and that telemedicine might be being used in the absence of a good legal framework to protect both patients and health care professionals.

While significant advances have been made in legal frameworks for eHealth – and in general recognition of the importance of good governance and legal frameworks seems to exist – a lack of coherence and connected policy-making in eHealth would seem to be undermining the investments made. Four overarching conclusions therefore emerge from the data collected in this section of the survey.

- Considerable and positive advances have been made since 2010, but work needs to continue globally and with special focus on developing countries.
- A positive trend in respect for privacy of health data can be seen, although more targeted legislation may be appropriate; a more coherent approach on wider patients' rights in the context of eHealth is needed in many jurisdictions.
- Good advances have been made in accommodating core eHealth tools, such as EHRs, into legal frameworks, but many countries still have some way to go in developing robust governance to support the use mHealth and telehealth solutions for health care delivery systems.
- A general lack of coherence in addressing the legal needs of full integration into health care systems is evident in many regions, particularly in developing countries. This is undermining the return-on-investment that could be achieved for eHealth and its potential to be an accelerator in achieving UHC targets.

The survey shows that some Member States, mainly in the Regions of Europe, the Americas and the Western Pacific have a reasonable baseline of legislation relevant to eHealth in place. However, the questions relating to data sharing for care or research, show that more work is needed to ensure the regulatory framework has been adapted to allow full exploitation of the potential of eHealth. A next step for countries with such a baseline of regulation is therefore to undertake a thorough review of the legislation to ensure coherence across issue such as use of EHRs, telemedicine, mobile health and health research. Such a review should also ensure that patients' rights are clearly addressed.

It may be argued that countries in which the regulations applicable to eHealth are very limited are in an easier position. Rather than seeking to amend and adapt rules that were created in a pre-eHealth era, it may be simpler to develop new specific regulations for eHealth, without seeking to accommodate legacy laws.

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7. Social media

Key findings

- **Nearly 80% of responding Member States reported health care organizations use social media for promotion of health messages (n=98; 78%).**

- **Nearly 80% of countries reported that individuals and communities use social media primarily to learn about health issues (n=99; 79%), while in over 62% of countries there are individuals and communities using social media to run community-based health campaigns.**

- **Social media is an important means of conveying messages for health organizations and of receiving and sharing information for individuals and communities, but there is still much to be done to understand how best its potential can be used, e.g. to support universal health coverage (UHC).**

Introduction

There has been a huge expansion in the use of information communication technologies (ICT) and social media in health. However, only 29% of the world's 3.4 billion people living in rural areas benefit from the 3G-coverage that is needed to enable a rich social media experience *(1)*, though "lite" versions are available *(2)*. Nevertheless, as the survey instrument indicated "social media, such as Facebook, Twitter or YouTube are changing the dynamics and nature of interactions between health

care consumers, health professionals and health care organizations". They generate interactive platforms for individuals, communities and organizations to share and discuss content, debate issues and promote new ideas. Social media impacts on universal health coverage (UHC) as well, as it increases the involvement of health care consumers in their own health and can promote health care in general. It can also be used to improve dissemination of knowledge to and from the health workforce about delivering UHC.

The Ebola education and training campaign in Nigeria exemplifies the use of social media in health behaviour change; in 2014 it helped to dispel rumours and false information about the disease *(3)*. Indeed, social media lends itself to promoting a range of health messages and announcements e.g. about campaigns, health issues, etc., as well as providing the opportunity for feedback on service performance. All of these contribute to its role in supporting the concepts and implementation of UHC *(4)*. WHO has developed evidence-based arguments to support civil-society organizations (CSOs) advocating for UHC, and included the recommendation "publicise through academic papers and the media (including social media) good and bad examples of health financing policies" *(5)*.

Accessing health information is also a fundamental part of health workforce education *(6)*. Social media allows easy access to the views of experts in the field of UHC and for sharing of experiences from the country level through blogs, video reportage and case studies which will enable and empower cross-pollination of ideas, feedback loops and the development of partnerships. Health workers are being actively encouraged to embrace social media. For example, the Health Worker Advocacy Initiative (HWAI[1]) has a toolkit that explicitly advocates using social media to develop and deliver health messages *(7)*. In 2014 on UHC Day (12 December) HWAI encouraged members to tweet about why health workforce strengthening is integral to achieving UHC *(8)*.

Social media technologies are evolving rapidly. And what is not yet clear is what sort of social media, at any given time, are best suited to different requirements for disseminating or collecting the different types of health data and information that are needed by health organizations or individuals and communities. The results of the 2015 GOe survey begin to shed some light on these issues, but much more work is needed, as well as a dynamic environment for learning the lessons of what works well and for framing an appropriate policy environment for promoting the use of social media.

Results and analysis

While training in the use of social media for health as part of the continuing development of health professionals was briefly addressed in section 1 of the survey, in section 7, respondents were asked questions intended to establish the current situation regarding social media in terms of national policies, and about its use by organizations, communities and individuals.

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1   A broad-based network of CSOs.

National policies or strategies for social media

The existence, or not, of a national policy or a strategy on the use of social media by government organizations was the first topic. The findings showed that approximately a fifth of countries (n=23; 19%) reported having a national policy or strategy on the use of social media by government organizations (Fig. 7.1).

Fig. 7.1. Countries with a national policy or strategy on the use of social media by government organizations
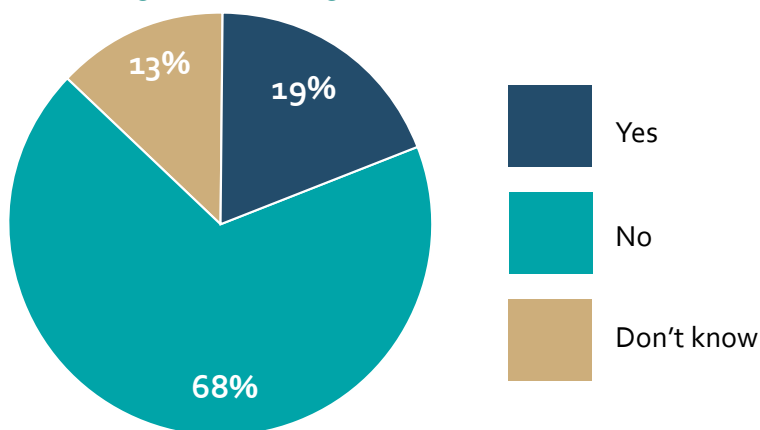
When the data were viewed by WHO region, the percentage of countries with a national policy or strategy on social media use was highest in the Western Pacific Region (n=5; 46%) and the South-East Asia Region (n=2; 40%)[2], while in each of the other four regions about 15% (n=16) of countries had a policy for social media use by government organizations (Fig. 7.1a).

Fig. 7.1a. Percentage of countries with a national policy or strategy on the use of social media by government organizations, by WHO region

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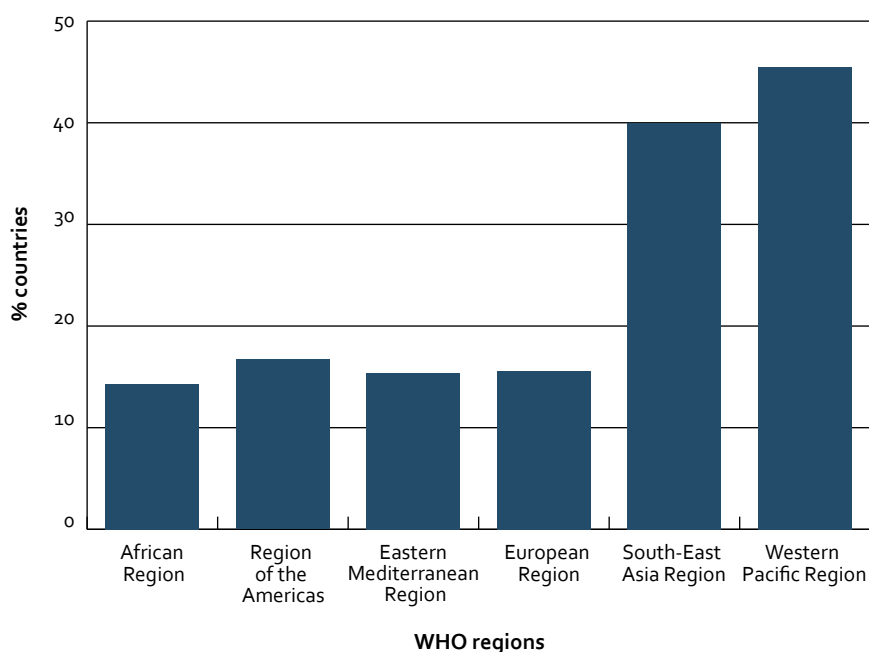
2   As noted elsewhere, data from the South-East Asia Region should be viewed with caution due to the low number of responding countries

It is not surprising that the numbers are small when the use of social media is such a recent phenomenon, and therefore caution should be exercised when comparing the percentages between the regions. Nevertheless, the data provide a baseline for future surveys, and in aggregate provides some interesting trends in cumulative uptake globally.

The first reported policy on the use of social media was introduced in 2008 by Uganda. Since then there has been a steady, if unspectacular, increase in the cumulative number of countries adopting a policy on the use of social media (Fig. 7.1b).[3]

Fig. 7.1b. Countries with a national policy or strategy on the use of social media by government organizations, cumulatively by year of adoption
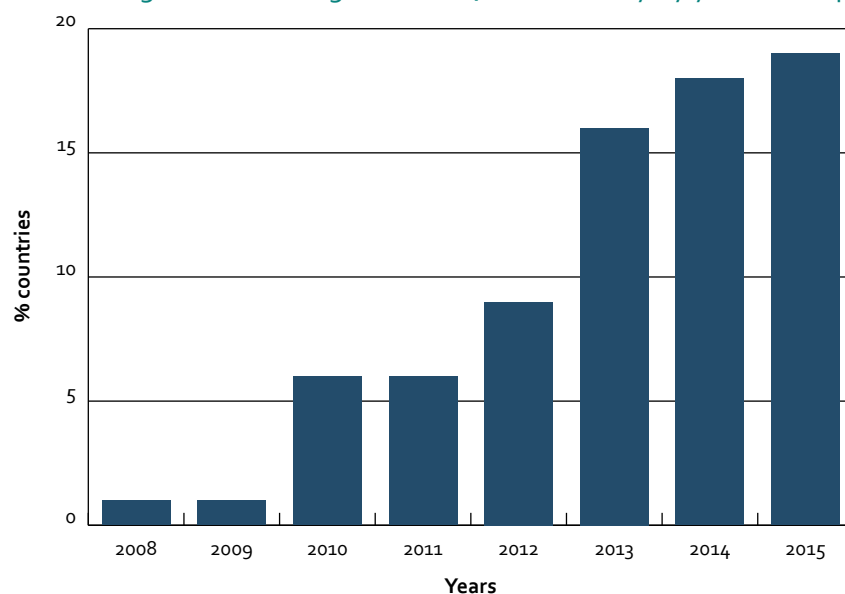
Use of social media by health organizations

The survey then asked about the ways in which health care organizations are using social media. The survey did not set out to assess the extent of the usage of social media within each country – simply whether it was in use for the purposes mentioned. Therefore some caution is needed in interpreting these early findings. There were questions concerning how messages about health could be promoted by use of social media, and whether it was being used for general health and emergency health announcements. Following this, its use in sending feedback on services was requested and also whether it was used to help manage patient appointments.

The data for each of these categories was analysed by WHO region and also by World Bank income group, and are shown in Figs. 7.2a and 7.2b to provide an overview of usage.

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3   Note: Five of the 23 countries that reported having a national policy or strategy on social media did not report its year of adoption.

Fig. 7.2a. Use of social media by health care organizations, by WHO region

Categories (top to bottom):
- Help manage patient appointments
- Seek feedback on services
- Make emergency announcements
- Make general health announcements
- Promote health messages in health promotion campaigns

Legend:
- Western Pacific Region
- South-East Asia Region
- European Region
- Eastern Mediterranean Region
- Region of the Americas
- African Region

X-axis: % countries (0, 20, 40, 60, 80, 100)
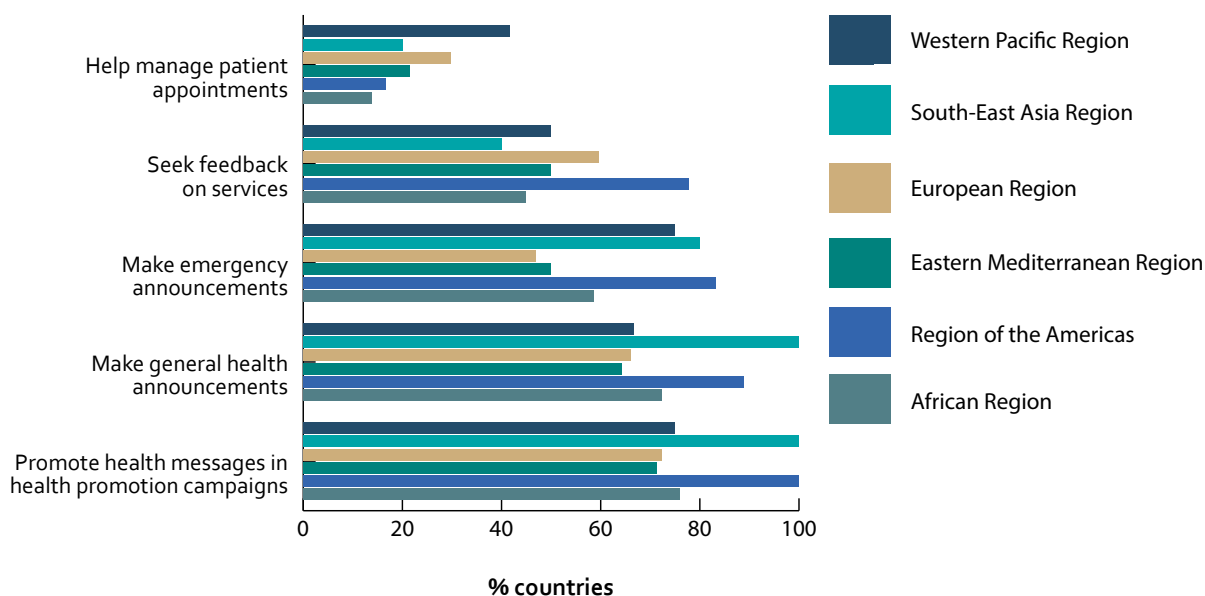
Fig. 7.2b. Use of social media by health care organizations, by World Bank income group

Categories (top to bottom):
- Help manage patient appointments
- Seek feedback on services
- Make emergency announcements
- Make general health announcements
- Promote health messages in health promotion campaigns

Legend:
- Low-income
- Lower-middle income
- Upper-middle income
- High-income

X-axis: % countries (0, 20, 40, 60, 80, 100)
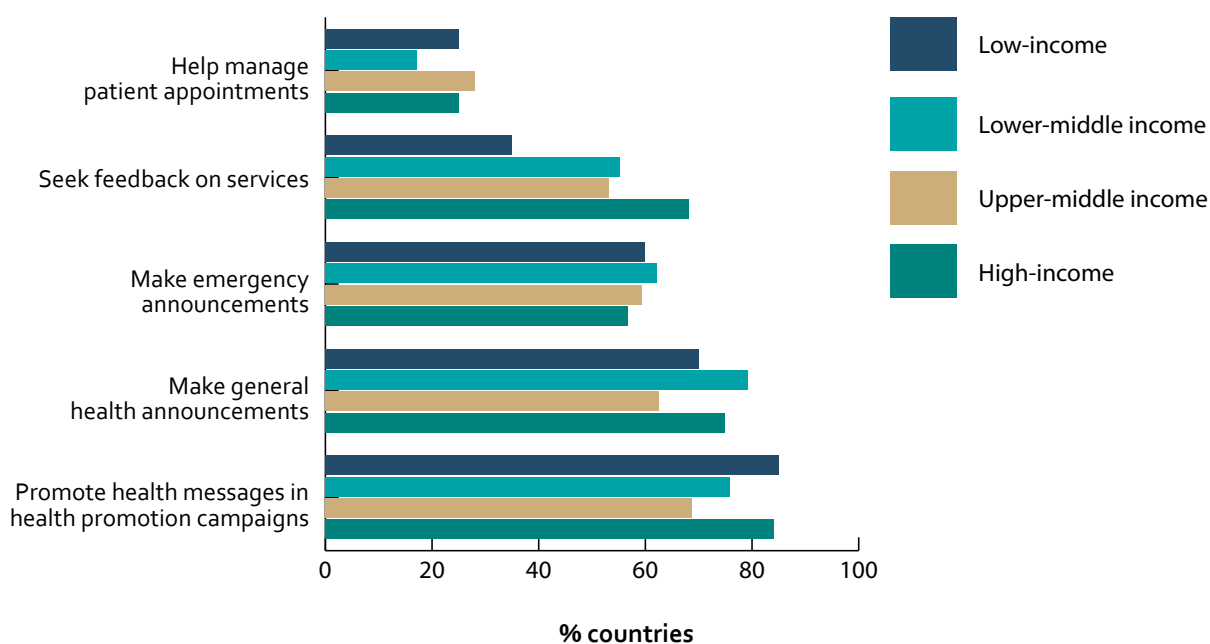
Help manage patient appointments

The use of social media to help manage patient appointments was reported less often than all the other uses (n=30; 24%). This type of social media use was more common among countries in the Western Pacific (n=5; 42%) and European Regions (n=14; 30%) than in countries of the other four regions, where use ranged from approximately 14% to 21%. Differences by income group were minimal.

The use of social media as well as smartphone apps for managing patient appointments may need further investigation, and the small numbers involved make any analysis difficult at present.

Seek feedback on services

Just over half of countries reported health care organizations used social media to seek feedback on services (n=70; 56%). Differences between the African, Eastern Mediterranean, South-East Asia and Western Pacific Regions were minimal, ranging from 40% to 50%; the Regions of the Americas (n=14; 78%) and European Region (n=28; 60%) were the exceptions where a majority of countries reported use of social media for seeking feedback on services. As expected, there was a declining trend by income group; higher levels of use in high-income countries (n=30; 68%), which decreased as income levels dropped – upper-middle (n=17; 53%), lower-middle (n=16; 55%) and low-income (n=7; 35%).

There is a fairly steady gradient from high- to low-income countries in terms of whether social media is used to seek feedback on services. Health organizations need both the technology and a culture which encourages them to seek feedback. Both of these requirements are more likely to be present in high-income countries where investment in "market research" is common and where the widespread use of social media by communities and citizens makes it more interactive and informative. The provision of feedback by communities and individuals is addressed below.

Emergency announcements

Nearly 60% of countries reported health care organizations used social media to make emergency announcements (n=74; 59%). Countries in the Region of the Americas (n=15; 83%), the South-East Asia Region (n=4; 80%) and the Western Pacific Region (n=9; 75%) more commonly reported social media use for emergency announcements by health care organizations, whereas in the other three regions this was less common (under 60%).

Given that the extent to which social media is used to make emergency announcements within countries is not known (and may of course vary considerably depending on the size of the country and the nature of emergencies), it is interesting that across the four income groups the usage of social media in this context is very similar (ranging between 57% and 62%).

General health announcements

Nearly three quarters of countries reported that health care organizations used social media to make general health announcements (n=90; 72%). By WHO region, 100% of country respondents from the South-East Asia Region (n=5), 89% from the Region of the Americas (n=16), and 72% from the African Region (n=21) reported social media use for general health announcements, while in the other three regions roughly two thirds of countries reported this type of social media use. Differences between the World Bank income groups were minimal, and ranged between 62% and 79%.

The survey found that health organizations in most countries are now using social media to make general health announcements, and the pattern of its use for this purpose between the regions is very similar.

Promotion of health messages

Nearly 80% of countries reported health care organizations used social media for promotion of health messages (n=98; 78%). By WHO region, 100% of country respondents from the South-East Asia Region (n=5) and the Region of the Americas (n=18) reported social media use for health promotion messaging, while in the other four regions the percentage was between 70% and 75%. There was some variation by income group, with high- (84%; n=37) and low-income (85%; n=17) groups reporting the greatest use of social media for health promotion, while the middle-income groups were near 70% (n=44).

The most frequently reported use of social media is to promote health messages. The survey found that social media is in use to promote health messages in most countries, and despite the challenges of interpreting small numbers, its relatively high use in the Region of the Americas and the South-East Asia Region is striking (as it is for general health announcements).

Use of social media by individuals and communities

Moving from health organizations to the use of social media by individuals and communities, the survey then asked about how social media was used for learning about health issues; running community-based health campaigns; providing feedback to health facilities or health professionals; in supporting community-based health forums; and in providing help on deciding what health services to use.

The data for each of these categories was analysed by WHO region and World Bank income group, and are shown in Figs. 7.3a and 7.3b to provide an overview of uptake.

Fig. 7.3a.   Use of social media for health by individuals and communities, by WHO region
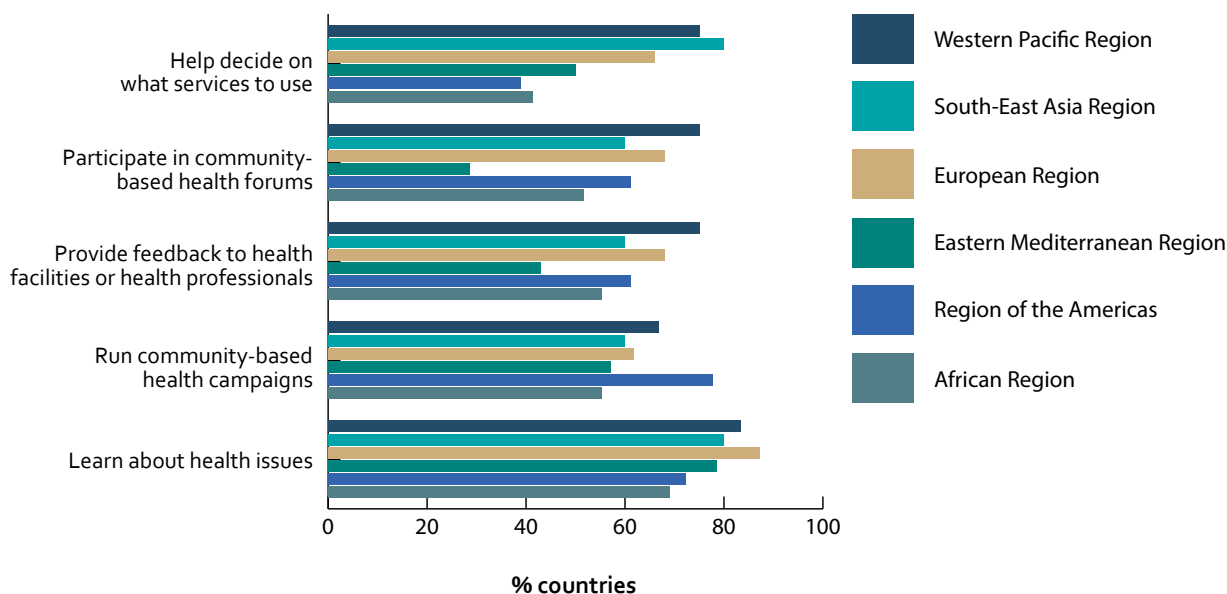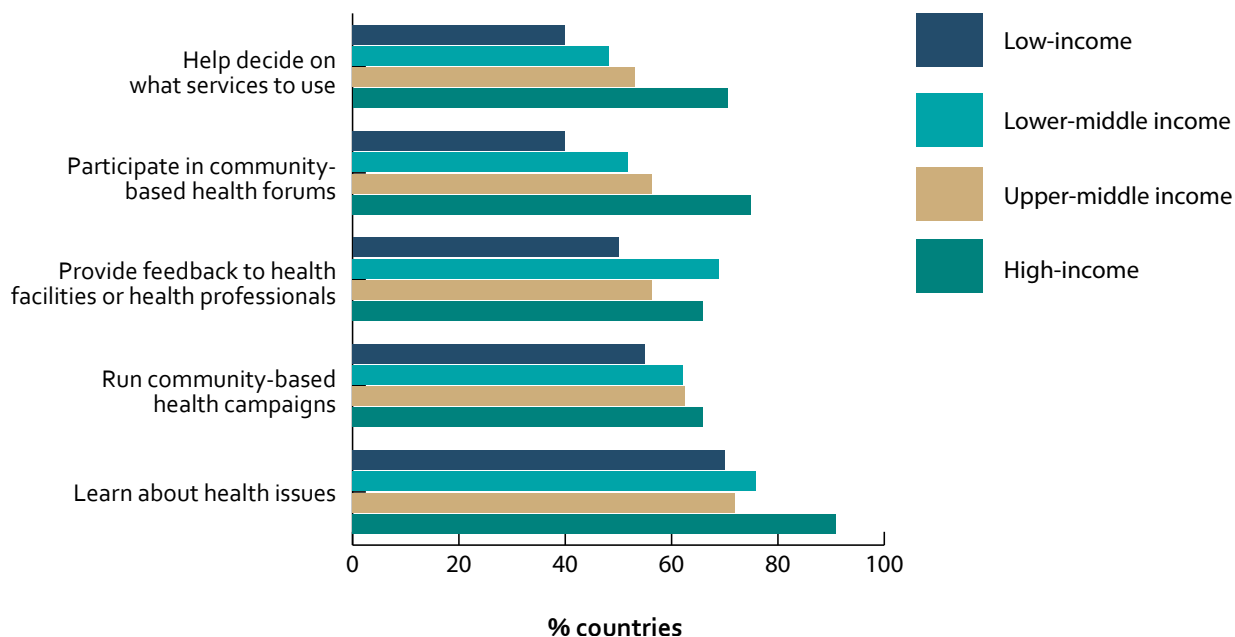
Fig. 7.3b.

Fig. 7.3b. Use of social media for health by individuals and communities, by World Bank income group

Overall, there is more homogeneity in the uses of social media by individuals and communities in the countries of each WHO region than there is in its use by health organizations. When reviewed by income group, however, the usage percentages do show a discernible increase from low- to high-income (with only two anomalies concerning usage by countries in the lower-middle group in providing feedback and learning about health issues).

Decide what health services to use

Just over half of countries (n=70; 56%) reported use of social media by communities and individuals to help aid decisions around what services to use. This type of social media use was most common among countries in the European Region (n=31; 66%), the Western Pacific Region (n=9; 75%) and the South-East Asia Region (n=4; 80%); in the other three regions, less than 50% of countries reported social media use to support decisions around service use. There is a steadily declining trend in reported use of social media for this purpose, from high-income countries (n=31; 71%) to low-income countries (n=8; 40%).

Of course, deciding what services to use implies that information about relevant services is available via social media and that communities and individuals have the means to access this information. The pronounced gradient in use between high- and low-income countries suggests not only that both of the above criteria are more likely to be met in high-income countries, but that even within countries there may be an important gradient in its use for this purpose between high- and low-income communities.

Community-based health forums

Social media use for participation in community-based health forums was reported by 59% of countries (n=74). Over 60% of countries in the Regions of the Americas, Europe, South-East Asia and Western Pacific reported this type of social media use, whereas uptake was far lower in the Eastern Mediterranean Region (n=4; 29%) and somewhat lower in the African Region (n=15; 52%). There was a steadily declining trend in reported use of social media for this purpose when moving from high-income countries (n=33; 75%) to low-income countries (n=8; 40%).

While the same observations as for deciding what services to use apply here, an additional consideration in the use by communities and individuals of community-based health forums is that these may well require some facilitation. Again, this additional investment in a social infrastructure may be more easily made in high-income countries (and communities).

Provide feedback to health facilities or health professionals

Overall, 62% (n=77) of countries reported use of social media to provide feedback to health facilities and health professionals. Countries in the Western Pacific Region (n=9; 75%) and European Region (n=32; 68%) reported higher use of this type of social media compared to the other four regions, where in roughly 40% to 60% of countries communities and individuals use social media for providing feedback. Regarding World Bank income groups, approximately two thirds of high-income (66%; n=29) and lower-middle-income countries (69%; n=20) reported social media use for providing feedback; use of social media for this purpose was comparatively lower among the upper-middle (56%; n=18) and low-income countries (50%; n=10).

Social media, at least at the country level, is clearly being widely used by communities and individuals to provide feedback. The characteristics of the social media used and the nature of the feedback given to health facilities or individual health professionals need further examination, which preferably should also be related to the training in the use of social media by health professionals.

Run community-based health campaigns

Sixty-two per cent of countries (n=78) reported that individuals and communities are using social media to run community-based health campaigns. This type of social media use for health was most common among countries in the Region of the Americas (n=14; 78%), compared to the other five regions, where use ranged from 55% to 67%. Expectedly, countries in the higher-income group reported higher use of social media for this purpose (n=29; 66%), but variability between income groups was less pronounced, ranging from 55% (n=11) in the low-income group to 63% (n=20) in the upper-middle-income group.

That individuals and communities are using social media to run community-based health campaigns in at least 55% of countries in each region is an important benchmark finding. Though it is not possible to tell from these data how this varies within countries, and the nature of the communities and individuals who run such campaigns, it is nevertheless an interesting indication of the potential uses of eHealth to support community-led developments in health.

Learn about health issues

Countries reported that individuals and communities use social media to learn about health issues more than for any other of the suggested purposes (n=99; 79%). Approximately 90% of countries (n=40) in the high-income group reported that social media is used to learn about health issues; in the other three income groups this figure varied between 70% and 75%.

Although these assessments do not give any indication of the proportions of individuals or communities within a country who are using social media to learn about health issues, nevertheless it is evident that social media has a significant role to play in helping dissemination of knowledge about them. The quality of this knowledge, however, may of course vary considerably between and within countries.

Taken together these findings suggest that, while social media is an important means of conveying messages for health organizations, and of receiving and sharing information for individuals and communities, there is still much to be done to understand how best its potential can be used to support UHC.

Discussion

Survey data show that nearly 80% of countries report health care organizations use social media for promotion of health messages (n=98; 78%), and also that in over 62% of countries there are individuals and communities using social media to run community-based health campaigns. Social media is a dynamic and now demonstrably widespread aspect of eHealth that can support greater engagement in health issues by health organizations, communities and individuals in all countries, regardless of income. But there are some important challenges to be addressed if its considerable potential is to be fully realized.

Rapid innovation (and its converse – obsolescence) characterizes the use of social media. Those media referenced in the survey mentioned YouTube, Facebook and Twitter. But there are many others, such as WhatsApp, Storify, Flickr, Instagram, etc., as well as those not yet developed. And the distinctions between social media and social networks, e.g. LinkedIn, podcasts, blogs, RSS feeds, etc., are blurred. How is this dynamic situation best addressed? The policy framework needs further and urgent examination, both by government organizations in general and health organizations in particular.

The rapid development of social media presents some important challenges to confidentiality. Legal frameworks for eHealth (Chapter 6) need to adapt to deal with the issues raised. And, while addressing these issues, the potential for analysing the rapid growth of aggregate social media information in unstructured big data sets, and its subsequent use for improving the efficiency of care packages that are delivered to individuals will also need to be considered. The big data perspective is considered in Chapter 8.

One way forward would be to study for (and within) selected countries, the current and potential extent of the positive (and negative) usage of social media and social networks to support improvements in the delivery of health care, in particular UHC. This should be done from the viewpoint of individuals and citizens, health care organizations and health workers. The associated implications for the development of supportive eHealth policy that can deal with the rapidly changing sociotechnical environment that characterizes social media also need to be addressed.

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Case study
Social media

Break Dengue,
Brussels, Belgium/global

Break Dengue is an initiative that was created in August 2013 to combat dengue fever – a neglected global disease from which approximately half of the world's population is at risk. Break Dengue is built on partnerships which bring together all stakeholders by encouraging them to examine the bigger picture of dengue, not just single aspects such as vector control or vaccine development. Essentially, Break Dengue encourages its partners to look at dengue from a public health and patient perspective, at the disease as a whole and its impact on society. It identifies the most successful dengue prevention initiatives from around the world to help replicate them in other countries. This brings patients closer to potential treatments and disseminates effective dengue prevention strategies, which heretofore were very fragmented.

Break Dengue uses digital channels and social media to target and connect patients, doctors, the pharmaceutical industry, research and development (R&D) organizations, NGOs and associations at both global and local levels. Using social media to drive digital engagement they empower their audiences with information on dengue prevention, the latest news on dengue fever, and real stories from patients and clinicians who have encountered dengue. This helps to "put a face" to the disease and has promoted a different narrative that did not exist previously.

Dengue is the fastest growing mosquito-borne disease in the world today, causing nearly 400 million infections and an estimated 20 000 deaths every year.[1] In the past 50 years dengue has spread from a small number of countries to being endemic in 128 countries, affecting marginalized and wealthy populations alike.

> *"Due to the complex nature of dengue fever transmission, efforts to decrease its spread require both effective collaborative models to bring together diverse stakeholders, and approaches that leverage the power and scalability that our connected world offers. By combining both of these aspects, Break Dengue is ideally positioned to catalyse the conception and implementation of innovative solutions to curb dengue."*
>
> *– Mauricio Santillana*
> Mauricio Santillana, PhD, is a physicist and applied mathematician, and is a faculty member at Boston Children's Hospital

Break Dengue set about creating a global online community. The first step was a Facebook page to build a core audience. This page now has over 250 000 followers and averages over 1000 "likes" per day. Utilizing boosted posts[2], the page quickly grew and "DengueBreakers" have grown into an army to help spread the message and raise awareness of the disease. The team uses Pinterest[3] to target more visual users through eye-catching informative images and infographics. Using Google+[4] the team was able to optimize search engine results more readily.

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1   WHO global strategy for dengue prevention and control 2012–2020. Geneva: World Health Organization; 2012 (http://www.who.int/denguecontrol/9789241504034/en/, accessed 24 November 2016).
2   For a fee, "boosted posts" appear higher in a Facebook news feed resulting in a better chance the audience will see them.
3   Pinterest is a social network that allows users to visually share, and discover new interests by posting (known as "pinning" on Pinterest) images or videos to their own or others' boards (i.e. a collection of pins, usually with a common theme) and browsing what other users have pinned.
4   Google+ is a platform focused on bringing all of Google together. It is an interest-based social network that is owned and operated by Google Inc.

On Twitter, they took a different approach. @BreakDengue is not only focused on raising public awareness on dengue prevention, but also seeks out and builds strategic relationships with key opinion leaders on dengue worldwide. These include experts from the pharmaceutical industry, medical professionals, health care analysts, educators, marketing professionals for the health care sector, activists and other organizations that share the same goal.

The team employs a variety of tactics often related to world events to continue building awareness and to ensure the conversation still gains attention online. During the 2014 World Cup there were "red cards for dengue", and a balloon campaign to break the silence on dengue as a neglected disease.

Simultaneously the "Dengue Lab" was created, an online community of 1000 experts working on the prevention, surveillance or treatment of dengue fever. It enables members to share best practices, data, and their experiences and insights on dengue fever to inspire concrete actions at the global and local levels for the control of the disease.

The next step for Break Dengue was to use the awareness that has been created through social media mobilization and turn it into action, to "close the loop" and enable society to have an impact via crowd surveillance. Launched just prior to the 2016 Olympics in Rio de Janeiro, Brazil, users were able to submit information on the Break Dengue website about dengue outbreaks to inform authorities if an individual or someone in the family has contracted the disease.

The information provided online currently is available in English, Spanish and Portuguese. Plans include reproducing it in other languages, such as Mandarin Chinese, Hindi, Indonesian, Bengali, Filipino, Vietnamese, Thai and Malaysian. The majority of followers in the online communities are from Malaysia, Singapore, Indonesia, Thailand, Brazil and Mexico. While Break Dengue was founded in Belgium, it is a truly global initiative using digital channels and social media to connect citizens and reduce the incidences of dengue worldwide, thereby contributing to UHC.

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5   The eyeforpharma Barcelona Awards support pharmaceutical companies that prioritize value for patients and customers. Break Dengue won "Most Impactful Emerging or Global Initiative" at the eyeforpharma Barcelona awards in March 2015.

> *"What makes Break Dengue unique is the unprecedented level of partnership; coming together asone to fight against a disease against which no prevention or cure currently exists. Break Dengue is the perfect example of identifying a need for something bigger in the fight for disease awareness; and demonstrates an ideal model which could be replicated for so many other diseases across the globe."*
>
> – Paul Simms, Chairman of eyeforpharma[5]

Despite the health and economic impacts of dengue, population-level control methods are limited, resource intensive, and largely ineffective. However, new data sets from internet users' activities have been shown to capture social mechanisms that frequently help fill epidemiological surveillance information gaps. These data sets include social media monitoring (Twitter microblogs or Facebook posts), tracking of Google search patterns, monitoring mobile phone use and crowd-sourced participatory disease surveillance tools.

Break Dengue has partnered with the HealthMap[6] team at Boston Children's Hospital who has been successful at developing accurate methods to produce real-time and forecast estimates of flu incidence. Together they hope to create an innovative internet-based surveillance platform for dengue that will depend in part on the data generated by their social media friends and followers.

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6   http://www.healthmap.org/site/about

8. Big data

Key findings

- **Less than a fifth of countries (17%; n=21) reported having a national policy or strategy regulating the use of big data in the health sector.**

- **Lack of integration and privacy and security were the major barriers to adopting big data to support UHC indicated by responding Member States (72% and 68% respectively).**

Introduction

As the use of big data is relatively new in the health sector in many countries, questions in the GOe 2015 survey were kept to a minimum. However, harnessing the data revolution via appropriate use of eHealth (see Chapter 1) offers the potential to integrate both the individual/community perspective on information systems for universal health coverage (UHC) as well as that of public and population health.

Big data can be both structured and unstructured. Data sources may concern what people say *(1)*: International and local online news sources, publicly accessible blogs, forum posts, comments and public social media content (see Chapter 7). Incorporating social media analytics into disease surveillance and outbreak management practice is recommended *(2)*. Data sources of course are also concerned with what people do. Passively collected transactional data from the use of digital health services is now generating increasing volumes of data. Examples include clinical operations; research and development; public health; evidence-based medicine; and device/remote monitoring *(3)*.

In the health context a recent review *(4)* suggests that the challenges and potential solutions for big data implementations include addressing the exponential growth of data; the special infrastructure needed to analyse them; the need to agree on interoperability standards to integrate data; the privacy and security risks involved in these projects; and the requirement of a strategic vision that contemplates the need to include people, processes and policies to ensure their adoption.

Wyber et al. *(5)* suggest that the "best case" model for deploying big data would be associated with an approach in which:

- health data are owned by patients
- there are robust governance structures and laws regarding the use of data (including when and how anonymized data can be shared)
- interoperability standards exist and are implemented
- data are presented in a usable format to patients, health care providers, entrepreneurs and policy-makers.

In worst-case scenarios, however, big data would be an expensive distraction driven by high-income countries, focused on disease specific outcomes and unintelligible to those who most need data access. Breaches of data security could threaten personal safety, and the global health community could oversee the spending of huge amounts of money on big data, with potentially little to show for the investment.

Big data contributes to UHC through the provision of new and unique data on populations and individuals that, using predictive analytics, supports better health care for all. To meet the challenges of improving health measurement and accountability, a major strategic approach to strengthening national data capacity through robust health information systems was outlined in June 2015 *(6)*. This agenda is now being developed by the Health Data Collaborative with the objective of enhancing country capacity to monitor and review progress towards the SDGs through better availability, analysis and use of data *(7)*.

Results and analysis

In section 8 of the GOe 2015 survey respondents were asked, firstly, about the existence of policies concerning the use of big data in the health sector and in private companies. Given this context, the main focus of the survey was on finding out the importance of a number of potential barriers to the use of big data. These included issues concerning standards, information sharing, capacity, privacy, analytical methods and integration of services.

National policies or strategies for big data

As with social media, the emergence of big data is relatively recent, and so national policies for addressing it are just emerging. The survey found that less than a fifth of countries (n=21; 17%) reported having a policy or strategy for big data in health.

Given these small numbers, it is difficult to draw any robust conclusions, but it is worth noting that countries from every WHO region and World Bank income group reported having such a policy. The GOe 2015 survey, therefore, provides a useful baseline for future work, and to monitor the development globally of national policies for big data in health.

## Regulating the use of big data in private companies

Turning to the use of big data by private companies, the survey asked similar questions. The responses indicated that less than 10% of countries (n=10; 9%) reported having a policy or strategy for big data, and no countries in the African, Eastern Mediterranean or South-East Asia Regions reported having such a policy.

Interpretation of the data is difficult given the small numbers, but seems to corroborate the evidence from elsewhere that, if regulation is associated with privacy issues, then "very few countries have a privacy framework only for Big Data" (8). The importance of legal frameworks for governing the sharing of health-related data have been addressed in Chapter 6, but big data highlights the opportunities of sharing non-health data for health purposes, e.g. the use of anonymized phone records for disease modelling (9).

Adopting policies for regulation of big data

As with the adoption of other policies, (see Chapter 1 on eHealth), there is value to be gained from asking when policies have been adopted. Comparing the year of adoption (between 2000 and 2015) of regulations concerning the use of big data in the health sector and private companies, Fig. 8.1 shows that the steady increase in the number of countries reporting adoption in the health sector consistently exceeds the rate of increase in the private sector.

Fig. 8.1.   Countries with a national policy or strategy regulating the use of big data in the health sector and private companies, cumulatively by year of adoption
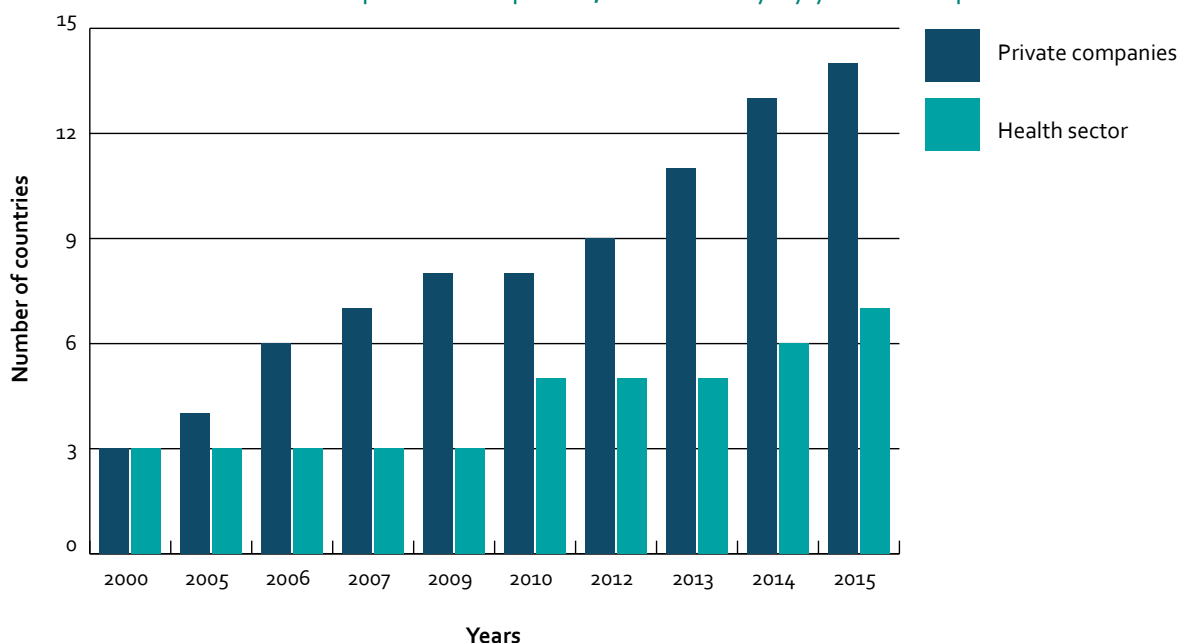
The health sector may be particularly concerned with regulating the use of big data, not least because of the many perceived threats from the inappropriate use of personal data, together with concerns of use of cloud-based solutions (particularly when hosted outside the country). What remains to be seen is whether the rate of development of policies for big data will begin to accelerate as the implications of UHC, for example, begin to have an impact.

Barriers to adoption of big data for health

Recognizing that there may be various factors as to why big data is not yet contributing to UHC, countries were asked to rate a list of six suggested barriers according to how important the barrier is in relation to big data supporting UHC. For each of the six suggested barriers, less than 10% of countries reported the barrier as "not important", suggesting that all of the barriers are viewed as major issues to support adoption of big data for health (Fig. 8.2).

Fig. 8.2. Barriers to adoption of big data for health, globally
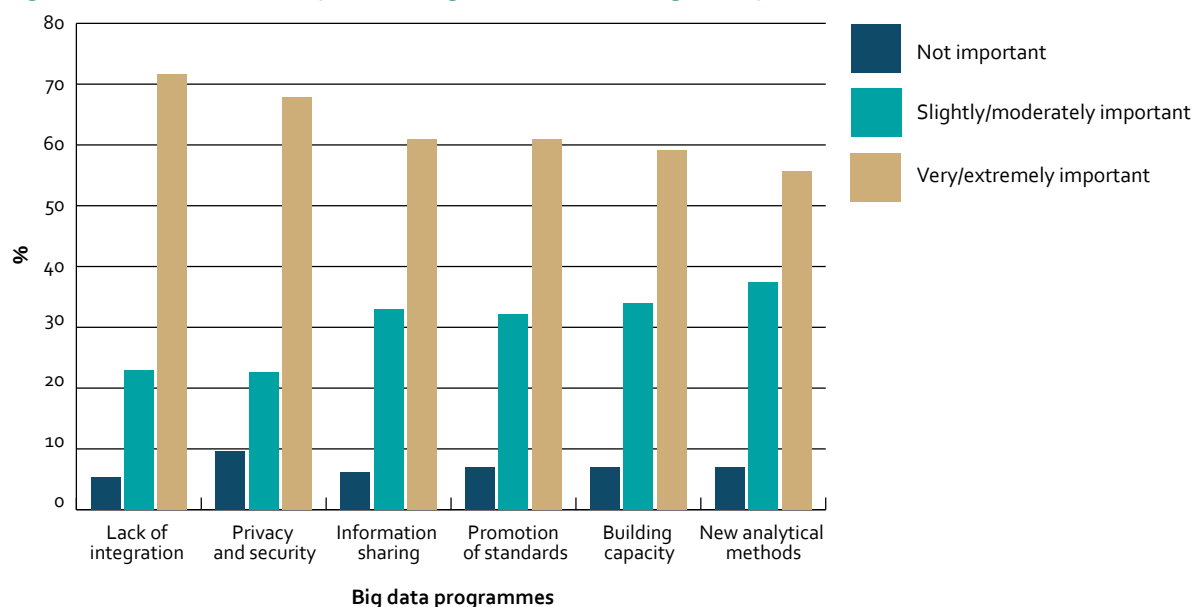
Roughly 70% of countries rated lack of integration (72%; n=81) and privacy and security (68%; n=78) as very or extremely important barriers to adoption of big data for health. Similarly, about 60% of countries considered information sharing (61%; n=70), promotion of standards (61%; n=70), and building capacity (59%; n=68) as very or extremely important adoption barriers. Of least concern, relatively, was the need for research into new analytical methods to meet the challenges of new data and emerging research scenarios.

Limited integration between different health services and other systems collecting relevant data was considered by responding Member States as a major barrier. This underscores the challenges that both UHC and eHealth face in supporting the coordination (and recording) of care that can be person-based. As the survey findings suggest, this requires addressing the closely-associated barriers of privacy and security. The need for effective standards and best practices for data capture to be

established and operational was seen as just as important as ensuring that incentives are provided to the public and private sectors to accelerate information sharing and to avoid information remaining in silos. Again, addressing these barriers cannot be done in isolation from each other. And none of these challenges can be faced without the building the capacity of appropriately skilled personnel to use the new analytical methods that enable maximum value to be extracted from big data.

Discussion

Use of big data is relatively new in the health sector. Less than a fifth of countries (n=21; 17%) reported having a policy or strategy for big data in health. Though the rate of growth of policies to regulate big data in the health sector was reported as consistently greater than that for the private sector, there are still some major barriers to be addressed before its use becomes widespread in support of UHC. For almost 60% of countries all six of the suggested barriers were considered very or extremely important, with 72% of countries rating lack of integration, and 68% rating privacy and security as the major barriers to adopting big data to support UHC.

While the potential uses for big data to support health services in general, and UHC in particular, are considerable there are some important gaps and risks to be addressed. To overcome each of the key barriers to adoption of big data requires targeted national policy or strategy. Though some of these may be developed in the wider field of eGovernment, all will need to be reflected in health-specific strategies, and in particular eHealth. Strategies for eHealth need to address the current gaps around supporting integration, privacy, information sharing, standards development, capacity building etc. But it must also be recognized that big data is an area of rapid development, and eHealth will need to be agile in its response, while remaining true to supporting country-driven requirements. This survey has confirmed that more understanding of the risks and opportunities is needed.

One way forward would be to follow up with a more in-depth review of the current and potential uses of big data for health (and UHC), together with the risks in using it and appropriate governance arrangements. In doing this, the current and potential uses of both structured and unstructured data in developed and developing countries need to be fully examined. This should be done with the intention of explaining how the potential to integrate both the individual/community perspective on information systems for UHC as well as that of public and population health can best be delivered.

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Annex 1.
Survey methods

Survey development and focus

The survey instrument was developed by WHO's Global Observatory for eHealth (GOe) with broad consultation and input from experts in digital health as well as staff from the WHO regions.

The survey studied eight key themes in eHealth:

- Foundations for eHealth
- mHealth
- Telehealth
- eLearning
- Electronic health records
- Legal frameworks for eHealth
- Social media
- Big data

As Universal Health Coverage (UHC) is a priority for WHO and many Member States, it was decided that the 2015 global survey should consider how eHealth supports UHC.

To facilitate country responses and ensure more accurate answers, the survey questions and communications were translated into all WHO official languages (Arabic, Chinese, English, French, Russian and Spanish) as well as Portuguese.

Building support for the survey

An important aim of the survey is to achieve as high as possible rate of responses to enhance the validity of the results. To this end, all WHO regional offices assigned staff to assist in coordinating the survey process and liaise with the GOe Secretariat in Geneva. At the national level, survey coordinators were appointed to manage the national operations and were responsible for working with the relevant ministries and academic and research institutions to identify a core of between five and 10 national experts in the fields covered in the survey. The expert informant groups generally consisted of eHealth specialists, professionals in telehealth, electronic health records (EHRs), mHealth and statisticians responsible for national health data. Informants met for one day to systematically work through the questions and reach consensus on a single national-level response. The survey was conducted between 1 April and 30 June 2015, with late submissions being accepted until 30 September. This was the third of a series of global surveys undertaken by the GOe. The previous surveys occurred in 2005 and 2010.

Regional focal points worked hard to encourage their Member States to participate. Some Member States could see the relevance of contributing and carried out the survey without the need for much encouragement. In other cases discussions were required, not all of which were successful. Some countries had too many conflicting priorities to take on the survey and others were experiencing serious public health crises or periods of political instability, which prevented them from responding.

Online data collection

The survey was presented in LimeSurvey, a web-based tool that simplifies online form creation for data collection and management. The data collected were stored in an SQL database maintained by WHO database administrators, and exported as a Microsoft Excel file for statistical analysis.

Individual login names and passwords were assigned to each country to avoid multiple entries by the same country. Each participating country submitted a single national survey with input from its group of expert informants. Survey coordinators were responsible for completing the forms after obtaining agreement on the responses from the experts.

Data processing

On receipt of the completed questionnaires, all non-English responses were translated into English. Survey responses were checked for consistency and the data cleansed. Data were then analysed by thematic section. For closed-ended questions, percentages were computed for each response to obtain the overall results for all responding countries.

Response rate overview

The response rate of 125 Member States (64% response rate) is the highest achieved in a global GOe survey and enhances the credibility of the data. It is due to a high level of commitment by countries to share their information, and the enthusiasm of staff in all regions who strove for the maximum response possible. All Member States that participated in the 2015 survey are listed in Table A3 at the end of the annex.

Response rate by WHO region

Administratively, WHO is made up of six geographical regions; however, the regions themselves are not homogenous. Their Member States are countries with differing characteristics of size, wealth and health-care problems. Nevertheless, WHO often provides analysis based on regional trends. A breakdown by regional responses is presented in Table A1. It shows the number of responding countries per region and the associated response rate.

Table A1. Rate of response to the 2015 GOe survey, by WHO region

WHO region	Number of responses	Number of Member States per region	Response rate by WHO region (%)
African Region	29	46	63
Region of the Americas	18	35	51
South-East Asia Region	14	22	64
European Region	47	53	89
Eastern Mediterranean Region	5	11	45
Western Pacific Region	12	27	44

The global response rate was an impressive 64%; this indicates that roughly two thirds of all Member States considered the survey important and worth responding to. Regional response rates ranged from 43% to 89%. Notably, the highest rate was achieved by the European Region through a concerted effort by staff (which included engaging additional temporary staff to focus exclusively on the survey effort). Staff in all other WHO regions contributed as much time and resources to the survey as they could. The Regions of South-East Asia and the Western Pacific did not fare as well as other regions due to staff changes around the time of the survey.

Response rate by World Bank income group

The response rate from both the high- and low-income group countries within the World Bank classification was roughly around two thirds whereas the rates of response from the upper-middle- and lower-middle-income groups were substantially lower (approximately one third); see Table A2. This is a similar trend in response rates as for the 2010 survey. High-income countries are likely to be the most advanced in the eHealth domain and may be eager to share their successes with other countries. Low-income countries are often at earlier stages of eHealth development but equally wish to promote their progress by sharing it with other countries and potential funders.

Table A2. Rate of response to the 2015 GOe survey, per World Bank income group[a]

World Bank income group	Number of responses	Number of Member States per income group	Response rate by income group (%)
Low income	29	43	67
Lower-middle income	18	55	33
Upper-middle income	14	46	30
High income	47	66	71

a Data source: worldbank.org/about/country-classifications.

Limitations

Member States were limited to one response per country; thus the expert informants were required to propose a single response for each question that was most representative of the country's situation as a whole. Coming to a consensus was difficult in cases where the situation varied widely within the country, for instance from state-to-state, or where there were significant differences in opinion. While survey responses were checked for consistency and accuracy during data cleaning, it was not possible to verify all responses to every question. Every effort was made to select the best national experts to complete the instrument; however, it cannot be determined whether the focus groups had the collective eHealth knowledge to answer each question accurately.

The survey does not attempt to measure local activity at the subnational level. While there are pragmatic reasons for this, given the timescale and resources available, performing more detailed survey work by including subnational questions would clearly provide a much richer picture of how eHealth operates in individual countries. For the time being the responsibility for doing individual national surveys in more detail and looking at activity in the various levels of the health system will have to remain the responsibility of respective ministries of health.

Approximately one third of WHO Member States did not respond to the survey, which is another limitation. A further limitation concerns the perceived barriers that were cited in many sections of the survey. Although many were suggested, there will always be more that are not listed; and asking about specific barriers may lead to response bias.

Notwithstanding these common survey limitations, the strength of the work comes from the fact that the Global Observatory's effort is unique in the eHealth domain – no other global survey on eHealth has been performed by any other entity. The present survey follows a previous one, carried out five years before, using a similar methodology. Hence, longitudinal comparisons are possible.

Table A3. Member States that participated in the 2015 global survey on eHealth

Afghanistan	Bulgaria
Albania	Burkina Faso
Algeria	Burundi
Argentina	Cabo Verde
Armenia	Cambodia
Australia	Canada
Austria	Central African Republic
Azerbaijan	Chile
Bahrain	China
Bangladesh	Colombia
Belarus	Comoros
Belgium	Costa Rica
Benin	Cote d'Ivoire
Bhutan	Croatia
Bosnia and Herzegovina	Cuba
Botswana	Cyprus

Czech Republic

Democratic People's Republic of Korea

Denmark

Dominican Republic

El Salvador

Equatorial Guinea

Estonia

Ethiopia

Finland

Gambia

Georgia

Ghana

Greece

Guatemala

Guinea-Bissau

Honduras

Hungary

Iceland

Iran (Islamic Republic of)

Iraq

Ireland

Israel

Italy

Jamaica

Japan

Jordan

Kazakhstan

Kenya

Kiribati

Kyrgyzstan

Lao People's Democratic Republic

Latvia

Lebanon

Lesotho

Lithuania

Luxembourg

Madagascar

Malawi

Malaysia

Maldives

Mali

Malta

Mauritania

Mexico

Mongolia

Montenegro

Morocco

Netherlands

New Zealand

Niger

Norway

Oman

Pakistan

Panama

Paraguay

Peru

Philippines

Poland

Portugal

Qatar

Republic of Moldova

Romania

Russian Federation

Rwanda

San Marino

Senegal

Serbia

Seychelles

Singapore

Slovenia

Somalia

South Africa

South Sudan

Spain

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Global diffusion of eHealth:

Making universal health coverage achievable

Report of the third global survey on eHealth

Global Observatory for eHealth