POLICY AND PRACTICE

The contribution of eHealth and mHealth to improving the performance of the health workforce: a review

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ABSTRACT

Introduction: eHealth and mHealth are technologies that allow services to be extended closer to patients, in pursuit of the objectives of *Health 2020: a European policy framework and strategy for the 21st century* and of the *Global Strategy on Human Resources for Health: workforce 2030*. As Europe faces increased demand for health services due to ageing populations, rising patient mobility, and a diminishing supply of health workers caused by retirement rates that surpass recruitment rates, this paper illustrates how eHealth and mHealth can improve the delivery of services by the health workforce in response to increasing demands.

Methods: Through a scoping literature review, the impact of eHealth/mHealth on the health workforce was assessed by examining how these technologies affect four dimensions of the performance of health professionals, according to the so-called AAAQ: availability, accessibility, acceptability, and quality.

Results: Few high-quality studies were found. Most studies focused on the utilization of text messaging (SMS) for patient behavior change, and some examined the potential of mhealth to strengthen health systems. We also found some limited literature reporting effects on clinical effectiveness, costs, and patient acceptability; we found none reporting on equity and safety issues. Facilitators and barriers to the optimal utilization of eHealth and mHealth were identified and categorized as they relate to individuals, professional groups, provider organizations, and the institutional environment.

Discussion: There are ongoing clinical trial protocols of large-scale, multidimensional mHealth interventions, suggesting that the current limited evidence base will expand in coming years. The requirement for new digital skills for human resources for health (HRH) was observed as significant. This has implications for the education of health workers, the management of health services, policy-making, and research.

Keywords: EHEALTH/MHEALTH; HUMAN RESOURCES FOR HEALTH; HEALTH WORKFORCE PERFORMANCE; DIGITALIZATION OF HEALTH

INTRODUCTION

The potential contribution of eHealth and mHealth to making health care delivery more effective is broadly recognized *(1)*. Here we refer to eHealth as the “cost-effective and secure use of information and communication technologies in support of health and health-related fields, including health care services, health surveillance, health literature, and health education"; and to mHealth as the “use of mobile and wireless technologies to support the achievement of health objectives” *(1, 41)*.

In Europe, their use is already extensive in some countries, while their use in the majority has just begun. Among other requirements, the implementation of eHealth/mHealth-based services depends on the availability of health professionals, administrative and support staff, and managers with adequate new digital skills *(2)*. Innovations such as the provision of alerts to patients for therapeutic guidance and for monitoring drug adherence, or digital support to clinical and administrative tasks, offer the potential of making services more accessible, effective and

efficient. Such services are expected to benefit the users of services, health care professionals, provider organizations and the entire health care system, in the form of increased safety, quality of services, and efficiency gains *(3)*. However, many obstacles to the implementation of eHealth/mHealth remain *(4)*.

This paper focusses on addressing how eHealth/mHealth can increase the availability, accessibility, acceptability and quality (AAAQ) of the health workforce *(2)*, and thereby scale-up its capacity to deliver services that are better aligned with population needs.

We present examples that illustrate how eHealth and mHealth are used and how they improve performance and thereby "help improve the lives of European citizens, both patients and health professionals, while tackling the challenges to health care systems" *(5)*. We also include examples of countries with advanced implementation, and discuss facilitators and barriers to the optimal utilization of new communication and management technologies and their implications for the education of health workers, service management, policy-making, and research. But first, the general picture of their utilization in Europe is reviewed.

METHODS

A scoping review of literature published in English was performed on the utilization of eHealth/mHealth in Europe; the search in the PubMed and Google Scholar databases combined the following terms: Human Resources for Health, eHealth, mHealth, healthcare service delivery, and digital skills.

The example of two so-called digitally advanced countries, identified as such by the *European momentum for mainstreaming telemedicine deployment in daily practice* (MOMENTUM), a platform where clinicians share their experience in deploying telemedicine services into routine care *(6)*, was used. These are Norway, as this country's geography led to the necessity of deploying ehealth to address health coverage issues; and Portugal, a small country with a national centralized ehealth system. The examples were documented in detail to draw lessons on what enables or impedes the optimal utilization of ehealth/mhealth technologies, and on changes observed in the performance of the health workforce. The literature review and the country examples were analyzed according to the AAAQ dimensions. This in turn helped identify the impact of ehealth/mhealth on the education and management of health workers and on related policy and research.

RESULTS

The literature review identified several examples of using eHealth and mHealth technologies in the process of the digitalization of health care services, including support for electronic health records, electronic prescription and Internet-of-Things (equipping patients' home with sensors to monitor and transfer health data), and big data/artificial intelligence *(7)*.

Most studies focused narrowly on text messaging systems for patient behavior change, and a few studies examined systems for strengthening aspects of eHealth/mHealth *(8)*. There was limited literature on clinical effectiveness, costs, and patient acceptability, and none on equity and safety issues. In addition, there were only four papers on eHealth/mHealth and digital skills requirements for health professionals *(9–12)*. Despite the bold promise of eHealth/mHealth to improve health care, much remains unknown about whether and how this will be fulfilled. We identified registered clinical trial protocols of large-scale, multidimensional eHealth/mHealth interventions, suggesting that the current limited evidence base will expand in the coming years.

The results are presented in three parts: eHealth/mHealth in Europe, case studies of Norway and Portugal, and the impact on the performance of the health workforce and conditions for successful implementation and utilization.

EHEALTH AND MHEALTH IN THE EUROPEAN REGION

The literature suggests that eHealth/mHealth can be used as tools to meet the challenges of healthy ageing and universal and equitable access to health services in the context of the increasing burden of chronic diseases *(13)*. More specifically, eHealth/mHealth has showed capacity to:

- improve access to a wide range of services at all levels of health care – primary, secondary and tertiary – covering conditions such as mental illness, heart and cerebrovascular disease, diabetes, cancer and trauma. Services such as radiology, pathology and rehabilitation have also benefited *(14, 15)*;
- promote individualized, patient-centered care at a lower cost *(16, 17)*;
- enhance efficiency in clinical decision-making and prescribing, through easier communication between health care providers *(14)*;
- increase the effectiveness of chronic disease management in both long-term care facilities and at home *(14)*;
- promote the adoption of healthy lifestyles and self-care *(18)*.

As of 2008, the European Commission adopted a policy to encourage the development of telemedicine *(5)*. It identified the ways in which telemedicine services might assist patients, particularly those living in remote areas or experiencing conditions that might not be treated as easily or as often as needed. It also cited specific benefits, such as: improving access to health care by giving access to specialists who are not available locally, and; at the organizational level, helping to shorten patient waiting lists, to optimize the use of resources and enable productivity gains.

In the last decade, a number of European, national and regional initiatives have been launched in support of the development of eHealth/mHealth under the *Competitiveness and Innovation Programme* – in particular its *Policy Support Programme (19)*, and its pilot experiments or European FP7 projects such as *Renewing Health (20), United4Health (21)*, and *Digital Agenda for Europe (22)*. Major policy documents, such as *Horizon 2020 (23)*, the *European Innovation Partnership (EIP)* and its first partnership on *Active and Healthy Ageing (AHA) (24)*, the 2012 *European eHealth Action Plan (5)*, and the *New Health Technologies: Managing Access, Value and Sustainability (25)*, have highlighted the value of using technologies, such as eHealth/mHealth, in health care. The 2008 European Health Telematics Association (EHTEL) brief, *Sustainable Telemedicine: paradigms for future-proof healthcare*, proposed good practices in the use of ICT in integrated care *(6)*. The deployment of eHealth/mHealth is already the objective of several European initiatives (see Box 1).

BOX 1: EHEALTH/MHEALTH INITIATIVES AND ACTIONS IN THE EUROPEAN REGION

- European Momentum for Mainstreaming Telemedicine Deployment in Daily Practice (http://www.telemedicine-momentum.eu/) (2012–15)
- European Innovation Partnership on Active and Healthy Ageing (https://ec.europa.eu/eip/ageing/home_en) (2014–20)
- Discussion Paper: *Filling the Gap: Legal and Regulatory Challenges of Mobile Health (mHealth) in Europe* (ITU, 2014)
- EU Green Paper (2014) on the potential of mHealth for health care services
- EU project *DECIPHER PCP*, to create a mobile health care platform which would enable secure cross-border access to existing patient health care portals. (www.decipherpcp.eu) (2013–17)
- *Renewing Health*: aimed at implementing large-scale, real-life testbeds for the validation and subsequent evaluation of innovative eHealth/mHealth services for the remote monitoring and treatment of chronic patients suffering from diabetes, chronic obstructive pulmonary disease or cardiovascular diseases. Nine regions from different European countries participate: Regione Veneto (Italy), Region Syddanmark (Denmark – Coordinator), Northern Norway Regional Health Authority (Norway), South Karelia Social and Health Care District (Finland), County Council of Norrbotten (Sweden), Catalunya (Spain), Region of Central Greece, Carinthia (Austria), and Land of Berlin (Germany). (2011–14)
- Centre for Telemedicine and Telehealthcare, 2012, Central Denmark Region (http://www.smartaarhus.eu/projects/centre-telemedicine-and-telehealthcare).
- An implementation resource that focuses on coaching, monitoring and consultations for people with long-term conditions, developed by the University of York to address innovation in long-term care *(26)*.
- A toolkit that provides a structured approach to delivering the business objectives of eHealth/mHealth, developed to support the UK's National Health Service challenge to leverage the use of mHealth *(27)*.
- A collection of eHealth/mHealth case studies (http://www.cocir.org/fileadmin/ Publications_2011/telemedicine_toolkit_link2.pdf*)(28)*.
- A collection of eHealth/mHealth testimonials collected by the campaign for eHealth/mHealth in support of integrated care, a 2011 initiative of Brussels-based organizations (http://telemedicine-momentum.eu/testimonials/) *(29, 32)*.

Currently, eHealth/mHealth exists through three main types of services: diagnosis, monitoring and consultation:

- Diagnosis: The results of x-ray, ultrasound, CT, MRI, ECG or Holter exams are sent digitally from a diagnostic device to the appropriate health professionals who in turn make a diagnosis that is sent digitally to the referring physician or diagnostic clinic.
- Monitoring: Data derived from eHealth/mHealth devices measuring patient vital signs are tracked by a monitoring centre, individual clinician or website. Typically, the recipient of the data uses clinical guidelines to identify any deviation from what is considered normal for that patient. Embedded algorithms, written guidelines or professional judgment all support this process. If an unusual event occurs, the monitoring process generates a response in the form of an alert, contact with a clinician, or some form of online guidance to the patient.
- Consultation: When a virtual visit or dialogue takes place instead of, or in addition to, a face-to-face encounter.

TWO EXAMPLES OF UTILIZATION OF EHEALTH/MHEALTH IN NORWAY AND PORTUGAL

NORWAY

The *Electronic platform for integrated home care of long lasting and chronic ulcers* at the University of North Norway Hospital (UNN: http://www.telemedicine-momentum.eu/ulcers-no/) aims to facilitate cooperation between the patient, out-patient clinic at the hospital, patient's general practitioner, and home care personnel. The platform is a web-based electronic health record available via the Internet that can be used from computers, mobile phones and tablets. It is possible to register digital images of ulcers, compare images over time, ask for advice, and discuss the most appropriate treatment. This service is expected to lead to better care, better quality of life for the patient, and more effective treatment. It is expected that the number of hospital visits will be reduced along with resulting cost-savings. It also leads to the upgrading of ulcer treatment skills among involved home care personnel.

The service covers patients with chronic conditions and those undergoing a specific treatment. Up to ten people receive the service each month. This service offers diagnosis, mobile access to information, monitoring, therapy and treatment. Local health personnel as well as the patient can send images and questions electronically to the hospital, receive answers, and discuss different options for action.

PORTUGAL

For every 1000 newborns worldwide, eight contract some type of cardiopathy *(29, 30)*. For children delivered in District Hospitals, telemedicine allows for a rapid and valid diagnosis of complex paediatric cardiopathies and for an adapted follow-up.

The Hospital Pediátrico de Coimbra (HPC) is a 95-bed hospital that serves central Portugal and a population of 2.3 million representing about 25% of the total population of the country. In October 1998, HPC launched *Medigraf*, an eHealth system for teleconsultation that enables the reading of an eco-cardiogram in real-time at a distance, for example, in district hospitals *(29)*. It is also possible to communicate by telephone with a physician – usually a paediatrician – based at HPC, in order to make a complete distance examination. Images and sounds can be recorded in the system database and made available at both ends. In practice, the project experienced some barriers, such as in communicating the objectives of the telemedicine service, being seen as a non-user-friendly technology, not being clear regarding the remuneration of consultations, and insufficient training. Leaders of the project promoted the participation of physicians in a pilot experiment and invited other regional hospitals to join the task force responsible for the development of the experiment at HPC. Workshops to train physicians in the use of telemedicine were conducted and helped raise their interest in the project.

IMPACT OF EHEALTH/MHEALTH ON THE PERFORMANCE OF THE HEALTH WORKFORCE

Literature remains scarce about how these new services affect the health workforce: here we examine what the literature says about the AAAQ dimensions of the health workforce:

Availability: The more general literature indicates that the utilization of eHealth/mHealth augments the productivity of clinicians thanks to time-saving practices, less paper work and more rapid access to information. Higher productivity translates into increased availability and capacity to provide services to more users, even if the absolute numbers of health professionals remain constant *(8, 9, 28, 29, 31, 33, 34)*.

Accessibility: Accessibility improves as providers intervene at a distance, with the capacity to diagnose problems and monitor patient conditions through mobile devices *(14, 30, 31)*. Specialists, who typically concentrate in urban areas and higher-complexity clinics and hospitals, become accessible as they interact with their colleagues in general practice or directly with patients, irrespective of distance. This has the potential to facilitate the development of home care as well as the integration of services *(10, 12, 18, 29, 35)*.

Acceptability: eHealth/mHealth services make communication with patients easier, and more direct and adapted to each individual needs, thereby potentially enhancing the acceptability of providers. This is more likely with younger persons who are more familiar with the utilization of computers and mobile devices; strategies to facilitate their use by older patients may therefore be needed *(14, 28, 36)*.

Quality: Finally, eHealth and mHealth tools give providers rapid access to valid information, second opinions and guidelines, all of which contribute to scaling-up the competencies and compliance with professional standards, and thereby improving patient safety and service effectiveness *(7, 10, 18, 28, 30)*.

DISCUSSION

Online services are already changing how many sectors of the economy function, but they are relatively new in health care. This raises questions about what can facilitate their utilization, and which barriers need to be overcome to make real the potential performance gains of health workers and health services. eHealth/mHealth is not a panacea, but it offers significant opportunities to improve access to care, contain costs and scale-up quality.

Facilitators and barriers have been identified in relation to: individuals, such as patients, providers and managers; professional associations; provider organizations; and the institutional and regulatory environment. The acquisition or development of digital skills by health workers is critical. This has implications for the education of health workers, the management of health services, policy-making and research. Proper eHealth service implementation requires adjustments in service delivery and in how work is organized *(37–38)*.

Competencies to work in a digitalized environment have already been identified as among the core competencies which health professionals must have to deliver the services that meet the current and future needs of populations *(39, 40)*. The policy challenge here is for educational institutions to adapt the contents of curricula and learning strategies to prepare future professionals for transformed ways of practicing; it also includes the need to help the existing workforce acquire digital skills which did not exist when they were initially educated. Curricular changes are notoriously long to make as they imply the review of accreditation norms, retraining of teaching staff or the introduction of new mechanisms to evaluate competencies.

The impact of eHealth/mHealth on the provision of services will affect the availability of the health workforce differently, depending on the type of service. In some instances, it may lead to a reduction of needs if productivity increases and demand remains constant. More likely, it will generate additional and new needs. For instance, as these tools enable reaching out to populations previously without access to some categories of health workers – such as medical specialists, physiotherapists and psychologists – the demand for the services of these professionals will increase. Also, as professionals are now able to monitor patients remotely, more physicians, nurses and pharmacists will be needed to respond to a demand in rapid growth from a population of patients with one, and often more than one, chronic condition. New categories of professionals in telenursing, telepharmacy, health data analysis, and most probably in other areas and functions which are not yet known, will also be needed.

The facilitators and barriers to the diffusion of eHealth/mHealth are not very different from that of other innovations. Their adoption as routine tools by health workers and provider organizations will be facilitated by the favorable cost-benefit ratio of their utilization. As costs continuously drop, the power and potential of these tools will rise. Also, the new generations of health workers born into a rapidly digitalized environment are less likely to resist adopting these tools; on the contrary, it can even be expected that they will contribute to their further development. Factors such as engaging stakeholders in implementing change, the visibility of its advantages and user-friendliness, the leadership of respected so-called champions, access to training, the commitment and support of managers and decision-makers, good planning, and an enabling financial and legal environment can all play a positive role *(41)*. Their absence can constitute barriers, but in the case of eHealth/mHealth, the risks of barriers being stronger than facilitators are reduced. For instance, a typical barrier such as the resistance of older workers becomes less of an issue as the new tools become more user-friendly and as their utility for the worker, patient and organization is almost immediately apparent.

The technology is changing more rapidly than the organizational and institutional environment. Issues linked to legal responsibility, the definition of scopes of practice, remuneration and reimbursement, and the standardization of tools are starting to be addressed *(6, 32, 42)*. These are particularly difficult in a context such as that of the European Union where the mobility of health workers and patients is a fundamental right. Another issue relates to planning the future health workforce in a context of rapid technological, demographic, epidemiological, economic and social change.

There are two principal limitations to this article. First, it only covers publications in English. It does not include publications in French, Portuguese, Russian or Spanish that report experiences of the utilization of eHealth/mHealth in countries where these languages are used, although researchers tend to publish in English to reach out to a broader audience. The second, more important, limitation is that the literature reviewed does not include studies that report experiences evaluated according to a rigorous research protocol. Information on the results of experiences is based primarily on administrative evaluations and on assessments by providers and patients.

CONCLUSION

It is a paradox that the uptake of eHealth/mHealth services is more advanced in some low-income countries than in more economically developed one. This is changing rapidly as numerous initiatives to promote and facilitate their use have been launched and as some countries are becoming good models of integration for new communication technologies. The challenge remains to move from the recognition of the potential benefits of eHealth/mHealth to their actual utilization on a large scale, in a routine manner. In the European context, there seems to be more facilitators than barriers which bodes well for the future of health services in terms of improved accessibility, effectiveness and efficiency. It also offers the potential for better working conditions and higher satisfaction for health workers as they will be better equipped to do their job.

The benefits of eHealth/mHealth will not come spontaneously. An enabling policy environment is a prerequisite, as is the case for any major change. Research can help inform the policy process if it is well targeted and if its results are communicated to policy-makers in a way that encourages and supports their utilization. Policy-makers will be interested in the economics of the utilization of eHealth/mHealth; direct costs may be low and there may be savings from less visits and hospitalizations, but indirect costs also need to be assessed, whether it is for training or through increased demand induced by the greater accessibility facilitated by the technologies. Research on the process of implementation of eHealth/mHealth-based services is also important, including cross-national comparisons and studies. Another topic for research, more complex to study but most relevant, is their impact on health outcomes.

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