Building Continents of Knowledge in Oceans of Data: The Future of Co-Created eHealth
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Digitalization of Healthcare: Where Is the Evidence of the Impact on Healthcare Workforce' Performance?

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Introduction

The digital revolution is transforming society; yet, health seems to lagging behind [1]. There is a disproportion between the appealing launch of innovative services and the measures of its economic impact and the creation of employment [2]. Among researchers, two ideas are dominating, each opposing the other. From one side, the skeptical picture about the payoff of eHealth and the need to deal with healthcare reorganization due to low level of economic growth and increasing demand for services. Digitalization shows potential impact on unemployment from change in healthcare services [3]. Other authors are more convinced of the promise of innovation in healthcare, believing that the economic gains from the digital revolution still to come [4].

The Internet and related digital technologies have produced a significant growth of information in healthcare. Emerging evidence provides support for some beneficial effects of interactive digital systems; although many challenges remain with respect to understand approaches to methodology, implementation, and evaluation [4]. Chronic diseases are the main cause of mortality throughout Europe, with a prevalence and impact on the cost of care that is threatening the sustainability of health systems and pushing to significant reorganization of the healthcare services efforts [5].

Healthcare reorganizations are using very different approaches: from reorganizing processes and skill-mix, staff education and training; appropriate pay and reward systems; to designing new digital services. Health *digital* services are expected, as in the banking sector, to be an effective way to improve services [6]. A large gap exists between the promises and evidence with demonstrated benefits [7]; there are still a lot to learn and to study how to overcome the barriers that limit this "transformation" process.

This study aims at addressing the effect of digitalization of healthcare services on the reorganization of healthcare. Moreover on how eHealth, or mHealth, can increase the availability, accessibility, acceptability and quality (AAAQ) of the workforce [8], and thereby scale-up its capacity to deliver better aligned services.

1. Methods

We combined a literature review with the results from a focus group. A scoping literature review was performed on the utilization of eHealth in Europe; the search

(covering the last 5 years) in the PubMed and Google Scholar databases combined the following terms: Human Resources for Health (HRH), eHealth, mHealth, healthcare service delivery, and digital skills. The literature review was analyzed according to the AAAQ dimensions. This helped identify the impact of eHealth/mHealth (EM) on the education and management of health workers and on related policy and research.

The focus group included 5 experts, both academics and managers, with expertise. The full exercise took 125 minutes, during which a list of eHealth services [6-7] and its expected impact on health workforce was presented, and discussed, as a baseline. After that, the literature review findings on major trends were addressed: EM in the process of the digitalization of healthcare services; the support for electronic health records; the electronic prescription, the potential of Internet-of-Things (e.g., equipping patients' home with monitoring sensors), and of big data/artificial intelligence [9].

2. Results

The digitalization is comparable to the advent of steam power and electrification, as examples of general-purpose technologies, i.e., technologies with broad application across an economy. Moore's law allows for improvements and reductions in costs of EM technologies [2]. As a result, healthcare organizations are likely to find even wider use than previously expected for sensors and medical devices, open up the services to new categories of workers. A different prospect could emerge from the potential of machine-to-machine communication, allowing devices to interact with each other and respond to new conditions without human intervention. Considering the scenario where there is the digitization of all processes in healthcare, it would produce a stream of data making possible a ubiquitous "Internet of things" and eventually providing the necessary information for continuing improvement in the healthcare processes [10].

2.1. Digitization Impact on Health Workforce

From the literature review, we found that most studies focused narrowly on text messaging systems for patient behavior change and few studies examined systems for EM strengthening [10]. There was limited literature on clinical effectiveness, costs and patient acceptability, and none on equity and safety issues. There were only 4 papers on digital skills requirements for professionals [11-14]. Despite the bold promise of EM to improve health, much remains unknown about whether and how this will be fulfilled. We identified clinical trial protocols of large-scale, multidimensional EM interventions, suggesting that the current limited evidence base will expand in the coming years.

2.2. Scoping Literature on eHealth and mHealth in the European Region

The literature suggests that eHealth/mHalth can be used as tools to meet the challenges of healthy ageing and universal access to healthcare services in the context of the increasing burden of chronic diseases [15]. More specifically, it has showed capacity to:

- Promote the adoption of healthy lifestyles and self-care [11].
- Improve access to a wide range of healthcare services, covering conditions such as mental illness, heart and cerebrovascular disease, diabetes and cancer. Services such as radiology and rehabilitation have also benefited [16-17].

- Enhance efficiency in clinical decision-making and prescribing, through easier communication between health care providers [15-16].
- Promote individualized, patient-centered care at a lower cost [17].
- Increase the effectiveness of chronic disease management in both long-term care facilities and at home [15-17].

The European Commission adopted a policy to encourage the development of EM [6]. It identified the ways in which EM services might assist patients, particularly those living in remote areas or experiencing conditions that might not be treated as often as needed. It also cited specific benefits such as improving access to healthcare 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 initiatives have been launched in support of the development of EM under the Competitiveness and Innovation Programme, in particular its Policy Support Programme, and its pilot experiments or European FP7 projects such as Renewing Health, United4Health, and Digital Agenda for Europe. Major policy actions, such as Horizon 2020, the European Innovation Partnership (e.g. Active and Healthy Ageing), and the 2012 European eHealth Action Plan have highlighted the value of using technologies, such as EM. The EHTEL Sustainable Telemedicine: paradigms for future-proof healthcare, proposed good practices in the use of ICT in integrated care [8]. The deployment of eHealth is already the objective of several European initiatives. Currently, EM exists through three main types of services:

- Diagnosis: The results of x-ray, ultrasound, etc. exams are sent digitally from a diagnostic device to the appropriate health professional who in turn make a diagnosis that is sent digitally to the referring physician or diagnostic clinic.
- Monitoring: Data derived from devices measuring patient vital signs are tracked by a monitoring centre or individual clinician. Embedded algorithms, written guidelines or professional judgment all support this process. If a unusual event occurs, the monitoring process generates a response in the form of an alert, contact with a clinician, or some form of guidance to the patient.
- Consultation: When a virtual visit or dialogue takes place instead of, or in addition to, a face-to-face encounter.

2.3. Impact of eHealth/mHealth on the performance of the health workforce

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

Availability: The more general literature indicates that the utilization of EM 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 [10-12].

Accessibility: Accessibility improves as providers intervene at a distance, with the capacity to diagnose problems and monitor patient conditions through devices [16]. Specialists, who typically concentrate in urban areas and hospitals, become accessible as they interact with their colleagues or directly with patients, irrespective of distance. This has the potential to enable the expansion of homecare and service integration [14].

Acceptability: EM 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 [15, 17].

Quality: EM 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 [8,11-12].

3. Discussion

Digital services are already changing how many sectors of the economy function, but they are relatively new in healthcare [2]. The experts agreed that 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 services. EM is not a panacea, but it offers significant opportunities to improve access to care, contain costs and scale-up quality. The experts helped identify facilitators and barriers; like 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. It was said that this has implications for the education of health workers, the management of health services, policy-making and research. Proper digital service implementation requires adjustments in service delivery and in how work is organized. 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. The policy challenge is for educational institutions to adapt the contents of curricula and learning strategies to prepare future professionals for new 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. The impact of EM on the provision of services will affect the availability of the health workforce, 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, such as health data analysts [10]. As professionals are now able to monitor patients remotely, more physicians and nurses will be needed to respond to a demand in rapid growth from a population of patients with chronic condition or mental impairment. New categories of professionals in tele-nursing, smart decision-making, etc. will also be needed. The experts mentioned that most facilitators and barriers to the diffusion of EM are not very different from that of other innovations. 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.

A typical barrier, one participant stated, could be resistance of older workers becomes less of an issue as the new tools become more user-friendly and as their utility for the worker and patients is almost immediately apparent. Other stated that the technology is changing more rapidly than the organizational and institutional environment. Most agreed that issues linked to legal responsibility, the definition of scopes of practice, remuneration and reimbursement, and the standardization of tools are starting to be addressed. However, these are particularly difficult in a context such as that of the EU where the mobility of workers and patients is a fundamental right. Another

important issue pointed out relates to planning the future health workforce in a context of rapid technological, demographic, epidemiological, economic and social change. Most agreed that more research is needed to improve the understanding.

4. Conclusion

The uptake of EM services is taking some time. The benefits of EM will not come spontaneously. Policy-makers will be interested in the economics of the utilization of EM; direct costs may be low and there may be savings from less visits and hospitalizetions, 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 EM-based services is also important, including cross-national comparisons and studies.

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