Perspectives and Debates

Public health platforms: an emerging informatics approach to health professional learning and development

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Significance for public health

The landscape of healthcare systems, public health systems, health research systems and professional education systems is fragmented, with many gaps and silos. More sophistication in the management of health data, information, and knowledge, based on public health informatics expertise, is needed to tackle key issues of prevention, promotion and policy-making. Platform technologies represent an emerging large-scale, highly integrated informatics approach to public health, combining the technologies of Internet, the web, the cloud, social technologies, remote sensing and/or mobile apps into an online infrastructure that can allow more synergies in work within and across these systems. Health professional curricula need updating so that the health workforce has a deep and critical understanding of the way that platform technologies are becoming the foundation of the health sector.

Abstract

Health informatics has a major role to play in optimising the management and use of data, information and knowledge in health systems. As health systems undergo digital transformation, it is important to consider informatics approaches not only to curriculum content but also to the design of learning environments and learning activities for health professional learning and development. An example of such an informatics approach is the use of large-scale, integrated public health platforms on the Internet as part of health professional learning and development. This article describes selected examples of such platforms, with a focus on how they may influence the direction of health professional learning and development.

An informatics approach to health: definition and rationale

Health informatics is a distinctive interdisciplinary field of scientific knowledge and professional practice. It aims to improve human health by optimising the use of data, information, and knowledge in, about, and for healthcare and biomedical science. It focuses on why and how to describe, collect, store, assure, secure, share, integrate, analyse, visualize, and mobilise health data, health information, and health knowledge. It advances the application of information science across the spectrum from molecular medicine to population health, in order to contribute to planning, problem-solving, decision-making, enquiry and learning in health.

There are many reasons to take an informatics approach to health professional education, based on the ways that digital data management, information management, and knowledge management are changing health. Some general examples are described here. First, health data processing is now complex and globalised; consider for example the big data generated by the revolution in digital medical imaging, by omics medicine, and by the Twittersphere and other social media. Big data are distinguished from previous ways of thinking about health data by four Vs: such data are huge in *volume*, they are generated at high *velocity*, they originate from a wide *variety* of sources, and their *veracity* is not always assured.[1] The widening array of formats of digital medical images (including all of the radiology modalities, plus medical laboratory images and newer molecular images) is a growing basis for artificial intelligence and robotics applications in specialties such as pathology and surgery.[2] Omics data include masses of molecular level data about individuals' genomes, the genomes of their gut micro-organisms and the environmental chemicals and prescription medications to which they have been exposed, and are increasingly important to bring greater precision to medical diagnosis and treatment.[3] Messages being exchanged minute by minute on Twitter are now being mined to enable more rapid responses to infectious disease outbreaks and large-scale medical emergencies,[4] while Twitter data streams combined with those from other social media channels, search engines, mobile phone apps and wearable sensing devices, create a torrent that enables new approaches to health monitoring, promotion and research.[5]

Second, health professional practice is increasingly information-intensive. The concept of e-health is one way of capturing the potential offered by Internet information and communication technologies for improving health systems, through integrating patient health records, disease registries, and public health reporting. As online tools for decision-making, documentation and messaging are implemented in health systems, health professionals' responsibilities also change. Organisational change management is needed to embed not only new interprofessional practices among clinicians but also new collaborative arrangements among clinicians, clients, administrators, funders and policy-makers, as described for example in several papers.[6,7] The effect of information and communication technologies on the changing nature of work is becoming recognised across the health professions, for example in medicine,[8] nursing,[9] and pharmacy.[10]

Third, new biomedical knowledge is exponential and impossible to master by relying on traditional modes of professional education and knowledge management.[11,12] For example, new challenges are raised by the systematic review process overload, by the burgeoning of stealth research, and by the emergence of citizen science initiatives. Systematic review production cannot meet the demand for evidence in all fields while remaining affordable, high-quality and timely, unless it adopts technological innovations.[13] The slow pace of peer reviewing has not kept pace with the need for transparency in clinical research and development, giving rise to the phenomenon of stealth research (*i.e.* findings claiming credibility while withholding critical details about reliability),[14] and inspiring an international online campaign to

have all clinical trials registered and all results reported.[15] Mobile and social web technologies have begun to change the dynamics of research in biomedical science, by facilitating the participation of ordinary citizens on a wider scale and on a more meaningful level than ever before.[16,17]

An informatics approach to redesigning professional education

As health systems undergo the digital transformation that has occurred in many other sectors of modern society and the global economy,[18] there are implications and opportunities for entry level education, post-basic training, and continuing professional education, in all health professions, internationally (see, for example Tierney *et al.* and Skiba).[19,20] The redesign of health professional learning environments and educational activities is part of enabling the digital transformation and realising the vision of a health system that learns and improves continuously.[21,22]

Educational redesign in response to this transformation demands specialised health informatics input. There are many enthusiastic but poorly-informed developers of technological tools for learning and for practice (for instance, the burgeoning of mobile health apps and tools that lack usability, overlook data privacy laws, and do not integrate or scale). Such innovation does not deliver the same health systems outcomes as professional practices that are based on training in the health informatics discipline and understanding of health informatics approaches to managing data, information, and knowledge.[23] Despite steady evolution in the health informatics content included in health professions curricula,[24] health professional education lags in this area overall,[25] and most health professionals in most health systems are not yet well prepared to take an informatics approach to learning or practice. Unreconstructed health professional education and training also flows through to have a limiting effect on those in the clinical workforce, who become involved in clinical research, health services management, and population health administration.[26] Meanwhile, patients and clients are under-served by health services, compared to the services they can access via the Internet in other industries. Further, they are vulnerable in a world where health services online (which include not only information provision but also personal data management and peer-to-peer knowledge sharing) can be offered without the standards of evidence or governance expected in the mainstream of healthcare.[27]

Such considerations highlight many gaps limiting the performance of healthcare systems, public health systems, and health research systems, that the redesign of professional education is called upon to bridge. Platform technologies represent an emerging informatics approach to span many of these gaps. Alongside learning in the familiar haunts of campus, classroom, clinic and conference, and in conventional online education settings, health professionals should undertake some of their professional learning activities in the large-scale, highly integrated online environments that are emerging in 21st century health systems.

What are platform technologies and functionalities?

Platforms are various combinations of technologies – Internet, the web, the cloud, social technologies, remote sensing and/or mobile apps – into online infrastructure that brings new synergies to doing work within and across previously separate online systems. In the most general terms, they are *software-based facilities offering two- or even multi-sided markets where providers and users of content, goods and services can meet* [and they are] *ever more central to how businesses and consumers access information and engage in e-commerce.*[28] They demand big-picture thinking about management and governance issues, so that transparency and accountability measures are in place around the use of data that platforms acquire; equity in the relations between platforms and suppliers of services and resources to them; and options for individuals and organisations to switch platforms.

In the health sector platform technologies have catered to specific types of activity for some time already. There are platforms that have been purpose-built for health professional education, and as well there are platforms for public health workers, platforms for biomedical research, and platforms for activity by patients and consumers. Some examples of the functionalities of these separate, specialised platforms are described next.

Dedicated platforms for formal instruction and continuing professional development in health are long-standing and well-understood. A platform to support multimedia education across biomedical disciplines was reported in 2002, for example.[29] A global forum on innovation in health professional education in 2015 gave many examples of ways that platforms have been used to span institutional, professional or national boundaries.[30]

Purpose-built platforms for telehealth, particularly for the direct provision of healthcare services over distance, have advanced in scale and sophistication as well, as illustrated by Hua *et al*. and Lamprinakos *et al*.[31,32] Likewise, the use of research platforms is established as a way to support the collaborative processes of multi-institutional, multi-stakeholder research programs in clinical and biomedical science.[33]

The concept of *population health platforms* is currently shaped by US government policy, and dominated by health provider organisations and health IT vendors under its influence. Their platforms aim to provide data analytics services over aggregated electronic patient health records, and to generate insights that will support more coordinated health care management.[34] In other contexts than US policy, in the developing world and in developed nations, there is rising interest in population health platform approaches to under-served and under-resourced areas of health.[35-37]

More informally and unofficially, social networking platforms on the open Internet have facilitated the emergence of the social movement known as participatory health among some patient and consumer groups.[38]

Large-scale, highly integrated platforms as environments for professional learning

The previous paragraphs have outlined examples of specific categories and functions of platforms, about which health professionals need some knowledge. Increasingly, platform technologies are capable of sustaining many of these types of functionality in concert, including health professional learning and development. Rather than being limited to separate platforms for specific uses, it is increasingly possible and desirable to integrate multiple functions into new public health platforms that simultaneously engage a wide range of users – clinical health professionals, public health workers, students, researchers, and patients and citizens.

Three examples of platforms that fall into this more expansive class are outlined next, and discussed with a particular focus on how they may influence the direction of health professional learning and development. These examples were selected because they have been the focus of recent peer-reviewed health and biomedical journal articles, which directly address aspects of learning.

Cure Together (http://curetogether.com), founded in 2008, aims to harness large amounts of data crowd-sourced from tens of thousands of patients to improve diagnostics, research, and treatment of many diseases. It was started by two biotechnology researchers and entrepreneurs to help them resolve a personal issue with chronic pain, and subsequently acquired by a direct-to-consumer personal genomics testing service, adding to the volume and complexity of data donated and further accelerating the potential for biomedical discovery. As well as being a large-scale data gathering tool, it enables individuals to share information and knowledge about hundreds of different medical conditions. For clinicians, it has been said to have inherent value as a way to learn about the patient experience and shared decision making.[39]

Cancer Commons (https://www.cancercommons.org), started in 2011, aims to encourage the global cancer community to share data and knowledge, and to leverage expertise and resources , so as to identify effective treatments in a more efficient way than clinical trials alone can do. Its network of patients, physicians, scientists and volunteers turns every treatment event experienced by a participating patient into an immediate opportunity to understand models of treatment better. Its educational paradigm is rapid learning across an entire community of practice.[40]

Million Hearts® (http://millionhearts.hhs.gov/), started in 2012, aims to prevent one million heart attacks and strokes by 2017. It is led by US Centers for Disease Control and Prevention and the Centers for Medicare & Medicaid Services working in partnership with health profession associations, local health authorities, health insurers and other private sector organisations. It provides resources and activities not only for patients but also for health professionals and students in medicine, nursing, nutrition, pharmacy, physiotherapy and public health, mobilising them to conduct mass screening for risk factors. It offers them web-based training in preventive health techniques, plus resources to support them to screen citizens who register on the website, and also further opportunities to work in interprofessional teams with aggregated screening data uploaded online.[41]

Directions

How may such examples of public health platforms, in the broadest sense, influence the way we approach health professional learning and development? Several directions are apparent.

Health professional curriculum needs updating, so that the health workforce has a deep and critical understanding of the way that platform technologies are influencing the health sector, and adequate health informatics knowledge and skill for professional practice in such environments. Health professional education methods should be taking advantage of the avenues that platforms provide for augmenting *in situ* patient interactions, through interacting over distance: with patients whose health conditions they may not encounter otherwise; with patients willing to share their experiences and their data; and with expert patients and citizen scientists.

Conventional education in evidence-based practice should be revised to reflect the new tools and techniques that platforms are contributing to speed up knowledge discovery, dissemination and translation. Traditional educational resources should be re-evaluated in light of the innovative sources of information and knowledge that are being generated through new platform-supported partnerships for prevention, promotion and policy-making in health.

Educational uses of public health platforms need to address some interesting aspects of implementation and evaluation. The way these aspects are addressed will vary, depending on the level of education for which professional recognition is sought. As an example, the use of social media platforms has begun to take hold as an informal tool for clinicians' just-in-time learning; however, it is difficult to recognise such learning as a form of continuing professional development without new tools and techniques to assess the learning that has occurred.[42] Another concern is how to ensure safe and ethical engagement, from the perspectives of learners, educators, researchers, patients, and other people who interact on the platform. Although this issue is not unique to health profession education,[43] it is complicated by the overlay of health data privacy laws which may block access to patient data for learners who are not a treating clinical or a named researcher. Another area for attention is finding the optimal interplay between learning experiences *in silico* and learning experiences *in vivo;* while platforms are a site of very real activity in health, this issue has some commonalities with simulation in health education.[44]

Public health platforms enable many different interest groups to collaborate – and to compete – in leveraging digital health data, information and knowledge, at speed, on a global scale. This is changing the design and delivery of healthcare services, as well as the design and dissemination of the research that underpins safety and quality in healthcare. Health professionals need learning and development opportunities that build their capabilities to work amid these changes with more sophistication than ever before.

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