Improving Usability, Safety and Patient Outcomes with Health Information Technology
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Ghosts in the Machine: Identifying the Digital Health Information Workforce

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Abstract. In descriptions of digital health the role of human agency and the work of managing and governing health information and communication technology is often invisible. This paper reports preliminary results of a scoping review of the literature and a national workforce census, undertaken as part of a research program to shed light on the responsibilities and the contributions of the health information workforce. The global literature is not a good indicator of the actual proportion of health informaticians, health information managers, health librarians or other health professionals who are engaged in health information work in Australia. While the research interest in health information work of all descriptions is increasing, the practice of health information work is neither highly skilled nor easily identifiable in findings of an Australian census. Reforming this workforce may be a key to translating digital health rhetoric into measurable improvements in health system performance.

Keywords Health information, information technology, labour force, occupational status

1. Introduction

Digital health may appear to have a life of its own. Consider the ITCH conference statement "Health information technologies are revolutionizing and streamlining healthcare and their uptake is rising dramatically"- as though these technologies could do all of this without human support or intervention or collaboration. Healthcare in general is notable for its highly trained professional workforce, carefully regulated in the interest of public safety. Yet in descriptions of digital health, the role of human agency and the work of managing and governing health information and communication technology, of ensuring that digital health data are harnessed for health knowledge, is often invisible.

Major investment in digital health initiatives too often proceeds without recognising and implementing the specialised workforce development that is needed to deliver on the promises for healthcare - enhancement, streamlining, transformation, revolution, and so forth. Clinicians, managers and technicians cannot be assumed to have the skills,

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experiences, attitudes or perspectives necessary for this work. Yet these initiatives proceed despite decades of calls for attention to this issue, and reports of lessons learned. For example, in Australia national accreditation standards for documentation and communication of critical information in healthcare do not specify agents [1]; Standards Australia's Digital Hospital Handbook identifies only two key roles - chief clinical information officers and health information systems managers [2].

Health workforce policy and planning in this area is not helped by multifarious claims to the expert high ground. Existing professional associations may be in competition for members at the same time as new and more nuanced professional associations also are emerging (for example, [3], [4]). The aim of this paper is to describe progress, through a literature review and a workforce survey, toward making the case for a distinctive specialised digital health workforce, with a clear professional identity, a definitive body of knowledge, and formal education paths.

2. Scoping Review Method

A scoping review [5] was used to trace the emergence and evolution of health information work as specialised work, through bibliometric and thematic analysis of the published literature describing an instrumental or professional human role in health information work. Searches were conducted between July 2017 and March 2018 using health, social science and information science databases: Ovid Medline, Embase, CINAHL, Applied Social Sciences Index, and Library and Information Science Abstracts. Relevant items were also identified through citation checking and search of grey literature. In the structured databases, we searched for combinations of the words in Table 1, in title or abstract (example item counts show Medline result numbers at July 2017).

Table 1. Health information work search term sets.

"health information" OR "healthcare information" OR "health care information" = 19,375 items OR "health knowledge OR healthcare knowledge OR health care knowledge" = 2,417 items OR "health data OR healthcare data OR health care data" = 5812 items
NO FEWER THAN TWO OF [informatics OR management OR technology OR library OR systems OR digital] = 138,199 items
[work / worker / workers / workforce OR profession / professional / professionals / professions OR role / roles OR staff /staffing OR expert / expertise / experts OR specialist / specialists / specialized /specialised / specialisation /specialization OR leader / leaders / leadership OR champion / champions OR manager /managers OR "change agent"/ change agents"] = 3,767,278 items

Combining all three sets in Medline retrieved 1,782 items; a similar strategy in the additional databases retrieved 1,466 items. The combined results were screened for relevance by applying the inclusion criterion "describes an instrumental or professional human role in health information work" to the abstract of each item. The final group comprised 253 publications; selected examples are included in this paper and a full list is available from the authors. The following details were extracted manually from the

abstract of each item: Position identity, title, or label; Role, responsibilities, functions; Knowledge, skills, attributes.

3. Scoping Review Results

We found literature on this topic from 1973 onward. The number of items expanded dramatically from 1990s; numbers since 2010 are more than double all of the 1990s. Differing core concepts persist about what 'health information' is, giving rise to a variety of titles for the roles of people doings3pecialized work with health information, e.g. information manager, information specialist, librarian, computer specialist, informatician, knowledge manager, or informationist [6], [7]. We grouped the titles that appeared in the literature into 6 major categories as shown in Figure 1.

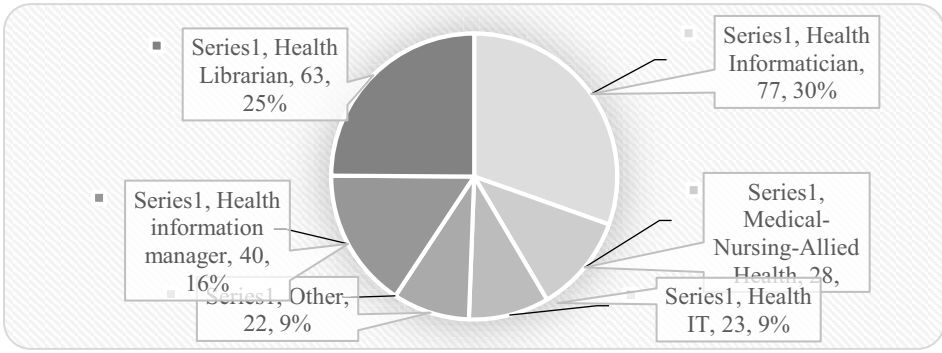

Figure 1. Titles of people who do specialized health information work, in the literature

Not all identities used in earlier decades have continued in mainstream use, and some contemporary terms have gained favour. 'Knowledge manager' was used in the 2000-2009 decade but not much since then. Newer position titles include 'clinical decision support staff', 'patient education specialist', 'health information counsellor', 'information therapist', 'health literacy practitioner', 'information doctor', and 'digital health advisor'. Work described as 'health information systems' and 'health IT' currently has high profile champions [8], [9]. Positions in low- or middle-income countries are more likely to include the term 'community' or 'community-based' implying roles that use the existing health workforce to gather health data or monitor health information activities. (e.g. [10], [11]). Future merging of roles is sometimes predicted or proposed, e.g. health information management interests in common with biomedical informatics [12]; "skills of health informatics, information systems, and data analytics bridging the interests of clinical and nonclinical professionals" (in an education program cited in [13]). Suggestions to redefine or widen the scope of an existing type of role are common. For health information managers, functions such as data scientists, data stewards, information governance [14], or in health services management and research [15] are proposed. For health information professionals or librarians, potential functions include guiding consumer access to health information [16], or data management in electronic medical record initiatives [17]. Ideas about informaticians' expanding roles are found in titles that include 'informatician' preceded by a range of adjectives – applied, clinical, biomedical, health(care), consumer health, medical, nursing, pathology, population, public health, or research (e.g. [18], [19], [20], [21]).

Assimilation of health information work within the scopes of practice of clinical healthcare professions including nursing, medicine and allied health is also expected (e.g. [22], [23]). Nurses are recognized as routinely using informatics processes and information technology to address patient safety concerns [24]. Allied health professionals such as pharmacists and physiotherapists are also acknowledged as users of health information for clinical decision making and stakeholders in health information systems (e.g. [25], [26]).

There is advocacy of graduate specialist education for health information workers (e.g. [27], [28]); and of continuing education options for updating practitioners' skills ([29], [30]). Competencies are frequently cited, often in terms of a 'minimum' set promulgated by a professional body (e.g. [31], [32]). There is seen to be potential for accreditation of different specialized university degrees by a combined health information authority [33].

4. Workforce Survey Method

Two universities began a joint program of empirical research into the health information workforce in 2016. This involved establishing a national health information workforce census. A Health Information Workforce Census Management Group, Expert Panel and Consultation Group were formed, with representation from key associations and agencies.

WHO guidelines were used to develop a minimum data set, and a Delphi approach was used from February 2017 to January 2018 to gather expert input and consult widely about the data elements required. Based on the agreed minimum data set an online survey instrument was constructed and pilot tested by members of the Management Group, Expert Panel and Consultation Group in early 2018 [34].

The census was open for one month in May 2018. It was promoted widely through industry, professional and government organisations, to anyone who self-identified as being part of the health information workforce. As a guide, and not exclusively, it encouraged participation by anyone working within the following areas: Clinical coding; Clinical costing; Clinical documentation improvement; Digital health infrastructure; eHealth systems; Health data analytics; Health informatics; Health information governance; Health information management; Health information systems or services; Health information technology; Health librarianship.

5. Health Information Workforce Census Results

There were 1849 usable responses to the inaugural Health Information Workforce Census. Detailed analysis is under way; rounded descriptive statistics from the summary report [35] are presented here. Respondents were from all Australian States and Territories, and were 78% female and 22% male. The highest educational level of respondents was: 44% Bachelor or Honours degree; 22 % Masters degree; 15% Graduate Certificate or Diploma. 7% had no post-secondary educational qualification in health information.

The main fields of occupation reported were health information management (37%), health informatics (22%), clinical coding and classification (16%), health librarianship (14%), data analytics (9%), and costing (2%). Additionally 12% were registered as healthcare professionals with the Australian Health Practitioner Regulation Agency. The

broad occupational categories with which respondents identified themselves were 51% professional, 34% managerial, and 14% clerical.

Professional associations to which at least 1% of respondents belonged were (in alphabetical order) the Australian College of Health Services Management, Australian Computer Society, Australian Healthcare and Hospitals Association, Australian Information Industry Association, Australian Library and Information Association Health Libraries Australia, Clinical Coders Society of Australia, Health Informatics Society of Australia, Health Information and Management Systems Society, and Health Information Management Association of Australia. However, 45% of respondents said that they did not belong to any professional association related to their health information work.

Respondents were also asked how long they intend to remain in the Australian health information workforce. Over half (56%) said that they plan to leave within 15 years.

6. Discussion

Taken together, these preliminary findings from our scoping review and workforce census show that the research literature is not a good indicator of the actual proportion of health informaticians, health information managers, health librarians or other health professionals who are engaged in health information work in Australia. Further, while the peer reviewed literature about health information work of all descriptions is increasing, the real-world practice of health information work is neither highly skilled nor easily identifiable in Australia. The arguments in favour of the status quo are not evident; it seems that greater coherence and cohesion in the current health information workforce could have obvious efficiencies (scope and scale) and widespread benefits (accountability and transparency) in the digital health environment.

It is not surprising if healthcare organisations struggle to work out optimal human resource planning to achieve their digital health vision and mission. The health information workforce seems hardly to see itself in terms of this bigger picture of health system change, and a fair proportion will disengage soon. The preliminary results of our research already highlight issues of relevance and sustainability for many health information associations. One possible scenario is that one such group will outcompete others to become the most distinctive and credible organising force for digital health information work. Another is that a broad coalition of such groups will take up the challenge to establish an evidence-based regulated health profession to manage and govern digital health. Workforce restructuring of this kind may be driven by high-level health policymakers, oblivious of the currently invisible expertise and available human resources. By default, health information technology vendors may own the risks and the returns on the investment in digital health, with their executive officers answerable under commercial law for service agreements.

Comparative international analysis of the literature review results is under way to see where there is evidence of health information workforce models that are more (or less) effective in contributing to realise the benefits of digital health. With the census, considerable care was taken to use standard census categories (for education level and occupational group, for example), and to structure data collection so that the census can be customised for use in jurisdictions other than Australia. In November 2018, a New Zealand version of the census, auspiced through a research collaboration between Australian and New Zealand universities, is the next step toward what needs to become a

global research effort. Only this way can the results be translated into workforce reform on the same scale at which digital health operates.

This paper uses the analogy of "the ghost in the machine" [36] to describe the absence of a readily recognisable, professional, specialised health workforce to manage and govern digital health. We believe that there is a serious risk to aspirations for safe and equitable health systems, if the concept of "digital health" is assumed to have inherent scientific and ethical power to inhabit and redirect the human beings in the health workforce into new and better ways of providing healthcare. The question "Why is ehealth it so hard?" [37] continues to resonate with the many and varied professionals who are engaged in digital health work. Our research is exploring answers that have a broad and deep focus on human agency in digital health. Reforming the existing health information workforce, clarifying the roles and responsibilities of those in it, may be a key to translating digital health rhetoric into measurable improvements in health system performance. Our work aims to make health information work visible, as a basis for such improvements.

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