Health Informatics

Kerryn Butler-Henderson
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The Health Information Workforce

Current and Future Developments

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Introduction

Chapter 1
The Specialised Data, Information, and Knowledge Workforce in Health: Present and Future

Kerryn Butler-Henderson, Karen Day, and Kathleen Gray

Abstract The health information workforce has existed for more than a century yet remains one of the most hidden workforces in health. This workforce supports the planning, delivery, and improvement of healthcare services by analysing, designing, developing, implementing, maintaining, managing, operating, evaluating, or governing health data, information, or knowledge. Lack of awareness about this workforce has flow-on effects: shortages of skilled workers, inadequate skills training opportunities, and ultimately suboptimal health information and communication technology implementation and scaling up. Even in the era of digital health, this essential workforce supporting the safe and efficient management of health and care is a hidden workforce. We call it the HIDDIN workforce. The HIDDIN workforce comprises the practitioners who have key responsibility for the specialised work in Health Informatics, Digital, Data, Information, and kNowledge (HIDDIN). This chapter examines each of these parts of the HIDDIN workforce and defines the framework for this workforce used throughout this book. This chapter also defines the purpose of this book and presents the three conceptual

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lenses that have been used to frame the structure of this book. This book provides a clearer and more comprehensive view than ever before of the specialised workforce required to manage and govern the health data, information, and knowledge infrastructure now and in the future.

Keywords Health data science · Health informatics · Health information management · Health knowledge management · Health librarianship

Specialising in Data, Information and Knowledge Work in Health

Information is critical in the planning, delivery, and improvement of healthcare services, increasingly so in the twenty-first century era of health big data analytics, digital, and Internet-supported hospitals, artificial intelligence in health, and health self-quantification. Information means many things to many people in the health sector. Broadly, it can be the data of a patient's diagnosis and treatment, such as a fasting blood sugar level. It can be a record of information to inform a prognosis, such as pelvic pain, amenorrhoea, increased CA125 levels, imaging showing an ovarian mass indicating ovarian cancer. It can be the knowledge gained from the outcomes that a healthcare system is achieving, such as the infant mortality rate in place X in decade Y. It can be the wisdom from health messages that are designed to support responsible public health behaviours, such as how to avoid sexually transmitted infections. It can be the summary of evidence from a field of health research, such as what is known about the effects of calcium supplements on osteoarthritis. It can be business intelligence about health care services and how people use them, such as comparative hospital emergency department waiting times, or how rapidly regional governments are rolling out COVID-19 vaccines for people in residential aged care. For the health sector to get full value from health information, the sector needs more than common sense or basic health and information literacy among its professionals; consequently, there is increasing recognition that everyone in the health workforce must acquire basic digital health capabilities. Even so, the need remains for a health workforce group that possesses specialised knowledge and skills, with the capabilities to manage the sophisticated structures, systems, and processes that support and advance everyone's ability to work safely and efficiently with health information.

Who are the health information specialists? What kind of work do they do, where, and when are they needed? Although this work is fundamental, it is hard to see and even harder to understand and define, even for some of the people who do it and certainly for many of the other people who work in the health sector and

beyond it. Unlike people in more commonly recognised healthcare roles, these specialists and their employers face challenges in finding one another. Specialised health information workers are not easy to locate in any healthcare organisation, nor is their value to health systems clearly articulated as a component of the overall health workforce (Martín-Sánchez and Gray 2014; Gray et al. 2019). Lack of awareness about this workforce has flow-on effects: shortages of skilled workers, inadequate skills training opportunities, and ultimately suboptimal health information and communication technology implementation and scaling up. Even in the era of digital health, this essential workforce supporting the safe and efficient management of health and care is a hidden workforce. We call it the HIDDIN workforce.

The HIDDIN workforce comprises the practitioners who have key responsibility for the specialised work in *H*ealth *I*nformatics, *D*igital, *D*ata, *I*nformation, and k*N*owledge. Roles in the HIDDIN workforce include functions not only as users of health data, information, or knowledge; rather they are managers, policymakers, clinicians, educators, researchers, and leaders who are tasked with analysing, designing, developing, implementing, maintaining, operating, evaluating, and governing the formats, technologies, systems, and services that mobilise health data, information, and knowledge. Typically, but not exclusively, this may include people who practice, administer, teach, or research in areas such as Biomedical engineering, Biomedical informatics, Biostatistics, Clinical coding, Clinical costings, Clinical documentation improvement, Clinical informatics, Consumer health information services, Digital health infrastructure, eHealth systems, Epidemiology, Health analytics, Health app development, Health artificial intelligence, Health cybersecurity, Health data science, Health informatics, Health information governance, Health information management, Health information systems or services, Health information technology, Health innovation, Health interoperability, Health librarianship, Health simulation, Health technology assessment, Medical research data management, Telehealth platform services, and Translational bioinformatics.

The aim of this book is to make the HIDDIN workforce visible and to explore its place in the health sector. The book begins by setting out the foundations of current knowledge about the HIDDIN workforce—how scholars have described it, how economies have categorised it, how education, professional development and certification have shaped and influenced it. The book continues by giving consideration to some emerging approaches to the work and their implications for this workforce—artificial intelligence and machine learning, consumerism, globalisation, and other leadership challenges. The book also provides a finer-grained analysis of what this workforce contributes to the health sector, in terms of safety and quality, access and equity. The book concludes with case studies of practitioners in the HIDDIN workforce that relate their real-world roles, challenges, changes, and achievements.

Ways of Exploring HIDDIN Work

This book looks at the HIDDIN workforce through three conceptual lenses, as defined in Box 1.1.

Box 1.1 Three conceptual lenses of this book

Identity

Who is this workforce, and what do they do; what positions do they occupy in the health workforce; what specialised knowledge and skills do they have, and what do they do to acquire these?

Innovation

What is this workforce doing to advance the ways that its own members practice in response to healthcare changes; what is it doing to transform the ways that other people in the health system gain value from health information?

Impact

What is the impact of the work done by this workforce, and what criteria can be used to measure or assess its impact; what could be the impact of a more deliberately structured and supported workforce?

The motifs of identity, innovation, and impact (adapted from Bärnighausen and Bloom 2009) frame this book, as applied to specialised work in support of health data, health information, and health knowledge. The three concepts of data, information, and knowledge are fundamental distinctions in the discipline of information science (Zins 2007), and they align with many definitions used in models of this field of work (for example Georgiou 2002). Data, information, and knowledge management work are not easy to define or differentiate, and this is advantageous for our research. This allows us to explore a broad spectrum of people who may identify with this workforce, either exclusively or jointly with another health workforce identity (for example does a chief clinical information officer identify as an information manager, health informatician, as a clinician or as a combination of all three?). This means that we include work which may be called "information technology," but we are not limited to it. Even as data, information, and digital capabilities in health professionals increase, and as the technology changes to automate certain functions, we anticipate that there will be a continuing need for specialised knowledge and skills, even though we cannot be certain who will possess them or review them.

We use the theme of identity to conceptualise the work that is being done by this workforce. We know that this workforce finds it hard to clearly characterise who the people are and what work they do, both within its various professional communities and to external stakeholders. We broadly define work in scope for this book if it meets three criteria: the work is concerned with the management of data, the management of information, and/or the management of knowledge; the work is done in, about, for and/or with health (i.e. by people employed in the system, outsourced workers, government workers, industry, or advocacy groups, and researchers); and

the work is done in connection with clinical care, population health, health policy and health research.

Innovation—in terms of what the future holds for what health information work is done, how it is done, and who does it—may be explored using concepts of workforce automation and the digital workforce. The future of work of all kinds, everywhere in the world economy, is expected to change under the influence of the increase in computing power and artificial intelligence and the spread of Internet access and the Internet of Things. (Colbert et al. 2016; OECD 2016; Smith and Page 2016). We can use the theme of innovation to conceptualise the dynamic situation in which the health information workforce finds itself in the era of digital health. The future of the health information workforce may be influenced by intersecting scenarios. Some but not all people in the workforce may keep up with the technical skills required (re-skilling). The work may become the responsibility of another role in the workforce (platform economy). The work may be restructured as some industry sectors shrink and others expand (structural transformation). Human performance of the work may be made obsolete by machines or computer programmes (automation). These considerations apply to the health information workforce as much as they do to all other parts of the health workforce. They allow us to engage with the current workforce and its stakeholders to explore constructive thinking about the work and to plan for inevitable change.

Impact, in the sense of the contribution to the overall operation of the health system of the work done by health information professionals, may be viewed through the lens of health system performance. Many national governments monitor and report the operations of their publicly funded health care systems using performance indicators derived from international frameworks produced by OECD, WHO, and similar agencies (Smith et al. 2012). Typically, a nation's selected indicators are thematically grouped and linked to essential metrics, for example accessibility, appropriateness of care, competence, and capability, comprehensiveness, continuity of care, effectiveness, efficiency, efficient resource allocation, equity, expenditure, and cost, healthy lives, health status, innovation, and capacity to improve integration, patient experience, productivity, technical efficiency, responsiveness, and trust, safety. These aspects of performance can provide a comprehensive, systematic, and contextualised research approach to understanding the impact of the health information workforce in terms of clinical safety and quality of care, the patient or client experience, and service sustainability. We can use the theme of impact to evaluate and improve the work that is done by the health information workforce with a clear view of what we want to achieve for health and care.

The Present Position of HIDDIN Work

Parts of the HIDDIN workforce have been identified and organised formally for well over a century. Consider these milestones: The creation of the Index Medicus in the mid-nineteenth century, the analog-era forerunner of PubMed, led to the

establishment of the Medical Library Association in 1898 (Birchette 1973). At a time when clinical notes were written on cards or in large ledgers, medical secretaries began to manage this form of health information and organised themselves into the American Association of Medical Record Librarians in 1928 (Huffman 1947). The International Federation for Information Processing established Technical Committee 4, Health Care and Biomedical Research, and convened the first formal meeting of informaticians in Europe in 1967 (Peterson 2014). With the third and fourth industrial revolutions, health information practitioners have continued to form new associations around new health sector demands. For example a national membership organisation and network "for people working in health information and support … for an improved experience for patients and the public" (https://pifonline.org.uk), and a global community "for health data science and analytics that helps people connect, collaborate, share, learn, and make a meaningful impact on healthcare" (https://www.linkedin.com/company/healthdsa/).

Complex work in new kinds of work environments—sometimes called digital health ecosystems (for example Iyawa et al. 2016)—is being generated by the increasing pace of digital health information technologies in the present century. Managing and governing Internet-connected data, information, and knowledge in the service of healthcare, population health, and biomedical research, popularly called digital health since the 1990s, is critical to achieve higher order health system goals nationally and internationally (Grossmann et al. 2011; World Health Organisation [WHO], 2010a, 2021). This entails broad new strategic planning about how health organisations shift to digitally-enabled ways of operating and how they structure their workforce to do so (Kalra et al. 2016; Topol 2019). One emerging feature of digital health is a more fluid health workforce, less routinised, and more mobile and globalised; this requires major adjustments in how healthcare organisations and health systems are structured, how they support professional learning and development, and how their cultures adapt to digitally enabled ways of working (Accenture 2016). Making these adjustments is an important aspect of managing unforeseen or unintended consequences of digital health initiatives and mitigating risks to their success (Williams 2016).

It is not safe to assume that there are appropriately skilled professional practitioners behind every digital health system's design and operation; instead, the identification and organisation of technologically skilled health information work has gaps and blind spots (French 2014). Despite major investments in digital health systems and high expectations of the benefits that will ensue (Geiger and Gross 2017), there is scant empirical research into the specialised workforce that is needed to manage and govern the associated information infrastructure. Much of the human-centred research in digital health focuses on groups of stakeholders or end users. The considerable research on the technological and economic infrastructure of digital health is mostly silent about the specialised human resources needed to create and maintain it (Baird et al. 2014). This is ironic, to say the least, considering how highly regulated many health professions are.

It is known that many thousands of health information practitioners work in health systems around the world, whether professionally credentialled or

self-described. They work as employees, contractors, entrepreneurs, public servants; in public, private, and non-profit organisations in the health sector, in a range of roles that are rapidly being changed and globalised by the networked nature of digital health (Kluge 2017). Up to now, efforts to illuminate their actual and potential contributions to digital health have been scattered. The HIDDIN workforce census is a unique attempt to quantify and qualify the HIDDIN workforce. Originating in Australia (Butler-Henderson et al. 2017), the census was expanded to New Zealand in 2018 (Day and Grainger 2019) and globally in 2021 (Butler-Henderson and Gray 2021). The 2018 Australian HIDDIN census (Butler-Henderson and Gray 2018) confirmed the HIDDIN composition of this workforce and provided insights into the qualifications, credentials, professional memberships, and jobs in this workforce. Results from this census are used below to highlight the differences between each area of HIDDIN. This census is an important tool in the ongoing evaluation of the current and future configuration and development needs of this workforce.

An Overview of HIDDIN Work

Health information work and, as the health sector evolves, digital health work can be seen as a continuum of specialists whose overlapping roles support and advance healthcare through health information, technology, and innovation. Here we offer an overview of the continuum of HIDDIN work.

Health Informatics

*H*ealth *I*nformatics is defined as the theory and practice of health information systems design, development, implementation, and management for the improvement of health outcomes (Friedman 2012). It is the integration of several sciences, including healthcare, computer and information science, business science and cognitive science (Sweeney 2017; Friedman 2012). Health informatics includes the design, development, and implementation of information technologies, analysis of data and information for application in health services, management, and support of information systems and services, and the provision of health services via information and communications technologies, such as video, phone, social media and wearables. Some definitions are specific to an academic field, such as bioinformatics, and others are linked to clinical professions, such as nursing, pharmacy, or medicine (Hübner et al. 2018). Other areas captured above include primary health informatics, population, or public health informatics, health app development, health information systems or services, health information technology, health technology assessment, telehealth platform services, and translational bioinformatics. This

diversity of definitions is most likely the result of rapid advances in technology and the diverse adoption of digital and information systems in health services.

An analysis of the health informatics area in the previously referenced Australian health information workforce census reported that most (51.4%) people working in these jobs have done so for less than 10 years, reflecting the relative newness of these jobs in many health organisations (Butler-Henderson et al. 2019a). Furthermore, nearly two-thirds (63.6%) of respondents have been in their current role for less than 5 years, reflecting that most of these jobs are designed as time limited, temporary jobs. The average number of weekly hours worked was 33.5 h, further reflecting the part-time, casualisation of these jobs. A third (31.2%) of respondents undertake another role (i.e. they do not have a dedicated health informatics role), with a quarter (23.9%) reporting they are a registered health practitioners. Less than half (41.5%) of the roles are in a hospital, with roles spread across a wide variety of health settings. The majority of respondents do not hold a formal qualification in health informatics.

Digital Health

The second part of HIDDIN is *D*igital, for digital health. Digital health is "the field of knowledge and practice associated with the development and use of digital technologies to improve health" (WHO 2021). This expands the WHO definition of ehealth to include participatory consumer methods and tools (Kukafka 2019) and a wide range of connected smart devices, such as the Internet of Things, advanced associated sciences and analytics, artificial intelligence, and associated technologies (Jayaraman et al. 2020). Digital health brings the activated and engaged health consumer into the scope of health information workers, as well as leveraging the affordances of automation and advanced technologies. The work roles span all other areas of the HIDDIN continuum, and attract people from backgrounds in enterprise, technology, and education, for example biomedical engineering, digital health infrastructure, health innovation, health interoperability, and health simulation.

Data

Data form the raw materials of the HIDDIN work. Without *D*ata, HIDDIN work would not exist. "Merely using data isn't really what we mean by 'data science'. A data application acquires its value from the data itself, and creates more data as a result. It's not just an application with data; it's a data product. Data science enables the creation of data products." (Loukides 2011). Data scientists analyse data to access actionable insights from information. Data science activities include data gathering, preparation, and exploration, data transformation and representation, computing, data modelling, visualisation and presentation, and the science of data

science (Donoho 2017). The data could be "big data," for example large data collection such as routinely collected clinical data, or "little data" e.g. data in EHRs about specific patients. Since data are core to HIDDIN work, they form the foundation of all roles associated with HIDDIN work. Disciplines such as biomedical informatics, population, or public health informatics could be categorised here to the extent that they manage methods and tools for analysing micro or big data to draw meaningful conclusions. Other discipline areas that lead to work in this area include epidemiology and medical research data management, and some specialised mathematical and statistical modelling. Health artificial intelligence and machine learning roles clearly can be located here.

A yet to be published analysis of data roles in the 2018 Australian health information workforce census showed an emerging and evolving field. Most (77.3%) have a formal mathematics or data analytics qualification, but none reported a specific health qualification (which may reflect the small sample included in this census). Like health informatics, the majority (57.0%) have worked in the field for less than 10 years, with 65.1% in their current role for less than 5 years, highlighting the emergence of these jobs in health. Where this area differs from health informatics is that the majority (75.4%) work solely in their data role. Their roles are across health, largely in state or local health departments or for federal government organisations.

Information

Health information is data that has been given context and meaning (Zins 2007), enabling decision-making for clinical, business, and management purposes to support the improvement of health outcomes. In HIDDIN work, *I*nformation processes the raw materials of data to enable the development of meaningful insights. The field of health information ensures "…all stakeholders (providers, consumers, policy-makers, researchers, patients, etc.) have the best data and information available to make informed decisions" (Fenton et al. 2021). One subset of health information professionals, health information managers, are responsible for the creation, analysis, management, and governance of health information (AHIMA 2020; CHIMA 2021; HIMAA 2014). Job roles in health information can include clinical coding, clinical costing, clinical documentation improvement, health cybersecurity, health information governance, and health information managers. Health information management is the only area in HIDDIN recognised in the International Standard Classification of Occupations (International Labour Office 2008), available as a formal tertiary qualification and many roles requiring the qualification. This profession is rapidly changing to include project management, data analyst and statistician influences (Dimick 2012). This area is transforming with a greater focus on information governance (privacy and data protection) and integrity, management of the information lifecycle, and data analytics (Butler-Henderson 2017). Another distinct group within the HIDDIN workforce that historically is identified strongly

with health information is health and medical librarians. They develop, store, and make available electronic information resources used by healthcare providers and consumers and HIDDIN workers alike around the globe (Myers 2020). Their expertise has a substantial emphasis on quality assurance of information sources and synthesis of the information to form the evidence base for practice. Their roles are rapidly changing as biomedical publishing and literature search and retrieval are transformed by new technologies. For example the Network of the National Library of Medicine in the USA, and the National Health Service Library and Knowledge Service in the UK aim to provide national and global access to information that enables and supports informed decision-making for health (NNLM 2021; NHS 2021).

An analysis of the subset health information managers in the 2018 Australian health information workforce census (Butler-Henderson et al. 2019b) identified the average length of service in a health information management role was 17.0 years. Over four-fifths (81.4%) of respondents work in just one health information role, with 78.6% in a permanent role. The average weekly hours were 35.6 h, highlighting that most roles are full-time. And most (67.8%) are in a hospital environment, with other settings including state and local health departments and federal government organisations. These roles were more clearly defined by job title than any other area of HIDDIN, with most job titles being health information manager or clinical coder. Three-quarters (77.6%) hold a tertiary qualification in health information management.

Knowledge

Health k*N*owledge management is the work of systematically distilling value from raw data and tacit knowledge to provide an organised information base for trustworthy health advice, value-based care services, evidence-based clinical practices, learning health organisations, biomedical research impact, health programme evaluations, and other aspects of health systems (Nonaka and von Krogh 2009). Health knowledge management routinises the transformation of both digital data and real-world experiences into explicit, shareable forms of expression that enable a range of people to agree on what is occurring within their remit and to take decisive action on this basis. The central aim of health knowledge management is to keep individuals and communities safe and well; radiating out from this aim, knowledge management is undertaken as part of public health, clinical care, and health administration, research and policy work. Its facets are variously described as knowledge generation, curation, dissemination and translation, and it is essentially methodical work. The tools of the trade include ontologies, standards, guidelines, frameworks, indexes, all designed to give order and structure to cumulative biomedical science and health care knowledge, assure its quality, and make it accessible as appropriate. Health knowledge management is designed into a range of health information and communication technologies: the information architecture of an electronic health

record system; the search engine optimisation strategies of a consumer health information website; the forum topics set out in a discussion forum for health professionals; the content included in a clinical decision support system; the form in which a health app enables personal recordkeeping. This field of work is experiencing a resurgence, influenced on the one hand by the COVID-19 data demand and infodemic, and on the other hand by the extraordinary potential of precision medicine and machine learning; overviews are offered by Bowden et al. (2020), Chettipally (2020) and Pereira et al. (2021). The work may not be described as such; the people who do it may come from health administration, health librarianship, health education, biomedical publishing, business information systems, and other disciplines.

An analysis of the health librarian subset of the Australian health information workforce census identified nearly all (94.2%) of respondents are permanent employees, with the average time in the workforce being 21 years (Gilbert et al. 2020). Most respondents only do this role. Over half (58.3%) of respondents are working in a hospital, with other roles in education facilities or state or local health departments. Further, most (79.85%) hold an entry-level (bachelor) qualification in library studies (or similar) or higher, reflecting the need for qualified people in these roles. The average hours worked (28.6 h) is much lower than the average across the HIDDIN workforce (32.6 h), reflecting most roles are part-time.

The Future: A Coherent Framework for HIDDIN Work

Career pathways are not yet clearly defined, although some countries have attempted to develop frameworks to describe the work. There is no specific guideline from the WHO for the health information workforce. The Workload Indicators of Staffing Need (WISN) manual (WHO 2010b) provides a guideline for all health service staffing requirements, but the only reported application of it in the HIDDIN workforce was for health information workforce planning and implementation in Ghana (Ogoe et al. 2018). The more recent WHO (2016) global strategy for human resources for health provides a high-level strategy, yet does not specify the health information workforce. It has been used to create frameworks for specific professions in HIDDIN, such as TIGER (Hübner et al. 2018), but not HIDDIN as a whole. Shah and Mahrin (2021) describe a framework for big data analysts. Mongan et al. (2018) reported the results of a scoping literature review of workforce planning and implementation frameworks for use in strategic planning in Ireland. They indicate that the most commonly used frameworks are the RE-FRAME and PRECEDE-PROCEED frameworks but do not link them to the information workforce. The United Kingdom has produced a set of strategies and frameworks regarding digital health workforce planning, with a focus on health informatics and data science (Liu et al. 2019), and HIMSS has developed a digital health workforce strategy that links workforce to governance and digital health, using principles of governance to frame digital workforce planning (Snowden 2020), but again, neither describe the actual HIDDIN workforce.

The only two frameworks to comprehensively describe the HIDDIN workforce were developed in Australia. Health Workforce Australia (2013) identifies three levels of the workforce. Level 1 consists of the specialist workforce, specifically indicating that specialists who work (usually full time) with health information systems. Level 2 consists of health professionals whose work consists of significant use of information systems in their work. Level 3 consists of all health professionals who contribute, retrieve, use, and reuse information as part of their professional work. Based on the recommendations from Health Workforce Australia for further work to delineate the workforce, the Australian Digital Health Agency (ADHA 2020) describes eight digital profiles, as presented in Box 1.2. The ADHA developed these profiles in consultation with the industry, but these profiles have not been evaluated. The ADHA describes that a job can have multiple digital profiles.

Box 1.2 Australian Digital Health Agency eight digital profiles (ADHA 2020, p.54–55)

1. *Patient, consumer, and carer*: "maintaining health information, protecting the security and privacy of information, and adopting and advocating for new technologies that help manage their health."
2. *Frontline clinical*: "expectations for lifelong learning, adoption of digital technologies, understanding security and privacy, reliable and accurate recordkeeping, ensuring clinical safety with digital technologies, and advocating for consumer use of technology to empower them."
3. *Digital champion*: "a digital teacher and champion locally for a particular technology or system."
4. *Business, administration and clinical support*: "learning, adoption of digital technologies, understanding security and privacy and reliable and accurate recordkeeping."
5. *Leadership and executive*: "leadership of digital transformation and deployment, risk and quality assurance, and understanding sophisticated data analytics to drive better business decisions."
6. *Clinical and technology bridging*: "providing advice during the design and development of new digital technologies and systems, and leveraging clinical networks for user testing and adoption."
7. *Education and research*: "lifelong learning, translational research, evidence-based review, and health reform and innovation. It also addresses expectations relating to education."
8. *Technologist*: "those performing health information technology functions, including cybersecurity, programming, systems maintenance, digital design, interoperability, IT procurement, resilience and continuity planning, health information management and system testing."

The ADHA mapped their digital profiles to the three levels detailed by Health Workforce Australia (p52), identifying profiles 1–3 as aligning with level 3, profiles 4–6 as level 2, and profiles 7–8 as level 1 (the specialist roles). This would suggest

only roles that align with the ADHA's description of (7) Education and research and (8) Technologist are HIDDIN roles. Yet the above definitions highlight HIDDIN is more than simply "those performing health information technology functions, including cybersecurity, programming, systems maintenance, digital design, interoperability, IT procurement, resilience and continuity planning, health information management and system testing" (ADHA 2020, p.54–55). So how can we describe these five profile descriptions within the health workforce as a collective group?

Professionalisation of HIDDIN Work

HIDDIN work, as described above, comprises five parts, with many different roles in each. So how do we define what these parts mean to the overall HIDDIN workforce, and what does this mean for professionalisation? Trowler et al. (2012) expanded on the previous work of Becher and Trowler (2001) to define a discipline as (Trowler et al. 2012, p.9):

> Reservoirs of knowledge resources shaping regularised behavioural practices, sets of discourses, ways of thinking, procedures, emotional responses and motivations. These provide structured dispositions for disciplinary practitioners who reshape them in different practice clusters into localised repertoires. While alternative recurrent practices may be in competition within a single discipline, there is common background knowledge about key figures, conflicts and achievements. Disciplines take organisational form, have internal hierarchies and bestow power differentially, conferring advantage and disadvantage.

This definition is appropriate to describe the parts of the HIDDIN workforce; there are discrete knowledge, behaviour, practices, and procedures for each area.

As the digitisation of health increases, the uniqueness between each discipline decreases. This is evident from the HIDDIN definitions outlined above. For example *health informatics* "deals with the storage, retrieval, sharing, and optimal use of data that relates to human health, and it considers how we use this knowledge for problem solving and decision making" (Health Informatics New Zealand 2020). Similarly, *health information management* professionals "create, acquire, analyse and/or manage information to meet the medical, legal, ethical and/or administrative requirements of the health care system" (HIMAA 2014). These two definitions include the same functions, "storage, retrieval, sharing, and optimal use" versus "create, acquire, analyse and/or manage," with the difference being "data" versus "information." Two areas with the same functions at different levels reflects the advancement in digital health: as health move towards the capture of data through information systems as opposed to paper records, this shifts the focus from information brokering to rapid translate of data into actionable knowledge. Digital advances such as data protection, the use of new technologies, innovations such as artificial intelligence and automation of data analysis and management functions will create further overlap across all five areas of HIDDIN. So, whilst it could be argued that each area in HIDDIN is its own discipline, the changing landscape may see these disciplines either merging, transforming, or dissolving over time. Thus, it is

possible in the future that HIDDIN itself will become the collective discipline and each of these areas a specialisation.

The different disciplines attract different job titles, recognising that some jobs could be listed in multiple areas and other jobs overlap with one another. The International Standard Classification of Occupations (International Labour Office 2008, p.11) defines a job as "a set of tasks and duties performed, or meant to be performed, by one person, including for an employer or in self employment," with an occupation defined as "a set of jobs whose main tasks and duties are characterised by a high degree of similarity." To have a high level of similarity, there must be a set of practice, processes, and behaviours; in this sense, an occupation can be understood to be a discipline. The above definitions highlight there are specific jobs in each area of HIDDIN that can be found in different health organisations, and therefore the areas in HIDDIN can be defined as occupations. Yet, most of these areas are not defined as occupations in the International Standard Classification of Occupations.

Does this make the HIDDIN workforce a profession? Using the neo-Weberian perspective, a profession "is centred on attaining a particular form of formal legal regulation with registers creating bodies of insiders and excluding outsiders" (Saks 2012, p.4). Whilst several HIDDIN areas require a formal qualification for a job, have a formally structured salary classification linked to that qualification, and have national peak bodies requiring the qualification for membership (excluding outsiders), a register of qualified practitioners is not maintained for any HIDDIN area. There is an emerging trend to link health informatics qualifications to clinical registrations (e.g. in the United States and United Kingdom). Therefore, for HIDDIN to become a profession, it first needs to become a recognised discipline, with a clear body of knowledge underpinned and informed by scholarly research and discourses, and the formalisation of ethical practice and procedures.

These definitions highlight the infancy of the discipline of HIDDIN. The foundation for HIDDIN to be an occupation is present, and this is explored throughout this book through the examination of competencies, education, accreditation, professional development, certification, impact, and jobs. Yet, the only framework in existence, the ADHA digital profiles (2020), does not recognise HIDDIN as a discrete occupational group with its own norms, knowledgebase, and professional code. The emergence of leadership jobs (such as the Chief Information Office, Chief Clinical Information Officer, Chief Medical Information Officer, Chief Nursing Information Officer, Chief Digital Information Officer or the Chief Information Governance Officer) in specialised digital health areas is the start of an occupational structure, from which professionalisation can be achieved.

The Future: Deepening Insights into HIDDIN Work

This book provides a clearer and more comprehensive view than ever before, of the specialised workforce required to manage and govern the health data, information, and knowledge infrastructure now and in the future. It offers a coherent and critical enquiry into a workforce that is essential for healthcare services to function, for care

providers to practice at the top of their scope/licence, for researchers to generate significant insights, and for care consumers to be empowered participants in health systems, as digital information and communication technologies transform the health sector. It celebrates and champions those working in the HIDDIN workforce. It informs health sector health executives who need to develop and mobilise this workforce. It is a resource for health workforce planners, professional associations and educators who are responsible for setting and upholding practice and performance standards in this workforce. It sets the stage for forward-looking research and reflective practice to deepen how we understand the specialist knowledge and skills that we rely on in the digital health era.

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Part II
Identity

Chapter 2
Health Information Work: A Scoping Review

Cecily Gilbert, Kathleen Gray, and Simone Pritchard

Abstract The work of managing health data, health information and health knowledge is fundamental in healthcare systems, as increasingly they are transformed by information and communication technologies. However, this work is not acknowledged or understood as commonly as other kinds of work in healthcare, even though it has been described in scholarly writing for five decades. This chapter is a scoping review of literature from the domains of health sciences, health information technology and health information sciences; bibliometric and thematic analyses explore the responsibilities and the contributions of the health information workforce. 284 publications from 1973 to 2018 outline a wide variety of occupational sub-groups, job titles, work roles and skills. The status and prospects of this kind of work are influenced by: external drivers of role changes; definitions of competency requirements; healthcare professions' needs for general and specialised education regarding new technologies; and fragmented identities within the health information workforce. If specialised professional work is considered essential for healthcare systems to realise the benefits of information and communication technologies, then concerted health workforce planning is needed to consolidate historically disparate health information work practices and to establish a distinctive, accountable workforce that provides the human infrastructure for digital health.

Keywords Competencies · Health workforce · Historical trends · Human resources

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Introduction

"Historically, the diverse communities working in digital health—including government stakeholders, technologists, clinicians, implementers, network operators, researchers, donors—have lacked a mutually understandable language with which to assess and articulate functionality." (World Health Organization 2018, p. 2). This incoherence is an indicator of the diffuse status of a whole subsection of the health workforce, a multiplicity of people in specialised roles who together are responsible for the systems for capturing and using health data, health information, and health knowledge, and whom we characterise as HIDDIN—referring to their collective specialisations in Health Informatics, Digital, Data, Information and kNowledge management. Their work directly fuels the provision of health services, assures the quality and safety of care and underpins the translation of research into practice. This workforce may have an increasingly important role as the health sector moves toward greater use of digital technologies. Yet precise data about it is difficult to obtain; the work is largely invisible, ill-defined, unregulated and unmonitored (Gray et al. 2019). Further, allusions to it often convey little sense of human agents, creating an abstract impression, of unspecified work done by unspecified workers. The HIDDIN acronym is most apt because this work is so poorly recognised or understood, compared to other areas of work in the health sector.

"Health information" as the description of a specialist work domain emerged in the twentieth century. Individual professions and occupations, such as medical records managers and medical librarians, arose in the early decades of the 1900s, and developed in parallel, rather than intersecting, streams. Further specialisations, in particular health informatics, emerged from the mid-century onward. More recently the field has become very fluid, due in part to technological changes that enhance collaboration between computing or IT staff and those working with health data or health information. A range of professions now claim expertise in health information work, and position titles and career paths also vary greatly. Moreover, in the current era of digital transformation of health, some people in the health information workforce are confronting issues of their relevance and sustainability in the face of possible workforce structuring.

Subsections of the health information workforce have been studied occasionally over the years, for various purposes, in different parts of the world. This chapter takes a holistic approach, inspired by a government workforce planning agency report on the health information workforce (Health Workforce Australia 2013). This chapter is part of a larger research program studying the changing nature and scope of this workforce, starting with a world-first national Health Information Workforce Census in May 2018 (https://www.utas.edu.au/health/projects/hiwcensus), which invited participation by: "…anyone who self-identifies as part of the health information workforce working for/with an organisation that operates in Australia. You are