Health Informatics

Scope, Careers and Competencies

Version 1.9

November 2011

Contents

Acknowledgements

This document is one of the initial outputs of the Australian Health Informatics Council (AHIEC), developed during 2009 to 2011, as a deliverable of the 'AHIEC Strategic Work Plan 2009-10 and Beyond'.

This document has been prepared by the AHIEC Working Group, consisting of representatives with an interest in or expertise in Health Informatics from:

- Australian College of Health Informatics (ACHI)
- Health Information Management Association of Australia (HIMAA)
- Health Informatics Society of Australia (HISA)
- Health Level 7 Australia (HL7)
- Australian Computer Society (ACS)
- Australian Nursing Federation
- Nursing Informatics Australia
- Health Libraries Australia
- The University of Melbourne
- Curtin University
- La Trobe University
- Monash University
- University of Western Sydney
- University of New South Wales
- The University of Sydney
- eHealth Education Pty Ltd

This document has been endorsed by the AHIEC Steering Committee following endorsement by the auspicing organisations:

- Australian College of Health Informatics (ACHI)
- Health Information Management Association of Australia (HIMAA)
- Health Informatics Society of Australia (HISA)
- Health Level 7 Australia (HL7)
- Australian Computer Society (ACS)

The AHIEC Steering Committee would like to acknowledge all contributors to this document, and in particular Heather Grain as the principal author of the initial drafts and the competency content.

Amendments

It is anticipated that this document will undergo regular review.

Please email any suggestions for updates to Secretariat@AHIEC.org.au

We welcome your feedback and input.

Executive Summary

Australia is continuing to invest in information and communication technology to enhance health outcomes and improve the efficiency and effectiveness of the national healthcare system.

In order to support these activities and derive the outcomes required, a skilled and competent Health Informatics workforce is required.

Health Informatics is the application of information science and computer science to healthcare. To be effective, Health Informatics requires knowledge in technical (Information and Communication Technology - ICT), clinical and administrative (including governance and business) domains as they relate to healthcare.

Health Informatics is applicable to all levels and settings of healthcare, including health related research.

Based on this definition, there are many roles in the healthcare industry that directly or indirectly require Health Informatics knowledge and skills.

This document defines the scope of Health Informatics, identifies areas of Health Informatics specialisation, roles and career options, defines Health Informatics competencies, and identifies the Health Informatics skill sets required by people working in the healthcare industry.

Uses of the document include to:

- Outline the body of knowledge of Health Informatics and support the development of detailed competencies within speciality groups,
- Provide input to Health Informatics education strategic development for Australia,
- Inform and encourage educational program development,
- Identify career pathways within Health Informatics in Australia,
- Provide a base for workforce planning,
- Assist organisations to identify and assess the skills required in a given job or role, and
- Support broader and deeper understanding of the field among industry stakeholders, prospective students and future professionals.

It is intended that the definition of the scope, careers and competencies in Health Informatics will provide a foundation for the education and training of healthcare and Health Informatics professionals in Australia to enable greater adoption of information technology and greater value and benefit from its use in the healthcare environment.

1   Purpose

This document has been produced by the Australian Health Informatics Education Council (AHIEC) to:

- Define the scope of Health Informatics (HI),
- Identify areas of Health Informatics specialisation, roles and career options,
- Define Health Informatics competencies, and
- Identify the Health Informatics skill sets required by people working in the healthcare industry

Uses of the document include to:

- Outline the body of knowledge of Health Informatics and support the development of detailed competencies within speciality groups,
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- Identify career pathways within Health Informatics in Australia,
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- Assist organisations to identify and assess the skills required in a given job or role, and
- Support broader and deeper understanding of the field among industry stakeholders, prospective students and future professionals.

2   Scope of Health Informatics

To date, the domain of Health Informatics has not been clearly defined or commonly understood within the Australian healthcare industry.

Health Informatics is the application of information science <u>and</u> computer science to healthcare. To be effective, Health Informatics requires knowledge in technical (Information and Communication Technology - ICT), clinical and administrative (including governance and business) domains as they relate to healthcare.

Health Informatics is applicable to all levels and settings of healthcare, including health related research.
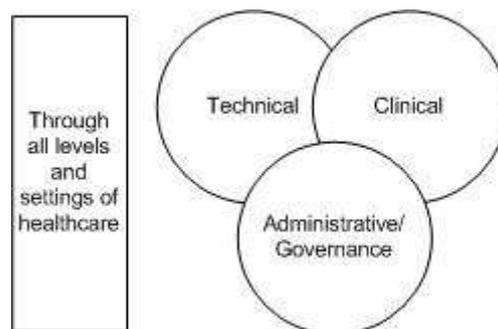
Figure 1 The Domains of Health Informatics

Figure 2 shows the scope of Health Informatics which aims to improve health outcomes and healthcare system performance in direct patient care, design and governance of healthcare organisations and the healthcare system, and health knowledge discovery and management, through the application of technology (hardware, software, and communication). Knowledge management refers to the collection and use of clinical and service information to improve health outcomes and healthcare system efficiency, for example care pathway automation and clinical decision support.
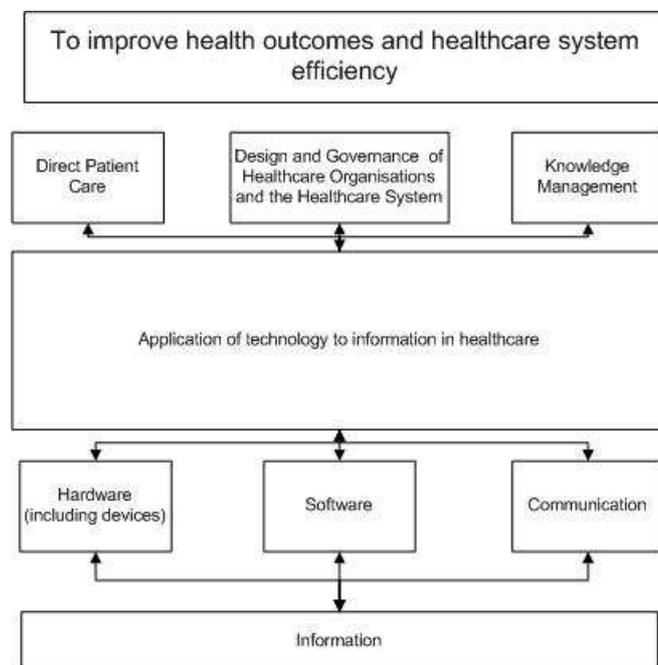
Figure 2 The Scope of Health Informatics

There are many roles in the healthcare industry that directly or indirectly have a Health Informatics component.

Figure 3 provides examples of the range of roles involved in Health Informatics. All of these roles need to have a level of understanding and skills in each of the Health Informatics domains of technical, clinical and administration.
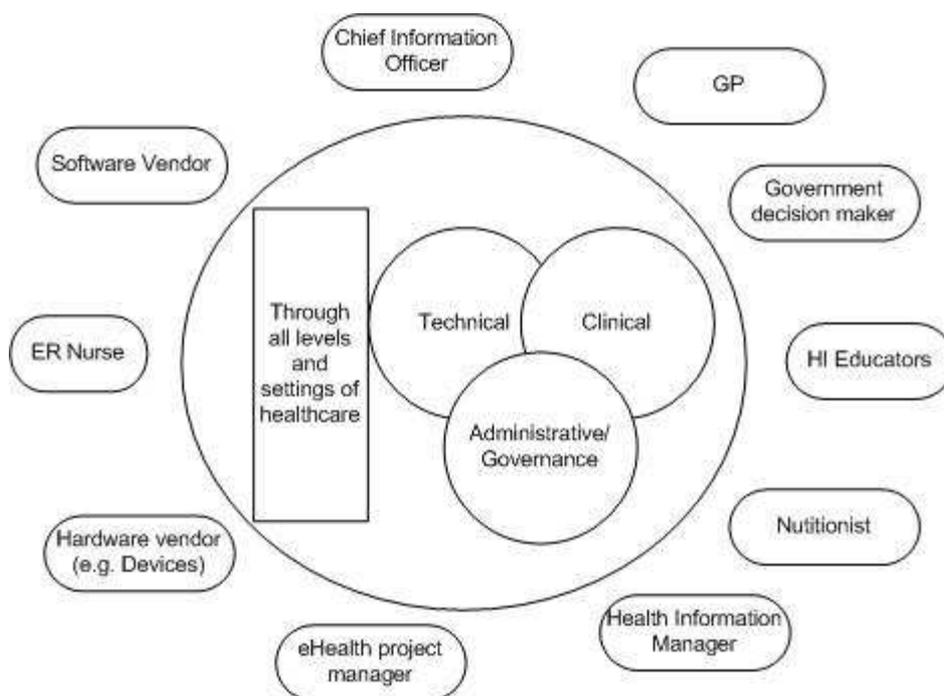
Figure 3 Examples of Health Informatics Roles and Professions

As an example, a Software Vendor may be an Information and Communication Technology (ICT) professional, a Health Information Manager (HIM), an administrator or a clinician, but whatever their background, they need to understand the technical, clinical and administrative issues associated with the product they are developing, implementing or maintaining for the healthcare context.

3   Background

3.1   Health Informatics Workforce Demand

Australia is continuing to invest in information and communication technology (ICT) to enhance health outcomes and improve the efficiency and effectiveness of the national healthcare system. Increasingly, health care and the business and governance systems that support it are reliant on ICT, creating a sharper focus on the intersection of ICT and healthcare professionals.

The current Australian policy context of the health reform agenda has increased the focus and requirement for Health Informatics, and in particular relative to:

- Hospitals
- GP and primary healthcare
- Residential and aged care
- Mental health
- Preventative healthcare
- Quality and safety of healthcare
- eHealth and telehealth

Australia's extensive program of biomedical research also requires Health Informatics expertise.

At a local, state, territory, and national level, the demand for a Health Informatics workforce that is skilled, competent and experienced has, and continues to, expand.

AHIEC is encouraged by research currently being undertaken by Health Workforce Australia to provide a more accurate mapping of Health Informatics demand and supply.

AHIEC considers that within these policy contexts, it is imperative to establish the required competencies, and educate and train the Health Informatics workforce.

3.2   AHIEC

The Australian Health Informatics Education Council (AHIEC) was formed in 2009 to ensure a coherent, comprehensive approach to quality Health Informatics education and training in Australia, in order that the health workforce is able to leverage advances in Health Informatics to improve health services and outcomes.

AHIEC has been established within the context of a lack of clearly defined Health Informatics competencies, an ad-hoc approach to Health Informatics education and training, and a lack of Health Informatics education and training courses available in Australia.

AHIEC's areas of focus include:
- identifying the needs for Health Informatics education and training in the health system
- identifying current and emerging competencies required in Health Informatics
- encouraging a high quality Health Informatics education delivery system, and
- building recognition of the importance of Health Informatics

AHIEC's role in these areas of focus, comprise coordination of a diverse set of activities:
- to analyse and forecast education and training requirements and strategies
- to develop policy proposals
- to provide leadership and advocacy, and

- to liaise with key agencies such as Health Workforce Australia, the Australian Department of Health and Ageing, the Australian Department of Education, Employment and Workplace Relations and training providers.

As part of its Strategic Work Plan (Australian Health Informatics Education Council, 2009), AHIEC identified a range of tasks required to develop a cohesive and integrated approach to the development of skills and quality educative approaches to Health Informatics education in Australia and the clear recognition of the profession of Health Informatics and the relationship of the discipline to existing professional areas.

This document is one of the deliverables from this Work Plan. Further information about the governance and membership of AHEIC can be obtained from www.AHIEC.org.au.

3.3 Roles

There are many roles in the healthcare industry that directly or indirectly require Health Informatics knowledge and skills. The demand for Health Informatics professionals is extending across existing professional groups and into new areas including those which support eHealth initiatives.

Some of the issues identified during the preparation and review of this document have included the natural evolution of different professional groups to meet the challenges of evolving Health Informatics needs, and the development of new Health Informatics skill sets by professional groups. Employers need to be able to identify Health Informatics skill sets and be confident when employing people that these people will have the skills needed to operate appropriately and effectively in their position.

Professional sub-disciplines, such as clinical informatics, and nursing informatics have emerged but it is often difficult to articulate what skills are expected of, or consistent between, individuals claiming to represent these specialties. It is equally true that the lines and boundaries of practice between different, often long standing, professional groups have become increasingly blurred.

Health Informatics is multidisciplinary. There are many variations or specialisations that have emerged and are likely to continue to do so. This document identifies core (or entry point) Health Informatics skills required of different groups of people in healthcare to support safe and efficient practice and improvements in health outcomes. Relationships between these skills and specific jobs and career pathways are represented as examples.

The skill (competency) based approach allows employers to identify the Health Informatics skills to mix and match for a task or position and to evolve over time as needs become more clearly and consistently defined. The professions and roles involved in healthcare, aged care, information science and ICT are constantly evolving to meet the needs of the healthcare system. Within this context, roles associated with Health Informatics will continue to evolve and mature.

3.4 Competencies

AHIEC has drawn on a wide range of international and national initiatives to inform the competency development.

A detailed international review of approaches to Health Informatics competencies and approaches to competency documentation was undertaken (and is covered in Appendix A). This document reflects the findings of that work and seeks to align with international standards and definitions.

Organisations who have provided, or whose information has been used to assist in the production of the competencies included in this document include the Health Information Management Profession (HIMAA, 2001, HIMAA Education Services, 2010), Nursing Profession (Australian Nursing Federation, 2010, Foster J. and Nursing Informatics Australia, 2010), International Medical Informatics Association (International Medical Informatics Association, 2009), Australian Computer Society (ACS) (SFIA Foundation, 2008), Canadian Health Informatics

Organisation (COACH), the Royal Australian College of General Practitioners (Royal Australian College of General Practitioners, 20076), Health Libraries Australia (HLA), the International Health Terminology Standards Development Organisation (IHTSDO) (Grain, 2010) and those skills included in the National vocational education and training sector resource generator for competencies (Department of Education Employment and Workplace Relations, 2007).

In general, the competencies identified are based upon the IMIA competencies with modifications to align with the Australian healthcare environment.

Competencies have been identified related to the skills expected at entry for Health Informatics roles (graduation based skill levels). It is recognised that professionalism includes the ongoing development of additional skills and education after graduation. This document includes individual competencies based upon the revised Bloom's Taxonomy of Learning Domain objectives but at broad areas of skills and competency attributes. Each professional group, educational organisation and employer can use these attributes and identify the Bloom competency relevant to their group or need, thereby supporting the broad and deep analysis and extension of the domain as required.

A competency based approach supports variations in curricula while still supporting quality assured skills and certification of competencies from educational programs. This approach allows educators to focus on the level and areas of expertise suited to their educational methods and scope and educator availability and skill.

3.4.1 Future Competency Expansion and Development
AHIEC recognises that the competencies stated within this document are a starting point only.

The competency table in Section 6 represents a beginning towards defining required Health Informatics competencies as they represent an educational outcome and need to be parsed into more detailed and specific competency standards to enable their consistent use for educational and training purposes. Standard Health Informatics competencies need to be fully developed by health industry, health and ICT professionals for national and professional endorsement to become nationally recognised and serve as the basis for assessment and formal qualifications. Such competency standards describe all the underpinning knowledge and skills required to perform to that standard.

Competencies need to be written in a form that meets three criteria, they must be observable, measurable and written in a language that is clear and cannot be subject to ambiguity or misinterpretation. Competency based education and training requires learning outcomes to be specified in terms of performance, what the learner will be able to do as a result of what has been learned.

The next phase of this project is about education and training providers being able to make use of these competencies for program/ course design, delivery and assessment purposes. This requires a strong commitment from all stakeholders, as well as time and funding to complete. The outcome being sought is that the Health Informatics discipline be incorporated into the mainstream well-developed and funded Australian vocational and tertiary education sector.

The next phase of this project requires each competency listed in the table to be defined as one or more competency standards to detail the minimal acceptable performance level the learner must demonstrate to be considered proficient in the competency and the conditions under which the learning will take place. Such competency standards will assist in better defining the many Health Informatics related roles and their competency needs.

It is anticipated that this will be completed in accordance with the Australian Government Department of Education, Employment and Workplace Relations' Training Package Development Handbook, www.training.gov.au (TGA), and the Community Services and Health Industry Skills Council.

Of particular importance is the need to identify competencies relative to the levels within the Australian Qualifications Framework (AQF) to enable many learning pathways to be collectively refined. For example many of the competencies listed can be defined at multiple levels reflecting various degrees of complexity and intellectual demand required to be able to perform at the specified level. The use of Bloom Levels, and the SFIA (Skills Framework for the Information Age) numbered levels in the competency table is a good start as these can be mapped to the AQF.

AHIEC will advocate for the recognition and development of the Health Informatics competencies as outlined above.

4 Roles

Individuals working in the healthcare industry perform specific roles and any given job may involve one or more roles. While this document does not attempt to define all the roles in Health Informatics, it provides a useful profile of roles and careers and the competencies required to appropriately and effectively perform the Health Informatics tasks associated with those roles.

There are two general skill domains:

- Health and Aged Care Professionals – the skills needed in an ehealth enabled healthcare environment, and
- Health Informatics general and specialist roles – the specific skills needed to create, operate in, manage and maintain the Health Informatics domain.

It could be argued that the majority of Health and Aged Care Professional roles in the healthcare industry are required to operate within a Health Informatics context. Examples of Health and Aged Care Professionals requiring base skills in technology, healthcare and administration (to equip them to work in ehealth enabled environments) include:

- Clinicians and aides in medical, nursing, allied and complementary health professions
- Service managers and business administrators in public, private and not-for-profit healthcare organisations
- Planners and policy-makers, researchers and educators in the health sector
- Other people working in health, ageing and related services, including administrative support.

These people need to know how to use, make decisions about and relate to ICT, clinical information and processes, and healthcare governance and administrative processes to effectively and efficiently apply that knowledge in their role.

Examples of Health Informatics roles, based upon common knowledge groups or specialisations identified by IMIA include:

HI Specialisation	Description
Health Informatician	A person with general Health Informatics knowledge and skills
IT Health Informatician	A person with a technology focus of Health Informatics knowledge and skills
IS Health Informatician	A person with an information systems focus of Health Informatics knowledge and skills
Biomedical Informatician	A person with biological/medical focus of informatics knowledge and skills
Clinical Informatician	A person with a medical, nursing or allied health education focus of Health Informatics knowledge and skills
Health Information Manager	A person with specialist health information management knowledge and skills
Clinical Terminologist	A person with specialist clinical terminology knowledge and skills
Health Informatics Administrator	A person who is a specialist in administrating processes associated with the adoption and use of health information technologies

Health Informatics Educator	A person with general Health Informatics and education knowledge and skills

It is acknowledged that Health Information Managers, have a broader set of knowledge and skills than the Health Informatics domain. As professionals with existing skills in information science and computer science, Health Information Managers are a valuable contributor within the Health Informatics domain, and have therefore been added as an example of a specialist role.

Figure 4 provides examples of specialisations, current and emerging roles in the Health Informatics and ehealth area. The diagram illustrates that roles may be performed by a person from more than one area of specialisation. It also demonstrates where there may be alignment of specialisation, based on the application of Health Informatics competencies. It does not however, preclude further overlap of roles within the specialisations.
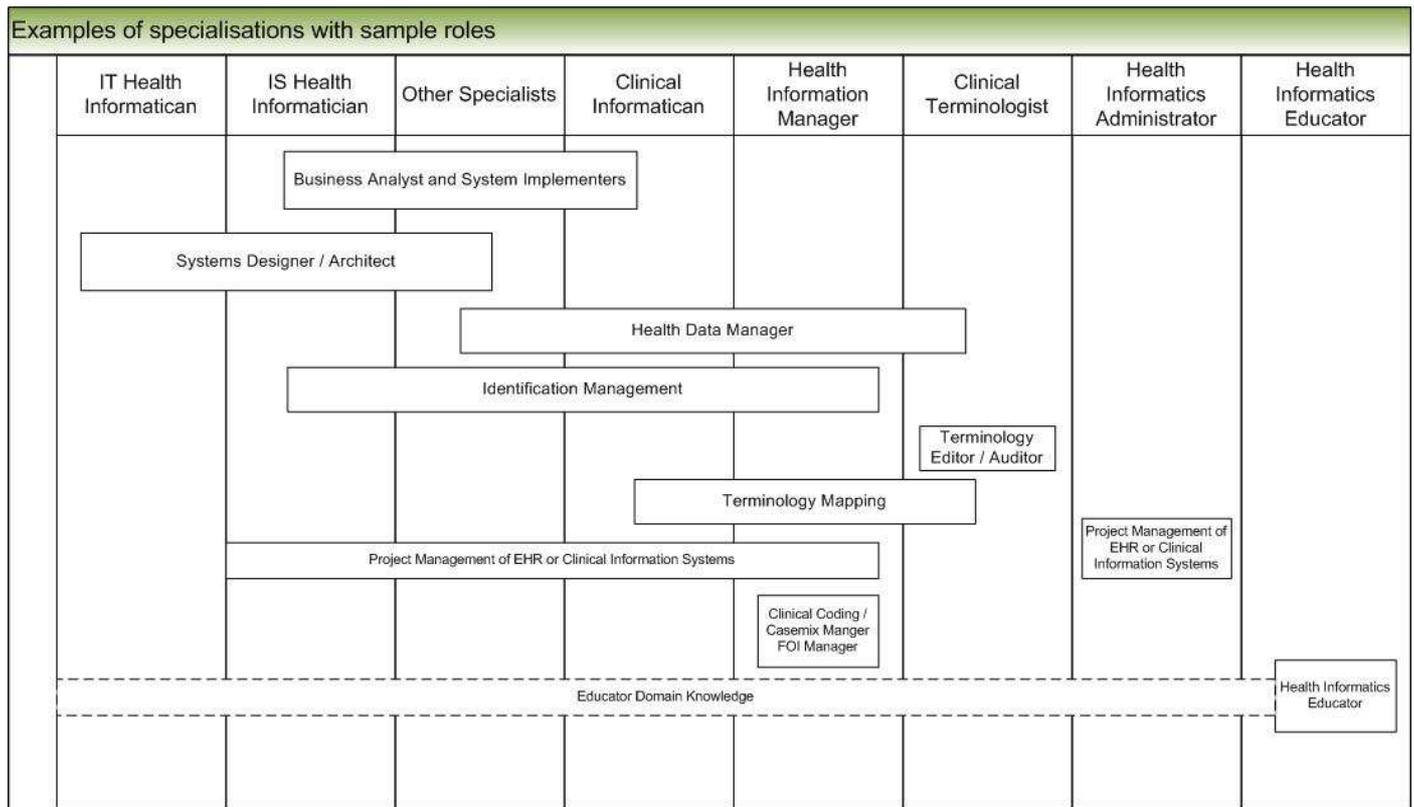

Figure 4 HI Specialisations with Examples of Roles

This document does not detail the positions or role combinations required for a given job, but the figure provides an example of possible position/role relationships. The figure shows positions based upon core (entry point) capacity defined by professional organisations today and recognises that many professional groups may have members performing outside these areas due to their experience or additional educational achievements.

5   Career Pathways

There are evolving career pathways in Health Informatics, though these have not been clearly defined to date. This document assists in the identification of career pathways through the identification of competencies.

IMIA have recognised that a person who begins in one area of qualification as an undergraduate can often lead to specialisation in another area through further study, and that some people may seek university based education to prepare for careers as Health Informatics specialists (IMIA Working Group on Health and Medical Informatics

Education, 2009).   Health Informatics includes people from a broad range of original qualifications and areas of practice and offers opportunities for those from many professional backgrounds to advance into more complex Health Informatics specialty areas.

There is a need to be able to recognise and design career pathways, and to recognise the skills inherent in diverse roles.

Figure 5 illustrates generic career pathways in Health Informatics. This diagram shows the three domains of Health Informatics (Technical, Clinical and Administrative) in the context of the key domain strength of the entry level educated professional and the additional knowledge and skills required to appropriately and effectively practice in Health Informatics. Specific additional education, skills and experience are required in order to further specialise.
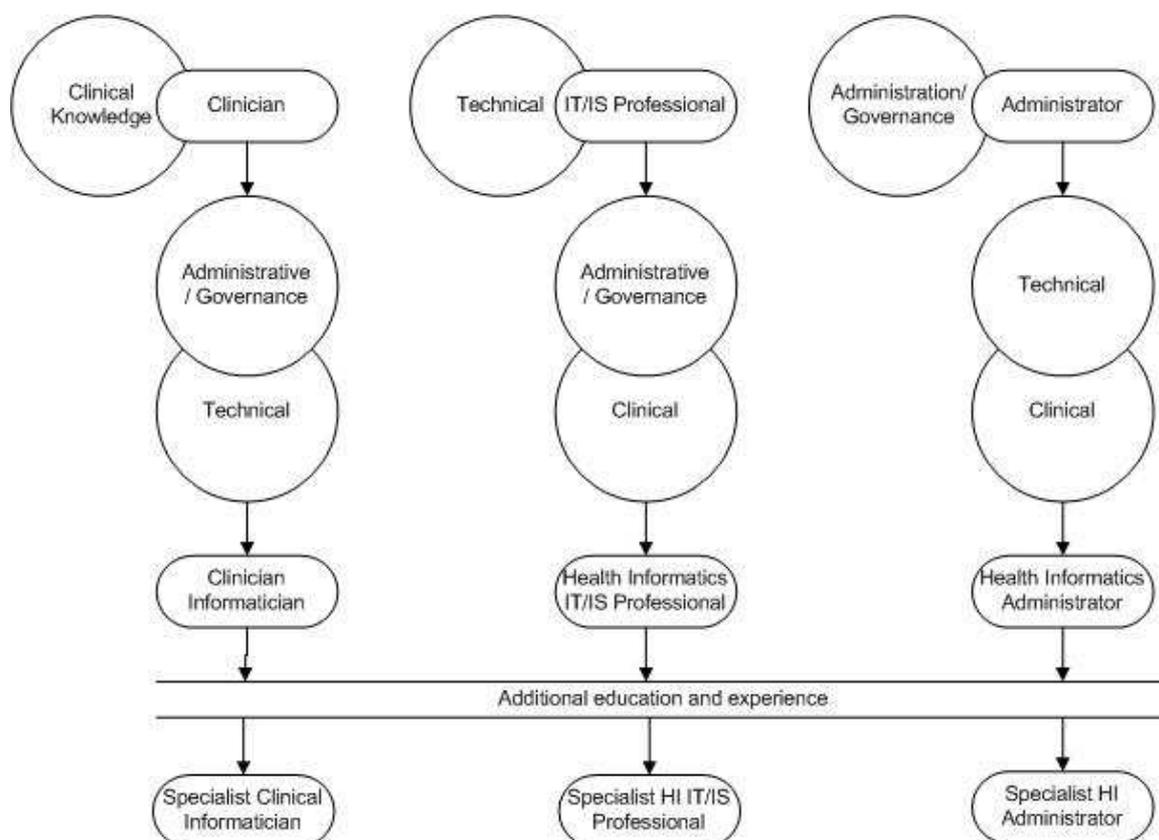
Figure 5 Generic career pathways in Health Informatics

An example of a more specific career pathway in the area of clinical terminology is shown in Figure 6. This shows an example of how an individual with existing skills might move through a career pathway in clinical terminology. This career pathway shows more senior skills in the domain as well as administrative skills and other types of career advancement. The shaded boxes represent units of competency that could be delivered in a wide range of ways. The clear boxes indicate starting professions and skills (at the top of the figure) and show how jobs could change through education based competency development.
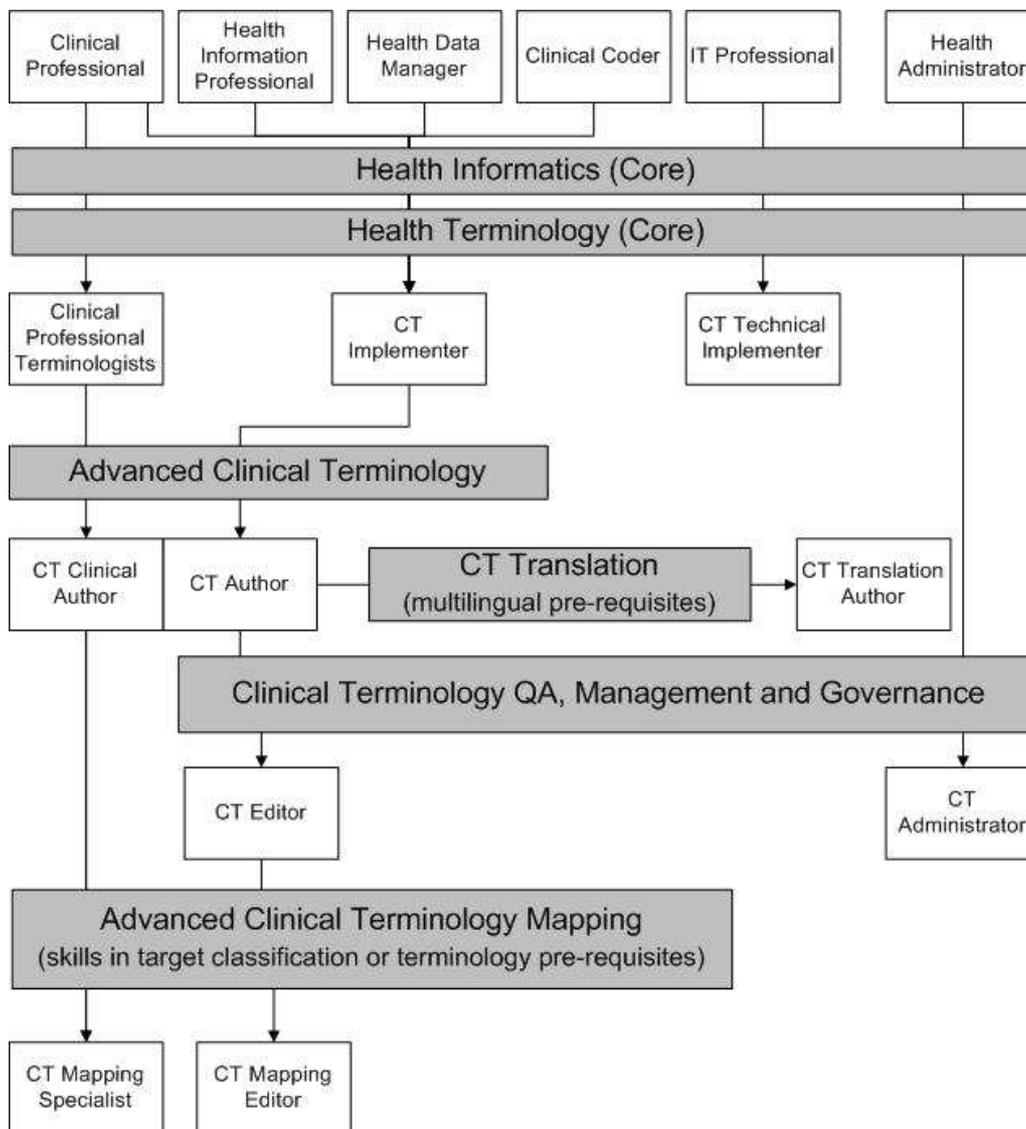
Figure 6 Competency Units and Career Pathways in Clinical Terminology (Grain, 2010)

It is acknowledged that further work needs to be done to map out career pathways for Health Informatics roles.

5.1   Skill Development

The increasing demand for Health Informatics skills at all levels and areas of health and aged care necessitate both generalists and specialists in the discipline and the need to enhance the existing workforce through a range of strategies and programs.

It is recognised that the approach to development of skill in Australia will require significant education programs, some short certification programs and some less formal educative processes. The core requirement of the education strategy is the ability to build quality programs to develop and assure those skills in our community and to support industry's capacity to evaluate an individual's capacity to do a specific job.

Short term up-skilling may occur through professional and industry organisations and the vocational sector. Addressing longer term workforce impacts requires higher education programs which can develop the entry level health workforce and post graduate programs to support skill extension and career change.

There are effectively four streams to the development of skills in our community:

- School leavers – development of the existing health professionals (largely through higher education)
- Existing workforce – up-skilling to meet the requirements of today's healthcare
- Existing workforce seeking to extend into another discipline
- Development of combined degrees (e.g. medical and information systems)

The approach of competency based requirements in this document supports each stream and provides flexibility in the delivery mechanism chosen to develop skills.

6   Competencies

Acknowledging that competencies will become clearer and develop over time, the competencies required to support Health Informatics are described as follows:

- Healthcare Professional – general Health Informatics skills required of all healthcare and aged care workers
- Health Informatician – Health Informatics skills required of anyone working in Health Informatics, irrespective of specialisation which may have higher but not lower requirements
- Specialist examples based upon existing Health Informatics related roles in Australia:
    o   Health Informatics Information Technologist (HIIT)
    o   Health Informatics Information System Specialist (HIIS)
    o   Clinical Informatician (CI)
    o   Health Information Manager (HIM)
    o   Health Informatics Administrator (HIA)

Health Informatics competencies for the specific Health Informatics specialisations will continue to mature and be developed by professional organisations, international standards organisations (e.g. IHTSDO is developing competency requirements for all the terminology specialisations) and others. Additional areas of Health Informatics specialisation may also be included in the future as the domain of Health Informatics continues to expand to meet the Australian healthcare industry needs.

It is assumed that all healthcare professionals requiring Health Informatics competencies will have the following basic professional and/or employability skills[1], and therefore these are not included in the competency table:

- Written and oral communication
- Interpersonal communication
- Teamwork
- Presentation of information
- ICT literacy, technology
- Problem solving
- Planning and organising
- Continual professional development, self-management and life-long learning
- Ethical behaviour
- Social responsibility
- Initiative and enterprise skills

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[1] http://www.deewr.gov.au/schooling/careersandtransitions/employabilityskills/Pages/Overview.aspx

This section also does not describe pre-existing or broader skills of clinicians, technical professionals or others, and only considers those skills that relate to Health Informatics.

The skills required for providers of education and training are already defined in Australia and therefore the requirements for a Health Informatics Educator were not included here in order to keep the table size manageable.

The competencies are listed in tables which show for each competency, the level of skills expected for each different generalist or specialist area at an entry or graduation based level. It is acknowledged that individuals may have higher levels and broader competencies that cross into multiple specialist areas or other professional domains than what is depicted in the table.

The level of skill expected is depicted using the revised Bloom's Taxonomy of Learning Domains. Further information on the levels and how they relate to the SFIA (Skills Framework for the Information Age) levels and Benner competency levels is provided in Appendix A.

Level	Category	Definition
1	Remembering	Recall previous learned information.
2	Understanding	Comprehending the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.
3	Applying	Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the work place.
4	Analysing	Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.
5	Evaluating	Make judgments about the value of ideas or materials.
6	Creating	Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.

Read the table by reading the competency description and the verb from the list above related to the number shown for the relevant Health Informatics role.

For example:

All workers in the Health and Aged Care Industry need to understand (skill level 2) the evolution of informatics as a discipline and as a profession (Competency 1.1).

6.1 Competency Area 1 – Knowledge

Id	Competency Description	Competency Level						
		Healthcare Professional	Health Informatician	HIIT	HIIS	CI	HIM	HIA
1.1	Evolution of informatics as a discipline and as a profession	2	2	3	3	2	2	2
1.2	Need for systematic information processing in healthcare, benefits and constraints of information technology in healthcare	2	4	5	4	5	4	4
1.3	Efficient and responsible use of information processing tools, to support health care practice and decision making	3	3	5	5	5	3	3
1.4	Use of personal application software for documentation and communication including internet for access to publications and basic statistics	3	3	3	3	3	3	3
1.5	Characteristics, functionalities and examples of information systems in healthcare (e.g. clinical information systems, primary care information systems)	3	3	4	6	6	3	3
1.6	Architectures of information systems in healthcare: approaches and standards for communication and cooperation and for interfacing and integration of component, architectural paradigms (e.g. service-oriented architectures)	1	2	6	6	2	2	2
1.7	Characteristics, functionalities and examples of information systems to support patients and the public (e.g. patient-oriented information system architectures and applications, personal health records, sensor-enhanced information systems	2	2	3	3	6	5	3
1.8	Methods and approaches to regional networking and shared care (eHealth, health telematic applications and inter-organisational information exchange)	2	2	4	4	6	4	2
1.9	Appropriate documentation and health data management principles including ability to use health and medical coding systems, construction of health and medical coding systems	1	2	2	3	3	5	2
1.10	Structure, design and analysis principles of the health record including notions of data quality, minimum data sets, architecture and general applications of the electronic health record (all types)	1	2	4	4	5	6	2
1.11	Socio-material and socio-technical issues, including workflow/process modelling and reorganisation	1	3	4	6	6	4	3
1.12	Principles of data representation and data analysis using primary and secondary data sources, principles of data mining, data warehouses, knowledge management	1	3	4	4	3	3	3

Id	Competency Description	Competency Level						
		Healthcare Professional	Health Informatician	HIIT	HIIS	CI	HIM	HIA
1.13	Biomedical modelling and simulation. Biometry and epidemiology including study design	1	1	1	1	3	1	1
1.14	Ethical and security issues including accountability of health care providers and managers and Health Informatics specialists and the privacy, and security of patient data	3	3	5	5	5	6	3
1.15a	Nomenclatures, vocabularies, terminologies, ontologies and taxonomies in health care	1	2	3	2	3	4	2
1.15b	Classification and casemix	1	1	1	1	3	5	2
1.16	Informatics methods and tools to support education (including flexible and distance learning), use of relevant educational technologies, including internet and world wide web	2	2	3	3	2	3	2
1.17	Evaluation and assessment of information systems, including study design, selection and triangulation of (quantitative and qualitative) methods, outcome and impact evolution, economic evaluation, unintended consequences, systematic reviews and meta-analysis	1	2	4	5	5	3	3

6.2 Competency Area 2 – Medicine, Health and Biosciences, Health System Organisation

Id	Competency Description	Competency Level						
		Healthcare Professional	Health Informatican	HIIT	HIIS	CI	HIM	HIA
2.1	Fundamentals of human functioning and biosciences (anatomy, physiology, microbiology, genomics, and clinical disciplines such as medicine, nursing, allied health)	3	2	2	2	6	3	2
2.2	Fundamentals of what constitutes health, from physiological, sociological, psychological, nutritional, emotional, environmental, cultural, spiritual perspectives and its assessment	3	2	2	2	6	3	2
2.3	Principles of clinical decision making and diagnostic and therapeutic strategies	3	2	2	3	6	3	2
2.4	The Australian Health System, inter-organisational aspects and shared care	3	2	2	2	5	3	4
2.5	Policy and regulatory frameworks for information handling in healthcare	3	2	2	2	5	5	4
2.6	Principles of evidence-based clinical practice	3	2	2	4	6	3	2
2.7	Health administration, health economics, health quality management and resource management, patient safety initiatives, public health services and outcome measurement	2	2	2	3	2	5	5
2.8	Quality assessment and performance in healthcare, supporting direct patient care and safe clinical practice	1	2	2	2	5	5	2
2.9	Accreditation and Standards	2	3	5	5	5	5	4
2.10	Health Vocabulary	3	1	2	2	3	4	2
2.11	Health Terminology (including terminology systems such as SNOMED CT and LOINC)	2	2	2	2	3	4	2
2.12	Health Terminology development	1	1	1	1	1	1	1
2.13	Clinical terminology QA, Management and Governance	1	2	2	2	2	2	1
2.14	Advanced clinical terminology mapping, including building, and assessing maps and term sets	1	1	1	1	1	1	2
2.15	Identity management in healthcare, including collection and data quality management for identifiers in a shared healthcare environment	3	3	3	3	3	6	2

6.3 Competency Area 3 – Informatics/Computer Sciences, Mathematics, Biometry

Id	Competency Description	Competency Level						
		Healthcare Professionals	Health Informatican	HIIT	HIIS	CI	HIM	HIA
3.1	Basic informatics terminology, including data, information, knowledge, hardware, software, computer networks, information systems, information systems management	2	3	4	4	4	4	2
3.2	Ability to use personal computers, text processing and spreadsheet software, easy to use database management systems	3	3	4	4	3	4	3
3.3	Ability to communicate electronically, including electronic data exchange, with other health care professionals, internet/intranet use	3	3	6	5	3	5	3
3.4	Methods of practical informatics/computer science, including programming languages, software engineering, data structures, database management systems, information and system modelling tools, information systems theory and practice, knowledge engineering, (concept) representation and acquisition, software architectures	1	3	5	5	4	3	2
3.5	Methods of theoretical informatics/computer science e.g. complexity theory, encryption/security	1	2	3	3	2	3	2
3.6	Methods of technical informatics/computer science, e.g. network architectures and topologies, telecommunications, wireless technology, virtual reality, multimedia	1	2	3	3	2	2	2
3.7	Methods of interfacing and integration of information system components in healthcare, interfacing standards, dealing with multiple patient identifiers, including HL7	1	2	5	4	2	3	2
3.8	Information system lifecycle: analysis, requirement specification, implementation and /or selection of information systems, risk management, user training	2	4	4	6	4	4	3
3.9	Methods of project management and change management (i.e. project planning, resource management, team management, conflict management, collaboration and motivation, change theories, change strategies)	1	4	4	5	4	4	5
3.10	Mathematics: algebra, analysis, logic, numerical mathematics, probability theory and statistics, cryptography	2	2	3	2	2	2	1
3.11	Methods for decision support and their application to patient management, acquisition, representation and engineering of medical knowledge; construction and use of clinical pathways and guidelines	2	3	4	4	5	3	3
3.12	Basic concepts and applications of ubiquitous computing (e.g. pervasive, sensor-based and	1	2	3	3	2	2	2

Id	Competency Description	Competency Level						
		Healthcare Professionals	Health Informatican	HIIT	HIIS	CI	HIM	HIA
	ambient technologies in healthcare, health enabling technologies, ubiquitous health systems and ambient assisted-living)							
3.13	Usability engineering, human-computer interaction, usability evaluation, cognitive aspects of information processing	1	2	2	3	4	4	2

Id	Competency Description	Competency Level						
		Healthcare Professionals	Health Informatican	HIIT	HIIS	CI	HIM	HIA

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Appendix A – International Background

This document has been produced from an ontological perspective which recognises that there are many factors to explaining the scope of Health Informatics. The OECD Pisa Education Conference identified that competencies relative to employment and life are more than just knowledge and skills. It involves the ability to meet complex demands, by drawing on and mobilising psychosocial resources (including skills and attitudes) in a particular context (OECD, 2005). The Canadian Health Informatics Association (COACH) identify that the "competency profile for Health Informatics professionals collectively represents a unique blend of knowledge skills and abilities obtained from a variety of disciplines including information, health and management sciences" (COACH, 2009). COACH also indicate, as has been identified in Australia, that "Health Informatics core competencies are progressive and continuously evolving" (COACH, 2009).

Competency Definitions and Scope

In this document competencies are defined using a matrix related to knowledge as well as skills.

The scope of Health Informatics in this document was based upon the work done by IMIA, extended and refined to reduce duplication and represent broader skill sets required in Australia. This work has been reviewed by members of international organisations including:

- IMIA
- AMIA
- AHIMA
- HL7 International
- IHTSDO
- COACH

Skill Descriptions

Skills are defined activities which an individual is able to perform to a consistent standard. Health Informatics skills are relevant at different Levels and Domains. The Bloom/Benner Levels relate to levels of competency and definitions of those levels. Competencies are described using verbs which indicate the skill expected of an individual. They are used to define skills. The Australian Computer Society applies The Skills Framework for the Information Age (SFIA) which has 7 levels of competency (SFIA Foundation, 2008). Table Appendix 1 shows both the revised Bloom's Taxonomy of Learning Domains (used in education) and the SFIA levels identifying proposed relationship between the two classifications developed to support this process.

Bloom's Taxonomy	Verbs used to describe the levels of tasks an individual at a given level of competency is able to perform.	SFIA levels
Remembering	defines, describes, identifies, knows, labels, lists, matches, names, outlines, recalls, recognizes, reproduces, selects, states.	1: Follow
Understanding	comprehends, converts, defends, distinguishes, estimates, explains, extends, generalizes, gives an example, infers, interprets, paraphrases, predicts, rewrites, summarizes, translates.	2: Assist
Applying	applies, changes, computes, constructs, demonstrates, discovers, manipulates, modifies, operates, predicts, prepares, produces, relates, shows, solves, uses.	3: Apply
Analysing	analyses, breaks down, compares, contrasts, diagrams, deconstructs, differentiates, discriminates, distinguishes, identifies, illustrates, infers, outlines, relates, selects, separates.	4: Enable
Evaluating	appraises, compares, concludes, contrasts, criticizes, critiques, defends, describes, discriminates, evaluates, explains, interprets, justifies, relates, summarizes, supports.	5: Ensure, Advise 6: Initiate, influence
Creating	categorizes, combines, compiles, composes, creates, devises, designs, explains, generates, modifies, organizes, plans, rearranges, reconstructs, relates, reorganizes, revises, rewrites, summarizes, tells, writes.	7: Set Strategy, inspire, mobilise

Skill Levels

Benner's degrees of competency from novice to expert can be related to Bloom's taxonomy. Figure Appendix 1 shows a comparison between Bloom's taxonomy (white) and Benner's degrees of competency (black). Note that the original Bloom's taxonomy, which is similar to the revised taxonomy above, is used on the left.
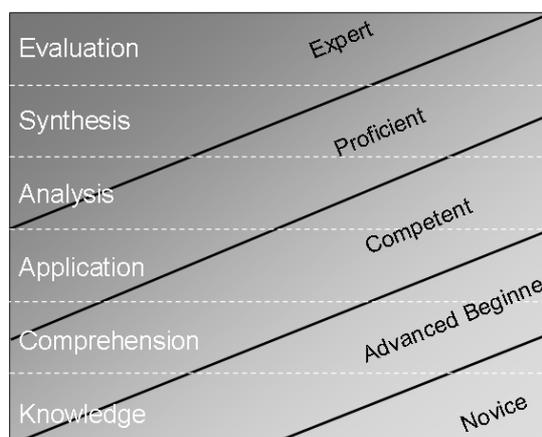

Figure Appendix 1 Bloom / Benner Level(Benner, 1984)

Health Informatics has a range of disciplines within which the skill sets operate; some are core informatics skills required within existing professional groups in healthcare, while others represent the emergent specialisations in Health Informatics.   The Skills Framework for the Information Age (SFIA) has 5 categories of skill. These are shown in Figure Appendix 2:

Figure Appendix 2 SFIA Categories

IMIA use a multi-axial approach identifying domains of competency and knowledge components. Table Appendix 2 shows each of these domains, though not their interactions (IMIA Working Group on Health and Medical Informatics Education, 2009). The interactions indicate the actual knowledge components at the intersection of each element.

Table Appendix 2 Knowledge domains

Knowledge domains	Area of healthcare
Biomedical equipment interfaces	
Collaborative internet architectures	
Computer literacy (ECDL)	
Computer systems	
Computer-aided design	
Computing methodologies	
Data structures	
Decision support systems performance evaluation	Health and social care processes
Decision support tools	Health (care) records
Demystifying IT for users	Health and social care industry
Design databases	Health Informatics standards
Design of IS and IT systems for health	Knowledge domains and knowledge discovery
Differentiate between technical, syntactic and semantic interoperability	Legal and Ethical
EPR: architecture, content, views and use	People in Organisations
Futurology	Politics and Policy
Human interaction principles	Technologies for health
Information and systems requirements	Terminology and classification and grouping
Information retrieval	Uses of clinical information
Knowledge management	Using informatics to support clinical healthcare governance
Messaging standards	Computer systems application in health
Mobile computing	
Natural language processing	
Networking	
Open systems	
Picture archiving systems	
Prototype systems for department	

Example Specialisations

 Health Informatics is not only emergent but multidisciplinary. In order to ensure that the scope is broad and deep enough to provide a realistic picture of the current and potential environments the scope has been kept very broad.

Figure Appendix 3 indicates the scope of Health Informatics and related fields as identified by IMIA. This diagram reflects the complex and multidisciplinary nature of the Health Informatics discipline.   IMIA use the term Medical to include all aspects of health care and the term is not meant to be limited to medical clinicians only. The following list is adapted to suit the terms used in Australia:

- A) Health information science
- B) Health chemoinformatics
- C) Clinical informatics
- D) Biomedical informatics (including translational)
- E) Public Health Informatics
- F) Health nanoinformatics
- G) Medical imaging and devices

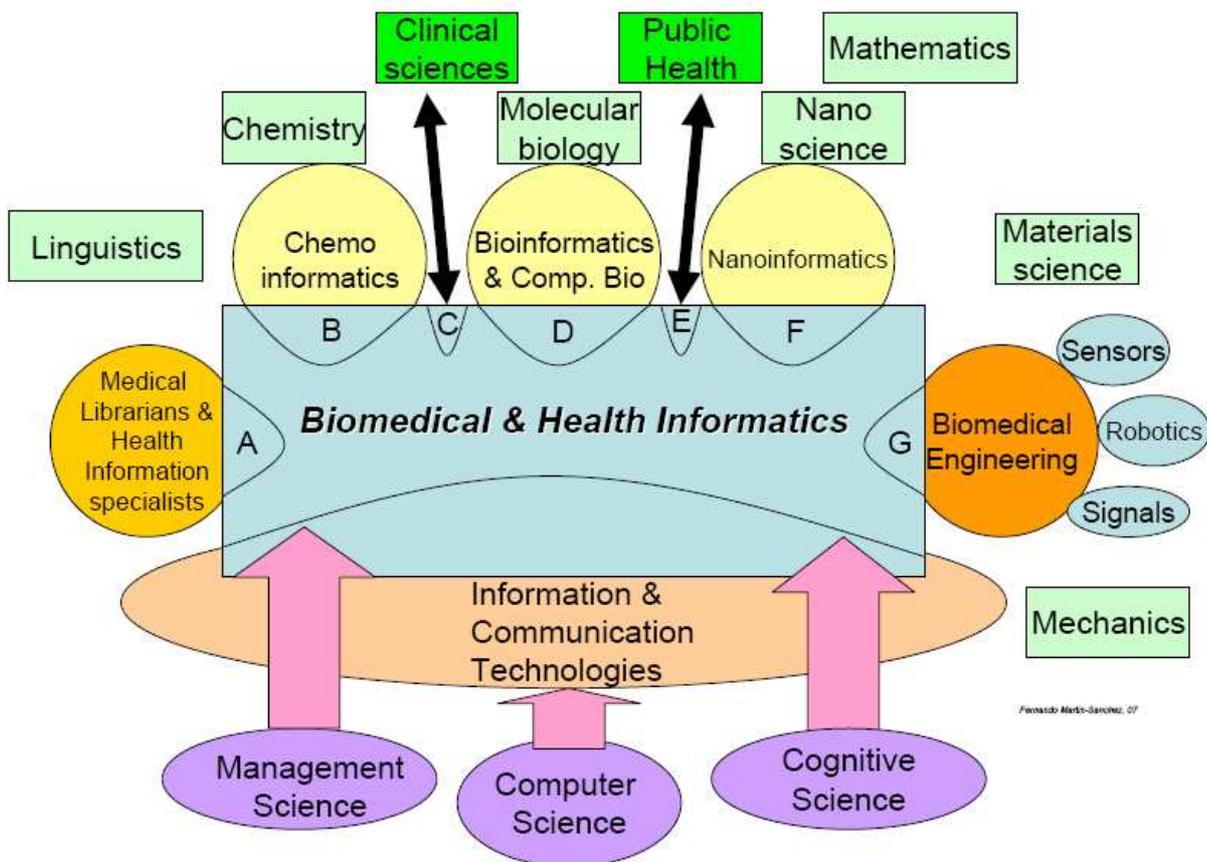Over time, the Health Informatics discipline in Australia may see similar specialisations emerge.

Figure Appendix 3 Biomedical and Health Informatics and related fields (IMIA 2009)