

Transatlantic collection of health informatics competencies

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Abstract

The electronic collection, processing and management of information is becoming increasingly important in healthcare. Because of the nature of the healthcare provision and delivery process, where the health, safety and quality of human lives are impacted on a daily basis, it is critical that those who work in the field are competent and able to perform all clinical, administrative, research and technology-impacted facets of their roles.

The United States and the European Union have been working to encourage broader and more effective use of Information and Communications Technology (ICT) within healthcare. The development, use and governance of ICT within healthcare, often called health informatics, requires a number of competences which need to be identified and integrated into relevant skills assessment, education and training. Ultimately, this will help produce a more proficient and a more confident mobile health informatics-empowered workforce.

A structured set of health information technology and eHealth implementation competences was collected in a co-operation project by voluntary experts in USA and European Union. The project took a deliberately broad starting point, seeking and reviewing an extensive range of related competencies. The skills cover the following domains of professions working with health information technology: direct patient care; administrative; engineering/information, communication, and technology (ICT); informatics; and research and biomedicine. The aggregation of over one thousand competencies was classified to a baseline set of skills and four levels of expertise in 33 focus areas according to Bloom's taxonomy. The data set also contains definitions of 268 'typical' professional roles. The use of the collection of competencies is supported by an open access web tool through which all the competencies can be searched through a query mechanism.

The limitation of this work is that only the Acute Care segment of roles and competencies impacted by ICT was evaluated within the scope of this project, however, this subset of other care settings such as ambulatory, rehabilitative care, surgery, and others serves as a representative set of roles and competencies within the health care field as well as a being an important proof of concept for future usefulness of the work if extended beyond its current span. This project has made a contribution to the potential improvement of workforce mobility internationally.

Keywords: health informatics competency, health informatics skills, health informatics workforce, health informatics education, health information technology, eHealth, professionalism, eLeadership, health information management, health ICT, skill, knowledge, competence/competency, health information roles, health information careers, technology enabled

Introduction

The proportion of information in digital form is increasing significantly. Dahlberg [1], referring to Hilbert and López [2] presented a prediction that 99.84 percent of information was in digital form by the end of year 2015. It is inevitable that this kind of change also touches the health sector, ranging from direct patient care to administration, support and systems development. As a consequence new and revised competencies for the health care work force are needed. This need was recognized when the European Union and the USA signed the Memorandum of Understanding (MoU) on co-operation in the area of health information technology (HIT) in 2010 [3]. In addition to the development of interoperability standards for electronic health record systems it was also seen important to continue to develop the HIT skills of the healthcare workforce in an embedded manner in parallel to their core job skills, in order to fully utilize the potential of this technology and its emerging new possibilities. The actual work of this project began with the EU-US Workforce Development Workgroup (WDW) in August 2013 when a series of intercontinental webinars and teleconferences was started to collect these competencies. This first phase ended in May 2015 with results summarized in this paper, which demonstrate that multi-national collaboration in defining workforce competence standards in eHealth, HIT and health informatics can produce elements and a tool that can be applied within and across professions and countries.

Material and methods

Material

Goal setting

Posnack and Cunningham defined the goals for the EU – US co-operation in the health informatics workforce competency development as follows [4]:

1. To achieve a robust supply of health professionals highly proficient in the use of Health Information Technology (HIT)
2. To assure current and future workforces have the required technology skills needed to be successful, and enhance experience and performance within the eHealth/Health IT Ecosystem
3. To support an innovative collaborative community of public- and private sector eHealth/Health IT entities, working toward the shared objective of developing, deploying, and using eHealth science and technology
4. To define standards, develop competencies and produce useful tools that support this work

The WDW initially set out to achieve all the goals set out under the EU-US MOU, particularly goal 1, which included mapping competencies, identifying and developing curriculum, and adopting skills and training standards for HIT professionals. However, because the project was time-limited and consisted of mainly voluntary experts who were donating time to reach the goals, it was quickly discovered that in order to be effective and achievable, the approach needed to be more pragmatic. Therefore the WDW made the decision to focus its primary tasks on a comprehensive competency analysis which achieved five sub-goals:

- 1) Outline scope statement and goals/objectives,

- 2) Identify setting of acute care,
- 3) Identify roles in acute care and map those roles between the EU and US,
- 4) Categorize and synthesize competencies from existing silos and sources,
- 5) Map aggregated competencies to professional roles.

As the group quickly agreed that the actual development of curriculum and provision of education were significant tasks in their own right, they should be moved to a subsequent phase of the project.

When these five tasks had been achieved, the volume of data the WDW had compiled and aggregated was comprehensive but not practicable. Therefore the WDW made a further decision to compile the results of the competency analysis and mapping in the form of a consumable, usable tool and repository that would be useful to educators, managers, new and incumbent healthcare workers, as well as all staff in healthcare delivery, management, administration, and support, including health information technology specialists and researchers in the field. This tool was designed and became the HITCOMP Tool and Repository [5].

Source materials

The WDW used over 15 different sources of HIT competencies in the areas of education, government and health IT, IM and informatics related associations. Among them were, for example, the International Medical Informatics Association (IMIA) which has been active also in the education sector [6], American Health Information Management Association (AHIMA) [7], AMIA [8] NHS [9], UKCES [10], the UK Council for Health Informatics Professions (UKCHIP) [11], European e-Competence Framework [12], ONC [13], University of Victoria [14], Cuyahoga Community College [15], Des Moines Area Community College [16] and BioMed Central [17]. The WDW identified also some new competencies which did not exist anywhere else yet. The competencies were developed to address both the competency of HI specialists and those of other professionals in the health domain who needed additional

competence embedded alongside their clinical, administrative / management or research skillset. An additional area of professionals addressed are those whose backgrounds are strictly in ICT/information systems who need to bridge the skills gap between the health care context and their technology specialism.

Other competence definitions not yet evaluated and cross-mapped include specialized initiatives such as the HIMSS TIGER (Health Information Management Systems Society – Technology Informatics Guiding Education Reform) initiatives. Both the United States and the European Union are currently working to encourage broader and more effective use of Information and Communications Technology (ICT) within the US and globally, defining the anticipated competence (structured by Information Literacy, Clinical Informatics Management and Basic Computer elements) of nurses with regards to deploying informatics. Necessary competence may also vary in different countries (for example Germany or UK) and for specialized and hybrid roles. Therefore, in order to provide usability internationally the WDW started from a wide range of competences which can be selectively combined for job role specification in different scenarios. The breadth of HITCOMP elements could facilitate cross-mapping against TIGER and other initiatives as appropriate.

Methodology

The WDW held weekly webinars and teleconferences over a period of 20 months. During these meetings, an impressive multinational collaboration of health informatics subject matter expert volunteers from 13 countries around the globe met to work on achieving the goals of defining standards, developing competencies and producing useful tools that support achievement of a robust supply of health professionals highly proficient, empowered in the use of HIT.

This work involved performing an in-depth competency analysis, which included the aggregation, categorization and synthesis of competencies in eHealth and health IT/informatics, and then mapping those competencies

to roles in the EU and US. In order to achieve the goals under the EU-US MOU, a focus needed to be placed on the education and development of a qualified workforce. As a 'proof of concept' the Acute Care area was chosen to be investigated due to the otherwise exhaustive range of areas that could have been selected. It was felt that 'Acute Care' covered the majority of competences that would be demonstrated across the health domain, and as such could be selectively extracted and added to if / when any other areas were considered. The methodology used to pursue the actionable and achievable goals planned included:

1. Narrowing down the focus to one setting where roles could be mapped to and evaluated against Health IT competencies. The WDW agreed to use the Acute Care setting, the setting was stable and consistent, provided little variance between environments, areas and regions, was organized similarly, and contained relatively common functions and definitions.

2. Collating and mapping over 250 job roles and careers in the Acute Care setting in the EU and US. Roles were researched and aggregated from various sources, including the EU Single Market Regulated Professions Database [18], the United States Department of Labor Bureau of Labor and Statistics Occupational Outlook Handbook for Healthcare Occupations [19], the UK National Health Service Health Careers Framework [20], and AHIMA Career Map [21] among others. These roles were then categorized into role types and service types, and associated with a generalized level of HIT skill needed for the role. Finally, the roles were thoroughly defined and were provided a synonymous name in five major European languages.

3. Gathering competencies from 15+ organizations from both the EU and US. This compilation included an exhaustive amount of data from over 3000 individual representative competencies, which were derived from 10,000 aggregated data sets, segments and components. As explained previously, the data came originally from only 10 organizations from the fields of education (community colleges), governments (e.g., NHS, US Department of Labor, etc.), and associations (AHIMA, IMIA, AMIA, IFHIMA, etc.), eventually the list grew to 18

source organizations, or silos. Within each silo, hundreds of competencies were categorized into domains and competency areas, and assigned a preliminary level. Then, each competency was reviewed, synthesized, and, where appropriate, revised for greater Transatlantic usefulness, appropriateness and applicability before adoption by the community after a formal consensus process.

4. Organizing, leveling and categorizing the competencies. The WDW first organized competencies into one or more of the following five domains: Direct Patient Care, Administrative, Informatics, Engineering/ICT, and Research/Biomedicine. Following this, the competencies were placed into a general skill level that could be mapped to an associated level for various roles: baseline (which skills are necessary for any health workers), basic, intermediate, advanced and expert. Finally, the competency was categorized into one of 33 areas of competency (e.g., Privacy & Security, Clinical Decision Support, etc.).

5. Reviewing and reworking the competencies. The WDW spent significant time reviewing and preparing the competencies for inclusion, including removing duplicate competencies, deleting those that did not apply or were not strongly health IT/eHealth focused, and editing, rewording or adding HIT language to some competencies to make them more internationally applicable, useful or updated. It should not be underestimated how valuable (if time consuming) the ability to meet 'virtually' so regularly and discuss and debate the relevance and meaning of competencies.

6. Providing standardization and integrating learning principles into the competencies. To enhance usability for career entry, career development/ladder progression, HIT staffing, job description development, instructional design, curriculum development and more, the WDW adopted some standards regarding their competency analysis and mapping process. This ensured that there would be a standards-based framework on which the materials were based, and heightened the possibilities for greater adoption, acceptance and use by official bodies and organizations in the health IT area. Both adult learning principles (i.e., ADDIE, Experiential Learn-

ing, etc.) as well as Bloom's Taxonomy of Educational Objectives [22] were incorporated to provide standard classifications and enhance the ease and usefulness of competency and curriculum design, development, delivery and evaluation.

Results

The work resulted into a collection of over a thousand competencies when all levels of competencies are counted separately. The results can be broken down into two significant accomplishments.

1. Adopting the competencies. The adoption process of the WDW was a lengthy one, which included a formal voting and consensus process. The workgroup members along with extended members of the HIT/eHealth community and leadership were invited to participate in the formal voting and consensus process, often resulting in further addition, modification or deletion of competency elements before finalization. Once competencies were finalized, they were either consented to

be adopted or adopted with comments, or not consented to. This resulted in a final tally of over 1000 carefully crafted and adopted competencies in 33 classes (see Table 1). Similarly, 268 professional roles were tabulated and classified according to domain, type, level and service category. Table 2 gives two examples of such role descriptions.

2. Placing the competencies into a tool. The HITCOMP Tool and Repository [5] is an open-source internet-based database, sorting and mapping tool that was developed to make the competencies the WDW had aggregated and synthesized useful and consumable. HITCOMP has also assured that adopted competencies are interoperable with educators, curriculum developers and workforce initiatives throughout the EU and US. Further, it strategizes the work to be poised for further alignment with existing industry standards, certification bodies and educational programs (i.e., apprenticeships, just-in-time workplace training, professional registration / credentialing, eHealth/Health IT occupational coding, etc.)

Table 1. Included focus areas of competencies.

Access to Information/Protected Health Information/Health Info Management	Information and Communications Technology/Information Systems/IT
Administration/General Management/Governance	Issue Management & Resolution
Business Process Design/Workflows	Legal
Care Coordination	Medications & Allergies
Clinical Decision Support & Pathways	Order Entry
Clinical Practice & Workflows	Patient Access & Engagement/Personal Health Records
Coding & Terminologies	Patient Centered Interactions/Patient Identification
Collection of Data/Knowledge Management (Library)	Policies & Procedures
Communication & Change Management	Population Management/Public Health
Confidentiality/Protected Health Information/Records Management	Privacy & Security
Data Compiling, Analysis, Modeling & Reporting	Project/Program Management
Documentation Process	Quality & Safety
eHealth/mHealth/Telehealth	Research/Biomed
Financial and Account Management	Risk and Compliance
General Health Information Technology	Standards and Protocols
Knowledge/System Use	
Health Information Exchange	Systems Development and Implementation
/Interoperability/Interfaces/Integration	
Informatics Process	

Table 2. Examples of two professional role descriptions out of 268 in the database.

Role and its classification	Role description
Role: Clinical Nurse Specialist, Informatics Domain: Informatics Type: Professional Level: Advanced Service Category: Nursing	The Clinical Nurse Specialist of Informatics integrates nursing science, computer science, and information science to manage and communicate data, information, and knowledge in nursing practice. The CNS–Informatics has responsibility for functional leadership and day-to-day operational support of Clinical Information Systems utilized in patient care areas. This position will serve as a liaison in system initiatives to all patient care disciplines and the IT department as it relates to clinical information systems. Typically require a bachelor's degree in area of specialty and at least 3 years of experience in the field or in a related area; requires certification as a registered nurse (RN).
Role: Healthcare Analyst Domain: Engineering/IS/ICT Type: Operational-Technical Level: Intermediate Service Category: Engineering/IS/ICT	Healthcare analysts compile important medical data through the use of computer-based applications. They usually work full-time at healthcare agencies or hospitals gathering, compiling, modeling, validating, and analyzing data needed by the healthcare organization. The data is then used to understand the current trends in the healthcare system and to make well-informed decisions. Healthcare analysts may also be asked to develop initiatives for providing more effective healthcare, as well as resolve current service issues. They must have the ability to manage multiple projects, as well as meet time constraints and expectations. Designing new approaches to healthcare delivery may also be included within the position.

The HITCOMP tool

The HITCOMP tool is intuitive to use and it responds to user actions relatively rapidly. In the entry web page it displays the entire list of competencies (see Fig 1). The user can then focus on a more limited set of competencies by applying filters for the domain, the level (baseline/basic/intermediate/advanced/expert) and the

focus area/category. All, one or some domains, levels or focus areas can be selected for the search. Figure 2 illustrates the search results for a more targeted search showing the nine definitions of the competencies found for the selected combinations of filters. The professional role database search has filters of its own limiting the search results according to the user's needs.

Filter

Reset

Domain: None selected | All | None

Level: None selected | All | None

Category: None selected | All | None

Data (1024 of 1024 Selected)

Export

Domain	Level	Category	Description	Code
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Coding & Terminologies	Describe the differences between health data and health information	EL04
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Data Compiling, Analysis, Modeling & Reporting	Be aware of and identify circumstances in which health information may be used (i.e., individual records, comparative reports, trending data, etc.)	GL02
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Data Compiling, Analysis, Modeling & Reporting	Identify methods and types of data collected in healthcare	GL05
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Documentation Process	Be able to identify the source of information entered in an electronic health record	HLO1
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	eHealth/mHealth/Telehealth	Use mobile and portable technology devices per policies and procedures, as applicable to your job role, to facilitate communication, information exchange, and interoperability	IL03
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	General HIT Knowledge/System Use	Be able to use, and assist others in using, technology as a reference or educational tool	JL02
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	General HIT Knowledge/System Use	Demonstrate knowledge of the essential aspects of data and file organization and storage (such as to a disk, thumb/flash drive, etc.)	JL04
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	General HIT Knowledge/System Use	Identify and be able to use icons, cursors, windows, menus and other device navigational tools	JL06
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Patient Access & Engagement/PHRs	Differentiate between the types of content of patient health records (such as paper-based records, scanned records, electronic medical record, personal health record, patient-supplied data, etc.)	OL02
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Baseline	Policies & Procedures	Maintain professional standards in all documentation activities	PL03

Figure 1. The entry screen to the Health Information Technology Competency database tool. When no domains, levels and categories are selected, all competencies are shown.

Filter

Reset

Domain: DPC | All | None

Level: Intermediate | All | None

Category: Policies & Procedures, Privacy & Security | All | None

Data (9 of 1024 Selected)

Export

Domain	Level	Category	Description	Code
DPC, Admin, Informatics, Rsrch-BioMed	Intermediate	Policies & Procedures	Adhere to health record documentation requirements of internal and external agencies and organizations (such as credentialing, licensure and reimbursement agencies, etc.)	PN01
DPC, Admin	Intermediate	Policies & Procedures	Demonstrate and utilize appropriate methods to add to, cull/correct or amend information personally entered in an electronic health record	PN03
DPC, Admin	Intermediate	Privacy & Security	Ensure all documentation and data in the EHR maintains data integrity and validity, within the parameters of your role	RN03
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Intermediate	Policies & Procedures	Explain informed consent	PN05
DPC, Admin, Informatics, Eng-IS-ICT, Rsrch-BioMed	Intermediate	Privacy & Security	Maintain the security, confidentiality and privacy of protected and non-protected health data, along with all health data related communications, per regulations, and report any possible breaches, or known retention or destruction of information	RN06
DPC, Admin, Informatics, Rsrch-BioMed	Intermediate	Policies & Procedures	Comply with and promote the professional standards related to the structure, content and handling of health records	PN02
DPC, Admin, Informatics, Rsrch-BioMed	Intermediate	Policies & Procedures	Utilize and apply professional, ethical, legal and policy standards in processing of patient information at all times (including following legal aspects and regulations of documentation and requests for information)	PN09
DPC, Admin, Informatics	Intermediate	Privacy & Security	Adhere to privacy and security requirements pertaining to the creation and use of health records	RN01
DPC, Admin, Informatics, Rsrch-BioMed	Intermediate	Privacy & Security	Maintain the highest regard for confidentiality, privacy and security when working within the health information environment, and encourage such behaviour in other members of the healthcare team	RN05

Figure 2. Example of competencies in the intermediate level in direct patient care concerning policies, procedures, privacy and security.

Discussion

The collection and organization of competencies is a useful starting point for the improvement of the HIT skills of the work force in health care organizations. The list of competencies builds off the extensive work done in this area by the world's leading HIT industry organizations and agencies. Due to the relative recent increased use of health information technology, health care organizations are facing challenges identifying the best candidates for their informatics and ICT positions. There is very little consistent evidence regarding the knowledge and skills required across a wide variety of roles. Additionally, there is only marginal evidence regarding the best competencies and skills to maximize effective clinical and others uses of ICT in their day-to-day activities.

To aid in identifying some potential uses and users for the HITCOMP tool, relevant case studies were developed that can be utilized in real-world situations. For example, a hiring/human resources manager might use the tool as a check list to include relevant health IT skills for the nurses he/she is hiring to his/her organization. The manager selects the levels of necessary skills and uses the output of the system to prepare the job advertisement including role title, job description and duties. In another case, an IT specialist wanting to enter the health informatics field could use the tool to review descriptions of the new role, and check what specific competencies are required for that role, also validating those competencies against the specialists' current skill set and perhaps undertaking additional studies to close any gaps found.

Educational programs can benefit from exploring the HITCOMP tool in planning the educational content for certificate and degree programs. Trainees in these programs could include those new to health care and information technology, as well as existing health care workers seeking to upgrade their skills or change from a clinical focus to an informatics focus and those who are keen to progress their own career pathway, within healthcare informatics by attaining recognized and consistent competencies. Many educational programs also develop and deliver continuing or professional

education for the existing work force which Zacks considered very important, as well [23]. Additionally, countries establishing national policies to modernize their health care workforce and/or recognizing an emerging workforce can use the database as a source to support the designation of roles and competencies. A consistent basis for recognizing competences internationally (such as HITCOMP or a cross-mapping of local competence through HITCOMP) can also be used to improve workforce mobility between countries.

As commented earlier, 'development of recognized HI competences can also be through vocational training and delivered in-house or through third parties. However provided it must be described using consistent terminology to provide a valid workforce profile and to enable robust workforce mobility (within countries and trans-nationally)'. Still, there are always some national elements in health informatics education due to different national legislation and health care models. For example, the national German GMDS recommendation of learning objectives for medical informatics [24] refers to a number of German laws. Attempts were made to raise the abstraction level of a competency described in a national context to a higher level so that the competency can be used universally. Additionally, the professional roles are typically not prescriptive, the competences described can be cross-mapped or collated to mirror roles in different care delivery models and national requirements. For example, the professional registration requirements for Health Informatics professionals and those requiring embedded HI competence can be 'translated / cross-mapped' to elements of the HITCOMP tool to enable professionals to describe their national recognition in international terms when required. It is increasingly important when multi-national health research is proposed that the competences of the participants are consistently expressed, regardless of national bases.

Professional roles change with time, particularly in areas which apply rapidly changing technology such as IT. Therefore it will be necessary to revise the competencies and learning objectives in HIT time to time, as well. The planners of education should target future needs, too, but that is not always easy because it is

difficult to predict which breakthroughs in technology will be applied rapidly to health care use. One such area is bioinformatics which is somewhat outside the competence scope of “traditional” medical informatics educators. The temporal development of the professional roles might be a topic for health care system research particularly if the numbers of people in each role became available.

The work in developing the skills of the workforce in HIT is by no means complete. For instance the mapping was only done for the acute care sector as the first focus area and consciously avoided ambulatory care as it was felt that the Acute Care elements would form the base of requirements of any other area of the health domain. The EU-US eHealth/Health IT MoU Roadmap [25] is currently being updated and is undergoing a Public Stakeholder Consultation in both Europe [26] and the US [27], which will be completed by the Spring of 2016. There will be additional opportunities to incorporate the latest ideas in HIT workforce development in future planning as well in both the EU and US.

Conflict of interest statement

The authors have no conflicts of interests with the producers of the equipment or producers of the data used in this study.

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Note: references 6-21 refer to sites which contain many aspects of professional workforce competence standards and definitions, and browsing these sites is recommended for context and detail if required.

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