

Informatics Research Workforce I – Training for Future Informatics Workforce Needs

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Outline

- Known data about the quantity of professions needed as well as the skills and competencies required
- Recent federal programs that have attempted to expand that workforce, including from the Office of the National Coordinator for Health IT (ONC), the National Library of Medicine (NLM), and others

Workforce needs – original motivations and questions

- As OHSU informatics program matured, and 10x10 was formed, wanted to know more about informatics workforce need
 - Extensive search for literature yielded little
- Thought process started with JAMIA (2006) paper, “Who are the Informaticians?”
 - Noted growing role for those who worked “professionally” in informatics

What did data from circa 2006-2007 show?

Group	Quantitative	Qualitative
IT	US and UK: ~1 FTE per 50-60 non-IT FTE ^{1,2,3}	Knowledge of health care deemed essential ⁴
HIM	~170,000 now, increasing to ~200,000 by 2016 ⁵	Evolving role as technology changes ⁶
Informatics	Unknown; minimum estimates of ~12,000 clinical (one MD and nurse per hospital) ⁷ and ~1,000 public health ⁸	CMIO is example of a new position and is evolving ^{9,10}

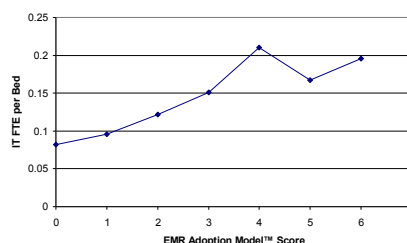
¹Gabler, 2003; ²Eardley, 2006; ³Hersh, 2008; ⁴Monegain, 2004; ⁵Dohm, 2007;

⁶AHIMA, 2003, ⁷Safran, 2005; ⁸Friedman, 2007; ⁹Leviss, 2006; ¹⁰Shaffer, 2007

In 2008, found a data source for possible answers

- HIMSS Analytics Database
 - Self-reported data from about 5,000 US hospitals, including IT FTE
 - EMR Adoption Model
- IT FTE per bed <0.1 for stages 1-2, rising to ~0.2 for stages 4-6
- Extrapolating to all of US
 - 108,390 IT staff at current adoption at present
 - Would increase to 149,174 if all stages <4 hospitals moved to stage 4
 - Need for >40,000 more!

Stage 7	Medical record fully electronic; CDO able to contribute to EHR as byproduct of EMR
Stage 6	Physician documentation (structured templates), full CDSS (variance & compliance), full R-PACS
Stage 5	Closed loop medication administration
Stage 4	CPOE, CDSS (clinical protocols)
Stage 3	Clinical documentation (flow sheets), CDSS (error checking), PACS available outside Radiology
Stage 2	CDR, CMV, CDSS inference engine, may have Document Imaging
Stage 1	Ancillaries – Lab, Rad, Pharmacy – All Installed
Stage 0	All Three Ancillaries Not Installed



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Among the things that led to

"SEC. 3016. INFORMATION TECHNOLOGY PROFESSIONALS IN HEALTH CARE.

"(a) In General.--The Secretary, in consultation with the Director of the National Science Foundation, shall provide assistance to institutions of higher education (or consortia thereof) to establish or expand medical health informatics education programs, including certification, undergraduate, and masters degree programs, for both health care and information technology students to ensure the rapid and effective utilization and development of health information technologies (in the United States health care infrastructure).

"(b) Activities.--Activities for which assistance may be provided under subsection (a) may include the following:

"(1) Developing and revising curricula in medical health informatics and related disciplines.

"(2) Recruiting and retaining students to the program involved.

"(3) Acquiring equipment necessary for student instruction in these programs, including the installation of testbed networks for student use.

"(4) Establishing or enhancing bridge programs in the health informatics fields between community colleges and universities.

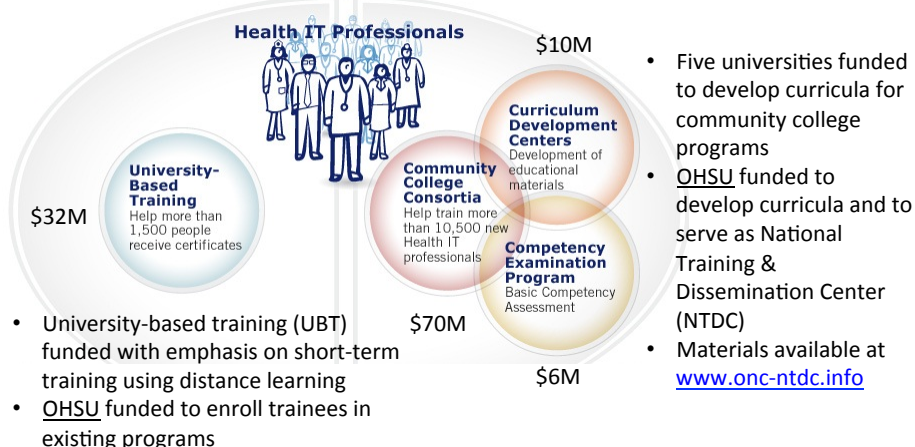
"(c) Priority.--In providing assistance under subsection (a), the Secretary shall give preference to the following:

"(1) Existing education and training programs.

"(2) Programs designed to be completed in less than six months.

Which led to ONC Workforce Development Program

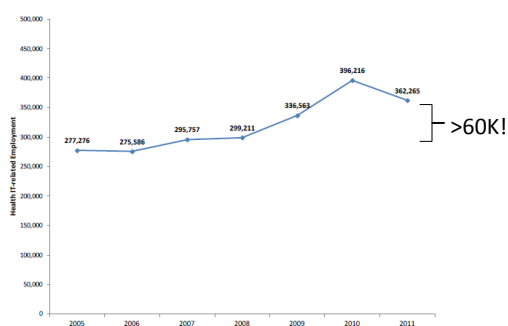
Investment of \$118M based on estimated need for 51,000 health IT professionals in 12 workforce roles (Hersh, 2012)



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HITECH outcomes

- Job growth under-predicted; actual numbers hired have been even higher (Furukawa, 2012; Schwartz, 2013)
- Despite growth of jobs and number trained, shortfalls persist that undermine success of IT projects, including achievement of meaningful use (CHIME, 2012; HIMSS Analytics, 2013; Towers-Watson, 2013)



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What are the competencies required of groups of the workforce?

Table 2 Inventory of competencies in biomedical and health informatics

Organization or Journal [Reference]	Year	Discipline	Title
Association for Computing Machinery [48]	1978	Computer science	Health Computing: Curriculum for an Emerging Profession
[50]	1992	Informatics	Recommendations of the German Association for Medical Informatics, Biometry and Epidemiology
Association of American Medical Colleges [51]	1999	Medical students	Medical School Objectives Project: Medical Informatics
International Medical Informatics Association [52]	2000	Informatics	Recommendations of the International Medical Informatics Association (IMIA) on education in health and medical informatics (updated in 2010)
UK National Health Service [53]	2001	Informatics	Health Informatics Competency Profiles for the NHS
American Nurses Association [54]	2001	Nursing	A Single Study to Determine Informatics Competencies for Nurses at Four Levels of Practice
University of Waterloo, Canada [55]	2001	Informatics	Pointing the Way: Competencies and Curricula in Health Informatics
Northwest Center for Public Health Practice [56]	2002	Public health professionals	Informatics Competencies for Public Health Professionals
American Association of Critical-Care Nurses [56]	2003	Nurse Practitioners	Informatics Competencies for Nurse Practitioners
Advances in Dental Research [57]	2003	Dental Researchers	Biomedical informatics training for dental researchers
American College of Medical Informatics [58]	2004	Bioinformatics	Training the Next Generation of Informaticians: The Impact of "BIS1" and Bioinformatics
Commission on Accreditation for Health Informatics and Information Management Education [59]	2005	Health Information Management	HIM Baccalaureate Degree Program Standards
Commission on Accreditation for Health Informatics and Information Management Education [60]	2005	Health Information Management	HIM Associate Degree Program Standards
International Journal of Medical Informatics [61]	2005	Nursing	Nursing Informatics knowledge and competencies: a national survey of nursing education programs in the United States
Australia [62]	2006	Informatics	Australian Health Informatics Educational Framework
Journal of Internet Research [63]	2006	"Information age" students	Health information literacy and competencies of information age students
UK Council of Health Informatics Professionals [64]	2007	Informatics	Health Informatics National Occupational Standards
Medical Library Association [65]	2007	Health Science Librarians	Health Information Science Knowledge and Skills
Methods of Information in Medicine [66]	2007	Informatics	Benchmarking Statement
Health Informatics Journal [66]	2007	Informatics	Competencies for graduate curricula in health, medical and biomedical informatics: a framework
COACH: Canada's Health Informatics Association [67]	2007	Informatics	Health Informatics Professional Core Competencies
American Nurses Association [68]	2008	Nursing	Scope and Standards of Nursing Informatics Practice

Organization or Journal [Reference]	Year	Discipline	Title
Nursing Clinics of North America [68]	2008	Nursing	Technology and Informatics competencies
AMIA-OHSU 10x10 Course [69]	2009	Informatics	AMIA-OHSU 10x10 Program - Detailed Curriculum, Learning Objectives
AMIA Core Content for Clinical Informatics [35]	2009	Informatics	Core content for certification of physicians (with others to follow later)
TIGER Nursing Informatics [70]	2009	Nursing Informatics	TIGER Informatics Competencies Collaborative (TICC) Final Report
Office of the National Coordinator for Health IT [71]	2009	Electronic health record adoption	HIT Workforce Competencies by Role
Centers for Disease Control and Prevention, [72]	2009	Informatics	Public Health Informatics Competencies
International Medical Informatics Association [73]	2010	Informatics	Recommendations of the International Medical Informatics Association (IMIA) on education in biomedical and health informatics

More recently:

- Clinical informatics core content (Gardner, 2009)
- Clinical informatics fellowship (Safran, 2009)
- Transitions, e.g., from implementation to analytics (Hersh, 2012)

Core content for clinical informatics (Gardner, 2009)

1. Fundamentals

- 1.1. Clinical Informatics
 - 1.1.1. The discipline of informatics
 - 1.1.2. Key informatics concepts, models, theories
 - 1.1.3. Clinical informatics literature
 - 1.1.4. International clinical informatics practices
 - 1.1.5. Ethics and professionalism
- 1.2. Legal and regulatory issues
- 1.3. The Health System
 - 1.3.1. Determinants of individual and population health
 - 1.3.2. Primary domains, organizational structures, cultures, and processes
 - 1.3.3. The flow of data, information, and knowledge within the health system
 - 1.3.4. Policy & regulatory framework
 - 1.3.5. Health economics and financing
 - 1.3.6. Forces shaping health care delivery
 - 1.3.7. Institute of Medicine quality components

2. Clinical Decision Making and Care Process Improvement

- 2.1. Clinical Decision Support
 - 2.1.1. The nature and cognitive aspects of human decision making
 - 2.1.2. Decision science
 - 2.1.3. Application of clinical decision support
 - 2.1.4. Transformation of knowledge into clinical decision support tools
 - 2.1.5. Legal, ethical, and regulatory issues
 - 2.1.6. Quality and safety issues
 - 2.1.7. Supporting decisions for populations of patients
- 2.2. Evidence-based Patient Care
 - 2.2.1. Evidence sources
 - 2.2.2. Evidence grading
 - 2.2.3. Clinical guidelines
 - 2.2.4. Implementation of guidelines as clinical algorithms
 - 2.2.5. Information retrieval and analysis
- 2.3. Clinical Workflow Analysis, Process Redesign, and Quality Improvement
 - 2.3.1. Methods of workflow analysis
 - 2.3.2. Principles of workflow re-engineering
 - 2.3.3. Quality improvement principles and practices

3. Health Information Systems

- 3.1. Information Technology Systems
 - 3.1.1. Computer Systems
 - 3.1.2. Architecture
 - 3.1.3. Networks
 - 3.1.4. Security
 - 3.1.5. Data
 - 3.1.6. Technical approaches that enable sharing data
- 3.2. Human Factors Engineering
 - 3.2.1. Models, theories, and practices of human-computer (machine) interaction (HCI)
 - 3.2.2. HCI Evaluation, usability testing, study design and methods
 - 3.2.3. Interface design standards and design principles
 - 3.2.4. Usability engineering
- 3.3. Health Information Systems and Applications
 - 3.3.1. Types of functions offered by systems
 - 3.3.2. Types of settings where systems are used
 - 3.3.3. Electronic health/medical records systems as the foundational tool
 - 3.3.4. Telemedicine
 - 3.3.5. Clinical Data Standards
 - 3.3.6. Standards development history and current process
 - 3.3.7. Data standards and data sharing
 - 3.3.8. Transaction standards
 - 3.3.9. Messaging standards
 - 3.3.10. Nomenclatures, vocabularies, and terminologies
 - 3.3.11. Ontologies and taxonomies
 - 3.3.12. Interoperability standards
 - 3.3.13. Information System Lifecycle
 - 3.3.14. Institutional governance of clinical information systems
 - 3.3.15. Clinical information needs analysis and system selection
 - 3.3.16. Clinical information system implementation
 - 3.3.17. Clinical information system testing, before, during and after implementation
 - 3.3.18. Clinical information system maintenance
 - 3.3.19. Clinical information system evaluation

4. Leading and Managing Change

- 4.1. Leadership Models, Processes, and Practices
 - 4.1.1. Dimensions of effective leadership
 - 4.1.2. Governance
 - 4.1.3. Negotiation
 - 4.1.4. Conflict management
 - 4.1.5. Collaboration
 - 4.1.6. Motivation
 - 4.1.7. Decision making
- 4.2. Effective Interdisciplinary Teams
 - 4.2.1. Human resources management
 - 4.2.2. Team productivity and effectiveness
 - 4.2.3. Group management processes
 - 4.2.4. Managing meetings
 - 4.2.5. Managing group deliberations
- 4.3. Effective Communications
 - 4.3.1. Effective presentations to groups
 - 4.3.2. Effective one-on-one communication
 - 4.3.3. Writing effectively for various audiences and goals
 - 4.3.4. Developing effective communications program to support system implementation
- 4.4. Project Management
 - 4.4.1. Basic principles
 - 4.4.2. Identifying resources
 - 4.4.3. Resource allocation
 - 4.4.4. Project management tools (non-software specific)
 - 4.4.5. Informatics project challenges
- 4.5. Strategic and Financial Planning for Clinical Information Systems
 - 4.5.1. Establishing mission and objectives
 - 4.5.2. Environmental scanning
 - 4.5.3. Strategy formulation
 - 4.5.4. Action planning and strategy implementation
 - 4.5.5. Capital and operating budgeting
 - 4.5.6. Principles of managerial accounting
 - 4.5.7. Evaluation of planning process
- 4.6. Change Management
 - 4.6.1. Assessment of organizational culture and behavior
 - 4.6.2. Change theories
 - 4.6.3. Change management strategies
 - 4.6.4. Strategies for promoting adoption and effective use of clinical information systems

More longstanding training in informatics has come from NLM

U.S. National Library of Medicine
National Institutes of Health

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NLM's University-based Biomedical Informatics Research Training Programs

In April 2012, Donald A.B. Lindberg, MD, Director of the National Library of Medicine (NLM), announced that NLM awarded 14 five-year grants, totaling more than \$67 million, for research training in biomedical informatics, the discipline that seeks to apply computer and communications technology to improve health. [View press release.](#)

The National Library of Medicine supports research training in biomedical informatics at selected educational institutions in the United States. These programs offer graduate education and postdoctoral research experiences in a wide range of areas including: health care informatics, translational bioinformatics, clinical research informatics, and public health informatics. Many programs also offer additional tracks in areas such as imaging and dental informatics. The organizations funded to do this training are responsible for the selection of trainees; questions about eligibility, program specifics, and levels of support should be addressed to the programs themselves. The location and contact information for NLM's training programs are provided below.

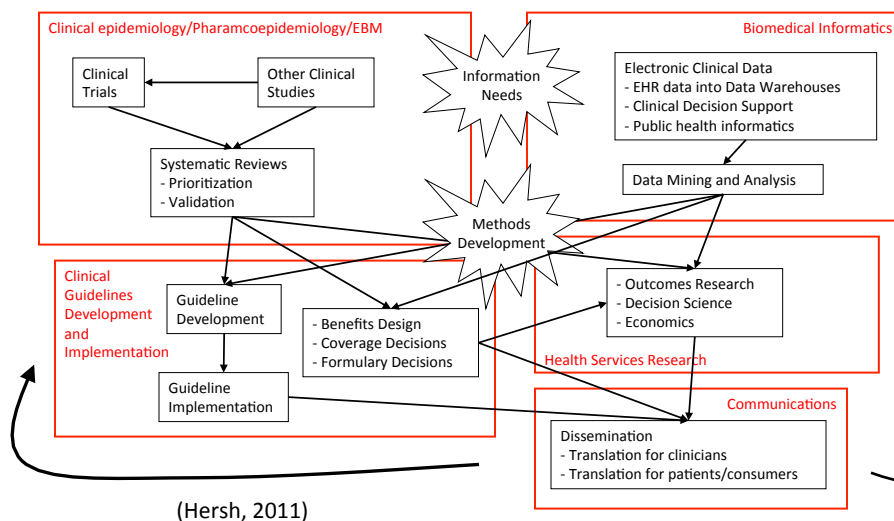
Each NLM informatics research training program makes special efforts to recruit individuals from underrepresented racial and ethnic groups, individuals with disabilities, and those from economically, socially, culturally or educationally disadvantaged backgrounds, into careers in biomedical informatics. Each NLM

Focused on training researchers but many have had operational roles as part of their jobs over the year

Numbers smaller than ONC but more prominent leaders



Informatics also part of comparative effectiveness research workforce



Conclusions

- There has been substantial growth in job opportunities for biomedical informatics
- Growth larger in operational/professional roles but still strong for academic/research areas
 - Augmented by shift of focus to data
- Tempered by reductions in federal research funding, end of meaningful use incentives, and other changes in healthcare