What Competencies in Clinical Informatics Are Required of 21st Century Clinicians and Informaticians?

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Outline

• Background
• Competencies for clinical informaticians
• Competencies in clinical informatics for healthcare professionals
• Educational activities and programs to achieve competence
Many problems in healthcare have information-related solutions

- Quality – not as good as it could be (McGlynn, 2003; Schoen, 2009; NCQA, 2010)
- Safety – errors cause morbidity and mortality; many preventable (Kohn, 2000; Classen, 2011; van den Bos, 2011; Smith 2012)
- Cost – rising costs not sustainable; US spends more but gets less (Angrisano, 2007; Brill, 2013)
- Inaccessible information – missing information frequent in primary care (Smith, 2005)

Substantial evidence that information interventions are part of solution

- Systematic reviews (Chaudhry, 2006; Goldzweig, 2009; Buntin, 2011; Jones, 2014) have identified benefits in a variety of areas, although
  - Quality of many studies could be better
  - Large number of early studies came from a small number of “health IT leader” institutions

![Chart](Buntin, 2011)
These problems and solutions led to the HITECH Act and “meaningful use”

“To improve the quality of our health care while lowering its cost, we will make the immediate investments necessary to ensure that within five years, all of America’s medical records are computerized ... It just won’t save billions of dollars and thousands of jobs – it will save lives by reducing the deadly but preventable medical errors that pervade our health care system.”

January 5, 2009

Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA) (Blumenthal, 2011)

- Incentives for electronic health record (EHR) adoption by physicians and hospitals (up to $27B)
- Direct grants administered by federal agencies ($2B, including $118M for workforce development)

Which has led to significant EHR adoption in the US

Office-based physicians (DesRoches, 2015)

Emergency departments (Jamoom, 2015)

Outpatient departments (Jamoom, 2015)

Non-federal hospitals (Henry, 2016)
But there are still major challenges (Hersh, 2004)

Health Care Information Technology
Progress and Barriers

William Hersh, MD

In the last decade, the term "electronic medical records" has been used, especially in the hospital setting, to refer to computerized patient information systems. "Electronic medical records" have developed as the result of many factors, including technological advances and regulatory pressures. They are a vital component of healthcare delivery systems and are becoming increasingly important in improving patient care and efficiency. However, they also raise important ethical considerations.

- Cost
- Technical challenges
- Interoperability
- Privacy and confidentiality
- Workforce

Biomedical and health informatics underlies the solutions

- **Biomedical and health informatics** (BMHI) is the science of using data and information, often aided by technology, to improve individual health, health care, public health, and biomedical research (Hersh, 2009)
  - It is about information, not technology
  - Area of field focused on informatics for healthcare called clinical informatics
- Practitioners are BMHI are usually called informaticians (sometimes informaticists)
- Overview textbooks: Shortliffe, 2014; Hoyt, 2014
Definition of clinical informatics (ACGME)

- Clinical informatics ... transforms health care by analyzing, designing, implementing, and evaluating information and communication systems to improve patient care, enhance access to care, advance individual and population health outcomes, and strengthen the clinician-patient relationship.

Growth of field has led to increased job opportunities and shortages

- Opportunities
  - Estimated need for 41,000 additional HIT professionals as we moved to more advanced clinical systems (Hersh, 2008)
  - Actual numbers hired were even higher (Furukawa, 2012; Schwartz, 2013)
- Shortages
  - 71% of healthcare CIOs said IT staff shortages could jeopardize an enterprise IT project, while 58% said they would affect meeting meaningful use (CHIME, 2012)
  - More recent surveys paint continued picture of healthcare organizations and vendors having challenges recruiting and maintaining staff (HIMSS, 2014)
Job growth and salaries are high


www.healthitjobs.com

A skilled workforce requires “competence”

• Competency-based education (Frank, 2010)
  – “An approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It de-emphasizes time-based training.”

• Growing adoption in medical education (Holmboe, 2014)
  – Aiming to create milestones for education achievement and development of entrustable professional activities (EPAs) for physicians in training (TenCate, 2013)

• Also being adopted in informatics education
Important topic for those entering the medical school business

Geisinger Health acquires Pa. medical school

By Maria Castelluccio | September 28, 2016

Danville, Pa.-based Geisinger Health System announced Wednesday that it has acquired the Commonwealth Medical College, based in Scranton, Pa. The school will give Geisinger a pipeline of future doctors.

Geisinger, which currently employs 30,000, will retain all 1,200 faculty members at Commonwealth Medical and its approximately 200 students. The system will also support operating costs and expansion at the institution.

Inventory of competencies for various groups (Hersh, 2010)

- Competencies differ by group
  - Informaticians
    - Developing, implementing, and evaluating systems
    - Making optimal use of information
    - Recent elucidation of core competencies by AMIA (Kulikowski, 2012)
  - Clinicians
    - Applying informatics in delivery of care
    - Recent publication of competencies for medical students (Hersh, 2014)
  - Patients
    - Health information literacy
Competencies of clinical informaticians (Safran, 2009)

- Search and appraise the literature relevant to clinical informatics
- Demonstrate fundamental programming, database design, and user interface design skills
- Develop and evaluate evidence-based clinical guidelines and represent them in an actionable way
- Identify changes needed in organizational processes and clinician practices to optimize health system operational effectiveness
- Analyze patient care workflow and processes to identify information system features that would support improved quality, efficiency, effectiveness, and safety of clinical services
- Assess user needs for a clinical information or telecommunication system or application and produce a requirements specification document
- Design or develop a clinical or telecommunication application or system
- Evaluate vendor proposals from the perspectives of meeting clinical needs and the costs of the proposed information solutions
- Develop an implementation plan that addresses the sociotechnical components of system adoption for a clinical or telecommunication system or application
- Evaluate the impact of information system implementation and use on patient care and users
- Develop, analyze, and report effectively (verbally and in writing) about key informatics processes

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
   1.1.6. Ethical and regulatory issues
   1.1.7. The Health System
   1.1.7.1. Determinants of individual and population health
   1.1.7.2. Primary domains, organizational structures, cultures, and processes
   1.1.7.3. The flow of data, information, and knowledge within the health system
   1.1.7.4. Policy & regulatory framework
   1.1.7.5. Health economics and financing
   1.1.7.6. Forces shaping health care delivery
   1.1.7.7. 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 systems
      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. Knowledge management 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. Network, messaging, and practice of human-computer interaction (HCI)
      3.1.7. Interface design standards and design principles
      3.1.8. Usability engineering
      3.1.9. Health Information Systems and Applications
      3.1.10. Health information standards for systems and applications
      3.1.11. Types of settings where systems are used
      3.1.12. Electronic health records systems as the foundational tool
   3.2. Telemedicine
   3.3. Clinical Data Standards
      3.3.1. Standards development history and current process
      3.3.2. Data standards and data sharing
      3.3.3. Transaction standards
      3.3.4. Messaging standards
      3.3.5. Nomenclatures, vocabularies, and terminologies
      3.3.6. Information models and ontologies
      3.3.7. Interoperability standards
      3.3.8. Information System Life Cycle
   3.4. Information System Lifecycle
      3.4.1. Institutional governance of clinical information systems
      3.4.2. Clinical information needs analysis and system selection
      3.4.3. Clinical information system implementation
      3.4.4. Clinical information system testing, before, during, and after implementation
      3.4.5. Clinical information system maintenance
      3.4.6. Clinical information system evaluation

4. Leading and Managing Change
   4.1. Leadership Models, Processes, and Practices
      4.1.1. Characteristics of effective leadership
      4.1.2. Governance
      4.1.3. Negotiation
      4.1.4. Conflict management
      4.1.5. Collaboration
      4.1.6. Empowerment
      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. Interpersonal communication
      4.3.2. Effective face-to-face communication
      4.3.3. Writing effectively for various audiences and goals
      4.3.4. Developing effective communications programs to support system implementation

4.5. Project Management
   4.5.1. Basic principles
   4.5.2. Identifying resources
   4.5.3. Resource allocation
   4.5.4. Project management tools (non-software specific)
   4.5.5. Identifying project challenges
   4.5.6. Informatics project challenges
   4.5.7. Strategic and Financial Planning for Clinical Information Systems
      4.5.1. Establishing mission and objectives
      4.5.2. Environmental scanning
      4.5.3. Strategic 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
      4.5.8. Evaluation of execution
      4.5.9. Evaluation of management and leadership
      4.5.10. Assessment of organizational culture and behavior
      4.5.11. Change theories
      4.5.12. Change management strategies
      4.5.13. Strategies for promoting adoption and effective use of clinical information systems
In reality, applicable to all healthcare professionals and students.

Part of larger health systems science
(Skochelak, 2016)
Academic programs for informaticians

- An ever-growing number of programs – list of US informatics programs on AMIA Web site
  - [http://www.amia.org/education/programs-and-courses](http://www.amia.org/education/programs-and-courses)
- Programs come in many flavors: medical, clinical, biomedical, health, bio-, nursing, etc. informatics
- Funding available for research programs from National Library of Medicine (NLM), which funds fellowships to train future researchers at doctoral and postdoctoral levels at 14 universities
  - Also others from Veteran’s Administration, Kaiser-Permanente, and other institutes of the National Institutes of Health (NIH)
- New fellowships for clinical informatics subspecialists accredited by Accreditation Council for Graduate Medical Education (ACGME)

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OHSU Biomedical Informatics Graduate Program

- Aims to train future professionals, leaders, and researchers
- Graduate level programs
  - Graduate Certificate
  - Master’s – research, professional
  - PhD
- Graduate Certificate and Master’s available online
- Innovations in online learning, including AMIA 10x10 Program

[http://www.ohsu.edu/informatics](http://www.ohsu.edu/informatics)
How have OHSU students and graduates done?

- Now have nearly 20 years of experience...
- General observation: What people do when they graduate is partially dependent on what they did when they entered, e.g.,
  - Physicians, nurses, public health, etc. draw on their clinical/professional background
  - Information technology professionals draw on their unique background and experience
- Graduates have obtained jobs in a variety of settings, e.g., clinical, academic, and industry
- Some have obtained jobs before finishing the program; a few before starting

Clinical informatics subspecialty

- Following usual path of five years of “grandfathering” training requirements to take certification exam before formal fellowships required
- Two paths to eligibility for exam in first five years
  - Practice pathway – practicing 25% time for at least three years within last five years (education counts at half time of practice)
  - Non-traditional fellowships – qualifying educational or training experience, e.g., NLM, VA, or other fellowship or educational program (e.g., master’s degree)
Clinical informatics subspecialty for physicians – history

• 2009
  – American Medical Informatics Association (AMIA) develops and publishes plans for curriculum and training requirements (Gardner, 2009; Safran, 2009)
• 2011
  – American Board of Medical Specialties (ABMS) approves
  – American Board of Preventive Medicine (ABPM) becomes administrative home
• 2013
  – AMIA board review course launched
  – First certification exam administered, with 456 physicians certified, including seven from OHSU

• 2014
  – ACGME rules for fellowship accreditation released, with first three programs accredited (including OHSU)
  – Another 331 physicians certified
• 2015
  – OHSU fellowship launched
  – Another 320 physicians certified (total of 1107)
• 2016
  – 20th program achieves ACGME accreditation
  – Second year of OHSU fellowship
• 2017
  – Last year of “grandfathering” period – although proposal under review at ABPM to extend for five additional years
Clinical training model presents some challenges

- Fragmentation and funding challenges (Detmer, 2014)
- Clinical fellowship model has some aspects of “fitting square pegs into round holes” (Hersh, 2014)
- Requirement of two-year, full-time fellowship for board certification may limit career paths
  - Many clinicians pursue informatics in mid-career
- Concerns about sustainability of funding
  - Fellows may practice but CMS rules do not allow them to bill
- Informatics is not only for physicians – AMIA developing Advanced Health Informatics Certification for others, including non-boarded physicians (Gadd, 2016)
  - [https://www.amia.org/advanced-health-informatics-certification](https://www.amia.org/advanced-health-informatics-certification)

After 2018 (2023?), only pathway will be clinical (ACGME) fellowships

- One of 9 specialties must serve as administrative home
  - Accreditation tied to specialty RRC
- Fellow must stay clinically active in their primary specialty
- Many hope over time that ACGME will allow flexibility and innovation, e.g.,
  - Blended with residencies or other fellowships
  - Training not limited by time or place – especially if we aim for competency-based training
Also need informatics education for clinicians

- OHSU developing curricula around our competencies (Hersh, 2014)
  - Interactive lectures and series, e.g.,
    - “Information is Different Now That You’re a Doctor”
    - “Informatics, EBM, and Critical Thinking”
  - Pearls – weekly 7-10 minute recording on various topics
  - Clinical skills – e.g.,
    - Using EHR
    - Applying quality measures
- Assessments key, including being part of board exams, e.g., USMLE

Conclusions

- Some problems in healthcare have informatics solutions
- Competence in clinical informatics is essential for 21st century healthcare professionals
- Many opportunities for clinical informatics professionals who will lead the way
For more information

- Bill Hersh  
  - [http://www.billhersh.info](http://www.billhersh.info)
- Informatics Professor blog  
  - [http://informaticsprofessor.blogspot.com](http://informaticsprofessor.blogspot.com)
- OHSU Department of Medical Informatics & Clinical Epidemiology (DMICE)  
  - [http://www.ohsu.edu/informatics](http://www.ohsu.edu/informatics)
  - [http://www.youtube.com/watch?v=T-74duDDwvU](http://www.youtube.com/watch?v=T-74duDDwvU)
  - [http://oninformatics.com](http://oninformatics.com)
- What is Biomedical and Health Informatics?  
  - [http://www.billhersh.info/whats](http://www.billhersh.info/whats)
- Office of the National Coordinator for Health IT (ONC)  
  - [http://healthit.hhs.gov](http://healthit.hhs.gov)
- American Medical Informatics Association (AMIA)  
  - [http://www.amia.org](http://www.amia.org)
- National Library of Medicine (NLM)  