Clinical Informatics Subspecialty: What It Is and Why It's Important

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Objectives

- Define biomedical and health informatics and the subspecialty of clinical informatics within it
- Describe why informatics is important to clinical medicine
- Discuss new innovations and approaches to training clinicians and informatics specialists

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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)
- Inaccessible information – missing information frequent in primary care (Smith, 2005)

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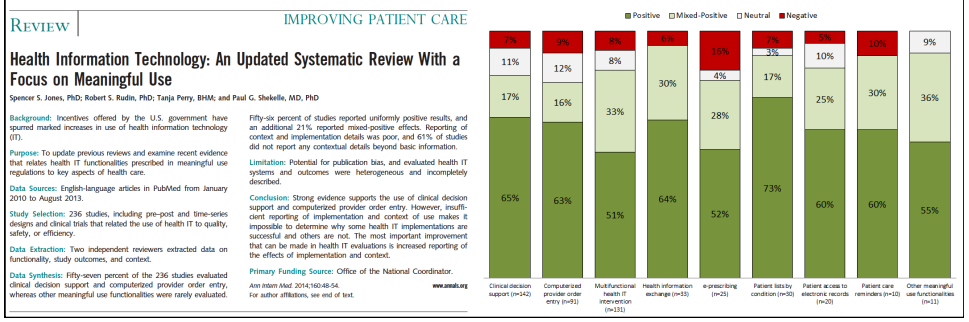
Growing evidence that information interventions are part of solution

- Series of systematic reviews (Chaudhry, 2006; Goldzweig, 2009; Buntin, 2011; Smith, 2014) have identified benefits in a variety of areas
  - Benefits aggregated by meaningful use categories
  - Increasing studies using commercial systems



REVIEW | IMPROVING PATIENT CARE

Health Information Technology: An Updated Systematic Review With a Focus on Meaningful Use

Spencer S. Jones, PhD; Robert S. Rudin, PhD; Tanja Perry, BHM; and Paul G. Shekelle, MD, PhD

Background: Incentives offered by the U.S. government have spurred marked increases in use of health information technology (IT).

Purpose: To update previous reviews and examine recent evidence that relates health IT functionalities prescribed in meaningful use regulations to key aspects of health care.

Data Sources: English-language articles in PubMed from January 2010 to August 2013.

Study Selection: 236 studies, including pre–post and time-series designs and clinical trials that related the use of health IT to quality, safety, or efficiency.

Data Extraction: Two independent reviewers extracted data on functionality, study outcomes, and context.

Data Synthesis: Fifty-seven percent of the 236 studies evaluated clinical decision support and computerized provider order entry, whereas other meaningful use functionalities were rarely evaluated. Fifty-six percent of studies reported uniformly positive results, and an additional 21% reported mixed-positive effects. Reporting of context and implementation details was poor, and 61% of studies did not report any contextual details beyond basic information.

Limitation: Potential for publication bias, and evaluated health IT systems and outcomes were heterogeneous and incompletely described.

Conclusion: Strong evidence supports the use of clinical decision support and computerized provider order entry. However, insufficient reporting of implementation and context of use makes it impossible to determine why some health IT implementations are successful and others are not. The most important improvement that can be made in health IT evaluations is increased reporting of the effects of implementation and context.

Primary Funding Source: Office of the National Coordinator.

Ann Intern Med. 2014;160:48-54.

For author affiliations, see end of text.

www.annals.org

What are the major challenges in getting where we want? (Hersh, 2004)

Health Care Information Technology
Progress and Barriers

William Hersh, MD

IN THE 3 DECADES SINCE THE TERM "MEDICAL INFORMATICS" was first used, individuals working at the intersection of information technology (IT) and medicine have developed and evaluated computer applications aim-

in this issue of JAMA, Slack demonstrates the value that patient-physician e-mail can have in improving patient care, and also catalogs the incomplete but encouraging underlying evidence.[11] As with many applications of IT, the technology can improve the existing situation but also empower clinicians and patients to think more fundamentally about how innovation can lead to changes in the way medicine is practiced

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

care IT.[8,9] It is no exaggeration to declare that the years ahead portend the "decade of health information technology."[10]

Informatics is poised to have a major impact in patient-clinician communication. In the Clinical Crossroads article

ment. The rest goes to those who typically do not pay for

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See also p 2255.

(Reprinted) JAMA, November 10, 2004—Vol 292, No. 18 2273

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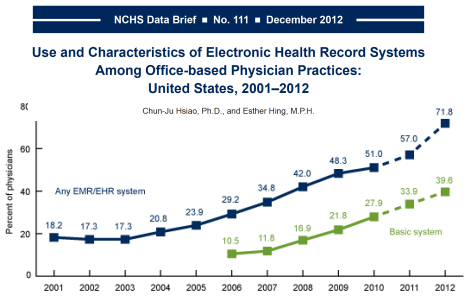
These problems and solutions led to HITECH Act (Blumenthal, various)



(Hsaio, 2014)

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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
  - http://www.billhersh.info/whatis
- Practitioners are BMHI are usually called *informaticians* (sometimes *informaticists*)
- Overview textbooks: Shortliffe, 2014; Hoyt, 2014

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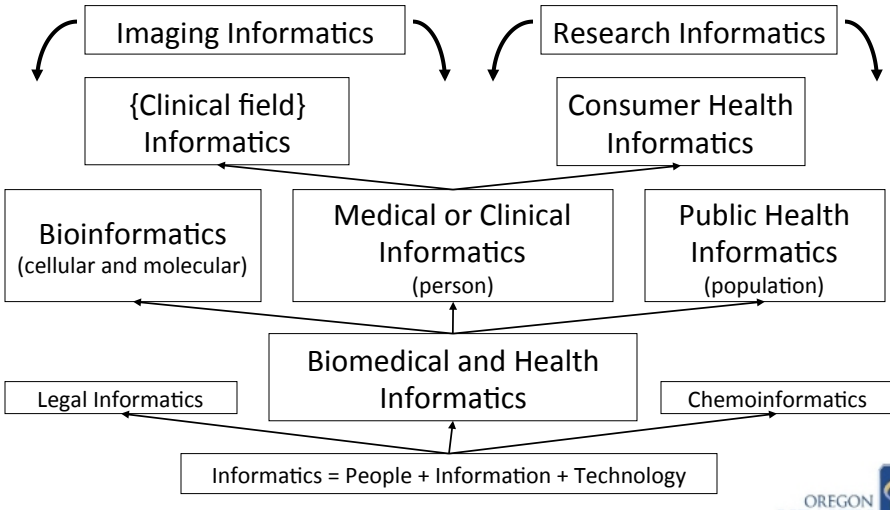
BMHI has many sub-areas



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Growth of field has led to increased job opportunities

- Analysis of HIMSS Analytics Database™ estimated need for 41,000 additional HIT professionals as we moved to more advanced clinical systems (Hersh, 2008)
- ONC increased estimate of need to 50,000, leading to Workforce Development Program being part of HITECH Program (Hersh, 2012)
- Actual numbers hired have been even higher (Furukawa, 2012; Schwartz, 2013) – see next slide

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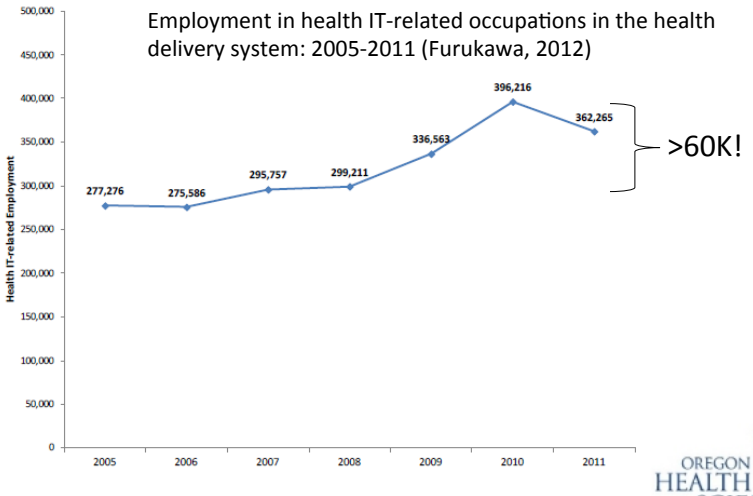
Although we all underestimated the growth

Employment in health IT-related occupations in the health delivery system: 2005-2011 (Furukawa, 2012)



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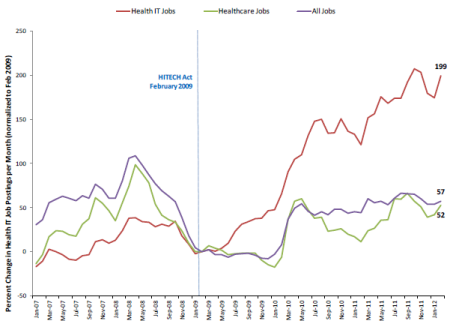
Job postings in health IT

- Percent change in online health IT job postings per month increased much more relative to healthcare jobs and all jobs (Furukawa, 2012)
- Between 2007-2011, 226,356 health IT jobs posted (Schwartz, 2013)



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Still, shortages persist for experienced health IT workforce

- Survey of healthcare CIOs (CHIME, 2012)
  - 71% said IT staff shortages could jeopardize an enterprise IT project, while 58% said they would definitely or possibly affect meeting meaningful use criteria for incentive funding
  - 85% also expressed concerns about being able to retain current staff
- Survey of health IT leaders (HIMSS, 2013)
  - Found comparable picture in both healthcare organizations and vendors having challenges recruiting and maintaining staff

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Clinical informatics subspecialty for physicians

- History
  - 2009 – American Medical Informatics Association (AMIA) develops and publishes plans for curriculum and training requirements
  - 2011 – American Board of Medical Specialties (ABMS) approves; American Board of Preventive Medicine (ABPM) becomes administrative home
    - Subspecialty open to physicians of all primary specialties but not those without a specialty or whose specialty certification has lapsed
  - 2013 – First certification exam offered by ABPM; 455 physicians pass (91%)
  - 2014 – ACGME fellowship rules released (today!)

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Definition of clinical informatics (ACGME)

- Clinical informatics is the subspecialty of all medical specialties that 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

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A better (re-)definition of clinical informatics

- Clinical informatics is the health profession that 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

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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

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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. Legal and regulatory issues
1.2. The Health System
1.2.1. Determinants of individual and population health
1.2.2. Primary domains, organizational structures, cultures, and processes
1.2.3. The flow of data, information, and knowledge within the health system
1.2.4. Policy & regulatory framework
1.2.5. Health economics and financing
1.2.6. Forces shaping health care delivery
1.2.7. 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
3.4. Clinical Data Standards
3.4.1. Standards development history and current process
3.4.2. Data standards and data sharing
3.4.3. Transaction standards
3.4.4. Messaging standards
3.4.5. Nomenclatures, vocabularies, and terminologies
3.4.6. Ontologies and taxonomies
3.4.7. Interoperability standards
3.5. Information System Lifecycle
3.5.1. Institutional governance of clinical information systems
3.5.2. Clinical information needs analysis and system selection
3.5.3. Clinical information system implementation
3.5.4. Clinical information system testing, before, during and after implementation
3.5.5. Clinical information system maintenance
3.5.6. 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

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Clinical informatics subspecialty (cont.)

- 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 fellowship, or educational program (master's degree)

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Clinical fellowship (ACGME) model presents some challenges

- One of 9 specialties must serve as administrative home
  - Accreditation tied to specialty RRC
- Fellow must stay clinically active in their primary specialty
  - But because they are a "fellow," CMS rules do not allow them to bill
- Fellowship duration is to be 2 years, regardless of experience, mastery of competencies, etc.
  - Can be done over 4-year period

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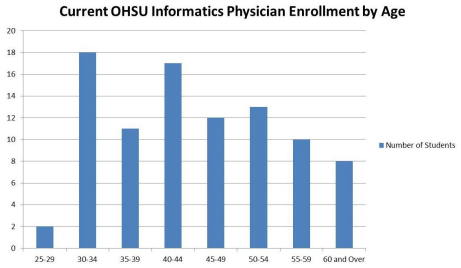
Concerns regarding capacity-building for the subspecialty (Hersh, 2012)

- Age at which many physicians enter informatics
  - OHSU experience shows many physicians (and others) enter field mid-career
- Ability of programs to provide both education and training
  - Will ACGME be flexible regarding educational portions?
- Paying for cost of training
  - Tuition and training grant models have served field well



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Clinical informatics education goes beyond physicians, fellowships, etc.

BMI Graduates to Date by Degree & Track					
	BCB	CI	HIM	Total	%
BCRT	2	291	45	338	61%
MBI	5	124	1	130	23%
MS	8	67	0	75	13%
PHD	5	9	0	14	3%
	20	491	46	557	100%

http://www.ohsu.edu/informatics-education

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Importance of clinical informatics goes beyond informaticians

- Optimizing the electronic health record (EHR)
  - Getting to the "meaningful" part of meaningful use
  - Analytics of EHR and other clinical data for increasing quality, efficiency, and coordination of healthcare
  - Standards, interoperability, and health information exchange (HIE)
  - Will expand to "big data" when we add in data from genomics, imaging, personal health devices, etc.
- Patient engagement
  - Use of personal health record (PHR) for engaging consumers and patients in their health and healthcare
- Precision/personalized medicine
  - Based in part on bioinformatics and computational biology, with potential to revolutionize diagnosis and treatment of disease

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Important for research too

- Clinical & Translational Science Award (CTSA) Program
  - Has galvanized related area of clinical research informatics (Richesson, 2013)
- Patient-Centered Outcomes Institute (PCORI)
  - Comparative effectiveness research
  - Clinical Data Research Networks – www.pcornet.org
- NIH Big Data to Knowledge (BD2K)
  - Training the next generation of scientists in data and related techniques
- I am sure audience can think of more

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Toward a "continuously learning healthcare system" (Smith, 2012)

- Records immediately updated and available for use by patients
- Care delivered the has been proven "reliable at the core and tailored at the margins"
- Patient and family needs and preferences are a central part of the decision process
- All healthcare team members are fully informed about each other's activities in real time
- Prices and total costs are fully transparent to all participants in the care process
- Incentives for payment are structured to "reward outcomes and value, not volume"
- Errors are promptly identified and corrected
- Outcomes are routinely captured and used for continuous improvement

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Informatics is not just for informaticians – what about clinicians?

- In addition to documentation using the electronic health record (EHR), will need competency in "secondary" uses of data (Safran, 2007), including
  - Health information exchange
  - Personal health records
  - Quality measurement and improvement
  - Predictive analytics to identify and act upon outliers
  - Clinical and translational research
  - Public health surveillance

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Informatics is also fundamental to clinician education

- OHSU medical school curriculum being revised
  - Provides opportunity to introduce more informatics into curriculum
  - Process also aided by AMA Accelerating Change in Medical Education grant
- Driven by competencies focused on uses for informatics and not just technology itself
- Each competency built out with
  - Learning objectives
  - Timing in curriculum
  - Mapping to six ACGME core competency domains

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Current working list of competencies (1/2)

- Find, search, and apply knowledge-based information to patient care and other clinical tasks
- Effectively read and write from the electronic health record for patient care and other clinical activities
- Use and guide implementation of clinical decision support (CDS)
- Provide care using population health management approaches
- Protect patient privacy and security
- Use information technology to improve patient safety
- Engage in quality measurement selection and improvement

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Current working list of competencies (2/2)

- Use health information exchange (HIE) to identify and access patient information across clinical settings
- Engage patients to improve their health and care delivery though personal health records and patient portals
- Maintain professionalism through use of information technology tools
- Provide clinical care via telemedicine and refer those for whom it is necessary
- Apply personalized/ precision medicine
- Participate in practice-based clinical and translational research

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For more information

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

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