

What Do 21st Century Medical Students Need to Know about Biomedical and Health Informatics?

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Before we can teach informatics, we must define it

- I get asked this so often that I keep a Web site
 - <http://www.billhersh.info/whatis/>
- And a blog
 - <http://informaticsprofessor.blogspot.com>
- I have also written articles about it
 - Medical informatics: improving healthcare through information (Hersh, 2002)
 - But there are barriers (Hersh, 2004)
 - Characterization of and changes in the profession (Hersh, 2006)
 - Many career opportunities as well (Hersh, 2008)
 - Reconciling definitions of terms (Hersh, 2009)
 - The informatics professional workforce (Hersh, 2010)

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Let us start by defining “informatics”

- The discipline focused on the acquisition, storage, and use of information in a specific setting or domain (Hersh, 2009)
 - Is more about information than technology
- Sometimes defined as activity at the intersection of people, information, and technology →
- The science of “sociotechnical systems” (Coiera, 2007)



(SUNY Buffalo)



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What informatics “is and isn’t” (Friedman, 2012)

- Is
 - Cross-training where basic informational sciences meets a biomedical application domain
 - Relentless pursuit of assisting people
- Is not
 - Scientists or clinicians tinkering with computers
 - Analysis of large data sets
- Fundamental theorem (Friedman, 2009)
 - Goal of informatics is:

$$(\text{Brain} + \text{Computer}) > \text{Brain}$$

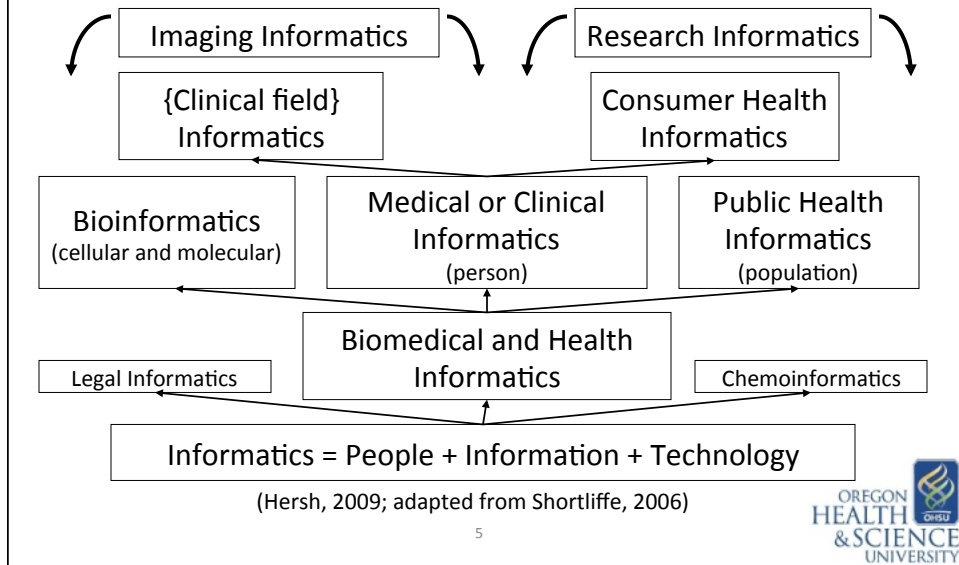
Goal is not:

$$\text{Computer} > \text{Brain}$$



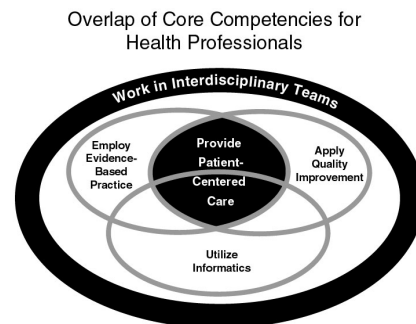
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Classification of biomedical and health informatics



Informatics now viewed as a core competency for health professionals

- According to Institute of Medicine report, the modern healthcare professional must have competency in informatics as part of larger goal to provide patient-centered care (Greiner, 2003)
- Informatics competency is not just computer literacy!
 - The “Google generation” does not necessarily have good information skills (CIBER, 2008)



People in the healthcare system who need competence in informatics

- Consumers/patients
 - And their families and caregivers
- Clinicians
 - Physicians, nurses, and others
- Others in the healthcare system
 - Administrators, librarians, financial personnel, etc.
- Informaticians
 - Researchers, professionals

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Focus of this talk is on clinicians, specifically medical students

- Principles for informatics education of medical students
 - Must approach with perspective of what type of physicians we want them to be
 - Education should be focused on informatics as a tool for better, safer, and cheaper healthcare
- Some visions to guide us
 - www.tomorrowsdoctor.org (Scott, 2013)
 - Inspired by: Smith, 2012
 - Also of note: Kernisan, 2013
 - My own view: Hersh, 2013

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US healthcare system is broken in many ways and needs fixing

BEST CARE AT LOWER COST

The Path to Continuously Learning Health Care in America

WHAT'S POSSIBLE FOR HEALTH CARE?

- Action must be taken to address (Smith, 2012)
 - \$750B in waste (out of \$2.5T system)
 - 75,000 premature deaths
- Sources of waste – from Berwick (2012)
 - Unnecessary services provided
 - Services inefficiently delivered
 - Prices too high relative to costs
 - Excess administrative costs
 - Missed opportunities for prevention
 - Fraud
- One vision for repair is the IOM's "learning healthcare system" (Smith, 2012)

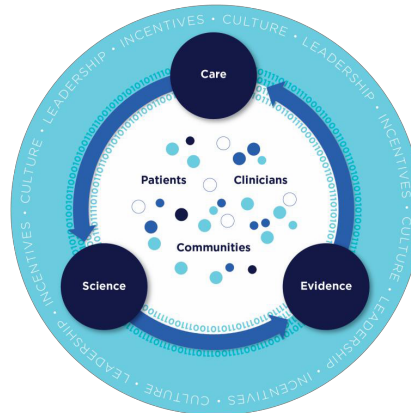
<http://www.iom.edu/Reports/2012/Best-Care-at-Lower-Cost-The-Path-to-Continuously-Learning-Health-Care-in-America.aspx>

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What is the "learning health system?"

- Pursuit of Berwick's "triple aim" of better health, better care, and lower cost (Berwick, 2008)
- A large role for informatics (Friedman, 2010)
- Elaborated in recent IOM report (Smith, 2012)



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What will tomorrow's doctor look like? (Kernisan, 2013)

- Be comfortable with the e-patients
- Engage in shared decision-making
- Be able to coordinate and cooperate with other clinicians
- Be comfortable with continuous quality improvement (CQI) and plan-do-study-act (PDSA) cycles
- Be comfortable learning new ways of practice
- Be comfortable with well-designed technology

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What informatics knowledge and skills must they have? (Hersh, 2013)

- Computer literacy
- Finding information and applying to patient care
- Proper role and use of the patient record
- Patient engagement
- Telemedicine and telehealth
- Population-based care
- Personalized medicine and genomics
- Clinical research

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Computer literacy

- A basic skill that is a prerequisite and not an end in itself
- Computer literacy is not informatics literacy but a requirement for it
- Basic skills include
 - Computer and its core applications – productivity applications
 - Basic Internet applications – email, Web, basic searching
 - Use of mobile devices – smartphones and/or tablets

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Finding and applying information

- Information retrieval, also called search or knowledge management (Hersh, 2009)
- Must be able to
 - Formulate clinical question into an answerable one
 - Select the proper search tool – Pubmed and other NLM databases, textbooks, National Guidelines Clearinghouse, US government sites (e.g., CDC), and even Google (when appropriate)
 - Be a “power” searcher – Pubmed Clinical Queries, advanced features of most search systems

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Finding and applying information (cont.)

- Also must be able to critically appraise search results, i.e., apply evidence-based medicine (EBM) (Straus, 2010)
 - Ask an answerable question
 - Find the best evidence to answer the question
 - Treatment/intervention – randomized controlled trials (RCTs) or systematic reviews thereof
 - Diagnosis – determination of test characteristics (e.g., sensitivity, specificity) and strategies
 - Apply to the patient situation

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Proper role and use of the patient record

- Evolution of patient record from documentation to source of data and information to improve individual and population care
- Essential tools include
 - Electronic health record (EHR) (Lehmann, 2011)
 - Health information exchange (HIE) (Kuperman, 2011)

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Principles of EHR use

- Adhering to standards – use of those ready for “prime time” (Fridsma, 2013)
- Achieving system and data interoperability (Benson, 2012)
- Appropriately and optimally implementing clinical decision support (Osheroff, 2012)
- Maintaining security to assure privacy and confidentiality (ACP, 2011)

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Other aspects of the EHR

- Quality measurement and improvement
 - Quality measures – process vs. outcome
 - Using EHR to streamline collection of quality data
 - Pay for performance, accountable care, and other approaches to quality improvement
- Patient engagement (Riccardi, 2013) – proper use of
 - Personal health record (PHR) (Detmer, 2008; Miller, 2009)
 - Patient portals (Wakefield, 2012)

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Telemedicine and telehealth

- Be able to participate in case where “time and distance separate patients and providers”
- Telemedicine (Lykke, 2011) – major applications include (Hersh, 2006)
 - Store-and-forward – asynchronous, care not in real-time
 - Office/hospital-based – expertise at a distance
 - Home-based – patients getting care in place
- Telehealth (Doty, 2008) – many definitions, related terms include eHealth, mHealth (Krohn, 2012), etc.



Population-based care (IHT², 2012)

- Clinician team will be caring for populations of patients
- Must be able to view care needs and results across their patient population
 - When a new test or treatment comes along that is determined to be highly effective, must be able to quickly identify patients who are candidates for it
 - Must also be able to identify outliers in population who require intervention, such as those with excessively high blood pressure or blood sugar, missed appointments or screening tests, or those at risk for hospital (re-)admission

Personalized medicine and genomics

- Modern clinician should have understanding of how genomics and related areas transforming our understanding of maintaining health, diagnosing disease, and treating it
- If vision of personalized medicine comes to pass, the 21st century clinician will need the help of decision support and other tools for help in applying it to individual patients (Collins, 2011)



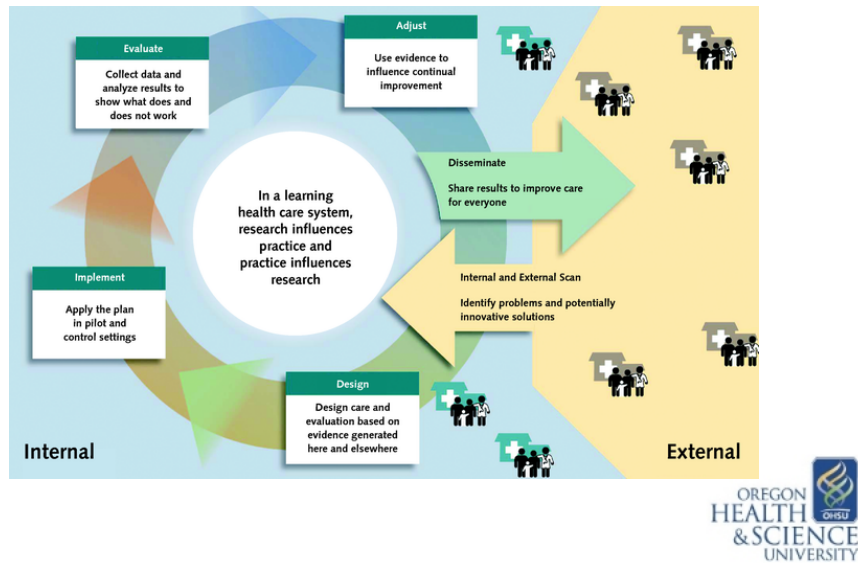
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Clinical research

- Must understand the differences and value contributed by experimental and observational studies
- Ideally, the student will have participated in research while in training
- Even if not, should understand issues like data quality, study design, and the limitations that come from the sharp focus perspective of a clinical study
- Should also be able to participate in clinical research studies and have basic understanding of informatics issues (Richesson, 2012)

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Operationalize learning health system in own environment (Greene, 2012)



Many opportunities, including the new subspecialty of clinical informatics

- Recognition of importance of EHRs and other IT applications focused on facilitating clinical care, clinical and translational research, quality improvement, etc. (Detmer, 2010)
 - Core curriculum (Gardner, 2009)
 - Training requirements (Safran, 2009)
- Growing number of health care organizations hiring physicians into informatics roles, exemplified by (but not limited to) the Chief Medical Informatics Officer (CMIO)
- Approval by ABMS in Sept., 2011 to apply to all specialties
 - Administrative home: American Board of Preventive Medicine (ABPM)
 - www.theabpm.org
 - For more information (Hersh, 2013): <http://informaticsprofessor.blogspot.com/2013/01/eligibility-for-clinical-informatics.html>

Role of educators

- Informatics educators must innovate with other medical educators
- Integration into clinical curriculum – many good examples, some published
 - University of Arizona (Silverman, 2012)
 - Universidad Nacional Autónoma de México (UNAM) (Sánchez-Mendiola, 2013)

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Some final thoughts

- Change can be hard!
- To promote informatics education for medical students, need to promote value of informatics clinically, from improved care to learning health system
- As use of informatics tools, practicing physicians need competence in using tools and informatics physicians must provide guidance and leadership

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