

# Introduction to Biomedical and Health Informatics for OHSU Summer College Interns

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## Goals for talk

- Welcome new summer interns
- Introduce you to field of biomedical and health informatics broadly
- Introduce you to myself and my work
- Highlight the big-picture issues that motivates the field and drives its work
- Describe the educational opportunities in the field



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## Outline of talk

- Information-related problems and solutions in healthcare
- What is biomedical and health informatics?
- Why do we need more informatics?
- Why are we not there?
- Details of ARRA programs
- The workforce need for informatics
- Educational and career opportunities in informatics

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## Many problems in healthcare have information-related solutions

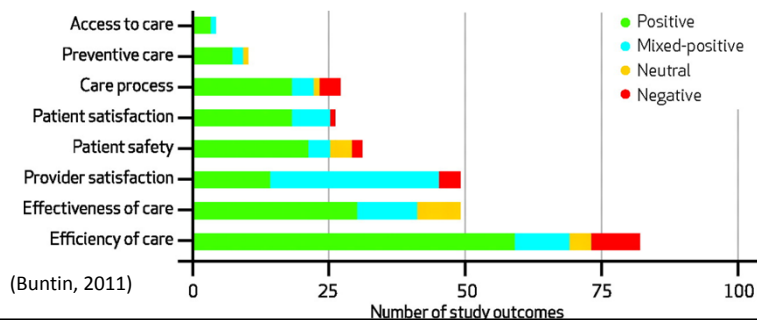
- Quality – not as good as it could be (McGlynn, 2003; Schoen, 2009; NCQA, 2010)
- Safety – errors cause morbidity and mortality; many preventable (Kohn, 2000; Classen, 2011; van den Bos, 2011)
- Cost – rising costs not sustainable; US spends more but gets less (Angrisano, 2007)
- Inaccessible information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

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## Growing evidence that information interventions are part of solution

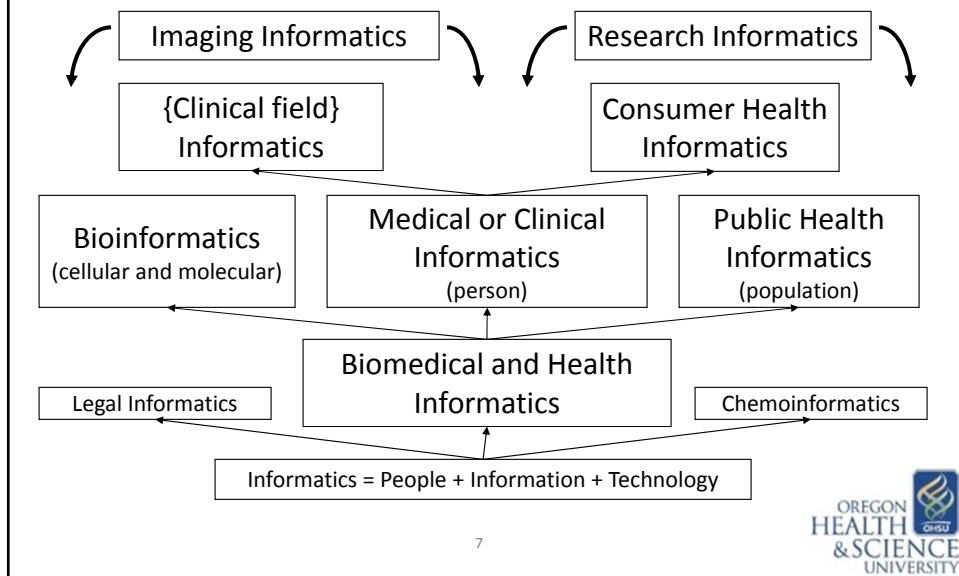
- Systematic reviews (Chaudhry, 2006; Goldzweig, 2009; Buntin, 2011) have identified benefits in a variety of areas
  - Although 18-25% of studies come from a small number of 'health IT leader' institutions



## 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*)

## BMHI has many sub-areas



## Informatics before the Obama era

- Growing recognition of value in healthcare
  - Evidence for improved safety, quality, and cost of healthcare
  - Widespread usage worldwide (Schoen, 2009; Protti, 2010)
  - Research and demonstration funding by NLM, AHRQ, and others
  - Actions of Bush Administration – e.g., appointment of first National Coordinator for HIT, establishment of AHIC, HITSP, etc.
- Emerging importance in other areas
  - Clinical and translational research – prominent role in CTSA programs (Bernstam, 2009; Richesson, 2012)
  - Genomics – bioinformatics, personalized medicine (Hamburg, 2010)
  - Consumer health – growth of personal health records (PHRs) (Detmer, 2008; Miller, 2009), including from companies, e.g., Microsoft HealthVault

Then a new US president came along...



*"To lower health care cost, cut medical errors, and improve care, we'll computerize the nation's health records in five years, saving billions of dollars in health care costs and countless lives."*

First Weekly Address  
Saturday, January 24, 2009



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...and we entered a new "ARRA"

- Health Information Technology for Economic and Clinical Health (HITECH) Act of the American Recovery and Reinvestment Act (ARRA)
  - Incentives for electronic health record (EHR) adoption by physicians and hospitals (up to \$27B)
  - Direct grants administered by federal agencies (\$2B)
- Other provisions in other areas of ARRA, e.g.,
  - Comparative effectiveness research
  - NIH and other research funding
  - Broadband and other infrastructure funding



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# Why has it been so difficult to get there? (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 aimed at improving health care. The work has been

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.<sup>11</sup> 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.<sup>12</sup> It is no exaggeration to declare that the years ahead portend the "decade of health information technology."<sup>13</sup> Informatics is poised to have a major impact in patient-clinician communication. In the Clinical Crossroads article

See also p 2255.

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

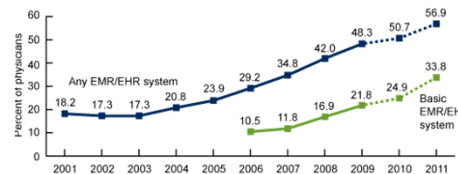
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(Reprinted) JAMA, November 10, 2004—Vol 292, No 18 2273

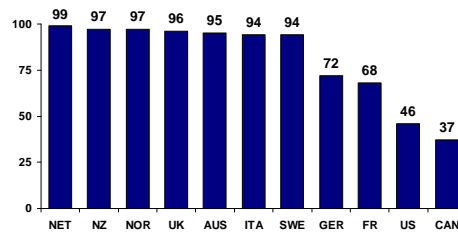


## US has low rates of adoption in inpatient and outpatient settings

- Adoption in the US is low for both outpatient (Hsiao, 2011) and inpatient settings (DesRoches, 2012) though improving
- By most measures, US is a laggard and could learn from other countries (Schoen, 2009)
- Most other developed countries have undertaken ambitious efforts, e.g.,
  - Denmark (Protti, 2010)
  - England (Payne, 2011)



(Hsiao, 2011)



(Schoen, 2009)

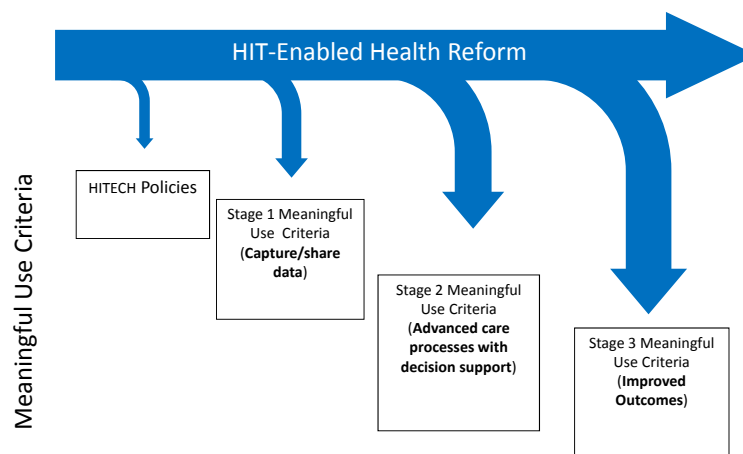
## The new “ARRA” of health information technology (HIT) in the US

- HITECH provides financial incentives for “meaningful use” (MU) of HIT
  - Inspired by Stark (2011); operationalized by Blumenthal (2011)
  - All initiatives administered by the Office of the National Coordinator for Health IT (ONC, <http://healthit.hhs.gov/>)
- MU is driven by five goals for the US healthcare system
  - Improving quality, safety and efficiency
  - Engaging patients in their care
  - Increasing coordination of care
  - Improving the health status of the population
  - Ensuring privacy and security

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## MU to be implemented in three stages



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# Implementation of MU

- Implemented through Medicare or Medicaid reimbursement to
  - Eligible professionals (EPs)
    - \$44-63K (differs based on Medicare vs. Medicaid)
    - Must achieve 15 core and 5 of 10 menu objectives (one in public health)
  - Eligible hospitals (EHs)
    - \$2-9M (based on size as measured by number of discharges)
    - Must achieve 14 core and 5 of 10 menu objectives (one in public health)

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## Stage 1 core criteria (14 EH, 15 EP)

Objective	Measure
Core set of objectives to be achieved by all eligible professionals, hospitals, and critical access hospitals to qualify for incentive payments	
Record patient demographics (sex, race, ethnicity, date of birth, preferred language, and in the case of hospitals, date and preliminary cause in the event of death)	Over 50% of patients' demographic data recorded as structured data
Record vital signs and chart changes (height, weight, blood pressure, body-mass index, growth charts for children)	Over 50% of patients 2 years of age or older have height, weight, and blood pressure recorded as structured data
Maintain up-to-date problem list of current and active diagnoses	Over 80% of patients have at least one entry recorded as structured data
Maintain active medication list	Over 80% of patients have at least one entry recorded as structured data
Maintain active medication allergy list	Over 80% of patients have at least one entry recorded as structured data
Record smoking status for patients 13 years of age or older	Over 50% of patients 13 years of age or older have smoking status recorded as structured data
For individual professionals, provide patients with clinical summaries for each office visit; for hospitals, provide an electronic copy of hospital discharge instructions on request	Clinical summaries provided to patients for over 50% of all office visits within 3 business days; over 50% of all patients who are discharged from the inpatient department or emergency department of an eligible hospital or critical access hospital and who request an electronic copy of their discharge instructions are provided with it
On request, provide patients with an electronic copy of their health information (including diagnostic test results, problem list, medication lists, medication allergies, and for hospitals, discharge summary and procedures)	Over 50% of requesting patients receive electronic copy within 3 business days
Generate and transmit permissible prescriptions electronically (does not apply to hospitals)	Over 40% are transmitted electronically using certified EHR technology
Computer provider order entry (CPOE) for medication orders	Over 30% of patients with at least one medication in their medication list have at least one medication ordered through CPOE
Implement drug-drug and drug-allergy interaction checks	Functionality is enabled for these checks for the entire reporting period
Implement capability to electronically exchange key clinical information among providers and patient-authorized entities	Perform at least one test of EHR's capacity to electronically exchange information
Implement one clinical decision support rule and ability to track compliance with the rule	One clinical decision support rule implemented
Implement systems to protect privacy and security of patient data in the EHR	Conduct or review a security risk analysis, implement security updates as necessary, and correct identified security deficiencies
Report clinical quality measures to CMS or states	For 2011, provide aggregate numerator and denominator through attestation; for 2012, electronically submit measures

## Stage 1 menu criteria (5 of 10)

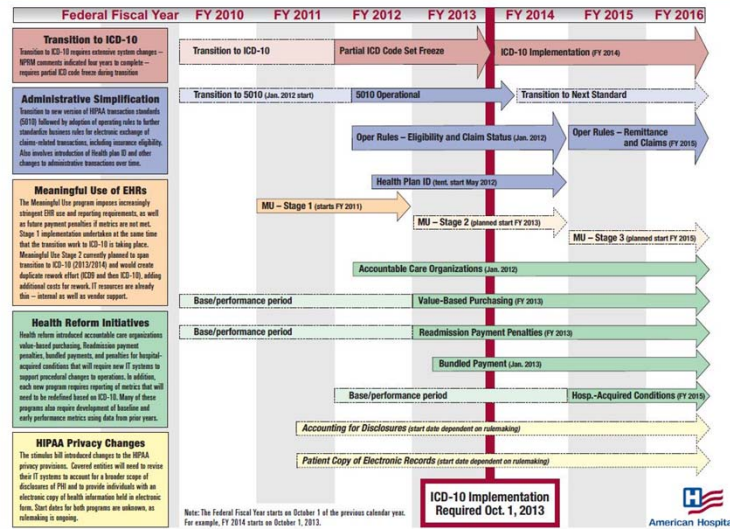
Objective	Measure
Eligible professionals, hospitals, and critical access hospitals may select any five choices from the menu set	
Implement drug formulary checks	Drug formulary check system is implemented and has access to at least one internal or external drug formulary for the entire reporting period
Incorporate clinical laboratory test results into EHRs as structured data	Over 40% of clinical laboratory test results whose results are in positive/negative or numerical format are incorporated into EHRs as structured data
Generate lists of patients by specific conditions to use for quality improvement, reduction of disparities, research, or outreach	Generate at least one listing of patients with a specific condition
Use EHR technology to identify patient-specific education resources and provide those to the patient as appropriate	Over 10% of patients are provided patient-specific education resources
Perform medication reconciliation between care settings	Medication reconciliation is performed for over 50% of transitions of care
Provide summary of care record for patients referred or transitioned to another provider or setting	Summary of care record is provided for over 50% of patient transitions or referrals
Submit electronic immunization data to immunization registries or immunization information systems	Perform at least one test of data submission and follow-up submission (where registries can accept electronic submissions)
Submit electronic syndromic surveillance data to public health agencies	Perform at least one test of data submission and follow-up submission (where public health agencies can accept electronic data)
Additional choices for hospitals and critical access hospitals	
Record advance directives for patients 65 years of age or older	Over 50% of patients 65 years of age or older have an indication of an advance-directive status recorded
Submit electronic data on reportable laboratory results to public health agencies	Perform at least one test of data submission and follow-up submission (where public health agencies can accept electronic data)
Additional choices for eligible professionals	
Send reminders to patients (per patient preference) for preventive and follow-up care	Over 20% of patients 65 years of age or older or 5 years of age or younger are sent appropriate reminders
Provide patients with timely electronic access to their health information (including laboratory results, problem list, medication lists, medication allergies)	Over 10% of patients are provided electronic access to information within 4 days of its being updated in the EHR

## Quality measures – differ for EP and EH but required for both

- EP (outpatient) – three required or alternate measures plus three of 13 others, e.g.,
  - Hypertension – blood pressure measurement
  - Tobacco use assessment and cessation intervention
  - Adult weight screening and follow-up
- EH (inpatient) – 15 required measures, e.g.,
  - Diabetes: Hemoglobin A1c, low-density lipoprotein, and blood pressure control
  - Influenza immunization for patients > 50 years old
  - Pneumonia vaccination status for older adults
  - Breast cancer screening
  - Colorectal cancer screening

# MU is just one of several challenges

## Overlapping Timelines of ICD-10, Meaningful Use of EHRs, and Health Reform Initiatives



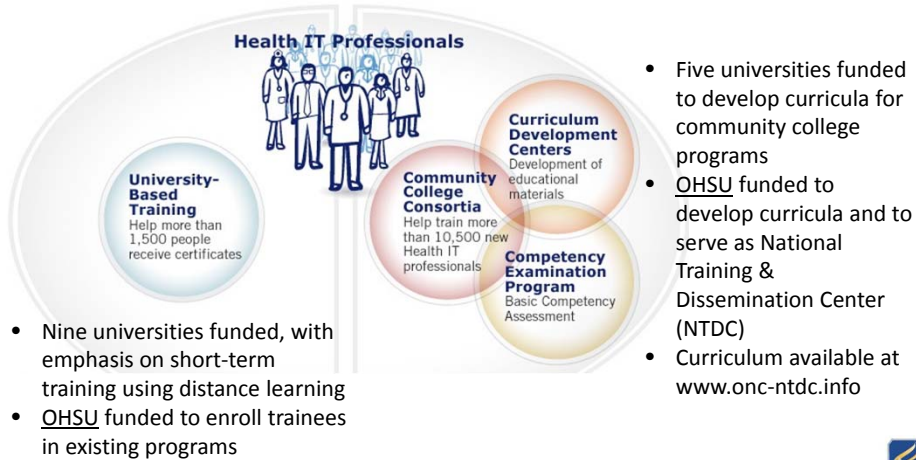
<http://www.aha.org/advocacy-issues/hit/mu/overw-time.shtml>

## Other HITECH funding initiatives

- HIT Regional Extension Centers (RECs)
  - \$677 million to fund 62 RECs that will provide guidance, mainly to small primary care practices, in achieving meaningful use (Maxson, 2010), e.g., in Oregon: OHITEC
- State-based health information exchange (HIE)
  - \$547 million in grants to states to develop HIE programs (Kuperman, 2011)
- Beacon communities
  - \$250 million to fund 17 communities that provide exemplary demonstration of the meaningful use of EHRs (McKethan, 2011)
- Strategic health information advanced research projects (SHARP)
  - \$60 million for four collaborative research centers

# ONC Workforce Development Program

Based on estimated need for 51,000 professionals in 12 workforce roles



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## ONC workforce roles to implement the HITECH agenda

- Mobile Adoption Support Roles
  - Implementation support specialist\*
  - Practice workflow and information management redesign specialist\*
  - Clinician consultant\*
  - Implementation manager\*
- Permanent Staff of Health Care Delivery and Public Health Sites
  - Technical/software support staff\*
  - Trainer\*
  - Clinician/public health leader†
  - Health information management and exchange specialist†
  - Health information privacy and security specialist†
- Health Care and Public Health Informaticians
  - Research and development scientist†
  - Programmers and software engineer†
  - Health IT sub-specialist†

(being trained in \*community colleges and † universities)

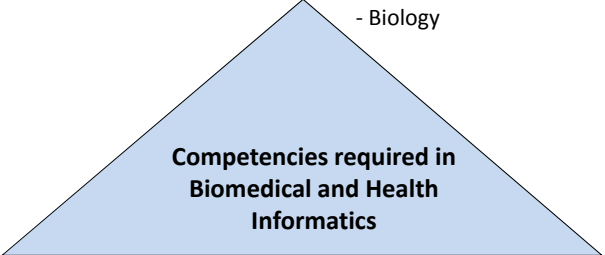
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## What competencies must informaticians have? (Hersh, 2009)

### Health and biological sciences:

- Medicine, nursing, etc.
- Public health
- Biology



### Competencies required in Biomedical and Health Informatics

### Management and social sciences:

- Business administration
- Human resources
- Organizational behavior

### Computational and mathematical sciences:

- Computer science
- Information technology
- Statistics

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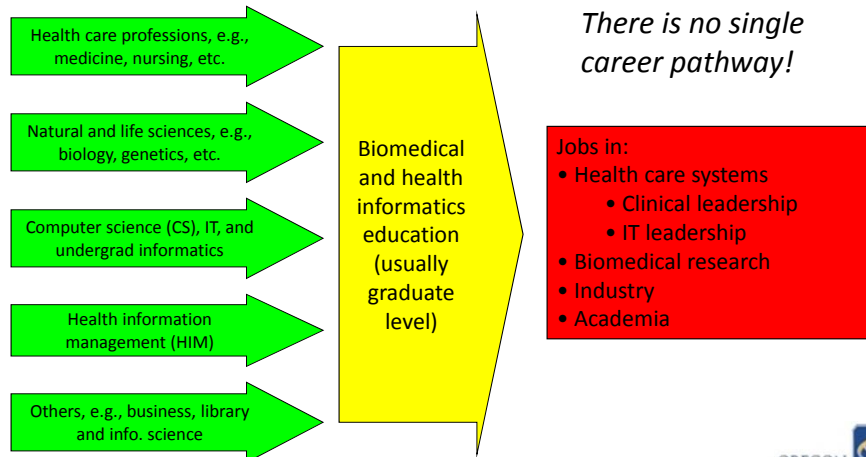
## Opportunities for career development and study in BMHI

- Formal certification in various disciplines
  - Baccalaureate certification in nursing informatics for many years
  - Long-standing certification in HIM, e.g., CCS, RHIT, RHIA
  - New subspecialty for physicians recently approved (Shortliffe, 2011)
- Educational programs at growing number of institutions
  - <http://www.amia.org/informatics-academic-training-programs>
- OHSU program one of largest and well-established (Hersh, 2007)
  - Graduate level programs at Certificate, Master's, and PhD levels
  - "Building block" approach allows courses to be carried forward to higher levels

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## Career pathways have diverse inputs and outputs (Hersh, 2009)



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## Experience of the OHSU program (<http://www.ohsu.edu/informatics/>)

- Graduate level programs at Certificate, Master's, and PhD levels
  - "Building block" approach allows courses to be carried forward to higher levels
- Two "populations" of students
  - "First-career" students more likely to be full-time, on-campus, and from variety of backgrounds
  - "Career-changing" students likely to be part-time, distance, mostly (though not exclusively) from healthcare professions
- Many of latter group prefer "a la carte" learning
  - This has led to the successful 10x10 ("ten by ten") program that began as OHSU-AMIA partnership (Hersh, 2007; Feldman, 2008)
    - Overview and access to demo: <http://www.billhersh.info/10x10.html>
  - Significant minority of these adult learners do not complete a program but still use knowledge and skills gained



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## Overview of OHSU graduate programs

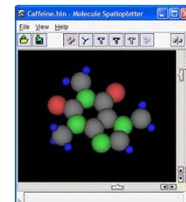
<u>Masters</u> - Tracks: - Clinical Informatics - Bioinformatics - Thesis or Capstone	<u>PhD</u> - Knowledge Base - Advanced Research Methods - Biostatistics - Cognate - Advanced Topics - Doctoral Symposium - Mentored Teaching - Dissertation
<u>Graduate Certificate</u> - Tracks: - Clinical Informatics - Health Information Management	
<u>10x10</u> - Or introductory course	

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## Opportunities in BMHI are not limited to healthcare

- Bioinformatics – genomics and personalized medicine (Sarkar, 2011; Fernald, 2011)
- Clinical and translational research – building a “learning” healthcare system (Friedman, 2010; Richesson, 2012)
- Public health – protecting the public and promoting health (Araujo, 2009)
- Consumer health – for all ages, especially aging Internet-savvy baby boomers (Detmer, 2008; Gibbons, 2009)
- Imaging informatics – use of images for biomedical research, clinical care, etc. (Bui, 2008)

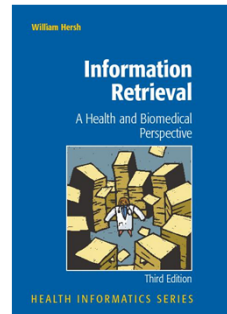


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## My own research

- Information Retrieval (aka, Search)
  - Access to online information, from journals, Web sites, images, etc. to medical records with major effort now focused on latter
    - TREC Medical Records Track (Voorhees, 2011) – part of larger interest in “secondary use” of clinical data (Safran, 2007)
  - Hosting ACM SIGIR 2012 conference this summer
    - <http://sigir.org/sigir2012/>



[www.irbook.info](http://www.irbook.info)  
(Hersh, 2009)



## Conclusions

- BMHI is an important science and profession for improving health, healthcare, public health, and biomedical research with data and information
  - Most resources in clinical informatics but plenty of other opportunity in bioinformatics, public health informatics, consumer health informatics, clinical research informatics, imaging informatics, etc.
- The grand experiment of HITECH is going on in the US – results not yet in
- There are many opportunities for practitioners, researchers, and others in BMHI



## 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://www.informatics-scholarship.info>
  - <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>