OHSU MS3 Continuity Curriculum:
What is Biomedical and Health Informatics?
Why is it Important?

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Outline

- Problems in our healthcare system and a vision for fixing them
- Biomedical and health informatics is part of the solution
- Growing use of the electronic health record (EHR)
- Secondary use of clinical data and its challenges
- Skills and workforce need to get there, including the new clinical informatics subspecialty

Some problems in healthcare addressed by informatics

- 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; OECD, 2011)
- Inaccessible information – missing information frequent in primary care (Smith, 2005)

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Some visions for solving these problems

- 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

Triple aim (Berwick, 2008)

- Better care
- Better health
- Lower cost

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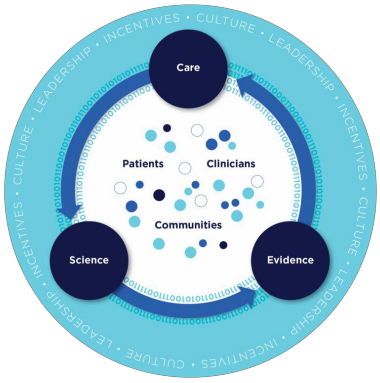
We need to go from:

(Smith, 2012)

To:



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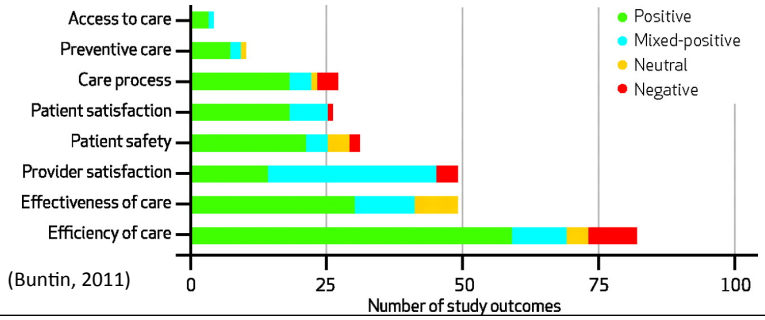
There is evidence that information interventions are part of solution

- 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



(Buntin, 2011)

What is [biomedical and health] informatics?

What is biomedical and health informatics?

- 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
- Practitioners are BMHI are usually called informaticians (sometimes informaticists)

What are the areas within biomedical and health informatics?

- Bioinformatics
- Medical/clinical informatics
- Consumer health informatics
- Clinical research informatics

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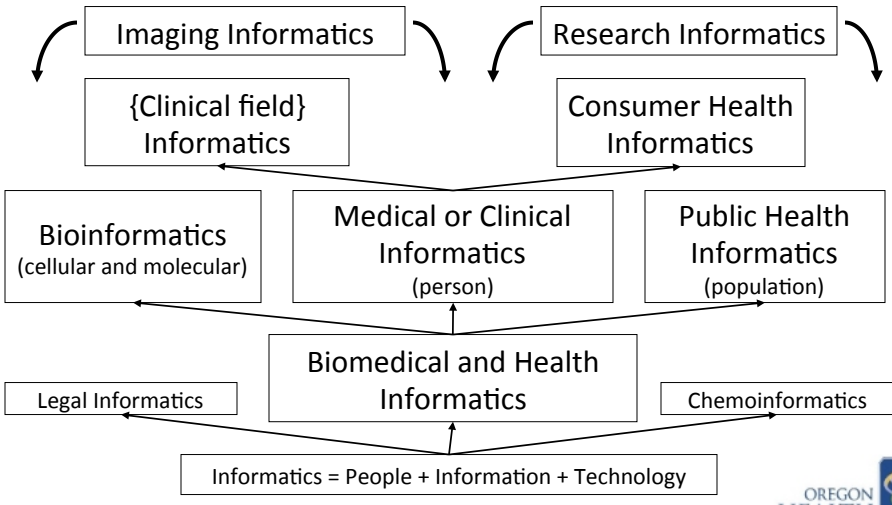
Biomedical and health informatics



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Sounds easy; why are we not there?

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Why are we not 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 aim-

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

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 inno-

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

See also p 2255.

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

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How far have we come?

- *What proportion of US physicians use EHRs?*
- *How does EHR use in the US compare to elsewhere in the world?*

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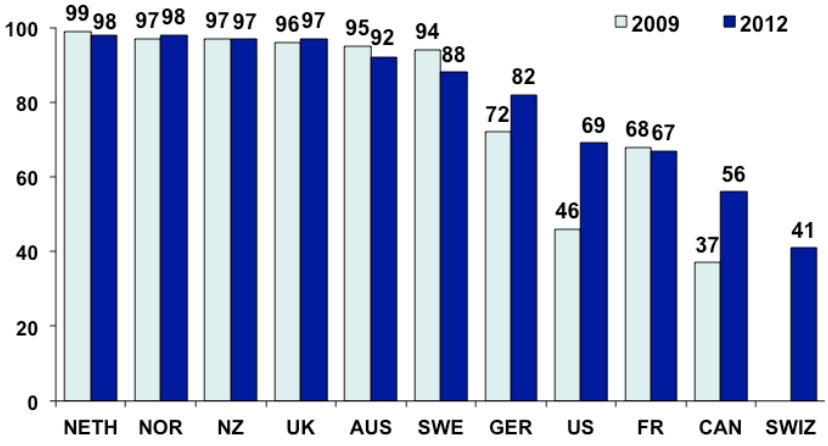
The US is a laggard, but improving (Schoen, 2012)



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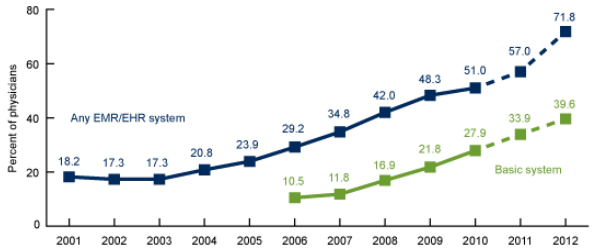
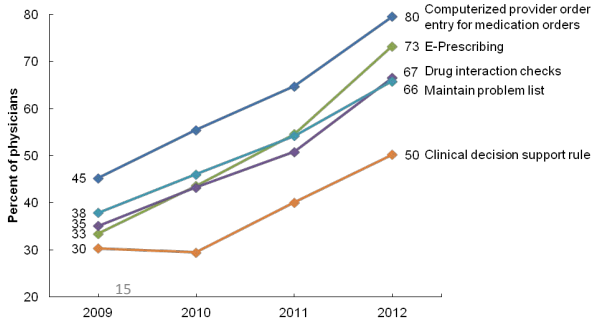
We are catching up

(Hsaio, CDC, 2012)



(King, ONC, 2012)



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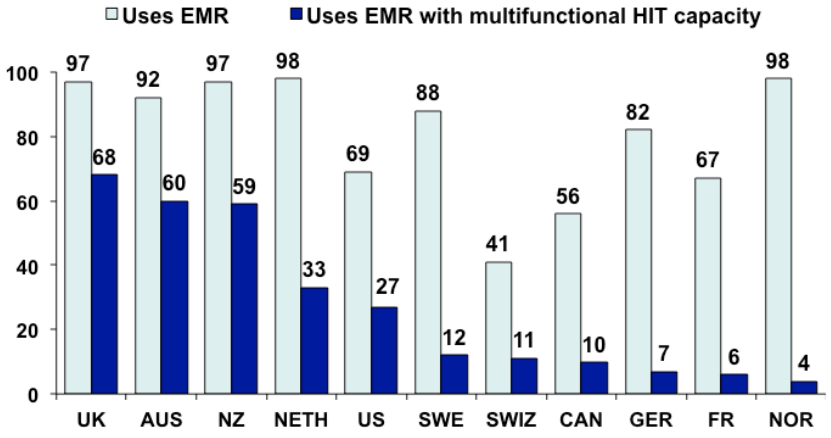
But advanced functionality is less common everywhere (Schoen, 2012)



Multifunctional health IT capacity – use of at least two electronic functions: order entry management, generating patient information, generating panel information, and routine clinical decision support

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How are we trying to get there?

- *Have you heard of the following?*
  - Meaningful use
  - Health information exchange
  - Clinical decision support
  - Healthcare quality measurement and improvement
  - Evidence-based medicine
  - Patient engagement

US investment has been substantial

"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)

Centerpiece of HITECH is incentives for "meaningful use" of EHRs

- Driven by five underlying goals for 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
- Consists of three requirements – use of certified EHR technology
  - In a meaningful manner – criteria mapped to above goals
  - Connected for health information exchange (HIE)
  - To submit information on clinical quality measures

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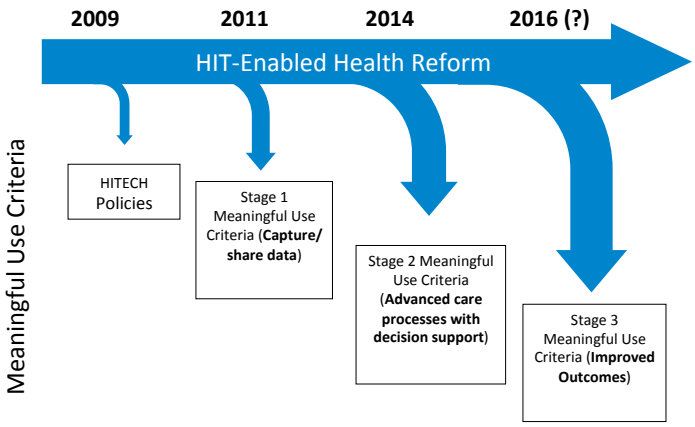
Implemented in three stages – www.healthit.gov



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Additional value from "secondary use" or "re-use" of clinical data

- Many secondary uses or re-uses of EHR and other clinical data (Safran, 2007); these include
  - Health information exchange
  - Personal health records
  - Using data to improve care delivery and coordination
  - Quality measurement and improvement
  - Clinical and translational research
  - Public health surveillance
  - Implementing the learning health system

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Health information exchange (HIE)

- Patients are "mobile" in many ways – data bears this out
  - In Massachusetts, of 3.69M patients visiting acute care facilities, 31% visited more than one, accounting for 56% of all visits, and 1% visited five or more (Bourgeois, 2010)
  - In Indiana, 40% of patients visiting EDs had data at more than one hospital, with network analysis showed all EDs sharing patients (Finnell, 2011)
- "Data following the patient"
  - Dr. Carolyn Clancy, Director, AHRQ, 2007
- "Electronic sharing of data among hospitals, physicians, clinical laboratories, radiology centers, pharmacies, health plans (insurers), and public health departments." (GAO, 2010)
- Requires that information be interoperable and flow seamlessly across business boundaries (Kuperman, 2011)
- Part of HITECH investment: $564 for state-based HIE

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Personal health record (PHR)

- "Electronic lifelong resource of health information needed by individuals to make health decisions," guided by principles (AHIMA, 2005)
  - Individuals own and manage information, which comes from healthcare providers and individual
  - Maintained in secure, private environment
  - Individual determines rights of access
  - Does not replace legal record of provider
- Types of PHRs (Miller, 2009)
  - Tethered – connected to one EHR, e.g., MyChart
  - Standalone – data entered by patient
  - Integrated – data comes from many sources

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Using data to improve care delivery and coordination

- US healthcare system still mostly based on fee for service model – little incentive for managing care in coordinated manner
- Primary care medical homes (PCMHs) coordinate care and provide incentive for better use of data (Longworth, 2011)
- Affordable Care Act (ACA, aka Obamacare) implements accountable care organizations (ACOs), which provide bundled payments for conditions (Longworth, 2011)
  - Oregon at forefront with coordinated care organizations (CCOs) (Stecker, 2013)
- All of these innovations require use of data to improve quality and reduce cost

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Quality measurement and improvement

- Quality measures increasingly used in US and elsewhere
- Use has been more for process than outcome measures (Lee, 2011), e.g., Stage 1 meaningful use

NQF Measure Number & PQRI Implementation Number	Clinical Quality Measure Title
Core Clinical Quality Measures	
NQF 0013	Hypertension: Blood Pressure Measurement
NQF 0028	Preventive Care and Screening Measure Pair: a) Tobacco Use Assessment, b) Tobacco Cessation Intervention
NQF 0421 PQRI 128	Adult Weight Screening and Follow-up
Alternate Clinical Quality Measures	
NQF 0024	Weight Assessment and Counseling for Children and Adolescents
NQF0041 PQRI 110	Preventive Care and Screening: Influenza Immunization for Patients 50 Years Old or Older
NQF 0038	Childhood Immunization Status

Quality measurement and improvement

- In UK, pay for performance schemes achieved early value but fewer further gains (Serumaga, 2011)
- In US, some quality measures found to lead to improved patient outcomes (e.g., Wang, 2011), others not (e.g., Jha, 2012)
- Desire is to derive automatically from EHR data, but this has proven challenging with current systems (Parsons, 2012; Kern, 2013)

EHR data use for clinical research

- Not only benefit conventional research but allows new approaches (Richesson, 2012), e.g.,
  - Replication of randomized controlled trial (RCT) outcomes using EHR data and statistical corrections (Tannen, 2007; Tannen, 2008; Tannen, 2009)
  - Associating "phenotype" with genotype to replicate known associations as well as identify new ones in eMERGE (Kho, 2011; Denny, 2010)
  - Promise of genomics and bioinformatics yielding other successes as well (Kann, 2013)

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Public health

- Improving interface between healthcare and public health systems (Klompas, 2012)
- "Syndromic surveillance" – uses data sources for early detection of public health threats, from bioterrorism to emergent diseases
  - Interest increased after 9/11 attacks (Henning, 2004; Chapman, 2004; Gerbier, 2011)
  - One notable success is Google Flu Trends – http://www.google.org/flutrends/
    - search terms entered into Google predict flu activity, but not enough to allow intervention (Ginsberg, 2009)
    - Less accuracy more recently (Butler, 2013)

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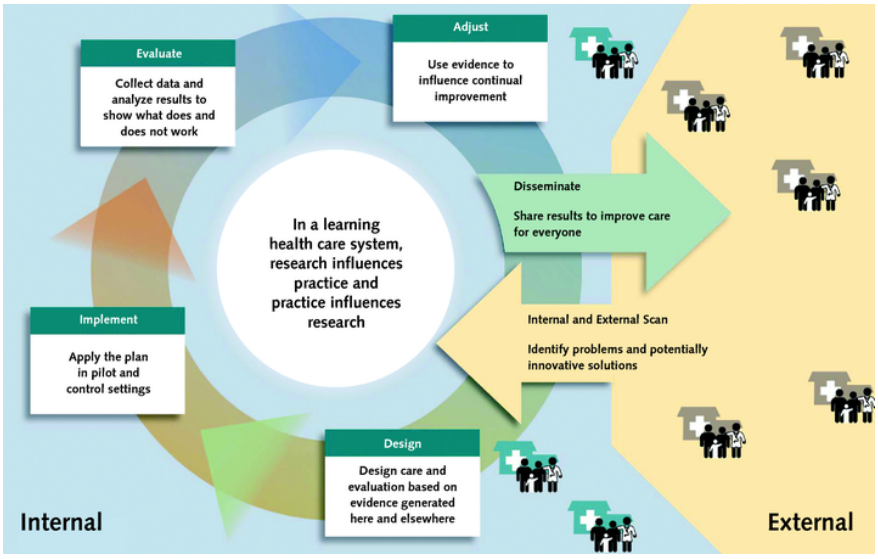
Implementing the learning healthcare system (Greene, 2012)



What are the limitations of EHR data for these uses?

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Some challenges for secondary use of clinical data

- Data quality and accuracy is not a top priority for busy clinicians (de Lusignan, 2005)
- Patients get care at different places (Bourgeois, 2010; Finnell, 2011)
- Standards and interoperability – mature approaches but lack of widespread adoption (Kellermann, 2013)
- EHR data can be incorrect and incomplete, especially for longitudinal assessment (Hersh, 2013)
- Much data is "locked" in text (Hripcsak, 2012)
- Average pediatric ICU patient generates 1348 information items per 24 hours (Manor-Shulman, 2008)

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Challenges (cont.)

- Many data "idiosyncrasies" (Hersh, 2013)
  - "Left censoring": First instance of disease in record may not be when first manifested
  - "Right censoring": Data source may not cover long enough time interval
  - Data might not be captured from other clinical (other hospitals or health systems) or non-clinical (OTC drugs) settings
  - Bias in testing or treatment
  - Institutional or personal variation in practice or documentation styles
  - Inconsistent use of coding or standards

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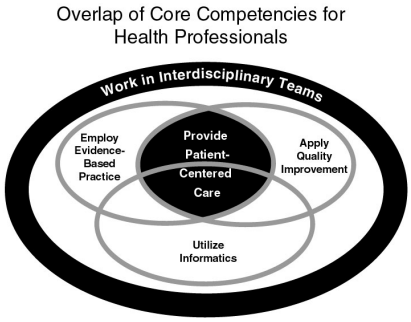
Another need is for skilled clinicians and informaticians

- Knowledge of informatics essential for data-rich, information-driven future – both for clinicians as well informatics professionals (Greiner, 2003; Hersh, 2010)
- 21st century physicians need skills, not only in using EHRs and knowledge sources, but the full range of vision in the IOM *Best Care, Lower Cost* report (Hersh, 2013)
- For informatics professionals, this may be aided by coming certification, starting with physicians (Shortliffe, 2011)



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Opportunities for career development and study in BMHI

- Historical training at graduate and/or postdoc levels
- 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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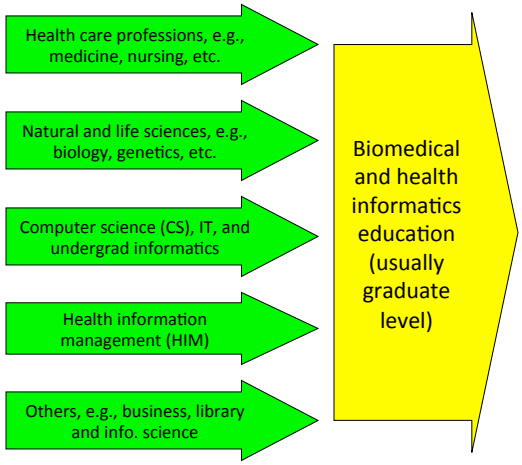
Career pathways have diverse inputs and outputs (Hersh, 2009)



There is no single career pathway!

Jobs in:
- Health care systems
  - Clinical leadership
  - IT leadership
- Biomedical research
- Industry
- Academia

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Overview of OHSU graduate programs

<u>PhD</u>
- Knowledge Base
- Advanced Research Methods
- Biostatistics
- Cognate
- Advanced Topics
- Doctoral Symposium
- Mentored Teaching
- Dissertation

<u>Masters</u>
- Tracks:
  - Clinical Informatics
  - Bioinformatics
- Thesis or Capstone

<u>Graduate Certificate</u>
- Tracks:
  - Clinical Informatics
  - Health Information Management

<u>10x10</u>
- Or introductory course

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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 (Shortliffe, 2011)
  - Administrative home: American Board of Preventive Medicine (ABPM)

Qualifications

- ABPM makes the rules but my interpretations (Hersh, 2013)
- MD degree from LCME-accredited institution
- Current valid license to practice medicine
- ABMS member board certification
- In first five years, one of
  - Practice pathway – minimum of 25% time over 36 months (education/training time counts as half)
  - Non-accredited fellowship – two-year minimum in fellowships offered by approved training programs (such as OHSU)
- After first five years
  - Accreditation Council for Graduate Medical Education (ACGME)-accredited fellowship

Next steps

- ABPM
  - First certification exam to be administered in October, 2013
- ACGME
  - Defining criteria for accredited fellowships; will be only pathway to subspecialization starting in 2018
- Institutions like OHSU with existing graduate programs and research fellowships
  - Adapt programs to new requirements

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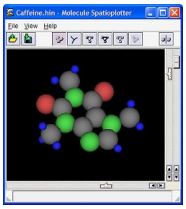
Opportunities in informatics are <u>not</u> limited to healthcare

- Bioinformatics – genomics and personalized medicine (Sarkar, 2011; Kann, 2013)
- Clinical and translational research – building a "learning" healthcare system (Embi, 2009; 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, 2010)



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Some issues ahead for informatics

- Who "owns" patient data?
- Should patients be able to access their medical records, all or part?
- Should healthcare delivery organizations be required to exchange data with others?
- Should physicians have their practices monitored for quality, safety, cost, etc.?

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Conclusions

- A growing body of evidence supports EHR and other IT to improve health and healthcare
- The world is gradually adopting EHRs and other IT
- The next step is to make use of the increasing data achieve the learning healthcare system
- There are challenges, but also benefits, to this use data-driven, information-driven evolution
- There are growing opportunities for physicians who want to subspecialize in clinical informatics

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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://www.healthit.gov
- American Medical Informatics Association (AMIA)
  - http://www.amia.org
- National Library of Medicine (NLM)
  - http://www.nlm.nih.gov