Overview of Clinical Informatics Activities in the US

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Outline

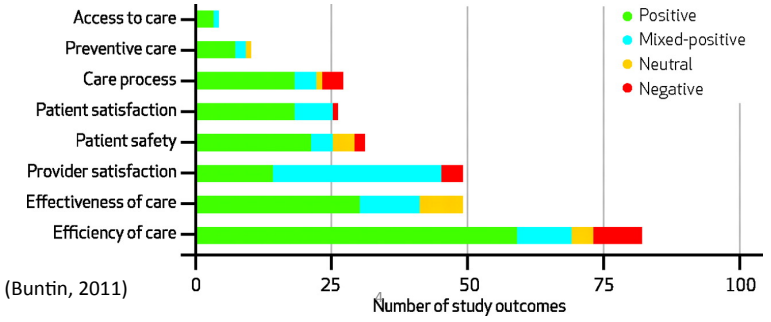
- Rationale for use of information technology (IT) in healthcare, including the electronic health record (EHR)
- Recent increase in adoption of EHRs due to the Health Information Technology for Economic and Clinical Health (HITECH) Act
- Results of HITECH – good and bad
- Physician leadership in clinical informatics

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 – cost growth has slowed, but US still spends more and gets less (Angrisano, 2007; Brill, 2013; Martin, 2016)
- Inaccessible information – missing information common in primary care (Smith, 2005)

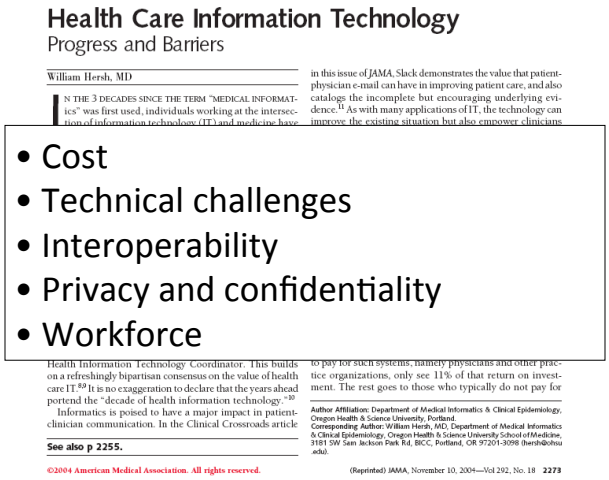
Growing evidence that information interventions are part of solution

- 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



(Buntin, 2011)

What has been holding us back? (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

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

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

Health Information Technology Coordinator. This builds on a refreshingly bipartisan consensus on the value of health care IT.[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

to pay for such systems, namely physicians and other practice organizations, only see 11% of that return on investment. The rest goes to those who typically do not pay for

See also p 2255.

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American Recovery and Reinvestment Act (ARRA) provided the opportunity

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updated 7:42 a.m. EST, Mon January 12, 2009

Obama's big idea: Digital health records

President-elect Barack Obama, as part of his effort to revive the economy, is proposing a massive effort to modernize health care by making all health records standardized and electronic. The government estimates about 212,000 jobs could be created by this program, CNNMoney reports. full story

"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

HITECH Act (Blumenthal, 2011)

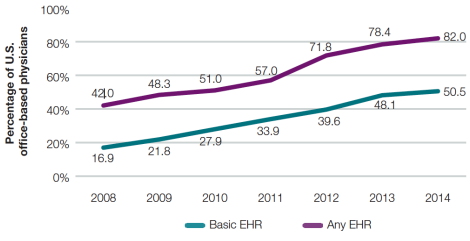
- Incentives for EHR adoption by physicians and hospitals (up to $27B)
- Direct grants by federal agencies ($2B, including $118M for workforce development)

What did HITECH entail?

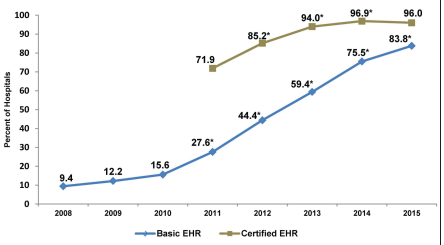
- Incentives for "meaningful use" (MU) of the EHR, which required (Blumenthal, 2010)
  - Eligible hospitals and professionals meeting criteria in three stages
  - Using certified EHR technology
  - Adhering to specified standards
  - Able to measure and send quality measures as well as enable health information exchange (HIE)

Results of HITECH

Office-based physicians
(DesRoches, 2015)

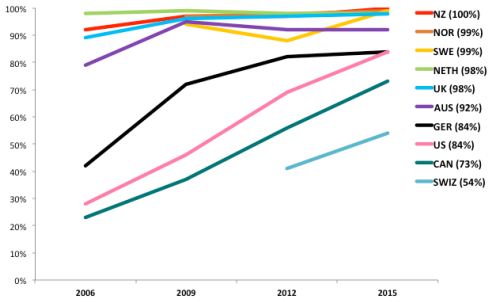


Non-federal hospitals
(Henry, 2016)

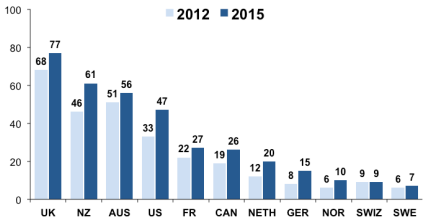


US no longer an international laggard but we all have a long ways to go

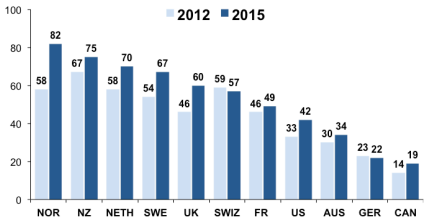
EHR adoption by physicians



Clinical decision support (computerized reminders)



Exchange patient summaries (health information exchange)



(Osborn, 2015)

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Although adoption increased, other problems arose

- Incomplete interoperability
- Adverse impact on workflow
- Conundrum of structured vs. unstructured data
- Problems with usability
- Safety
- Security

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Lack of interoperability

- Despite large-scale adoption, systems do not communicate well
- Several causes
  - Incomplete adoption of standards (ONC, 2015)
  - Inadequate (?) incentives for health information exchange (HIE) under MU
  - Information blocking (ONC, 2015)?

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Adverse impact on workflow

- Famous JAMA cartoon (Toll, 2012)
- Too much focus on computer than patient – "writing the wrong" (Patel, 2015)
- Dr. Paul Chang and the "demise of radiology rounds" (Jersild, 2012)
- Facilitates workarounds, such as copy-and-paste (or "sloppy and paste?") (O'Reilly, 2013)

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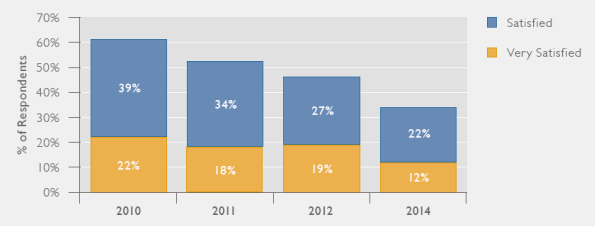
Usability

- Substantial physician dissatisfaction (Martineau, 2014)
- Partly due to conundrum of structured vs. unstructured data
  - Structured data facilitates re-use
  - Narrative data tells the patient's story
    - "Patients do not speak template" (Lewis, 2011)
    - Many physicians do not trust check boxes in EHRs (Personal Communications)



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OHSU

RESEARCH REPORT

Factors Affecting Physician Professional Satisfaction and Their Implications for Patient Care, Health Systems, and Health Policy

Mark W. Friedberg • Peggy G. Chen • Kristin R. Van Busum • Frances M. Aunon
Chau Pham • John P. Caloyeras • Soeren Mattke • Emma Pitchforth
Denise D. Quigley • Robert H. Brook • F. Jay Crosson • Michael Tutty

The Pros and Cons of Electronic Health Records

- Physicians approved of EHRs in concept and appreciated having better ability to remotely access patient information and improvements in quality of care.
- However, for many physicians, the current state of EHR technology significantly worsened professional satisfaction in multiple ways.
- Aspects of current EHRs that were particularly common sources of dissatisfaction included poor usability, time-consuming data entry, interference with face-to-face patient care, inefficient and less fulfilling work content, inability to exchange health information, and degradation of clinical documentation.

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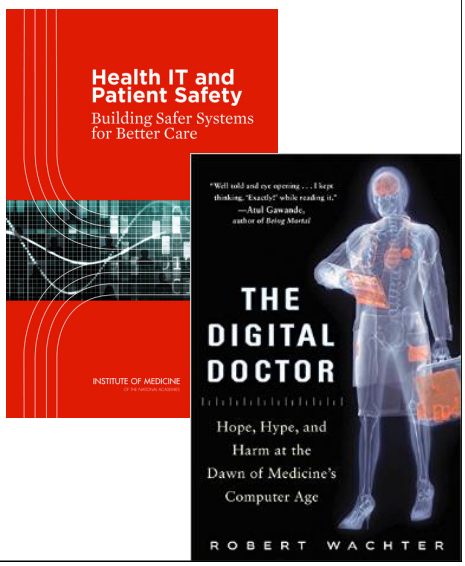
The same EHRs we tout for safety may undermine it

- Concerns led to Joint Commission Sentinel Event alerts (42, 2008; 54, 2015)
- IOM report called for more effective monitoring and study (IOM, 2012), including a roadmap for avoiding e-iatrogenesis (Ash, 2012)
- Well-known mishaps
  - 38 times dose of antibiotic (Wachter, 2015)
  - Ebola patient in Dallas hospital (Cortese, 2015)



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Security

- 2015 was the year of major breaches
  - Anthem – over 80M records (Rubenfire, 2015)
  - Premera Blue Cross – over 11M records (Vinton, 2015)
  - Excellus Blue Cross – over 10M records (Rubenfire, 2015)
- Going forward from 2015-2019, estimated 1 in 13 patients will suffer medical identify theft, at cost of $300B to system (Kalis, 2015)
- Not limited to healthcare
  - https://www.opm.gov/cybersecurity

"Your previous provider refused to share your electronic medical records, but not to worry —I was able to obtain all of your information online."

(Two-fer, NewYorker)

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Clinical informatics can lead to improved use of the EHR

- There is still research evidence that health IT improves care
- Emerging models for more effective use
- Advocacy for improved usability, interoperability
- Robust opportunities, especially related to data science/analytics

thinkgeek.com

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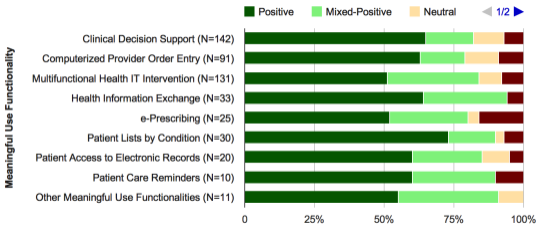
There is still a (mostly) positive evidence base (Jones, 2014)



Author Sentiment of Meaningful Use Functionality					
Meaningful Use Functionality	Number of MU Impacts	Positive	Mixed-Positive	Neutral	Negative
Clinical Decisions Support	142	65%	17%	11%	7%
Computerized Provider Order Entry	91	63%	16%	12%	9%
Multifunctional Health IT Intervention	131	51%	33%	8%	8%
Health Information Exchange	33	64%	30%	0%	6%
e-Prescribing	25	52%	28%	4%	16%
Patient Lists by Condition	30	73%	17%	3%	7%
Patient Access to Electronic Records	20	60%	25%	10%	5%
Patient Care Reminders	10	60%	30%	0%	10%
Other Meaningful Use Functionalities	11	55%	36%	9%	0%

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Evidence in support of value of EHR continues

- Enhancing patient-provider communication (Berry, 2011)
- Extracting phenotype from the EHR (Denny, 2013; Wei, 2015)
- Rapid learning in oncology (Yu, 2015)
- Detection and early action on, e.g.,
  - Delays in cancer diagnosis (Murphy, 2014; Murphy, 2015)
  - Risk of readmission (Amarasingham, 2013; Hebert, 2014)
  - Postoperative complications (Menendez, 2015)

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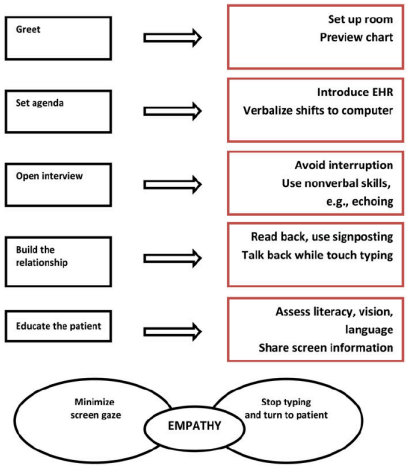
Emerging models for more effective exam room use



(Duke, 2013)

- POISED model (Frankel, 2015)
  - Prepare
  - Orient
  - Information gathering
  - Share
  - Educate
  - Debrief

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Advocacy for improved usability and interoperability

- AMA usability principles (AMA, 2014)
- AMIA white paper (Payne, 2015)
- ACP documentation (Kuhn, 2015)
- ONC Shared Nationwide Interoperability Roadmap (ONC, 2015)
  - Substantial push for Fast Healthcare Interoperability Resources (FHIR; Benson, 2016) – http://www.hl7.org/implement/standards/fhir/

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Opportunities still exist

- Optimists note the "data dividend" of MU (Perlin, in Walsh, 2015)
- Predictive analytics has potential to augment modern clinical practice (Sniderman, 2015)
- Rationale for EHRs still exists
  - Diagnostic (IOM, 2015) and therapeutic (James, 2013) errors still abound; informatics part of the solution
  - Precision medicine will require EHRs and mobile devices to build 1M patient cohort (NIH, 2015)

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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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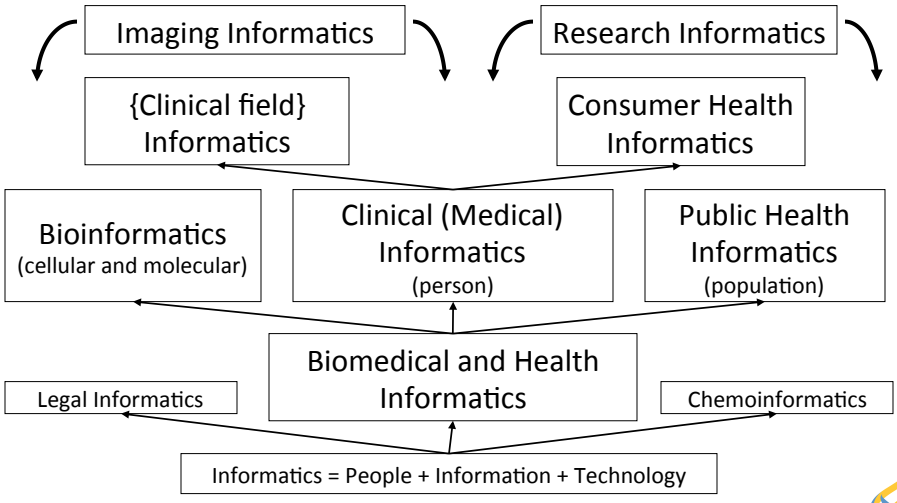
Informatics has many sub-areas



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Growing role for physicians in clinical informatics

- Most prominent (but not only) position is Chief Medical Informatics Officer (CMIO) (Kilbridge, 2012)
- Has led to new subspecialty of all specialties (Detmer, 2014)
  - *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* (ACGME)

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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)

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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 (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 7 from OHSU

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Clinical informatics subspecialty for physicians – history

- 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 reaches ACGME accreditation
  - Second year of OHSU fellowship
- 2017
  - Last year of "grandfathering" period; starting in 2018, only pathway to board certification is accredited fellowship

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Informatics competence is also fundamental to clinician practice

- 21st century physicians and other clinicians must have competence in clinical informatics
- Driven by competencies focused on uses for informatics and not just technology itself
- What are the competencies in clinical informatics for clinicians?
  - One listing focused on medical students (Hersh, 2014) – probably applicable to all health professional students

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PERSPECTIVES

Beyond information retrieval and electronic health record use: competencies in clinical informatics for medical education

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Abstract: Physicians in the 21st century will increasingly interact in diverse ways with information systems, requiring competence in many aspects of clinical informatics. In recent years, many medical school curricula have added content in information retrieval (search) and basic use of the electronic health record. However, this omits the growing number of other ways that physicians are interacting with information that includes activities such as clinical decision support, quality measurement and improvement, personal health records, telemedicine, and personalized medicine. We describe a process whereby six faculty members representing different perspectives came together to define competencies in clinical informatics for a curriculum transformation process occurring at Oregon Health & Science University. From the broad competencies, we also developed specific learning objectives and milestones, an implementation schedule, and mapping to general competency domains. We present our work to encourage debate and refinement as well as facilitate evaluation in this area.

Table 1 Competencies in clinical informatics and specific learning objective/milestone within each

Competency	Learning objectives/milestones
Find, search, and apply knowledge-based information to patient care and other clinical tasks	Information retrieval/search: choose correct source for specific task, search using advanced features, apply results Evaluate information resources (literature, databases, etc) for their quality, funding sources, biases Identify tools to assess patient safety (eg, medication interactions) Utilize knowledge-based tools to answer clinical questions at the point of care (eg, textbooks, calculators, etc) Formulate an answerable clinical question Determine the costs/charges of medications and tests Identify deviations from normal (laboratory tests/X-ray/results) and develop a list of causes of the deviation
Effectively read and write from the electronic health record for patient care and other clinical activities	Graph, display, and trend vital signs and laboratory values over time Adopt a uniform method of reviewing a patient record Create and maintain an accurate problem list Recognize medical safety issues related to poor chart maintenance Identify a normal range of results for a specific patient Access and compare radiographs over time Identify inaccuracies in the problem list/history/medication list/allergies Create useable notes Write orders and prescriptions List common errors with data entry (drop down lists, copy and paste, etc)
Use and guide implementation of CDS	Recognize different types of CDS Be able to use different types of CDS Work with clinical and informatics colleagues to guide CDS use in clinical settings
Provide care using population health management approaches	Utilize patient record (data collection and data entry) to assist with disease management Create reports for populations in different health care delivery systems Use and apply data in accountable care, care coordination, and the primary care medical home settings
Protect patient privacy and security	Use security features of information systems Adhere to HIPAA privacy and security regulation Describe and manage ethical issues in privacy and security
Use information technology to improve patient safety	Perform a root-cause analysis to uncover patient safety problems Familiarity with safety issues Use resources to solve safety issues
Engage in quality measurement selection and improvement	Recognize the types and limitations of different types of quality measures Determine the pros and cons of a quality measure, how to measure it, and how to use it to change care
Use HIE to identify and access patient information across clinical settings	Recognize issues of dispersed patient information across clinical locations Participate in the use of HIE to improve clinical care
Engage patients to improve their health and care delivery though personal health records and patient portals	Instruct patients in proper use of a personal health record Write an e-message to a patient using a patient portal Demonstrate appropriate written communication with all members of the health care team Integrate technology into patient education (eg, decision making tools, diagrams, patient education) Educate patients to discern quality of online medical resources (Web sites, applications, patient support groups, social media, etc) Maintain patient engagement while using an electronic health record (eye contact, body language, etc)
Maintain professionalism through use of information technology tools	Describe and manage ethics of media use (cloud storage issues, texting, cell phones, social media professionalism)
Provide clinical care via telemedicine, and refer those for whom it is necessary	Be able to function clinically in telemedicine/telehealth environments
Apply personalized/precision medicine	Recognize growing role of genomics and personalized medicine in care Identify resources enabling access to actionable information related to precision medicine
Participate in practice-based clinical and translational research	Use electronic health record alerts and other tools to identify patients and populations for offering clinical trial participation Participate in practice-based research to advance medical knowledge

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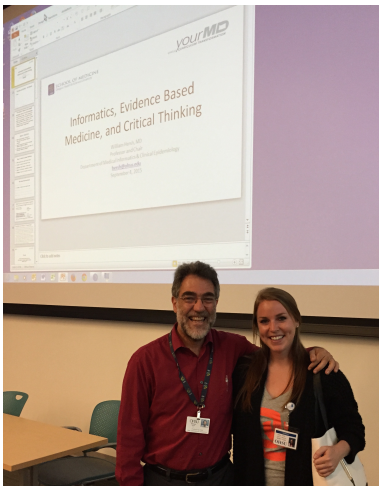
Also need informatics education for clinicians

- 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



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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

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