### Implementing Clinical Informatics in the MD Curriculum and Beyond

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## Convergence of opportunities in informatics and need for competence





# Definition of clinical informatics (ACGME)

- Clinical informatics "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"
- Part of larger biomedical and health informatics (Hersh, 2009)



# Different competencies and curricula for different learners

- Physicians
- Other health professionals
- Patients
- Clinical and translational researchers
- Informatics professionals



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PERSPECTIVES

### Open Access Full Text Article

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

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<sup>1</sup>Department of Medical Informatics and Clinical Epidemiology, <sup>2</sup>Department of Family Medicine, <sup>3</sup>Department of Medicine, <sup>4</sup>School of Medicine, Oregon Health & Science University, Portland, OR, USA 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.

### In reality, applicable to all healthcare professional students.

### (Hersh, 2014)

### Table 9.2 Competencies in Clinical Informatics for Health Care Professionals

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

# Different from competencies for clinical informaticians

- 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
- (Safran, 2009)



# And for clinical and translational researchers

- Utilize informatics-based tools in translational research including: locate relevant informatics tools; select appropriate informatics tools; and use those tools in research for managing and analyzing biomedical and health information
- Describe the essential functions of the major clinical systems (eg, the EHR and its feeder systems, such as radiology and lab) that are relevant to CTS and the challenges to using these data for research
- Describe the essential functions of major research computer systems (eg, clinical trials management systems, biospecimen management systems, research grant and finance management systems, and research services tracking systems) that are relevant to CTS
- Compare and contrast the organizational roles and principal responsibilities essential for access, management, and governance of data related to CTS
- Explain the role of health information technology standards in the interoperability of research, clinical, and administrative information systems and on secondary use of data for CTS
- Identify, retrieve, and manage biomedical and health science knowledge through literature searches using advanced search techniques (MeSH, PubMed, Google Scholar, etc.)
- Describe the essential information generation, management, analysis, transformation, summarization, and visualization methods that apply to CTS data, such as: genomic, proteomic and other "-omics" data; clinical data; imaging data; consumer and patient-reported data; and population-level and environmental exposure data
- (Valenta, 2016)



# Implementing clinical informatics in the OHSU MD curriculum

- New curriculum is
  - Organized into blocks with longitudinal threads
  - Built around weekly cases
  - Facilitated by innovative room design and active learning
- Informatics in new curriculum is
  - Based on AMEP paper competencies (Hersh, 2014)
  - Delivered in variety of manners (Hersh, 2017)



### Part of Epidemiology, EBM, and Informatics thread





### Threads in new curriculum





### Each clinical informatics activity

- Based on competency
- With stated learning objectives
- Delivered by appropriate modality
  - Large group lecture or interactive
  - Small group skills
  - Clinical informatics pearls (asynchronous)
- Each with appropriate assessment



### PRECLINICAL FOUNDATIONS PHASE

Clinical Informatics Pearls	About 50 weekly short online videos of skills—protecting PHI, EHR skills, and information retrieval skills are included in each block		
Clinical Informatics Assessments	About monthly assessment of EHR skills from Pearls		
Orientation to EMR: Epic Workshop	Orientation week intro to Epic	Clinical informa OHSU MD curr	
Orientation to Knowledge Sources	Orientation week intro to online resources		
Introduction to Third Science	Overview of health systems sciences threads		
Information Is Different Now That You're a Doctor	Overview of role of information in medicine		
Connecting Population Health and Value-Based Care	Value-based and population-based care principles	(Hersh <i>,</i> 2	2017)
Informatics and Evidence-Based Medicine Series	Weekly closure sessions wrap up case issues with EBM approach		
Informatics and Evidence-Based Medicine Skills Lab	Skills lab to introduce EBM and informatics skills	CLINICAL EXPERIENCES-FAMILY MEDICINE RO	
Clinical Informatics Skills Assessment	Assessment to demonstrate skills	EAR Objective Structured Clinical Examination	Assess use o
Epidemiology and Evidence-Based	Ten weekly skills labs cover epidemiology and EBM	EHR Chronic Disease Management Workshops	Use EHR da
Precision medicine: CF genes and therapies	Integrated into pulmonary block, precision medicine tools and examples	Telemedicine OSCE (TeleOSCE)	Telemedicin
		Population data seminar	FM departm
Improving Quality with Population	Local examples of successful improvement science application	Order-writing EHR workshop	Use EHR to
Data		EHR-related educational activities	Information
Improving Quality with Population Data Skills Lab	Skills lab on quality measures and data interpretation	INTERSESSIONS	
Infectious Disease Outbreak	EHR skills and systems based practice principles integrated into GI case	Honing EMR Skills Workshops	Between cle
Evidence-Based Medicine Literature	Weekly sessions based on Users Guides to literature	Formulating the question workshop	Between cle
Appraisal-3 skills labs		Literature search workshop	Between cle
Inpatient EHR Skills	Skills lab combining EHR skills needed for inpatient rotations	Decision Aids	Decision aid
Assessment: EHR skills diabetic meds and labs	Assessment of order entry and documentation	Evidence-Based Policy for Cancer Diagnosis and Treatment	State health
Outpatient EHR Skills	Skills lab combining EHR skills needed for ambulatory rotations	Population-based care and quality	Ouality imp
Assessment: EHR Skills	Assessment of outpatient EHR skills	improvement	~P
Advanced EHR Skills	Chart hygiene and record management	Public Health and System Information	Informatics,
Assessment: interpret medical literature	Assessment of EBM appraisal skills	Management of Outbreaks  - Prescription Opioid Overdose: Public Public 1	

### atics activities in riculum.

### OTATION

Lab atics Skills Assessment	Assessment to demonstrate skills	EHR Objective Structured Clinical Examination	Assess use of EHR in standardized patient encounter	
nd Evidence-Based Ten weekly skills labs cover epidemiology and EBM		EHR Chronic Disease Management Workshops	Use EHR data in population-based care, chronic disease	
s-10 weekly Skills Labs		Telemedicine OSCE (TeleOSCE)	Telemedicine encounter on rural rotation	
cine: CF genes and	Integrated into pulmonary block, precision medicine tools and examples	Population data seminar	FM department data from EHR for population care	
lity with Population	Local examples of successful improvement science application	Order-writing EHR workshop	Use EHR to pend orders in FM clerkship encounter	
		EHR-related educational activities	Information retrieval and information literacy	
lity with Population	Skills lab on quality measures and data interpretation	INTERSESSIONS		
ase Outbreak	EHR skills and systems based practice principles integrated into GI case	Honing EMR Skills Workshops	Between clerkships, building on EHR skills-4 required	
l Medicine Literature	Weekly sessions based on Users Guides to literature	Formulating the question workshop	Between clerkships, building EBM skills-4 required	
lls labs		Literature search workshop	Between clerkships, building lit search skills—4 required	
Skills	Skills lab combining EHR skills needed for inpatient rotations	Decision Aids	Decision aids session, integrated in cognitive impairment intersession	
HR skills diabetic meds	Assessment of order entry and documentation	Evidence-Based Policy for Cancer Diagnosis and Treatment	State health policy group using EBM approach to set policies	
R Skills	Skills lab combining EHR skills needed for ambulatory rotations	Population-based care and quality	Ouality improvement in dementia care of veterans	
IR Skills	Assessment of outpatient EHR skills	improvement	2	
R Skills	Chart hygiene and record management	Public Health and System	Informatics, evidence, and systems based practice for outbreak response	
erpret medical Assessment of EBM appraisal skills		Management of Outbreaks		
		Prescription Opioid Overdose: Public Health Perspective	Public health, systems based practice related to opioid epidemic	



### Some specific educational activities

- Interactive lectures, e.g.,
  - "Information is Different Now That You're a Doctor"
  - Friday Closure Sessions Informatics, EBM, and Critical Thinking
- Pearls weekly 7-10 minute asynchronous recording
- Clinical skills e.g., EHR, quality measures
- Enrichment (optional) in-depth topics (EHR), clinical informatics careers



### Student feedback valuable

- Materials need to be at appropriate level
- Learning objectives must be explicit
- Students "triage" study time based on what is assessed





### Beyond undergraduate medical education

- Graduate medical education
  - Minimal involvement by our group, though residents get ad hoc exposure
- Continuing medical education
  - Original efforts in mid-1990s for introduction
  - Currently exploring more integrated efforts



# Competence for other learners in clinical informatics

- Clinical and translational researchers
  - Courses in Human Investigations Program (HIP)
    - Subset of introductory course
    - Clinical research informatics course with students from HIP and informatics programs
  - Mapping of grant-funded (NIH BD2K open educational resources) curricular modules to competencies
    - <a href="https://dmice.ohsu.edu/bd2k/mapping.html">https://dmice.ohsu.edu/bd2k/mapping.html</a>



# Competence for other learners in clinical informatics

- Clinical informatics professionals
  - Graduate program (Certificate, Master's, and PhD)
  - Two tracks
    - Health and Clinical Informatics also available online
    - Bioinformatics and Computational Biomedicine
  - Focus on professionals and researchers within each
  - <u>http://www.ohsu.edu/informatics-education</u>



## New frontiers for informatics education

- OHSU-PSU School of Public Health
  - Course for undergraduates in health-related majors
  - Aiming to impart skills to all and attract some to field
- Other health professions at OHSU plenty of interest; how to fund?
  - Nursing
  - Basic science graduate students



### Conclusions

- Competence in informatics is vital for 21<sup>st</sup> century practice of medicine
  - Indeed all areas of healthcare: other health professions, researchers, and even patients
- Emerging competency frameworks, best practices for education, and assessment
- Biggest hurdle is competing for curricular "real estate"
  - In medical education, Dean-level support is critical



### References

- Hersh, W (2009). A stimulus to define informatics and health information technology. BMC Medical Informatics & Decision Making. 9: 24. <u>http://www.biomedcentral.com/1472-6947/9/24/</u>
- Hersh, W, Biagioli, F, et al. (2017). From Competencies to Competence: Model, Approach, and Lessons Learned from Implementing a Clinical Informatics Curriculum for Medical Students. <u>Health Professionals' Education in the Age of</u> <u>Clinical Information Systems, Mobile Computing and Social Networks</u>. A. Shachak, E. Borycki and S. Reis. Amsterdam, Netherlands, Elsevier: in press.
- Hersh, WR, Gorman, PN, et al. (2014). Beyond information retrieval and EHR use: competencies in clinical informatics for medical education. *Advances in Medical Education and Practice*. 5: 205-212. <u>http://www.dovepress.com/beyond-</u> <u>information-retrieval-and-electronic-health-record-use-competen-peer-reviewedarticle-AMEP</u>
- Safran, C, Shabot, MM, et al. (2009). ACGME program requirements for fellowship education in the subspecialty of clinical informatics. *Journal of the American Medical Informatics Association*. 16: 158-166.
- Valenta, AL, Meagher, EA, et al. (2016). Core informatics competencies for clinical and translational scientists: what do our customers and collaborators need to know? *Journal of the American Medical Informatics Association*. 23: 835-839.

