Competencies and Curricula Across the Spectrum of Learners for Health Informatics

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Outline

- Overview of field in context of education
- Competencies for health informatics
- Some curricular activities
- Future directions

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Health informatics education is challenging

- An interdisciplinary field requiring some level of knowledge and skills in
  - Biomedicine
  - Healthcare
  - Computer science (CS)
  - Math
  - Data science
  - Machine learning (ML)
- With practitioners/ professionals at different levels
  - Researchers
  - Developers
  - Implementers
  - Users
    - Clinicians
    - Consumers/patients/citizens

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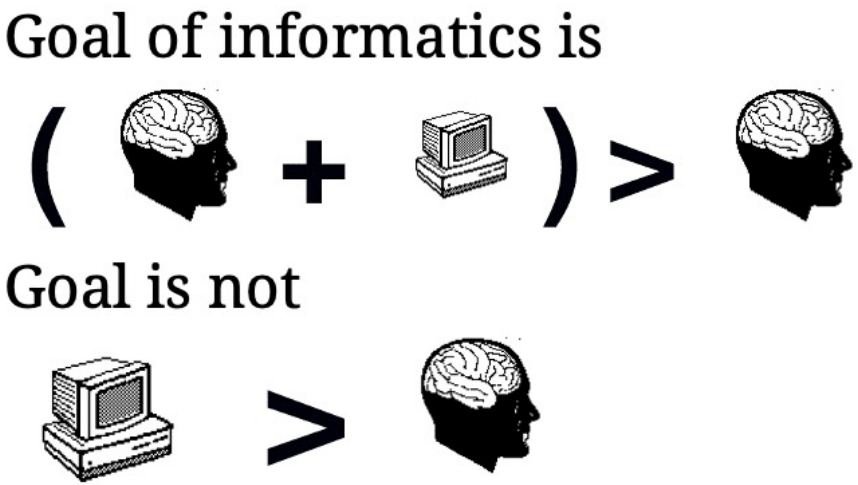
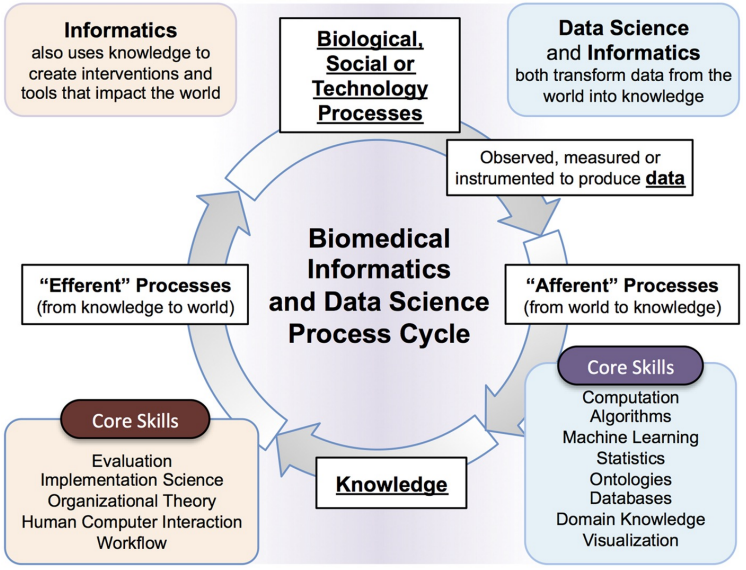
Some principles



(Friedman, 2009)



(Payne, 2018)

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Some of my writings along the way

- JAMA overview (2002), progress and barriers (2004)
- Who are the informaticians? (JAMIA, 2006)
- A stimulus to define informatics (BMC, 2009)
- Workforce estimates and demands (ACI, 2010)
- Competencies for medical education (APME, 2014)
- A passion and a calling (IMIA History Book, 2021)
- Competencies and curricula (SHTI, 2022)

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Competencies of informatics professionals – over a decade of work

- Core content of clinical informatics (Gardner, 2009)
- IMIA educational recommendations (Mantas, 2010)
- Core competencies for graduate education in biomedical informatics (Kulikowski, 2012)
- Foundational domains of applied health informatics (Valenta, 2018)
- Domains, tasks, and knowledge for clinical informatics subspecialty practice (Silverman, 2019)
- Domains, tasks, and knowledge for health informatics practice (Gadd, 2020)
- UK Clinical Informatics Core Competency Framework (Moulton, 2020)

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Paper provides deeper dive into specific programs

- OHSU Biomedical Informatics Graduate Program
- Introductory course – including 10x10
- Applied machine learning for clinical informatics students
- Others who “do” informatics and must have competence

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OHSU Biomedical Informatics Graduate Program

- Among oldest and largest programs in field – since 1996
- Two majors (formerly tracks)
  - Health & Clinical Informatics (HCIN)
  - Bioinformatics & Computational Biomedicine (BCB)
- Degrees and certificates
  - PhD
  - Master of Science – with and without thesis
  - Graduate Certificate (HCIN only)
- Two fellowships
  - NLM T15 Training Grant
  - Clinical Informatics Subspecialty
- Early adopter of distance learning (in HCIN)

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OHSU Biomedical Informatics Graduate Program

Degree	Total	BCB	HCIN
Grad Cert	483	0	483
MS	422	71	351
PhD	38	15	23
Total	943	86	857

International students from: Argentina, Singapore, Egypt, Israel, Saudi Arabia, Zimbabwe, Thailand, China, South Africa, and others

Introductory course

- Have always enjoyed introducing people to informatics within and outside of field
  - Initial effort was graduate-level course, taught since 1993
- Then came 10x10
  - Started when Dr. Charles Safran, former AMIA Chairman, stated need to train one physician and one nurse from each of America's 6,000 hospitals in informatics (Safran, 2005)
  - Original aim to train 10,000 individuals in informatics by the year 2010 (Hersh, 2007)
    - OHSU is largest and most successful offering, with 1000 completing program by end of 2010 and over 3000 by 2022
    - Program continued beyond 2010 based on continued interest and need in US and abroad
    - About 10-15% pursue graduate study, mostly at OHSU

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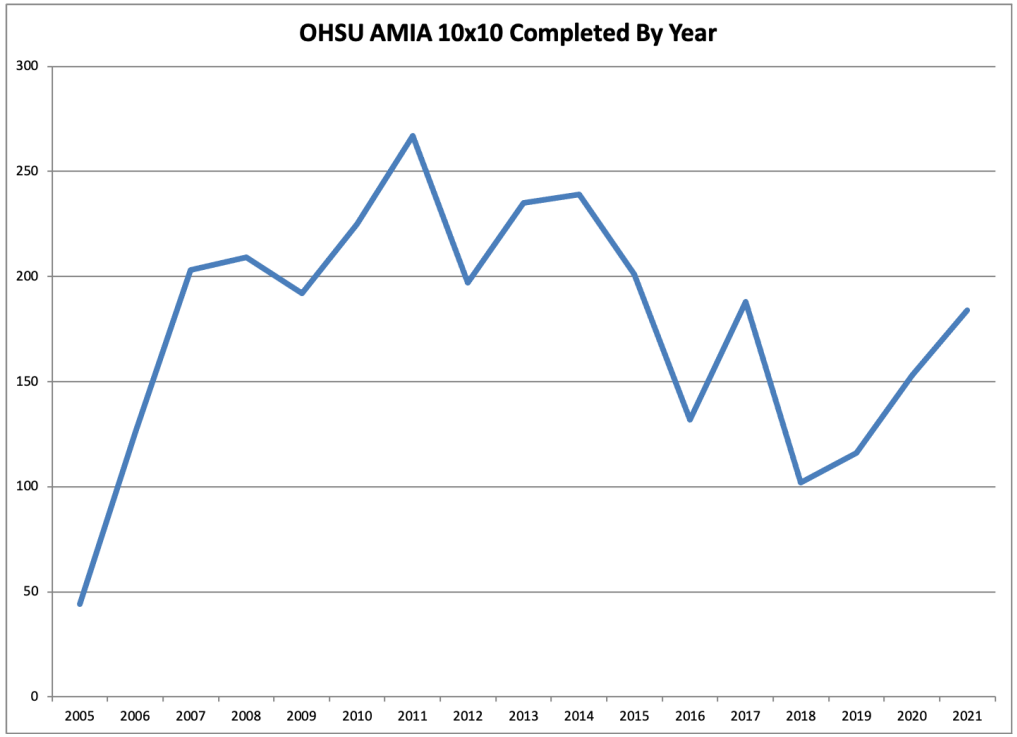
10x10 – milestone of 3000 by 2022



Organization	Course Offerings	People Completing
AMIA	48	1953
American College of Emergency Physicians	14	221
American College of Physicians	1	25
Academy of Nutrition and Dietetics	7	126
Centers for Disease Control	1	18
California Health Care Foundation	1	16
Gateway Consulting (Singapore)	26	377
Ministry of Health (Israel)	1	11
King Saud University (Saudi Arabia)	4	83
Mayo Clinic	2	87
New York State Academy of Family Practice	3	22
Abu Dhabi Health Services (United Arab Emirates)	1	54
Scottsdale Institute	1	15
Society for Technology in Anesthesiology	1	5
Total	111	3013

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Course in applied data science and machine learning for clinical informatics students

- Growing need for all to understand data science and ML beyond the “wranglers and modelers”
  - Including those without math and programming background for traditional ML courses
- Especially
  - Informaticians who implement and evaluate systems
  - Clinicians whose work will be impacted by them
  - Patients and consumers, especially those impacted by biased data and algorithms
- Elective now but likely to become a required course

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Others who "do" informatics

- Focus on medical students but applicable to all health professional students
- "Search engine as essential as stethoscope" for clinical practice (Glasziou, 2008)
- "Informatics training for clinicians is more important than hardware and software" (Safran, 2009)
- Health informatics is a "required skill for 21st century clinicians" (Fridsma, 2018)
- Competencies (Hersh, 2014; Hersh, 2020), curricula (Hersh, 2017), and challenges (Welcher, 2018)

1. Find, search, and apply knowledge-based information to patient care and other clinical tasks.
   a. Information retrieval/search—choose correct sources for specific task, search using advanced features, apply results.
   b. Evaluate information resources (literature, databases, etc.) 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 (labs/x-rays/results) and develop a list of causes of the deviation.
2. Effectively read from, and write to, 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/medications list/allergies.
   h. Create useable notes.
   i. Write orders and prescriptions.
   j. List common errors with data entry (drop-down lists, copy and paste, etc.).
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 Health Insurance Portability and Accountability Act (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. Maintain familiarity 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 HIE to improve clinical care.
9. Engage patients to improve their health care delivery though personal health records (PHRs) and patient portals.
   a. Instruct patients in proper use of a PHR.
   b. Write an e-message 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 (websites, apps, patient support groups, social media, etc.).
   f. Maintain patient engagement while using an electronic health record (EHR) (eye contact, body language, etc.).
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 patients as indicated.
    a. Be able to function clinically in telemedicine/telehealth environments.
12. Apply personalized/precision medicine.
    a. Recognize 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 eligible for participation in clinical trials.
    b. Participate in practice-based research to advance medical knowledge.
14. Apply machine learning applications in clinical care.
    a. Discuss the applications of artificial/augmented intelligence in clinical settings.
    b. Describe the limitations and potential biases of data and algorithms.

Parting thoughts

- No matter how focused your work in informatics (e.g., machine learning or NLP researcher), it is important to have big picture, e.g.,
  - Operations of healthcare system – good and bad
  - EHR – alert fatigue, burnout, etc.
  - Clinical decision support – benefits and shortcomings
  - Data standards and interoperability
  - Data and algorithm bias
- Even if you are an informatics "generalist," still must understand what new methods and technologies aim to do, e.g., ML, AI, etc.
- We must teach the right knowledge and skills to the appropriate audience
- We "own" the downsides to the EHR, biased data and algorithms, etc. – so we must teach about the good and bad

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Thank you!

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