State of the Program, State of the Field

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References


Bastian, H., Glasziou, P., & Chalmers, I. (2010). Seventy-five trials and eleven systematic reviews a day: how will we ever keep up? PLoS Medicine, 7(9),


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State of the Program, State of the Field

Agenda for this talk

• State of the Program
  – Department
  – Research
  – Education
  – Faculty
• State of the Field
  – How we got here
  – Where we’re going
Department of Medical Informatics & Clinical Epidemiology (DMICE)

- Academic department in School of Medicine that provides leadership, discovery and dissemination of knowledge in
  - Bioinformatics and computational biomedicine
  - Clinical epidemiology
  - Health and clinical informatics
- Mission fulfilled through programs of research, education, and service
- Programs, faculty, and students recognized internationally for accomplishment and innovation
- Updated Web site
  - [http://www.ohsu.edu/informatics](http://www.ohsu.edu/informatics)
- Can we make better use of our blog?
  - [https://blogs.ohsu.edu/health-data/](https://blogs.ohsu.edu/health-data/)

DMICE research productivity 1997-2018

- Total external funding 1997-2018: $150M
- Publications 2014-2019
  - 2014-2015 – 88
  - 2015-2016 – 109
  - 2016-2017 – 101
  - 2017-2018 – 101
  - 2018-2019 – 110
- Publications in “top 5” journals 2014-2019
  - Annals of Internal Medicine – 12
  - BMJ – 10
  - JAMA – 19
  - NEJM – 6

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<th>Year</th>
<th>Applications</th>
<th>Funded</th>
<th>Not Funded</th>
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<tr>
<td>2013-2014</td>
<td>38</td>
<td>19 (50%)</td>
<td>19</td>
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<tr>
<td>2014-2015</td>
<td>34</td>
<td>15 (44%)</td>
<td>19</td>
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<tr>
<td>2015-2016</td>
<td>46</td>
<td>21 (46%)</td>
<td>25</td>
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<tr>
<td>2016-2017</td>
<td>48</td>
<td>21 (47%)</td>
<td>24</td>
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<tr>
<td>2017-2018</td>
<td>42</td>
<td>29 (66%)</td>
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Accomplishments in education

- NIH (NLM) training grant funded continuously since 1992
  - Largest and second-oldest training grant at OHSU
  - Supplements in last few years for
    - Data science for informatics and other basic science students (Laderas, Weiskopf, Boudreau)
    - College student internships (McWeeney)
- Graduate program since 1996
  - Master’s since 1996, PhD since 2003
- Innovative use of distance learning in informatics since 1999
- AMIA 10x10 (“ten by ten”) program since 2005
  - Adaptation of online introductory course, completed by about 2600 people
- Clinical informatics for medical students since 2013 (Gorman and others)
- ACGME-accredited Clinical Informatics Fellowship since 2015
  - 5-6 other fellowship programs also using OHSU online courses (Mohan)
- Annual update in Clinical Informatics continuing education
  - 128 enrolled in first year (Mohan)

Many distinguished alumni

International students from (among others):
Singapore, Thailand, Argentina, Egypt, Israel, Saudi Arabia, Zimbabwe, China, and more

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<td>Master's (any)</td>
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<td>46</td>
<td>302</td>
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<tr>
<td>PhD</td>
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<td>9</td>
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<tr>
<td>Total</td>
<td>831</td>
<td>55</td>
<td>776</td>
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Current enrollment

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<td>MS Thesis</td>
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<td>Graduate Certificate</td>
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<td></td>
<td>24</td>
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<tr>
<td>Total</td>
<td>29</td>
<td>66</td>
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<td>95</td>
</tr>
</tbody>
</table>

(Does not include late registrants or those on Leave of Absence)

Faculty

• Among the most accomplished informatics faculty anywhere in the country or world

• Following slides have a sampling; see Web site for complete list
  – [https://www.ohsu.edu/school-of-medicine/medical-informatics-and-clinical-epidemiology/faculty-and-trainees](https://www.ohsu.edu/school-of-medicine/medical-informatics-and-clinical-epidemiology/faculty-and-trainees)
Faculty in institutional and national leadership roles

- David Dorr – Chief Research Information Officer, OHSU
- Karen Eden – President, Faculty Senate, OHSU
- Paul Gorman – Assistant Dean, Rural Medical Education, OHSU
- Vishnu Mohan – Chair, AMIA Clinical Informatics Program Directors
- Cynthia Morris – Co-PI, OCTRI; Co-PI EXITO BUILD
- Heidi Nelson – Director, Medical Student Scholarly Projects
- Shannon McWeeney – Director, Computational Biomedicine, Knight Cancer Institute

Faculty with career development awards

- Michelle Hribar, PhD – Modeling and Optimization of Clinical Processes Using EHR Data (R00LM012238)
- Lisa Karstens, PhD – Functional Considerations of the Urinary Microbiome in Overactive Bladder (K01DK116706)
- Nicole Weiskopf, PhD – Measuring and Improving Data Quality For Clinical Quality Measure Reliability (K01LM012738)
- Dana Womack, PhD – Echoes of Workplace Overload and Wellbeing (K12HS022981)
Other faculty joining in last few years

- James Jacobs, MD
- Steve Kassakian, MD, MS
- Ted Laderas, PhD
- Ben Orwoll, MD

State of the field

- How did we get here?
- Where are we going?

- (Disclaimer: somewhat of a clinical orientation but many opportunities for computational biomedicine)
We’ve come a long way in a decade

(Osborn, 2015)

But not without challenges

(Toll, 2012; Downing, 2018; Schulte, 2019; Mamlin, 1973)
Exciting areas for informatics going forward

- Machine learning and artificial intelligence
- Data interoperability
- Characterizing the professional work of informatics

Medicine is increasingly (and maybe always has been) a “data science”

- Clinicians cannot keep up
  - Average of 75 clinical trials and 11 systematic reviews published each day (Bastian, 2010)
- Data points per clinical decision increasing (Stead, 2011)
- Precision medicine
  - Requires management and use of large volumes and varieties of data (Collins, 2015; AllOfUs, 2019)
Informatics is more than data science (Payne, 2018)

21\textsuperscript{st} century resurgence of AI

- First era focused on human-engineered “knowledge bases” and algorithms to provide “artificial intelligence”
- Origin of field attributed to Ledley and Lusted (1959)
  - Diagnosis via symbolic logic and probability
- Led to “expert systems”
  - Computer programs mimicking human expertise
    - Rule-based, e.g., MYCIN (Shortliffe, 1975)
    - Disease profiles and scoring algorithms, e.g., INTERNIST-1 (Miller, 1982) and DxPlain (Barnett, 1987)
- But ultimately the “Demise of the Greek Oracle” (Miller, 1990)
  - Evolution to more focused clinical decision support in 1990s and beyond (Greenes, 2014)
Recent success most prominent in imaging and waveform (patterns)

Excellent summaries by @EricTopol (Nature Med, 2019; Deep Medicine, 2019)

AI not limited to imaging

• Clinical data
  – Predicting risk (readmission, mortality, etc.) from EHR data (Rajkomar, 2018)
  – Age and gender determination from retina (Poplin, 2018) or EKG (Attia, 2019)
  – Generating clinician documentation (Rajkomar, 2019)

• Beyond prediction
  – Predicting sepsis in ICU using vital signs (Barton, 2019) AND demonstrating reduced length of stay and mortality (Shimabukuro, 2019)

• Computational biomedicine
  – Variant calling and gene regulation in genomics (Zou, 2019)
  – Discovering drug targets (Chan, 2019)
But there are challenges to AI

- Systematic review of deep learning in imaging finds comparable performance to human healthcare professionals, but limitations include (Liu, 2019)
  - Realistic and validated data sets
  - Incomplete reporting of methods
- Emerging requirements
  - Meaningful evaluation in real-world settings (Parikh, 2019)
  - Reporting guidelines for clinical studies (CONSORT-AI and SPIRIT-AI Steering Group, 2019)
  - Explanation of algorithm output, especially in medicine (Tjoa, 2019)
  - Prevention of exacerbation of healthcare disparities (Rajkomar, 2018)

Improving use of data through interoperability

- Many re-uses (or secondary uses) of EHR data not primarily collected for research (Safran, 2007)
  - "Computational" re-uses of data require standardized data and terminology
- Emergence and merging of new standards
  - Fast Healthcare Interoperability Resources (FHIR)
  - Substitutable Medical Apps, reusable technologies (SMART)
- 21st Century Cures Act
  - “Correction” of interoperability and other EHR improvements (Mandl, 2017)
Forthcoming rules based on 21\textsuperscript{st} Century Cures Act

- “Net Neutrality for Health Data” (Jeff Smith, AMIA)
- EHR certification will require
  - FHIR-based access to all data elements
  - Open APIs
  - Easy export of data for patients and systems
  - No gag clauses or information blocking

SMART on FHIR and genomics (Alterovitz, 2015; Warner, 2016)
And critical role for the patient

Growing understanding of the work of informatics professionals

(Silverman, 2019; Gadd, forthcoming – leading to certification beyond physicians)
How will all this impact biomedicine?

- AI unlikely to replace physicians (Shah, 2019) any time soon but will make biomedicine better (Topol, 2019)
- Critical role for informatics faculty, students, professionals, and others

Questions?

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