“We are each, in effect, one-person clinical trials. Yet the knowledge generated from those trials will die with us because there is no comprehensive database of metastatic breast cancer patients, their characteristics and what treatments did and didn't help them.”

Adoption of EHRs – Acute Care Hospitals

https://dashboard.healthit.gov/quickstats/quickstats.php
Adoption of EHRs – Physician Offices

https://dashboard.healthit.gov/quickstats/quickstats.php
PERSPECTIVE

Predicting the Future — Big Data, Machine Learning, and Clinical Medicine

Ziad Obermeyer, M.D., and Ezekiel J. Emanuel, M.D., Ph.D.

The algorithms of machine learning, which can sift through vast numbers of variables looking for combinations that reliably predict outcomes, will improve prognosis, displace much of the work of radiologists and anatomical pathologists, and improve diagnostic accuracy.
Google AI now can predict cardiovascular problems from retinal scans

By Bill Siwicki | February 19, 2018 | 12:18 PM
mHealth for Children: 4 Concepts That Could Change the World

Smart thermometers, pacifiers, earbuds and necklaces have the potential to save millions of children's lives each year, and are gaining notice from USAID and UNICEF.
Precision medicine

• Classify patients into sub populations
• Focus intervention on those who will benefit/respond
Opportunities Abound

- AI
- Precision Medicine
- EHRs
- NLP
- Data
- Mobile devices
Meet Brian Bucher

Pediatric Surgery
Informatics-enabled Journey

Data analysis  NLP  Predictive analytics  Clinical decision support  Surveillance

Decrease surgical site infections
Decrease surgical site infections

K grant

JAMA Surgery

Data analysis
NLP
Predictive analytics
Clinical decision support
Surveillance

Research Operations

Decrease surgical site infections

NLP
Predictive analytics
Clinical decision support
Surveillance

Research Operations
7 Grants Submitted

5 Grants Secured
Improving patient care requires

Education

Research

Operational Services
Improving patient care requires

Education  
Research

Operational Services
Improving patient care requires:

- Education
- Research
- Operational Services

Informatics is a key ingredient.
Research Operations
Education

Est. 1964
You know, I went to Salt Lake to learn from Homer Warner in 1968.

*Kaz Kulikowski*
Synergy Across Missions

Education

Research

Operational Services
The state of education

Reach
Relevance

Karen Eilbeck, MSc, PhD
Vice-Chair, Education

Charlene R. Weir, PhD, RN
Director of Graduate Studies
PhD Alumni Careers Past 10 Years

- Academics: 27%
- Healthcare Delivery Organizations: 27%
- Research: 10%
- Government: 11%
- Other: 11%
- Health Information Industry: 14%
Increase our Reach – **MS degree**

- **Utah Campus**
- **Utah-Asia Campus**
- **Online 2019**
Utah NTMS Students Matriculated

- 59 MS
- 22 PhD

Current Students
Increase our Reach – Across Campus

DeCART Summer School

Physician Assistant Studies

Data Science for Basic Sciences
Increase our Relevance

Application Tracks

- Clinical Informatics
- Translational Bioinformatics
- Population & Public Health Informatics
- Bioinformatics
Increase our Relevance

Application Tracks

Clinical Informatics

Translational Bioinformatics

Population & Public Health Informatics

Bioinformatics

Methods Tracks

Semantic Interoperability

Sociotechnical Design & Evaluation

NLP

Data Science & Decision Support
Increase our Relevance – Hands-on Practica

- FHIR
- Global health
- Socio-technical
- Data science modules
PhD Student Highlight
Rosalie Waller

Undergrad degree
BS Biomedical Engineering

PhD Research
Translation of genomics discovery to care
• Genetic epidemiology
• Sociotechnical methods
• Clinical decision support
PhD Student Highlight

Rosalie Waller

Accomplishments

• NCI F99/K00 Award (6 years)
• John Morgan Award
• Gardner, Fay, and NLM T15 Fellowships
• AMIA poster award, AMIA Student Design Challenge Finalist
• 1 first-author and 3 co-author journal publications
• 2 manuscripts under review, 3 in preparation
NTMS Student Highlight

Yun Ding

Previous Degree
PhD Chemistry

DBMI Pathway

DeCART Summer School → Certificate → NTMS
NTMS Student Highlight

Yun Ding

Accomplishments

• Leveraged project-based learning in courses
  • further explore bioinformatics questions

• Bioinformatics Scientist 1

illumina®
The state of operations

ReimagineEHR

Kensaku Kawamoto, MD, PhD, MHS
Vice-Chair, Clinical Operations
Redesigning Care Processes
EHR provides

• Opportunity
• Barriers
We want to revolutionize the EHR
State of the art technology

Understanding of teams and workflow

Knowledge of human cognition
Example Epic-Integrated Applications

- Neonatal bilirubin app
- Procedure capacity mgmt.
- Surgical referral dashboard
- Diabetes Rx prediction app
- Opioid MME
- MDCalc
Neonatal Bilirubin Management App

- Recommendations based on AAP guidelines
- Pulls in baby and mother’s EHR data
- Estimated to save >300 MD hrs/year
- HHS Provider User Experience App Challenge Awards
Diabetes Rx Outcomes Prediction App

- Collaboration with Hitachi
- Data-driven Rx guidance (predictive model, AUC 0.87)
- Accounts for insurance for cost info
- In pilot use
MDCalc Integration

- MDCalc: leading calculation tool
  - > 1 million monthly users from 196 countries
  - 35+ specialties, 200+ conditions
- Top 20 calculators prioritized by UUH in production use
- Auto-population using EHR data
- 1-click integration with dot phrase

<table>
<thead>
<tr>
<th>Condition</th>
<th>EHR Data: High Confidence</th>
<th>EHR Data: Double Check</th>
<th>Relevant EHR Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confusion</td>
<td>No 0 Yes +1</td>
<td>15 Glasgow Coma Scale</td>
<td>- an hour ago</td>
</tr>
<tr>
<td>BUN &gt; 19 mg/dL (&gt; 7 mmol/L)</td>
<td>No 0 Yes +1</td>
<td>45 mg/dL - 9 hours ago</td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate ≥ 30</td>
<td>No 0 Yes +1</td>
<td>20 min - an hour ago</td>
<td></td>
</tr>
<tr>
<td>Systolic BP &lt; 90 mmHg or Diastolic BP ≤ 60 mmHg</td>
<td>No 0 Yes +1</td>
<td>Systolic BP: 90 mmHg - an hour ago</td>
<td></td>
</tr>
</tbody>
</table>

2 points
Moderate risk group: 6.8% 30-day mortality.
Consider inpatient treatment or outpatient with close followup.
Resourcing Model

- **Grant funding**
  - > $25 million direct costs

- **Clinical operations**
  - $900,000 / year

- **Industry**
  - >$225,000 in sponsored research
Interest and Impact

National leaders

- Significant interest from funding agencies due to potential to scale solutions nationwide
- >$25M grants awarded
- Doubling of team with flat operational budget
The state of research

Collaboration
Center grants

Guilherme Del Fiol, MD, PhD
Vice-Chair, Research
11 Research Faculty
8 Center Grants
56 Grants/Contracts
500+ Publications
$12,341,060 Research Expenditures
2013-2018
Multi-disciplinary Team Science

Translational Informatics

Reimagine EHR
Research Highlights – Translational Informatics

- PRISMS
- Recruitment Innovation
- Integration of Patient-centered Outcomes
- ClinGen
Utah PRISMS Informatics Center

Provide a flexible approach to collecting and managing data from sensors, based on data models for the exposome that can be integrated with clinical data.

Facelli, Sward

DBMI
Nursing
Pediatrics
Pulmonology
Electrical Engineering
Computer Science
SCI
Atmospheric Sciences

1U54EB021973
Recruitment Innovation Center

Address challenges in recruitment and retention of participants in clinical trials.

LaSalle
Facelli, Gouripeddi

UL1TR001579

DBMI
Vanderbilt University
EHR Access to Seamless Integration of PROMIS

Make it easier for researchers and clinicians to collect patient reported outcomes information and use it to improve clinical care and research.

Facelli, Local PI
ULTR001422

DBMI
Northwestern University

NIH
National Center for Advancing Translational Sciences
The Clinical Genome Resource

Provide curated information about all clinically relevant genes and variants

Eilbeck, Del Fiol

U41HG00965

DBMI
UNC
Geisinger
Multi-disciplinary Team Science

Translational Informatics

Reimagine EHR
Research Highlights – ReimagineEHR

- Family History of Cancer CDS Platform
- Family History of Cancer RCT
- Tobacco Cessation
- Pediatric Patient Summary
Early Cancer Screening

Population-based clinical decision support to identify patients who meet criteria for early evaluation based on family history.

Del Fiol, Kawamoto, Chapman
Schiffman, Kohlmann, Hess

DBMI
Huntsman Cancer Institute
UHealth Primary Care
Population Health Sciences
UHealth IT Services
Intermountain Healthcare
Randomized Controlled Trial

Compare genetic counseling versus self-directed genetic testing for familial cancer risk evaluation.

Kaphingst, Buys
Del Fiol, Kawamoto

Huntsman Cancer Institute
DBMI
UHealth Primary Care
Population Health Sciences
Uhealth IT Services
Smart Trial

EHR-enabled tobacco cessation intervention in Utah community health centers

Wetter
Del Fiol, Kawamoto

Huntsman Cancer Institute
DBMI
Population Health Sciences
IT Services
Utah Community Health Centers
Provide automated, cross-institutional EHR summary to help teams care for children with special health care needs.

Del Fiol, Norlin Thraen

DBMI
Pediatrics
Utah Health Information Exchange
State Medicaid
Intermountain Healthcare
2017-18 Faculty National Awards and Recognition

National Academy of Medicine Lindberg Innovation Award

U.S. HIT Advisory Committee HL7 Board

Elected Fellow of ACMI

2018 Homer Warner Paper Award
2017-18 Student National Awards and Recognition

2018 AMIA Student Paper Competition Winner

F99/K00 from the NCI

2017 Student Paper Competition Finalists (2nd place - Pallavi)

2018 Student Design Challenge Finalists
The state of industry
Conclusion
It’s about the people

Samir E. Abdelrahman, MSc, PhD
Machine Learning

Damian A. Borbolla, MD, MS
Clinical Informatics

Bruce E. Bray, MD
Clinical Informatics

Wendy W. Chapman, PhD
Natural Language Processing

Mike Conway, PhD
Population Informatics

Guilherme Del Fiol, MD PhD
Clinical Informatics

Karen Eilbeck, MSc, PhD
Bioinformatics

R. Scott Evans, MS, PhD, FACMI
Clinical Informatics

Julio C. Facelli, PhD
Translational Informatics

Bryan S. Gibson, DPT, PhD
Consumer Health Informatics
Ramkiran Gouripeddi, MS, MBBS
Translational Informatics

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Clinical Informatics

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Clinical Informatics

Stanley M. Huff, MD
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Radiology Informatics

Aaron Quinlan, PhD
Bioinformatics

Charlene R. Weir, PhD, RN
Sociotechnical Design & Evaluation
It’s about the partnerships

Education → Research

Operational Services
Join us!