Health Systems: The Next Generation 2018

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November 9th, 2018
Welcome

Pinar Keskinocak, PhD
Georgia Institute of Technology
William W. George Chair, School of Industrial and Systems Engineering,
Co-director, Center for Health & Humanitarian Systems
ADVANCE Professor, College of Engineering, Georgia Tech
Thank you to our generous sponsors!

Georgia Tech Health & Humanitarian Systems
Interdisciplinary Research Center

Georgia Tech ISyE
H. Milton Stewart School of Industrial and Systems Engineering

Georgia Institute for People and Technology
Rapid Fire Presenters

Jennifer R DuBose, MS
Georgia Institute of Technology
Associate Director of the SimTigrate Design Lab, Principal Research Associate

Danny Hughes, PhD
Georgia Institute of Technology
Professor in the School of Economics and Director of Georgia Tech’s Health Economics and Analytics Lab (HEAL)

Omer T. Inan, PhD
Georgia Institute of Technology
Associate Professor of Electrical and Computer Engineering and Adjunct Associate Professor of Biomedical Engineering

Zihao Li, PhD
Centers for Disease Control and Prevention
Prevention Effectiveness Fellow, Division of HIV/AIDS Prevention

Mark Styczynski, PhD
Georgia Institute of Technology
Associate Professor, School of Chemical & Biomolecular Engineering
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Mission: To transform the process of the design of the healthcare built environment, clinical processes, and technology, and establish a new field of academic healthcare research which is trans-disciplinary.

Vision: We will be the leader in integrated, trans-disciplinary healthcare simulation design and research.
Using the Built Environment to Improve Healthcare Systems

**The SimTigrate Approach**

- **Analyze Problems**
  - Build Evidence Base
  - Link Design to Key Outcomes
  - Collaborate with major government & industry partners
  - Evaluate Issues Impacting Healthcare Design

- **Conduct Research**
  - Field Studies
  - Simulation Tools
  - Explore & Test Solutions
  - Improving Care Coordination
  - Improving Well-being through the Built Environment

- **Speed up Learning and Innovation**
  - Optimizing Space Utilization and Care Process Using Simulation Modeling
  - Predict Design Models through Evidence-Based Design
  - Precision Planning

- **Develop Guidance**
  - Translate Evidence Base
  - Solve Real World Problems
  - Provide Consistent Experience and Quality of Care across Sites
Conduct Research in the Field

b) Framework

- Risky Behaviors
- Environmental Insufficiency
- Desirable Behaviors
- Environmental Requirements
  - What does the environment need to be like to achieve those goals?
- Criteria
  - How do we measure success?
- Strategies
  - What are the solutions to meet the criteria?
Speeding up Learning and Innovation Through Rapid Prototyping
Assessing the Design of Outpatient Clinics for Team-based Care

Functional Scenario Method

“RNs and rooming staff need to be aware of the status of the overall clinic”
Mild Cognitive Impairment Empowerment Program

Provide Scaffolding and Stimulation:
Safe Smart Kitchen
to increase independence
Craig Zimring, Ph.D.
Director, SimTigrate Design Lab
Professor of Architecture, College of Design, Georgia Institute of Technology
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HEALTH ECONOMICS & ANALYTICS LAB (HEAL)

DANNY R. HUGHES
PROFESSOR, SCHOOL OF ECONOMICS
DIRECTOR, HEAL
• $3 million, 5 year partnership with Harvey L. Neiman Health Policy Institute
  • Apply big data analytics and AI to large scale medical claims databases
  • Policy focused research
    • Payment models
    • Health care delivery systems
    • Predictive indicators of medical risk
• HEAL provides
  • Funding for students, faculty, and post-docs
  • Research and training opportunities
  • Access to large scale databases:
• Extensive collaborations with leading medical centers:
  - Emory University School of Medicine
  - MGH General Hospital
  - Mayo Clinic
  - NYU Langone Medical Center
  - Yale University School of Medicine
  - Northwell Health

• Foundation for other research:
  - $3 million NIH-funded grant with University of Washington
  - International reach:
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WEARABLE SEISMCARDIOGRAM SENSING FOR PATIENTS WITH HEART FAILURE

Collaboration with Dr. Liviu Klein at UCSF and Dr. Mozzi Etemadi at Northwestern

- Seismocardiogram (SCG) signals are measured with a wearable chest patch
- Measurements before and after six minute walk test exercise are used to assess patients’ clinical state
- Goal: Predicting and preventing heart failure exacerbations with home monitoring

CUFFLESS BLOOD PRESSURE MEASUREMENT USING SEISMOWATCH

Collaboration with Dr. Rama Mukkamala at MSU and Dr. Jin-Oh Hahn at UMD

- Pulse transit time (PTT) is measured using a watch form factor with the user placing the device against the chest.
- After initial calibration, PTT based blood pressure estimation yields low error for a wide range of perturbations.

50,000 children in US have juvenile idiopathic arthritis (JIA)
Many therapies exist, but matching a therapy to each patient is currently based on trial and error
Continuous monitoring would allow for therapies to be personalized to each patient using objective data

Wearable joint sounds measurements can address this clinical need

ELUCIDATING THE MECHANISMS OF JOINT SOUNDS WITH A CADAVER MODEL

- We used fresh frozen cadaver models such as those employed in training for orthopedic surgery.
- A total of n=9 limbs were studied to better understand the origin of joint acoustic emissions and to provide a clean dataset for algorithm development.
NON-INVASIVE VAGUS NERVE STIMULATION IN PATIENTS WITH PTSD

Collaboration with Dr. Doug Bremner at Emory University

- Sympathetic arousal in response to the recall of the traumatic event is blunted with VNS
- Brain imaging results show similar patterns

INAN RESEARCH LAB AT GEORGIA TECH

PhD Students
Caitlin Teague
Andrew Carek
Nicholas Bolus
Mobashir Shandhi
Oludotun Ode
Nil Gurel
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Beren Semiz
Hewon Jung
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Venu Ganti

Active Grants / Contracts
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Children’s Healthcare of Atlanta
Craig H. Neilson Foundation
Georgia Research Alliance
NextFlex

Collaborators
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Jin-Oh Hahn (UMD)
Lalit Mestha (GE)
Shuvo Roy (UCSF)
Teresa De Marco (UCSF)

Research Engineers
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Collaborators
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Liviu Klein (UCSF)
Doug Bremner (Emory)
Amit Shah (Emory)
Michael Sawka (GT)
Shawn Hochman (Emory)
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Geza Kogler (GT)
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Jim Rehg (GT)
Farrokh Ayazi (GT)

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HIV Prevention Modeling at the Centers for Disease Control and Prevention

Zihao Li, PhD
Prevention Effectiveness Fellow
Prevention Modeling and Economics Team

Health Systems: The Next Generation 2018
Atlanta, GA
November 9, 2018
Prevention Modeling for HIV

- Apply quantitative science to prevent HIV infection and reduce HIV-related illness and death
- Focus on effectiveness of prevention efforts
  - HIV testing
  - HIV care engagement/retention
  - Treatment as prevention
  - Pre-exposed prophylaxis (PrEP)
  - Behavioral interventions
Agent-based Model

- Progression and Transmission of HIV (PATH)
  - Track disease progression, treatment, and transmission at individual level
- Estimate HIV transmission rate
  - Population risk group
  - HIV care continuum
  - Age group
- Replicate transmission networks/clusters
Compartmental Model

- **HIV Optimization and Prevention Economics Model (HOPE)**
  - Population-level analysis
    - age group, risk level, transmission group, sex, race/ethnicity
  - System of differential equations solved in Matlab

- **Effects of Reaching National HIV/AIDS Strategy goals**

- **Analyze the cost effectiveness of different interventions**
  - Increasing testing frequency
  - Increasing adherence to HIV treatment
  - Increasing coverage of PrEP
Optimization Model

- **Resource allocation**
  - Excel-based tool for state/local health departments to allocate HIV funding
  - Input:
    - Efficacy of intervention programs
    - Epidemiological/clinical data
    - Budget
  - Use linear program to find the optimal fund allocation to each intervention program
Thank you!

For more information:
Zihao Li
nzv6@cdc.gov

Findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the CDC
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2018

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Low-cost, equipment-free, low-volume, quantitative diagnostic blood tests

Mark Styczynski
Georgia Tech
School of Chemical & Biomolecular Engineering
Health Systems: The Next Generation
November 9, 2018
When you think of medical diagnostic tests, you may think of...

Big needles and blood draws

Trained lab personnel

Expensive lab equipment

Waiting days for results

High costs
We are developing diagnostic tests that instead entail...

- Drops of blood
- Ease of use
- No analytical equipment
- Visible readouts in an hour
- Low costs
Our original motivator: vitamin & mineral deficiencies in the developing world

Estimated percentage of people with inadequate zinc intake

Directly responsible for over 100,000 deaths of children under 5 annually

Lack of data on specific areas affected limits efficient supplementation programs

Diagnostic tests are too expensive and logistically challenging for monitoring resource-poor areas

But health disparities exist at home, too...

Unequal access to healthcare

Uneven quality of healthcare when access is available? (resource and cost limitations)

If we had more diagnostic data, could we do a better job in the at-risk areas?

Our vision:
cheap, easy, equipment-free biosensor tests
We have developed a completely equipment-free test for zinc, a key nutrient, using microliter volumes of blood...
... and a generalizable approach to equipment-free semi-quantitation that compensates for **matrix effects**!

(matrix effects are a big issue... my blood ≠ your blood, other components interfere with what you are trying to measure, especially in “simple” systems like ours)
This yields a platform for low-cost, equipment-free, low-volume, quantitative diagnostic blood tests.
Thank you to the people who do all of the work!

Robert Dromms
Justin Lee
Monica McNerney
April Miguez
Sugantha Moorthy
Maren Smith
McKenzie Smith
Amy Su
Yan Tang
Katie Vermeersch
Daniel Watstein
Jason Ye
Weiwei Yin
Yan Zhang

Our cell-free “connections”:
Mike Jewett
Julius Lucks

Current/recent undergrads:
Cirstyn Michel
Caroline Sane
Manav Sevak
Madelyn Shelby
Adam Silverman
Paige Steppe
Kelsey Tjen
Bryan Wijaya

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NIH
Bill & Melinda Gates Foundation
NSF
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Moving from Sick-care to Healthcare & the Proactive Innovations Moving Healthcare Forward

Panel Discussion
Moderator

Tabia Henry Akintobi, PhD, MPH

Professor, Department of Community Health and Preventive Medicine
Associate Dean, Community Engagement
Director, Prevention Research Center
Director, Evaluation and Institutional Assessment
Department of Community Health and Preventive Medicine
Morehouse School of Medicine
Panelists

Bridget Hurley
Evidation Health
VP of Clinical and Regulatory

Jim McClelland
State of Indiana
Executive Director for Drug Prevention, Treatment, and Enforcement

J. Patrick O’Neal, M.D.
Georgia Department of Public Health (DPH)
Commissioner & Director of Health Protection

Vivian Singletary, JM, MBA
Public Health Informatics Institute (PHII), Task Force for Global Health, Director
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EVIDATION HEALTH:
EMPOWERING PATIENTS TO DRIVE HEALTHCARE THROUGH REAL WORLD DATA

NOVEMBER 2018

Bridget Hurley
VP, Clinical & Regulatory
@evidation
The Gold Standard: *Randomized Clinical Trials for Safety / Efficacy*

But how does this translate to medical practice in the Real World?
Real World Example:

Congestive Heart Failure: 5.7 Million Patients in the US

Three Landmark Trials:
20,000 patients

Only 1 in 5 patients

FEMALES

At Evidation, we see patients like this in the digital era of medicine.
Digital “virtual” studies allow patients to participate—anywhere, anytime.
PATIENT OUTCOMES HAVE BEEN HISTORICALLY MEASURED USING LIMITED DATA FROM WITHIN THE SYSTEM—NOT FROM DAILY LIFE.

DATA POINT

Visible
episodic, in the clinic

Invisible
continuous, in daily life

TIME
Harnessing this new data source allows us to ask and answer different questions about human health *in the real world*…

- Can quantifying everyday life better stratify chronic pain patients?
- Is a patient’s daily movement pattern a better measure of surgical recovery?
- How can we measure impact of digital interventions entirely outside clinic walls, *at any scale*?
Today we have >2M connected individuals permissioning their data for use in a whole new approach to measuring outcomes.

**REAL-TIME INTERFACE, DATA TRANSFER INTO EVIDATION PLATFORM**

- **BEHAVIOR DATA**
  - 100s OF CONSUMER AND CLINICAL-GRADE INTEGRATIONS/APIS

- **MEDICAL DATA**
  - eCOA/PROs, EMR, CLAIMS, LAB DIAGNOSTICS, PHARMACY DATA

- **CONTEXTUAL DATA**
  - WEATHER, POLLUTION, CENSUS, LOCATION, ETC.
Real World Clinical Data – *outside the clinic walls.*

The Medication adherence Improvement Support App For Engagement—Blood Pressure (MedISAFE-BP) trial

- First prospective trial to rigorously evaluate an mhealth application's effect on blood pressure and medication adherence in the U.S.
- Table 1 illustrates diversity that is straightforward to obtain in virtual, site-less clinical research
  - 57% female
  - 29% African American or Hispanic
  - 47% without a college degree
  - The above were not a requirement of study design

---

**Table 1: Baseline Characteristics by Treatment Group**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intervention (n = 209)</th>
<th>Control (n = 202)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD), y</td>
<td>51.7 (10.5)</td>
<td>52.4 (10.1)</td>
<td>.51</td>
</tr>
<tr>
<td>Female, No. (%)</td>
<td>120 (57.4)</td>
<td>127 (62.9)</td>
<td>.26</td>
</tr>
<tr>
<td>Race/ethnicity n (%)</td>
<td></td>
<td></td>
<td>.03</td>
</tr>
<tr>
<td>Black</td>
<td>43 (20.6)</td>
<td>60 (29.7)</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>149 (71.3)</td>
<td>119 (58.9)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>17 (8.1)</td>
<td>23 (11.4)</td>
<td></td>
</tr>
<tr>
<td>BMI, mean (SD)</td>
<td>35.38 (7.9)</td>
<td>35.59 (8.6)</td>
<td>.79</td>
</tr>
<tr>
<td>Physical activity, No. (%)</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>≤2 h/wk</td>
<td>127 (60.8)</td>
<td>116 (57.4)</td>
<td></td>
</tr>
<tr>
<td>&gt;2 h/wk</td>
<td>82 (39.2)</td>
<td>86 (42.6)</td>
<td></td>
</tr>
<tr>
<td>Education, No. (%)</td>
<td></td>
<td></td>
<td>.49</td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>3 (1.4)</td>
<td>5 (2.5)</td>
<td></td>
</tr>
<tr>
<td>High school graduate</td>
<td>31 (14.8)</td>
<td>20 (9.9)</td>
<td></td>
</tr>
<tr>
<td>Some college</td>
<td>46 (22.0)</td>
<td>56 (27.7)</td>
<td></td>
</tr>
<tr>
<td>College graduate</td>
<td>73 (34.9)</td>
<td>68 (33.7)</td>
<td></td>
</tr>
<tr>
<td>Vocational degree</td>
<td>19 (9.1)</td>
<td>22 (10.9)</td>
<td></td>
</tr>
<tr>
<td>Graduate degree</td>
<td>37 (17.7)</td>
<td>31 (15.4)</td>
<td></td>
</tr>
</tbody>
</table>


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Toward Better Lives and Stronger, Healthier Communities

A presentation by Jim McClelland

Executive Director for Drug Prevention, Treatment and Enforcement, State of Indiana

November 2018
Public Sector

- Education
- Social Services
- Criminal Justice
- Workforce Development
- Housing
Not-for-profit Sector
Addiction Treatment
Mental Health
Behavioral Health
Primary Care
Addiction Treatment
Mental Health
Behavioral Health
Primary Care
Wraparound Services
Education and Training
Employment
Housing
Transportation
Food
Child care/early childhood programs
After-school opportunities
Other youth opportunities
Family Services

Local Coalitions

Cross Sector
Public, Private, Not-for-Profit
Businesses, Educational Institutions, Health Care Entities
Local Governments, Law Enforcement Agencies, Courts
Philanthropies, Community-based Organizations, Faith-based Organizations

With strong local leadership
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State of Public Health

UPDATE from DPH

November 9, 2018/J. Patrick O’Neal, M.D., Commissioner
Georgia Department of Public Health

159 County Health Departments
159 County Boards of Health
18 Public Health Districts
18 District Health Directors
1 Commissioner
1 State Board of Public Health
Mission Statement

- Prevent disease, injury and disability
- Promote health and well-being
- Prepare for and respond to disasters
Our Priorities

- Early Brain Development
- Opioid Epidemic
- Cardiac Care
EARLY BRAIN DEVELOPMENT

- Created Brain Trust for Babies
- Newborn Screening for 31 disorders
- Early Hearing Detection and Intervention 1-3-6 month benchmarks to screen, diagnose, intervene
- Babies Can’t Wait increased autism screening and treatment
- Talk with Me Baby (TWMB)—one of four nationally-recognized initiatives to increase language nutrition
- TWMB partnered with Scholastic to develop the TWMB BOARD BOOK
- Children 1st identifies developmental delays and links to interventions
- Home Visiting program promotes early language literacy
- Oral Health promotes oral health literacy
- Centering Pregnancy Programs to reduce preterm births
- Safe to Sleep campaign
TALK WITH ME BABY

- A population-based initiative to ensure every child, beginning in utero, receives essential “language nutrition”
- The quantity and quality of nourishing language are critical to healthy brain development
- Abundant language nutrition ensures a strong foundation for
  - Social-emotional, cognitive development
  - Language and literacy
  - Pathway to third grade reading proficiency, high school graduation, lifelong success
Opioids In Georgia
REGIONALIZED CARE

Level I—Open Heart/LVAD

Level II—PCI

Level III—Front line facilities

EMS Goal—right patient, right place, right time!
Thank You
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Vivian Singletary, JM, MBA

Director of the Public Health Informatics Institute
“An ounce of prevention is worth a pound of cure.”

-Ben Franklin
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Closing Remarks

Tabia Henry Akintobi, PhD, MPH
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Thank you