Course Overview

• Instructor
  – Christian Poellabauer
    • cpoellab@nd.edu
    • Office location & office hours:
      – 323B Cushing Hall
      – Tue 9-10, Wed 11-12; before/after class; by appointment
  – TA: Afzal Hossain
    • afzal.hossain.3@nd.edu
    • Office location & hours:
      – TBD
Course Overview

• Time & Location
  – O'Shaughnessy Hall 116
  – MWF 9.25am-10.15am
  – Some lecture times will be “lab times”; pay attention to course schedule!

• Website:
  – https://www3.nd.edu/~cpoellab/teaching/cse40816/

• Slides, papers, assignments, etc. will be posted on that website!

• Sakai used for submissions and grading

Course Overview

• Expectations
  – Occasional reading assignments (avg. about 1 paper per week); submit brief summary (via Sakai) before lecture
  – Select topic of your choice; read 3-5 papers; write report (~5 pages) and provide brief presentation on your chosen topic
  – Course project
    • Teams of 1-3 students
    • Midterm progress report, final report, final demonstration
  – Mid-term quiz
Class Exercise

- Case 1: Tim has been diagnosed with Type-2 diabetes
- Case 2: Both of Jane’s parents died of cancer at an early age
- Case 3: Jennifer is obese and at a high risk for coronary artery disease
- Case 4: Michael is a college football player
- Case 5: Thomas is 65 years old and was just diagnosed with Parkinson’s Disease
- Case 6: Steve lost a leg in a car accident
- Case 7: Sylvia is a one-year old at risk of being diagnosed with autism spectrum disorder
- Case 8: Come up with your own scenario!

Come up with your three favorite examples of how you would imagine healthcare to be SMART!

"Smart" Systems

- Take a traditional ("dumb") systems and add some advanced functionality
IoT: Cisco Commercial

Smart Systems

- Combines sensing, actuation, and control
Smart Systems

- Make it smart: sense, calculate, actuate
- Make it smarter: sense, calculate/predict (historical data), actuate
- Make it even smarter: sense, calculate/predict (other data sources [person is eating right now]), actuate

Smart Health

- Blue Stream Consultancy:
  - “Smart healthcare is defined by the technology that leads to better diagnostic tools, better treatment for patients, and devices that improve the quality of life for anyone and everyone.”

- National Science Foundation:
  - “The goal of the Smart Health and Wellbeing program is to seek improvements in safe, effective, efficient, equitable, and patient-centered health and wellness services through innovations in computer and information science and engineering.”
Controversial?

• “That it will ever come into general use, notwithstanding its value, is extremely doubtful because its beneficial application requires much time and gives a good bit of trouble, both to the patient and the practitioner.”

Bloomberg Health Ranking

<table>
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<tr>
<th>2019 Rank</th>
<th>2017 Rank</th>
<th>Change</th>
<th>Economy</th>
<th>Health Grade</th>
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Goals of Healthcare Delivery System

(Often) competing goals

Challenge/Goal: Cost

Figure 1: Health spending per capita by government schemes and compulsory health insurance in 2015

Source: OECD Health statistics
Challenge/Goal: Cost

Health care expenditures as a share of GDP, 2016

Challenge/Goal: Cost

CAGR (2015 - 2020)

Global
North America
Western Europe
Asia & Australia
Latin America
Middle East & Africa
Transition economies

0 2,000 4,000 6,000 8,000 10,000
USD $ billion 2020 (P) 2015
Challenge/Goal: Access

What is Access to Healthcare?
EPF considers access to healthcare encompasses 5 key dimensions needed to ensure equitable access to high-quality healthcare from the perspective of patients:

1. **Availability**: Health facilities, services, and products are available in the healthcare system of a country.
2. **Affordability**: Health services do not cause financial hardship to patients.
3. **Accessibility**: Barriers preventing patients from accessing healthcare.
4. **Adequacy**: Coverage of health services is consistent with the needs of the population.
5. **Appropriateness**: Health services meet the needs of different groups in the population.

Overall Score: 64%

Challenge/Goal: Quality

**National Scorecard 2011**

- **Preventable Death**: 105 per 100,000 people
- **Health Insurance Waste**: $7.0 billion
- **Better Care**: 71.6%
- **Medicare Savings**: $3.1 billion

Overall Score: 64%

“D”
Challenge/Goal: Quality

All Nations Face Challenges Coordinating Care

Doctors in every country in a 10-nation survey reported that their practices struggled to coordinate care and communicate with other health providers, which is key to managing patients with complex care needs.

Percent of primary care doctors who report they always receive notification when patient is seen in ED is discharged from hospital

Source: 2015 Commonwealth Fund International Health Policy Survey of Primary Care Physicians

Challenge/Goal: Quality

30-Day Readmission Rates to U.S. Hospitals

1 in 5 patients with these procedures were readmitted:
- 23% Amputation of the lower extremity
- 19% Heart valve procedures

1 in 3 patients with these diagnosis were readmitted:
- 32% Sickle cell anemia
- 32% Gangrene

Sources: The Healthcare Cost & Utilization Project (HCUP) Statistical Briefs #153 and #154, 2010

American Institutes for Research | www.air.org
Other Challenges

- Disparities
- Malpractice
- Unnecessary Care
- Health Literacy
- Lack of collaboration
- Big data
- Cybersecurity