Smart Health – CSE 40816

University of Notre Dame

Spring 2020

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!

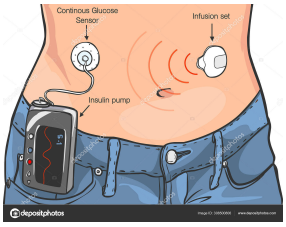
"Smart" Systems

- Take a traditional ("dumb") systems and add some *advanced* functionality

IoT: Cisco Commercial

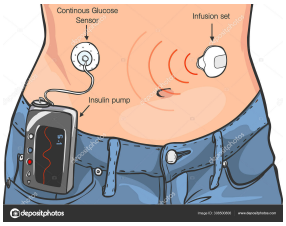
Smart Systems

- 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?

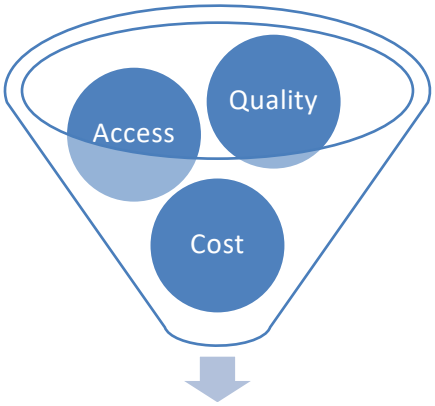
- "That it will ever come into general use, notwithstanding its value, is extremely doubtful because its beneficial application requires much time and gives a good bit of trouble, both to the patient and the practitioner."

Bloomberg Health Ranking

Bloomberg 2019 Healthiest Country Index

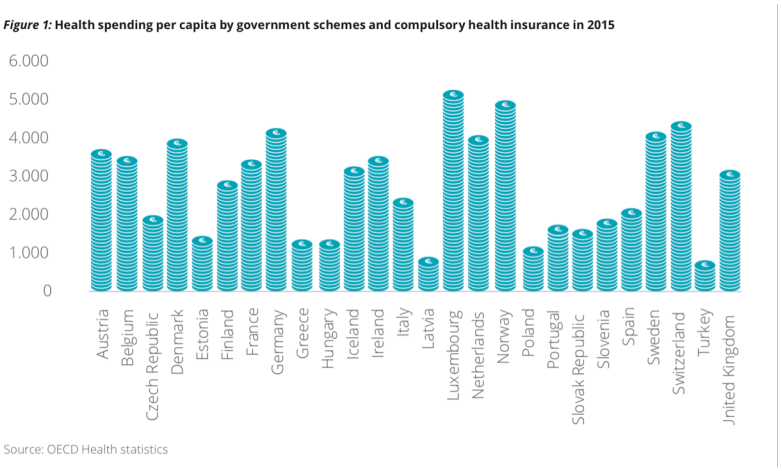
2019 Rank	2017 Rank	Change	Economy	Health Grade	Health Score	Health Risk Penalties
1	6	+5	Spain	92.75	96.56	-3.81
2	1	-1	Italy	91.59	95.83	-4.24
3	2	-1	Iceland	91.44	96.11	-4.67
4	7	+3	Japan	91.38	95.59	-4.21
5	3	-2	Switzerland	90.93	94.71	-3.78
6	8	+2	Sweden	90.24	94.13	-3.89
7	5	-2	Australia	89.75	93.96	-4.21
8	4	-4	Singapore	89.29	93.19	-3.90
9	11	+2	Norway	89.09	93.25	-4.16
10	9	-1	Israel	88.15	92.01	-3.86
11	10	-1	Luxembourg	87.39	92.03	-4.64
12	14	+2	France	86.94	91.70	-4.76
13	12	-1	Austria	86.30	90.81	-4.51
14	15	+1	Finland	85.89	90.18	-4.29
15	13	-2	Netherlands	85.86	90.07	-4.21
16	17	+1	Canada	85.70	90.31	-4.61
17	24	+7	S. Korea	85.41	89.48	-4.07
18	19	+1	New Zealand	85.06	89.68	-4.62
19	23	+4	U.K.	84.28	88.74	-4.46
20	22	+2	Ireland	84.06	89.57	-5.51

Goals of Healthcare Delivery System

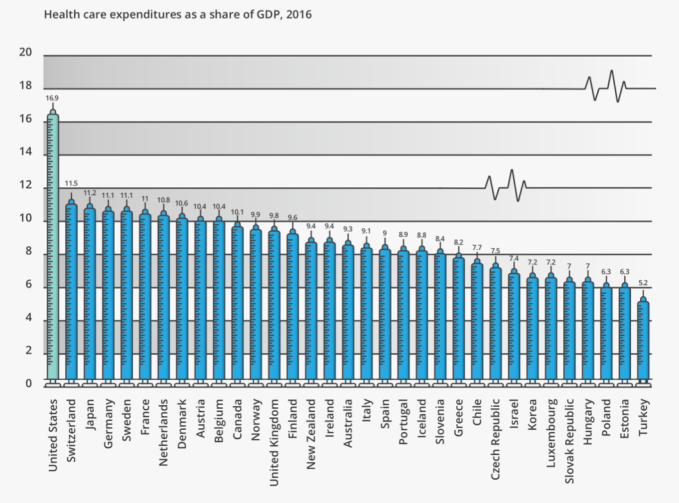


(Often) competing goals

Challenge/Goal: Cost



Challenge/Goal: Cost



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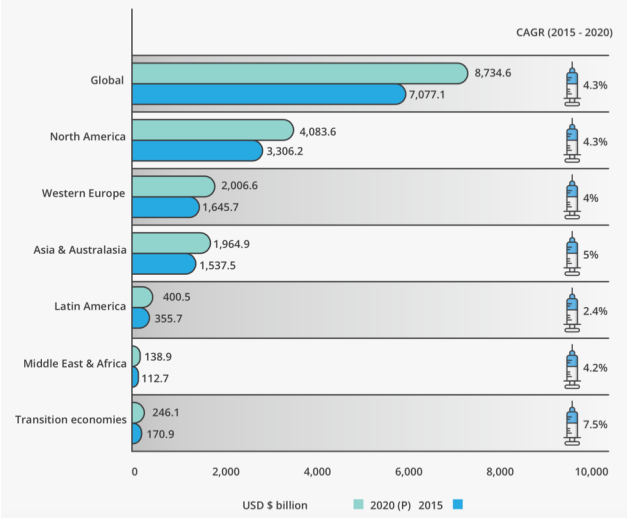
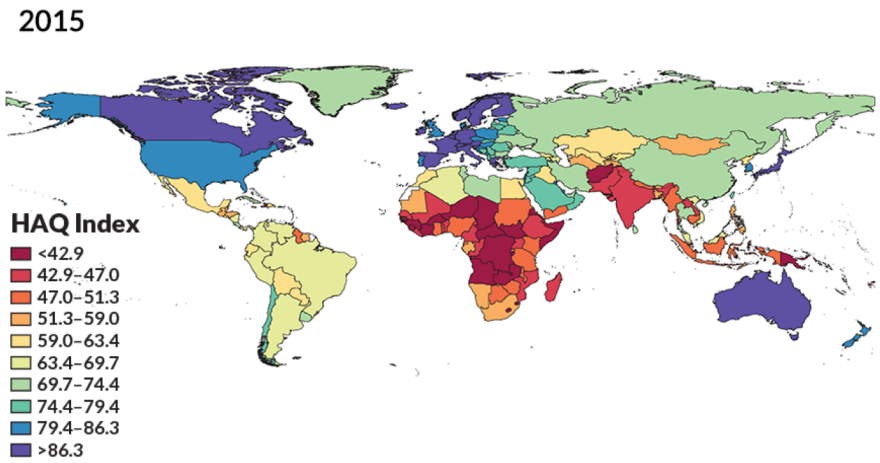


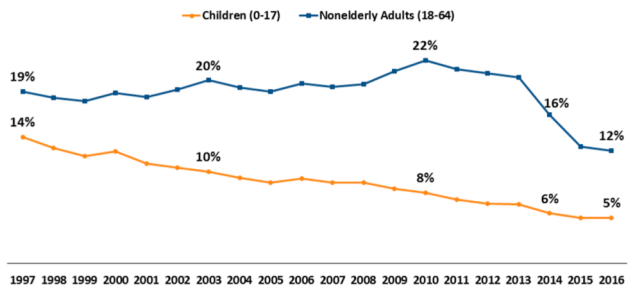
Challenge/Goal: Access



Challenge/Goal: Access

Figure 1

Uninsured Rates Among Nonelderly Adults and Children, 1997-2016

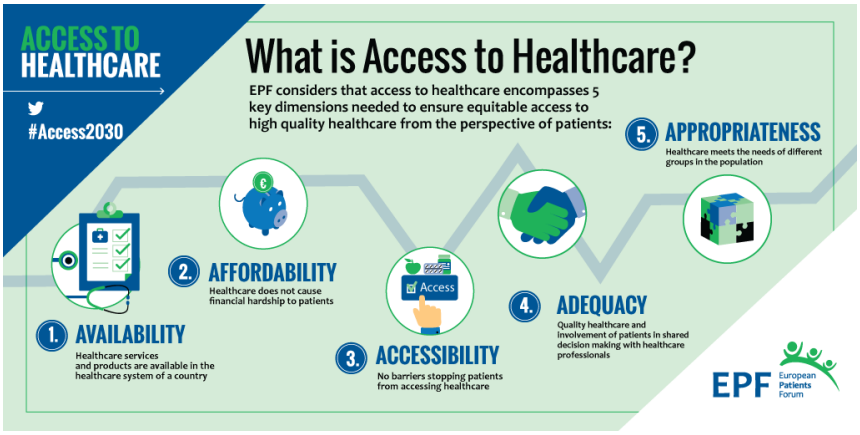


NOTE: Children includes all individuals under age 18. Uninsured rates for 2016 are as of June 2016.
SOURCE: Brian W Ward, Tainya C Clarke and Jeannine S Schiller, *Early Release of Selected Estimates Based on Data form the January-June 2016 National Health Interview Survey*, (Atlanta, GA: National Center for Health Statistics, CDC, November 2016), https://www.cdc.gov/nchs/data/nhis/earlyrelease/earlyrelease201611.pdf.

THE HENRY J KAISER FAMILY FOUNDATION

Figure 1: Uninsured Rates Among Nonelderly Adults and Children, 1997-2016

Challenge/Goal: Access

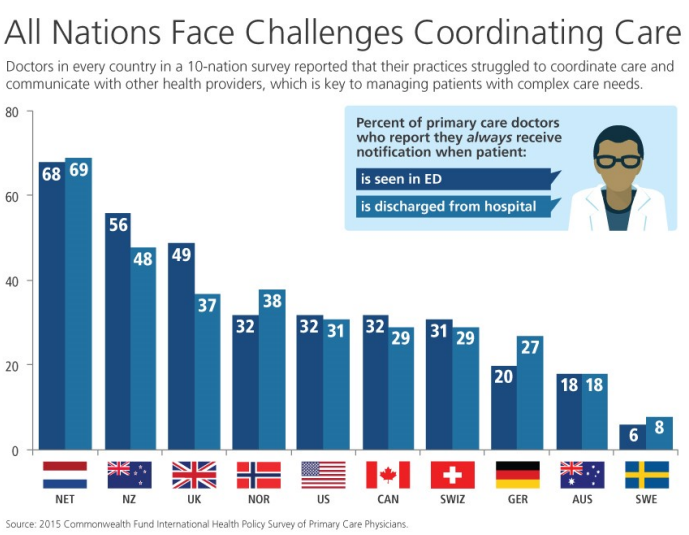


Challenge/Goal: Quality

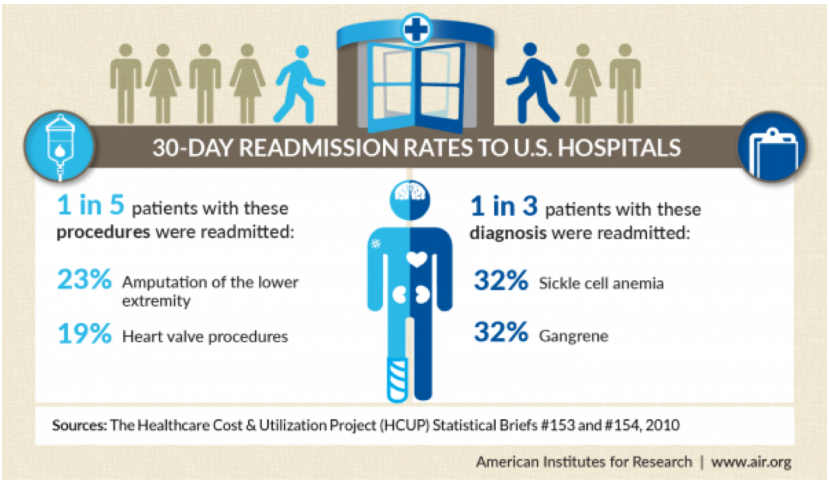
Overall Score 64%

"D"

Challenge/Goal: Quality

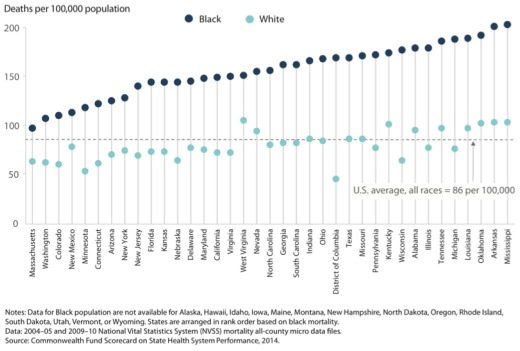


Challenge/Goal: Quality



Other Challenges

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



Notes: Data for Black population are not available for Alaska, Hawaii, Idaho, Iowa, Maine, Montana, New Hampshire, North Dakota, Oregon, Rhode Island, South Dakota, Utah, Vermont, or Wyoming. States are arranged in rank order based on black mortality.
Data: 2004–05 and 2009–10 National Vital Statistics System (NVSS) mortality all-county micro data files.
Source: Commonwealth Fund Scorecard on State Health System Performance, 2014.