intelligent use of health information to individualize and integrate health care

Variability is the law of life, and as no two faces are the same, so... no two individuals react alike and behave alike under the abnormal conditions which we know as disease. – William Osler
Changing External Environment

Non-competitive health outcomes

Life Expectancy vs Medical Expenditures

Unaffordable health care

Total Per Capita Medical Expenditures for OECD Countries

$1 trillion

10/20/2014

(c) Scott L. Zeger, Hopkins inHealth
How can JHU disrupt, then lead medicine toward affordable health in the next 100 years?

**Embrace meaningful variation** in patients and in their treatment effects; variation represents a natural experiment; organize to learn from it; teach others to do the same.

**Stratify (subset) diverse patients into subgroups and learn to treat each stratum optimally,** as we have done better than anyone for 100 years.

**Develop and disseminate knowledge/tools** to enable increasingly precise definition of subgroups and management of patients; e.g. Oncospace
Build on Current JHU/JHHS/APL Strengths

- Clinical research
- Public health research
- Bioscience
- Data science
- Patient care
- Population health care

Research → Health care delivery

Patients → Populations
Play Doctor (even if not on TV)

- 40 year old man, no family history of disease X, tests “positive” in a screening test
- What is his disease state?
- What action do you, his doctor recommend to him?

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<th>Test result</th>
<th>True cancer status</th>
<th>Total</th>
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<tr>
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<tr>
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<tr>
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</table>
Common Questions about Patient and Population Health

1. What is the person’s health state given health measurements?

2. What is the person’s health “trajectory”?

3. Does a particular intervention improve health – on average; for a particular person?

4. Is the intervention being used optimally? How much does it enhance the population’s health at what cost?
Complementary Approaches

• Expand biomedical knowledge
  – Discovery of mechanisms
  – Novel measurements of underlying processes

• Use existing science and measurement more intelligently
A data system designed to individualize radiation therapy

Todd McNutt, Kim Evans, Joe Moore, Harry Quon, Joseph Herman, Andrew Sharabi, Wuyang Yang, John Wong, Theodore DeWeese

Disclosure:
Funding from Elekta and Philips
Sample Automated Radiation Plan

Original

Automated plan

30% reduction in dose to parotids

Auto plan
Original Plan
Dot: right
No-dot: left

Dose(Gy)
Improved Health at More Affordable Costs

Clinical and Public Health Discovery

Scale and replicate

Biohealth Pilot Projects
- Cancer screening
- Cardiovascular disease diagnosis and treatment
- Genomics of cystic fibrosis
- Telomere biology and chronic diseases

OncoSpace in Radiation Oncology
- Management of autoimmune diseases
- Myostatin in sarcopenia

Population Health Demonstration
- Cancer screening and early diagnosis
- Cardiovascular disease
- Age-related cognitive loss
- Obesity and Diabetes
- Children’s asthma prevention and control

Methodology Cores
- Health measurement
- Bioethics
- Data and software solutions
- Statistical design and analysis
- Behavior change and dissemination
- Finance – organization models
Open Source Learning Environment for Research \textit{in}Health

OSLER \textit{in}Health

- Concept for R-package
- Primitives
  - Input
    - access data from standard (e.g. EPIC/Cogito; TransMart) data warehouses
  - Data structures
    - Encounter $\prec$ subject $\times$ clinician(s) $\prec$ practice group $\prec$ population
  - Functionality
    - Embed (individual, within “otherwise similar(x)” population, distance metric and limit (d)
    - Specifying local sub-models; integrating results
- Your ideas and developers welcome
Statistical Model Components

**State Equations**
1. Health state model
   - 1a. Health state definition
   - 1b. Health state trajectory
   - 1c. Covariate and intervention effects on health state

2. Intervention model

**Observation Equations**
3. Measurement model

**Embedding within Relevant Population**
Observations ($Y$) that Inform about Health State through Coefficients ($\varphi_i$)
Pilot Funding Process

RFAs to be released within 3 months covering Measurement Analytics

**Phase 1**
- Award 8 pilot applicants with $50K for 8 months
- Pilots that meet their defined goal at the end of 8 months receive $25K for additional 4 months
- Potential funding per pilot = $75K over 1 year
- Pilots that successfully complete Phase 1 are eligible to apply for continued funding (Phase 2)
Pilot Funding Process (continued)

Phase 2

- Award 3-5 pilot applicants with $100K - $150K for 12 months
- Requirements
  - Implementation of pilot solution at Johns Hopkins by end of Phase 2
  - Submission of external funding application

Total potential funding through Phases 1 and 2 = $175K - $225K over 2 years
How To Get Involved

Apply to become a member of the Hopkins *in*Health community
• Visit [http://hopkinsinhealth.jhu.edu/](http://hopkinsinhealth.jhu.edu/)
• Click “Join Us” and follow instructions

Benefits of Hopkins *in*Health membership
• Eligibility for forthcoming pilot funding
• Updates on research findings, news, etc.
• Development of partnerships/access to data
Hopkins inHealth

Thank you

http://hopkinsinhealth.jhu.edu/
Click “Join Us” to apply for membership