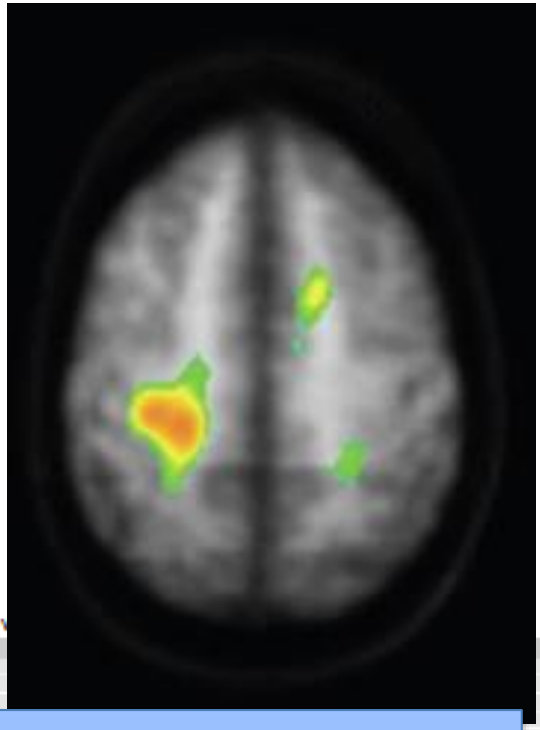
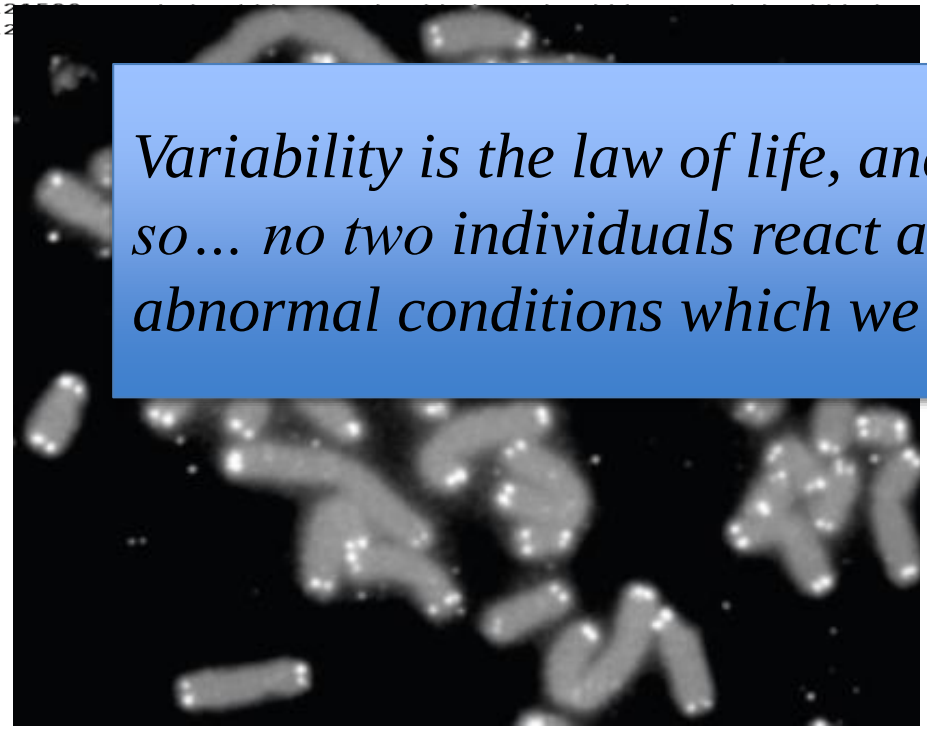
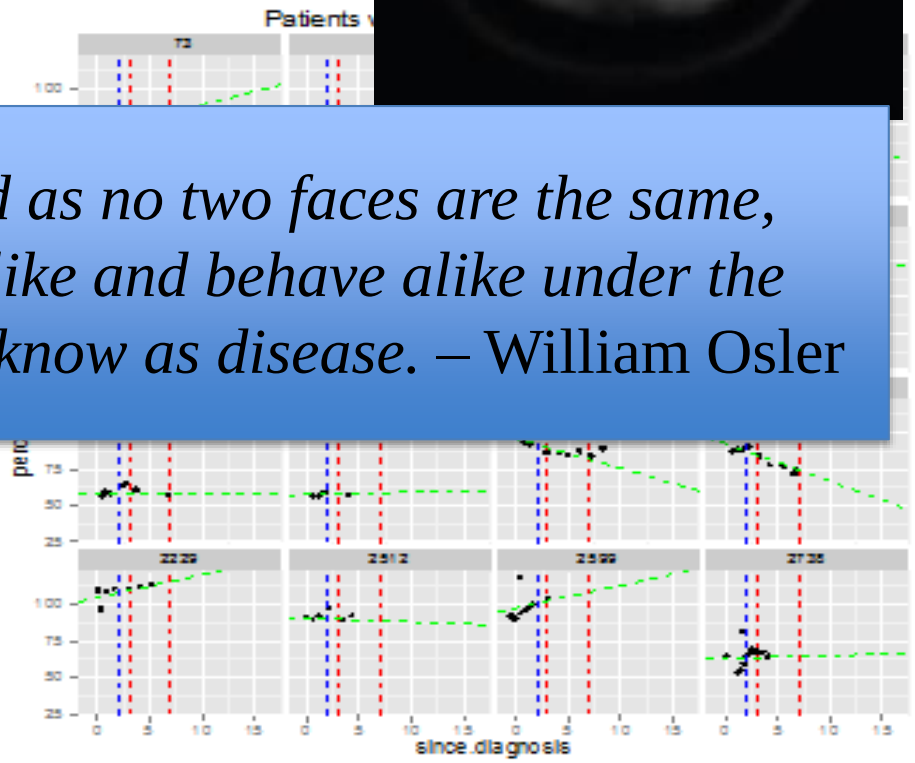
*in*telligent use of health
*in*formation to
*in*dividualize and
*in*tegrate health care

Hopkins *in*Health





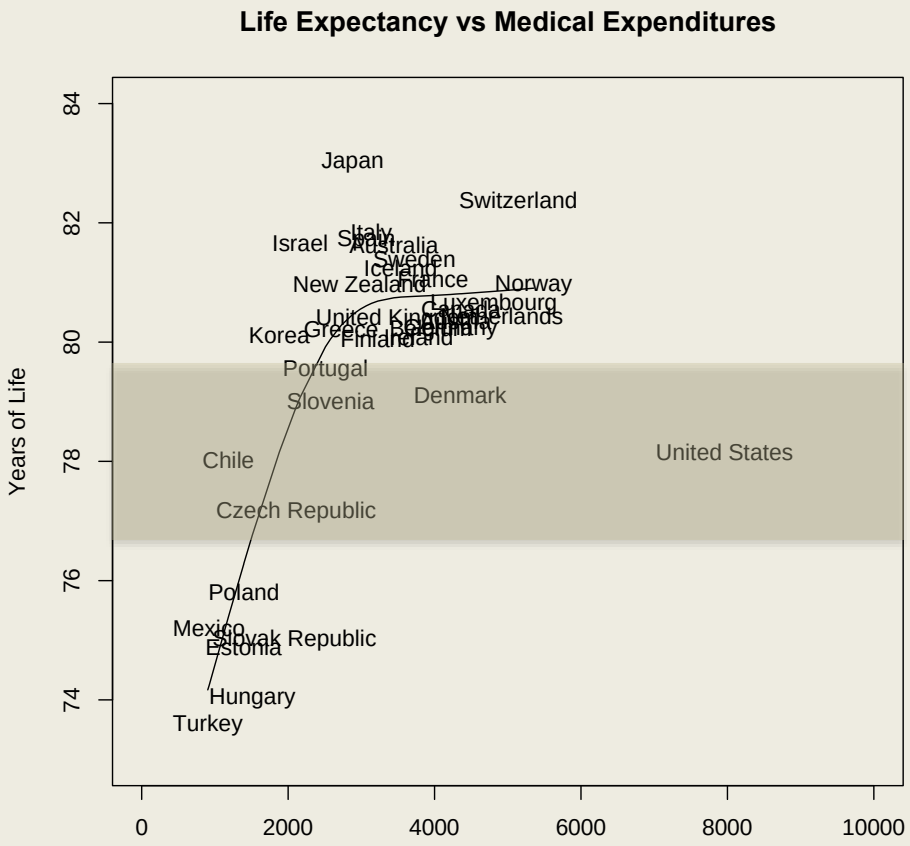


Variability is the law of life, and as no two faces are the same, so… no two individuals react alike and behave alike under the abnormal conditions which we know as disease. – William Osler

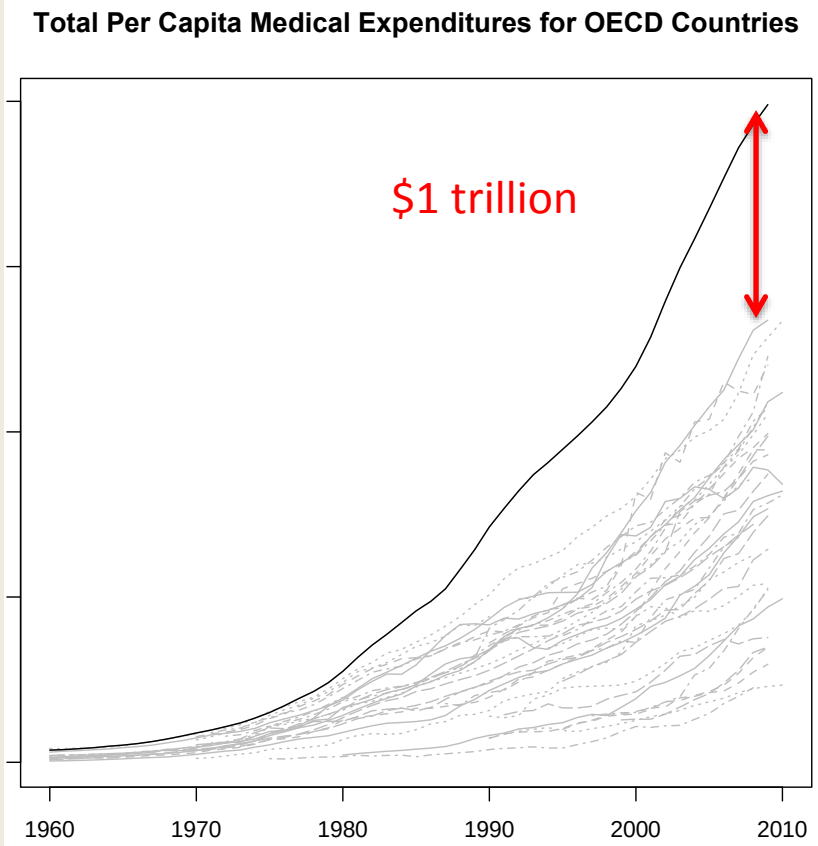
Changing External Environment

Non-competitive health outcomes

Bert Vogelstein, Nickolas Papadopoulos, Victor E. Velculescu, Shibin Zhou, Luis A. Diaz Jr., and Kenneth W. Kinzler*
The Ludwig Center and The Howard Hughes Medical Institute at Johns Hopkins Kimmel Cancer



Unaffordable health care



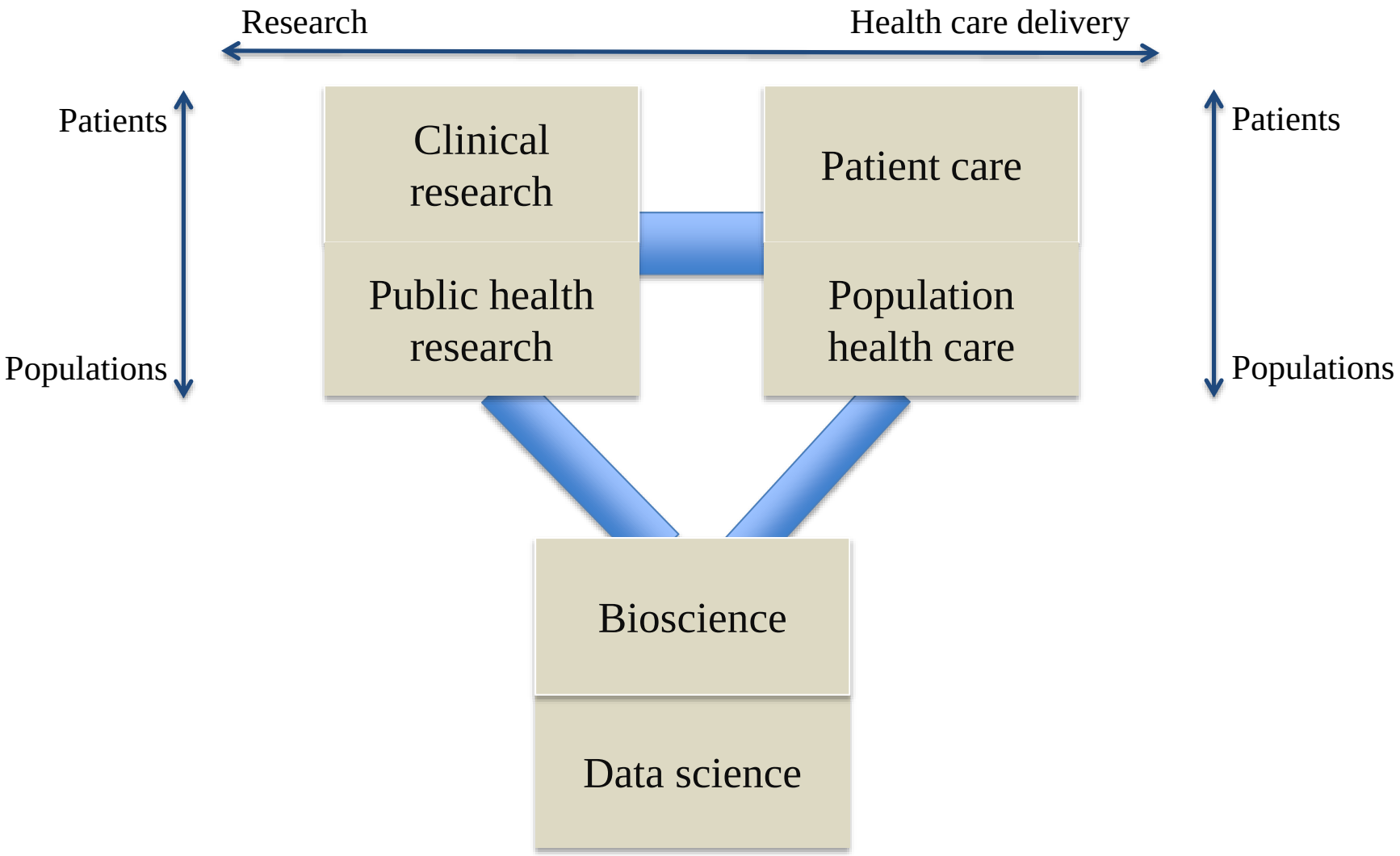
How can JHU disrupt, then lead medicine toward affordable health in the next 100 years?

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



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?

Data from population of "similar" people

	True cancer status		
Test result	Yes	No	Total
Positive	15	985	1,000
Negative	5	8,995	9000
Total	20	9,980	10,000

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 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

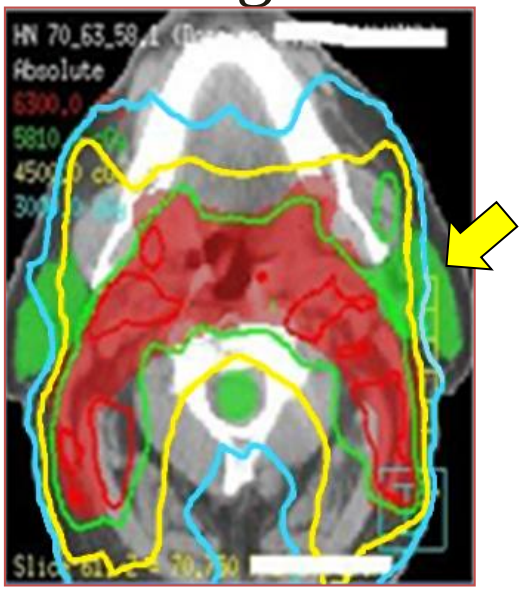
A data system designed to individualize radiation therapy

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

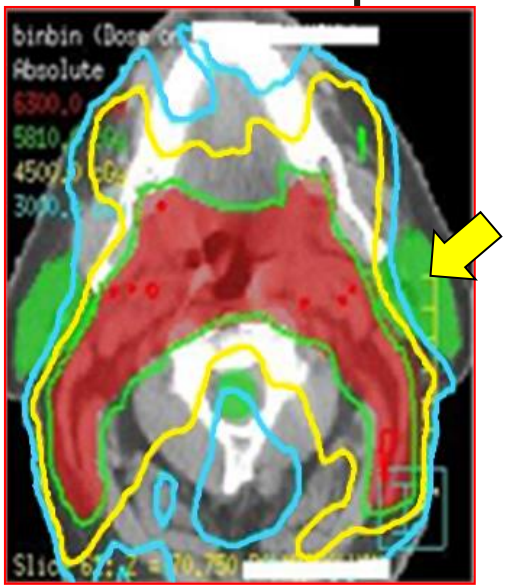
Disclosure:
Funding from Elekta and Philips

Sample Automated Radiation Plan

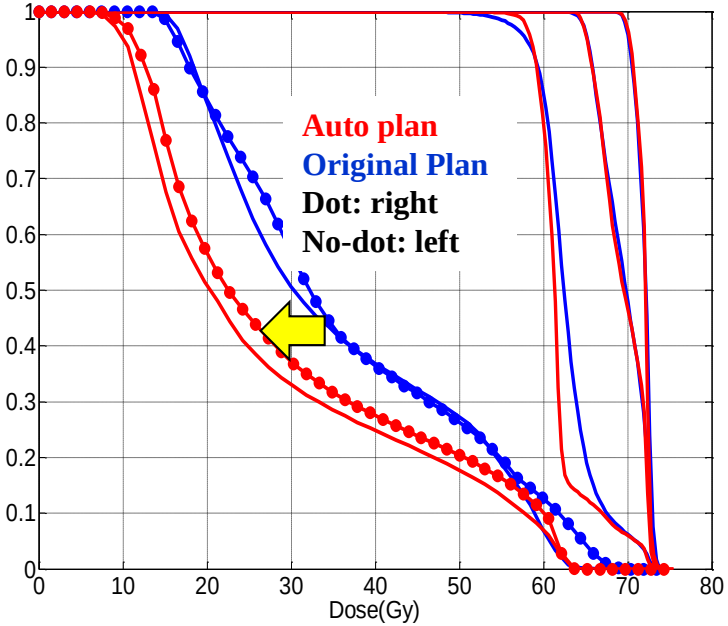
Original

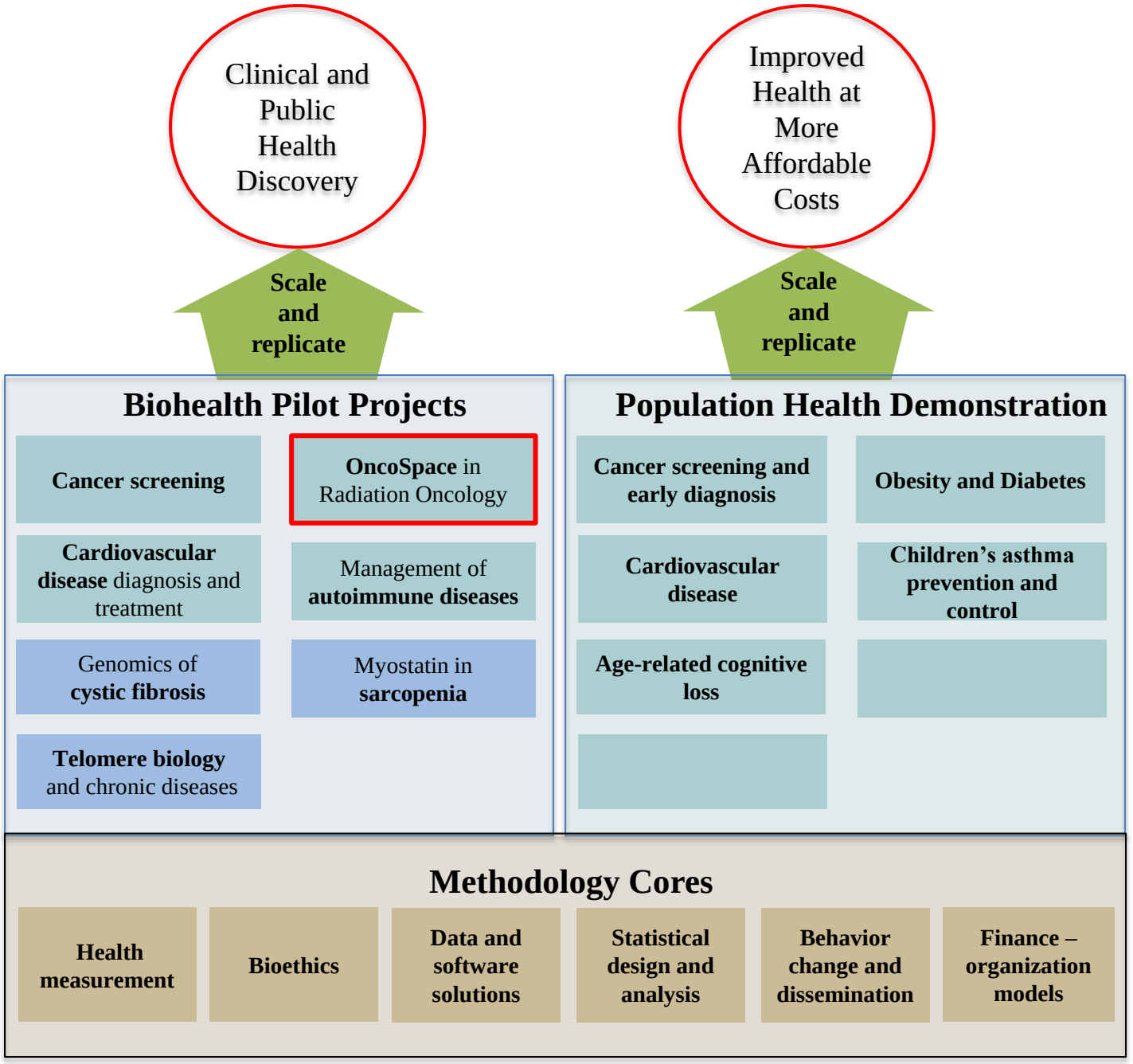


Automated plan



30% reduction in dose to parotids




Clinical and Public Health Discovery
Improved Health at More Affordable Costs
Scale and replicate
Scale and replicate
Biohealth Pilot Projects
Cancer screening
OncoSpace in Radiation Oncology
Cardiovascular disease diagnosis and treatment
Management of autoimmune diseases
Genomics of cystic fibrosis
Myostatin in sarcopenia
Telomere biology and chronic diseases
Population Health Demonstration
Cancer screening and early diagnosis
Obesity and Diabetes
Cardiovascular disease
Children's asthma prevention and control
Age-related cognitive loss
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 *in*Health
OSLER *in*Health

- Concept for R-package
- Primitives
  - Input
    - access data from standard (e.g. EPIC/Cogito; TransMart) data warehouses
  - Data structures
    - Encounter < subject $_{x}$ clinician(s) < practice group < 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

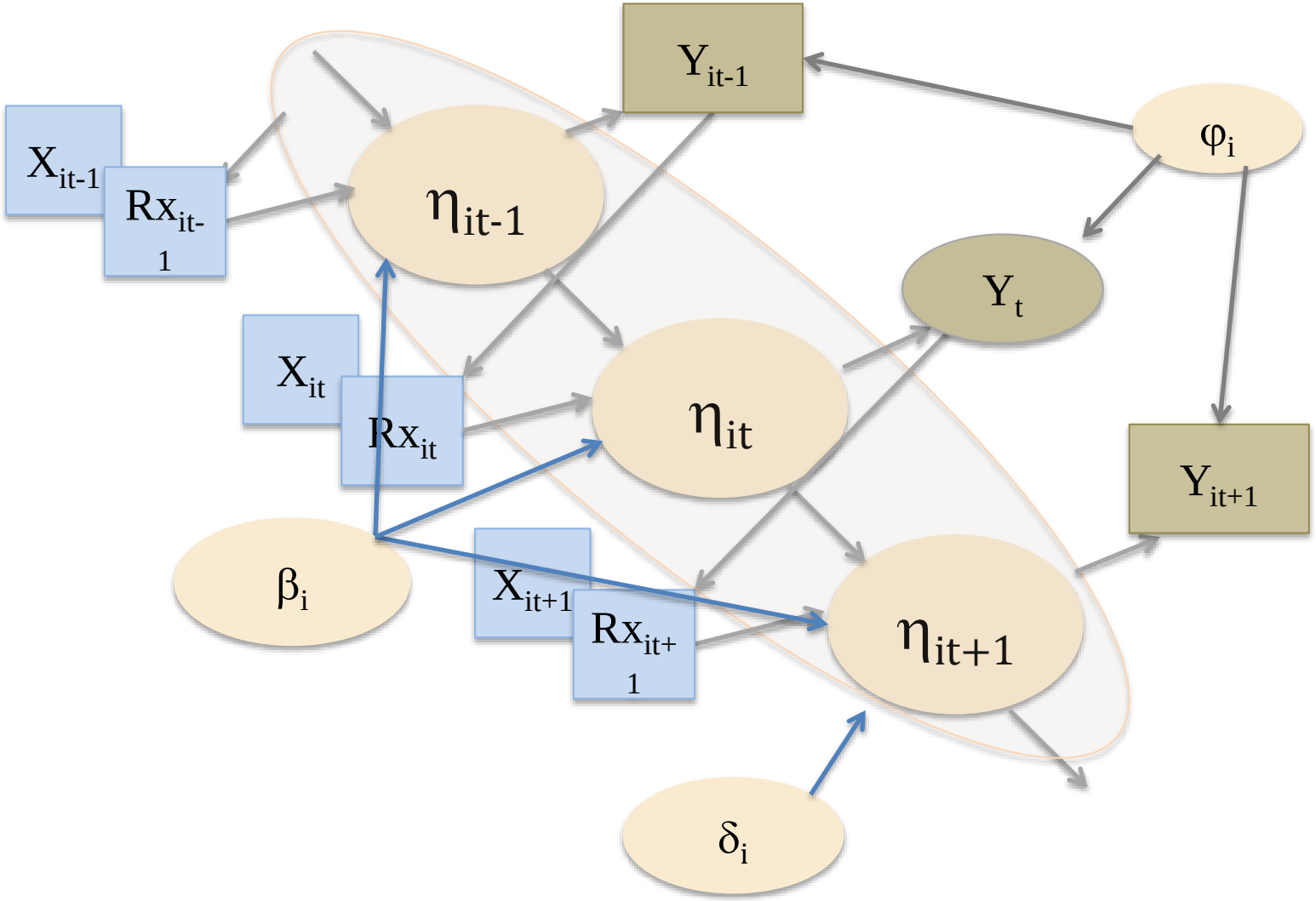
2. Intervention model

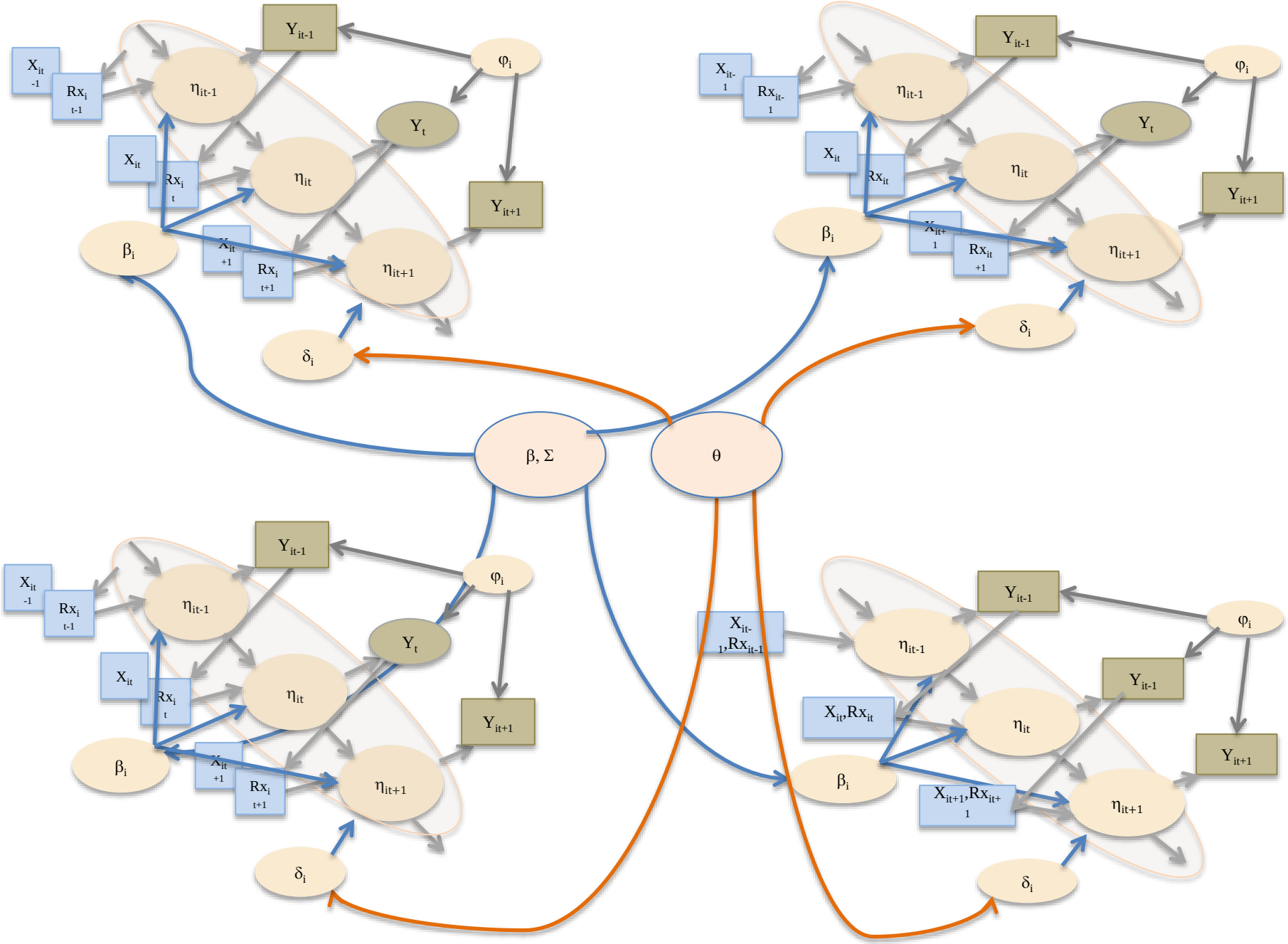
Observation Equations

3. Measurement model

Embedding within Relevant Population

Observations (Y) that Inform about Health State through Coefficients (φ_i)




Y it-1
φi
X it -1
Rx i t-1
ηit-1
Y t
X it
Rx i t
ηit
Y it+1
βi
X it +1
Rx i t+1
ηit+1
δi
β, Σ
θ
X it- 1
Rx it- 1
X it
Rx it
X it+ 1
Rx it +1
X it- 1,Rx it-1
X it,Rx it
X it+1,Rx it+ 1

Pilot Funding Process

RFAs to be released within 3 months covering

Measurement

Analytics

<u>Phase 1</u>

- 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/
- 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 *in*Health

Thank you

http://hopkinsinhealth.jhu.edu/

Click “Join Us” to apply for membership