Knowledge Generation with EHR Data

- How much can be learned at the population level?
  - How are findings validated?
- How much can be learned at the patient level?
  - Are there “Patients like me?”
  - What can be done with the information?
- How can we optimize (accelerate) learning healthcare system activities?
  - Embedded randomization
Samuel L Jackson
Pulp Fiction

SAY BIG DATA
ONE MORE TIME
Learning Healthcare System Tool Kit

• Infrastructure
  – EHR Data
  – EHR Application
  – Sophisticated Analytics
• Embedded clinical trials - ability to perform experiments
  – At low cost
  – Iteratively
  – At large scale
  – Pragmatically
    • Translatable results
• Decision support modules
Traditional Observational Health Research

- Cohort Identification
- Data Collection
- Data Cleaning
- Data Analysis

Knowledge Generation

Publication

Translation Gap
Observational Research with Guideline Implementation

- Cohort Identification
- Data Collection
- Data Cleaning
- Data Analysis

- Knowledge Generation
- Decision Support

- Publication
- Guideline Creation
Local Learning and Implementation

Cohort Identification → Data Collection → Data Cleaning → Data Analysis

Knowledge Generation

Patient Specific Decision Support

Individual Patient Data → Prediction Algorithm → Results

MAVERIC
MASSACHUSETTS VETERANS EPODEMOLOGY
RESEARCH AND INFORMATION CENTER
Integration of Randomization into Clinical Care

Patient and Providers

Initiate system for specific learning or research activities

Ongoing clinical care

Usual care continues

Research activities

Ongoing collection of data
Point of Care Clinical Trials

- Cohort Identification
- Enroll & Consent
- Randomize
- Intervention

Data Capture

Decision Support

Study DB

Analysis
Exemplars

• Insulin Study
  – Randomization to sliding scale or weight based insulin regimens
  – Recruitment from EHR without a registry or data warehouse

• Diuretic Comparison Study
  – Randomization to hydrochlorothiazide or chlorthalidone
  – Recruitment from Corporate Data Warehouse

• Precision Oncology Program
  – DNA targeted sequence with subsequent enrollment into matched clinical trial
  – Recruitment from the Precision Oncology Clinical Data Repository
Local Learning Through Experiments

Prior N patients

N+1 cancer genome

Dx

Tx

Similar patients

Outcomes

If equipoise, offer randomization within routine care

N+1 patient

Providers

randomized outcomes

Time
Traditional Research Process

- New discoveries
- Generalizable knowledge

Local Learning

- Specific local actionable insights
- Predictions

Providers
- Tumor board

Researchers

Patient
- Goals of care
- Functional status
- Obs daily living
- Cancer genomic alterations
- EHR clinical history
- Lab tests
- Imaging

Traditioanl translational processes

Curation for specific knowledge

POP Knowledge and algorithms

local knowledge with potential for generalizability