It is time to learn from patients like mine

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Let’s meet Laura

A teenager with systemic lupus erythematosus, proteinuria, pancreatitis and positive for antiphospholipid antibodies

The Green Button project

http://greenbutton.stanford.edu

- Given a specific case, provide a summary of similar patients in Stanford’s clinical data warehouse, the common treatment choices made, and the observed outcomes.

- An institutional review board approved study (IRB # 39709), which served 150 consultations across all service lines.

- Invented novel technology to search medical timelines.
Timeline

2014  **Green button**: using aggregate patient data at the bedside  
      (vision paper in Health Affairs)  
2015 Outlined steps for rapid cohort studies at the bedside  
2016  Built a search engine for patient timelines  
2017  Launched a pilot of the service  
2018 Described the methods used in the consult service, and  
      a perspective on why “It is time to learn from similar patients”  
2019 Completed the pilot study (writing up results)
An example report

Mildly elevated serum free light chains and subsequent malignancy

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Observed</th>
<th>Expected</th>
<th>(O – E)² / E</th>
<th>(O – E)² / V</th>
<th>chisq</th>
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<td>8.092</td>
<td>16.413</td>
<td>16.4</td>
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<tr>
<td>elevated</td>
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<td>90</td>
<td>71.635</td>
<td>8.287</td>
<td>16.413</td>
<td>16.4</td>
<td>5.00e-05</td>
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Service = software, data, and personnel

- **Software**: ACE search engine
  - For patient timelines

- **Data**
  - EMR
  - Claims

- **Personnel**
  - Informatics Physician
  - EMR Data Specialist
  - Data Scientist
patients with cryptogenic stroke

var st = Intersect(OR(icd9=436, icd9=434), NOT(OR(icd9=393, icd9=394, icd9=397.1, icd9=397.9, icd9=398, icd9=246, icd9=424.9, icd9=V43, icd9=433.1, icd9=431, icd9=434.11, icd9=434.01)), AGE (40 years, 90 years), VISIT TYPE="INPATIENT", NOT(TEXT="thyroid diseases"), NOT(TEXT="heart valve prosthesis"), NOT(TEXT="disease of mitral valve"), NOT(TEXT="rheumatic heart disease"))

those that got diagnosed with Afib

var afib = FIRST_MENTION(icd9=427.31)

those with a cryptogenic stroke, and then Afib in 1 to 5 years

SEQUENCE ($st, $afib)+($-5 years, $-1 year)
The process: 24 – 72 hours

1. Phenotype definition
2. Knowledge graph use
3. Cohort generation
4. Searching timelines
The first 100 consults

- 100 consultation requests received
- 83 consultations completed
- 17 consultations cancelled
  - Source data missing necessary detail: 9
    - laboratory records: 3
    - medication records: 2
    - clinical notes: 1
    - admit/discharge service: 2
    - provider: 1
  - Too few patients meeting criteria: 5
  - Insufficient detail for cohort definitions: 1
  - Requestor did not complete intake: 1
  - Required a different study design: 1

- 48 exploratory analyses
- 35 treatment effect analyses
  - 17 survival analyses

Number of consults vs Unique physicians requesting consult

- Internal Medicine
- Oncology
- Cardiology
- Pediatrics
- Dermatology
- Anesthesiology
The first 100 consults
How ‘reliable’ are the results?

1. Comparing with two reference sets
   - Applies to the 18 treatment effect estimation consults
   - 13-22% were “false discoveries”

2. Comparing across datasets (Truven, Optum)
   - Agreed 68-74% of the time
   - About the same rate as how often RCTs agree with each other

3. Comparing patient matching strategies
   - Agreed 79% of the time
Green button → Informatics Consult

- Point of care randomization / large simple trial
  - Queue / Consider for randomization at point of care

- Clinical situation
  - Guideline available?
    - Yes: Use level A guideline
    - No: Consult Service

- Consult Service
  - Priority list of clinical situations
  - High priority
    - Increment priority
  - Useful byproduct

- Analysis + Report
  - The question as posed
  - How we asked the question
  - Our interpretation
  - Research walkthrough

- Use professional judgment
Green button and the Informatics Consult

Informatics Consult team

- Saurabh Gombar
- Alison Callahan
- Vladimir Polony
- Ken Jung
- Nigam Shah
- Robert Harrington
- Rob Tibshirani
- Trevor Hastie

Stanford Health Care partners

- David Entwistle
- Tip Kim
- Christopher Sharp

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Related prior efforts

Estimating Prognosis with the Aid of a Conversational-Mode Computer Program

ALVAN R. FEINSTEIN, M.D., JOEL F. RUBINSTEIN, M.D., AND WALTER A. RAMSHAW, M.A.

has been developing a system method for capturing our clinical experience with patients who have coronary heart disease. We began endeavor because we believed the ability to recall what we had done found to whom we had done it, and we had happened would improve our abilities to care for each new patient. We began to use this accumulated clinical experience, or data bank, in the n

Evidence-Based Medicine in the EMR Era

Jennifer Frankovich, M.D., Christopher A. Longhurst, M.D., and Scott M. Sutherland, M.D.

<table>
<thead>
<tr>
<th>MEDICINE</th>
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<tr>
<td>ALIVE DEAD N.N.A. SURVIVAL</td>
<td>ALIVE DEAD N.N.A. SURVIVAL</td>
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<tr>
<td>SURGICAL</td>
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<tr>
<td>SIX-MONTH</td>
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<tr>
<td>THREE-YEAR</td>
<td>1 0 100.0%</td>
</tr>
<tr>
<td>THREE-YEAR</td>
<td>1 0 100.0%</td>
</tr>
<tr>
<td>RE-ANASTOM YET REACHED ANNIVERSARY</td>
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There were 0 PERFORATIVE MYOCARDIAL INFARCTIONS. Subsequently, 0 surgically treated patients had infarctions. 0 medically treated patients had infarctions. At the 6-month follow-up, 3 surgically treated patients were pain-free and 2 medically treated patients were pain-free.
Questions that remain

• Does having such a consult service change patient outcomes?
• How could we enable such consults nationwide?
• Could we automate such analyses to be “always on”?
• Could we get such a “curbside consult” from multiple health systems?
• Could patients benefit from having access to such reports?