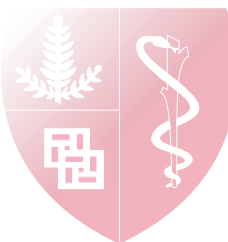# ADVANCING MEASUREMENT OF PATIENT-CENTERED OUTCOMES AND QUALITY METRICS WITH ELECTRONIC HEALTH RECORDS

Tina Hernandez-Boussard, PhD, MPH, MS

Director, Surgical Health Services Research Unit

Assistant Professor Surgery & Medicine (BioMedical Informatics)
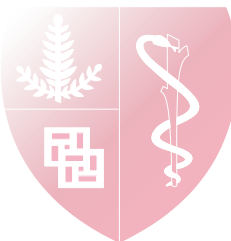
Disclosures

Background

- National Initiatives to improve quality of healthcare delivered in the US - Affordable Care Act (ACA)
  - Value-based payment modifiers (Section 3007)
  - Patient-centered care initiatives (Section 10602)
  - Accountable Care Organizations (Section 3022)
    - Coordinated care; Information exchange
- Patient-Centered Outcomes Research Trust Fund
  - PCORI - $3.5B through 9/19

Accurate quality measurement is essential – and must include patient centered outcomes

Patient-Centered Outcomes (PCOs)

- POCs are outcomes from medical care that are important to patients which can not be measured by lab values or diagnostic tests
- Current government initiatives highlight the need to include PCOs in healthcare evaluations
- Prostate Cancer Outcomes
  - Prostate cancer treatments have different risks of patient-centered, such as urinary incontinence and erectile dysfunction
  - Current treatment guidelines regarding these outcomes have been inconclusive
    - Lack of clear evidence

Patient-Centered Outcome Evaluations Limited

- Relevant data are not captured in structured formats
- Existing methods to algorithmically annotate EHR free-text are limited
  - Interoperability is a problem
- Current assessments of patient-centered outcomes research rely on
  - Manual chart review
    - Labor intensive
    - size limited
  - Administrative data
    - Lack clinical granularity
    - Lack patient centered outcomes
  - Patient Surveys
    - Select population
    - Not readily available
    - Size limiting
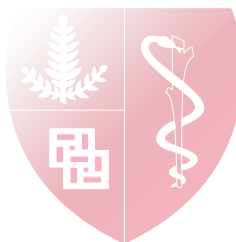
Electronic Health Records (EHRs)

- EHRs Offer New Opportunities for Quality Assessment
  - Improve quality, safety, efficiency, and reduce health disparities.
  - Engage patients and family
  - Improve care coordination and population and public health
- CMS has identified EHR Meaningful Use (MU)
  - Accessibility (MU-1)
    - National effort to increase EHR adoption
      - Opens new opportunities to facilitate comprehensive assessment of healthcare delivery
  - Granular Data (MU-2)
    - EHRs contain detailed information about care processes and outcomes
  - Improve healthcare delivery (MU-3)
    - *Future of EHRs*

Just beginning to tap into the wealth of information contained in EHRs!
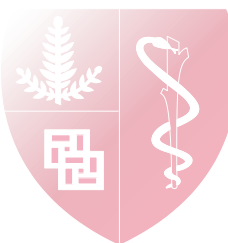
Hurdles Using EHRs

- Comprehensive assessment of EHRs hindered due to methodological reasons
  - Data are not organized according to patient and treatment – EHRs are not intended for research
- ~80% of data are entered as free-text in clinicians' notes
- Shared algorithms to use data with EHRs do not exist
  - Site or system-specific algorithms

While some studies have assessed 1-2 quality metrics, comprehensive quality assessment using EHRs is lacking

Research Question

- How can we use EHRs to improve measurement of quality indicators and patient-centered outcomes/metrics?

  ◦ Efficiently and accurately measure patient-centered quality metrics using data stored in EHRs

  ◦ <u>Use case</u>: Urinary incontinence in localized prostate cancer patients
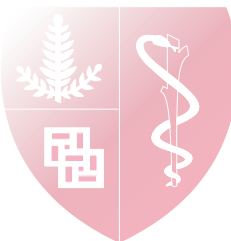
Methods

- Study Population
  - Male patients seen at the Stanford Medical Center, 1995-2013
- Inclusion criteria
  - ICD-9 code for prostate cancer (185)
  - Prostatectomy procedure
    - ICD-9 and CPT codes
    - Open, laparoscopic, robotic
- Exclusion criteria
 - No clinical note in their EHR (narrative text)

2252 Prostate cancer patients with EHR note
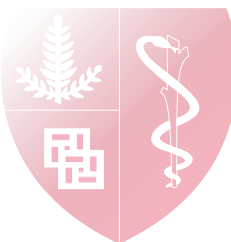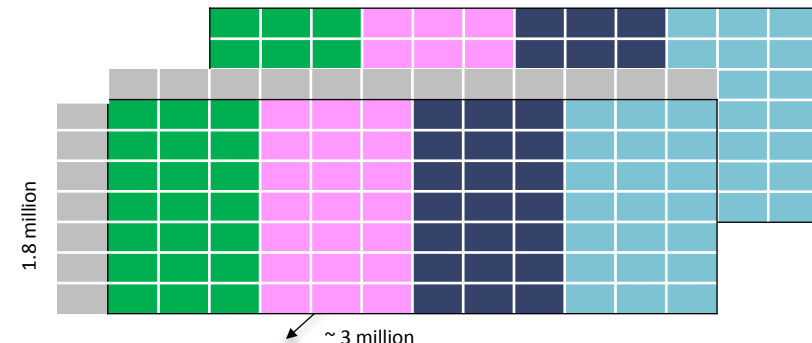
Hurdle 1: EHR-Data Organization

- Develop EHR-Based Database
  - Identify cancer patients in EHRs using ICD-9 codes
    - Confirmed in state cancer registry
  - Map structured elements of EHR to relational database
    - Tables for patient, diagnoses, procedure, etc.
  - Each patient visit contains link to clinicians' notes as free text

Integrates complex, longitudinal data from multiple electronic medical records and registries and provides a rich, validated resource for research on oncology care.
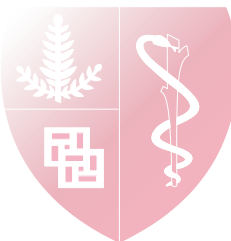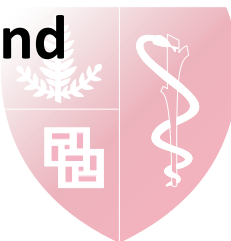
Hurdle #2: Assessing Free Text

- Processes free-text into matrices that indicate which medical terminologies were mentioned in each patient encounter
  - Ontology-based dictionaries
  - Natural language processing technologies
    - Negation, past medical history, family history, temporal sequencing
  - Standard measures to test accuracy

- Matrices have three dimensions
  - Rows are Patients
  - Columns are Medical Terms
  - "Sheets" are Time (different episodes of care)

- Matrices are used for further analyses

1.8 million

~ 3 million

Lependu P, Srinivasan VI, et al. *Nat Clin Pharm Therp.* 2013.
Liu Y, Lependu P, Iyer S, Shah NH. *AMIA Summit on Translational Science.* 2012;2012:47-56.

Hurdle #3: EHR Shared Algorithms

- Electronic Phenotypes
  - Electronic algorithms used to identify characteristics of patients within healthcare data
  - Team of clinical domain experts, bioinformaticians or NLP experts, and biostatisticians
- Electronic Quality Metric Phenotypes
  - Structured series of components that define an outcome or cohort of interest
  - Map quality metric terms to existing vocabularies and ontologies
  - Define temporal structure of elements

Quality Phenotype

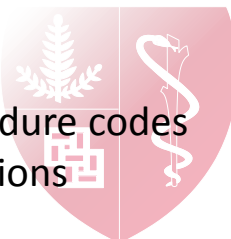- Pretreatment assessment of urinary incontinence

A. *time* ->

Physician → Oncologist → Oncologist → Oncologist
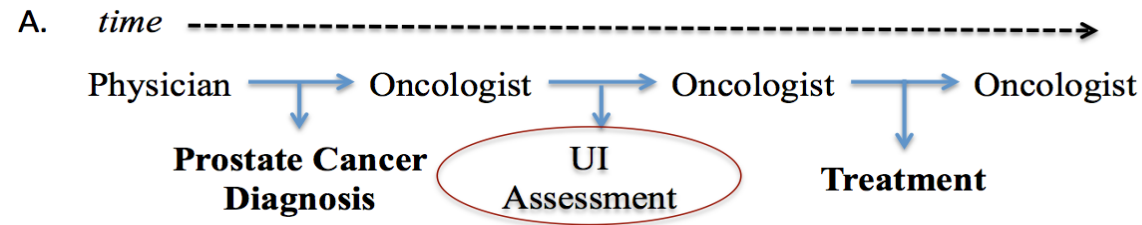
Prostate Cancer Diagnosis   UI Assessment   **Treatment**

Key Features
Incontinent
Leaky bladder
Urinary incontinence
Nocturnal enuresis
Wears diaper

B.

Quality Phenotype: Pretreatment Assessment of UI
Diagnosis of Prostate Cancer
NEXT
ICD-9 Code BEFORE Treatment
788.3 - Urinary Incontinence
OR
Text Mention of Urinary Incontinence Before Treatment
Urinary Incontinence (SNOMED: 165232002)
NEXT
Prostate Cancer Treatment

Linked to Diagnosis codes

Linked to Procedure codes And term mentions

Results

- 2252 Prostate cancer patients with EHR note
- Assessment of Urinary Incontinence
  - Pre-operatively
  - Recording of risks associated with treatment
 - Post-operatively

|	Open	Robotic	Other	Total
Postoperative Urinary Incontinence, Data Mining	19.7%	12.7%	29.3%	22.4%
Postoperative Urinary Incontinence, Coded Data	<1%	<1%	<1%	0.21%
Postoperative Urinary Incontinence, Total	**19.7%**	**12.7%**	**29.5%**	**22.6%**

Display of Urinary Incontinence in EHRs
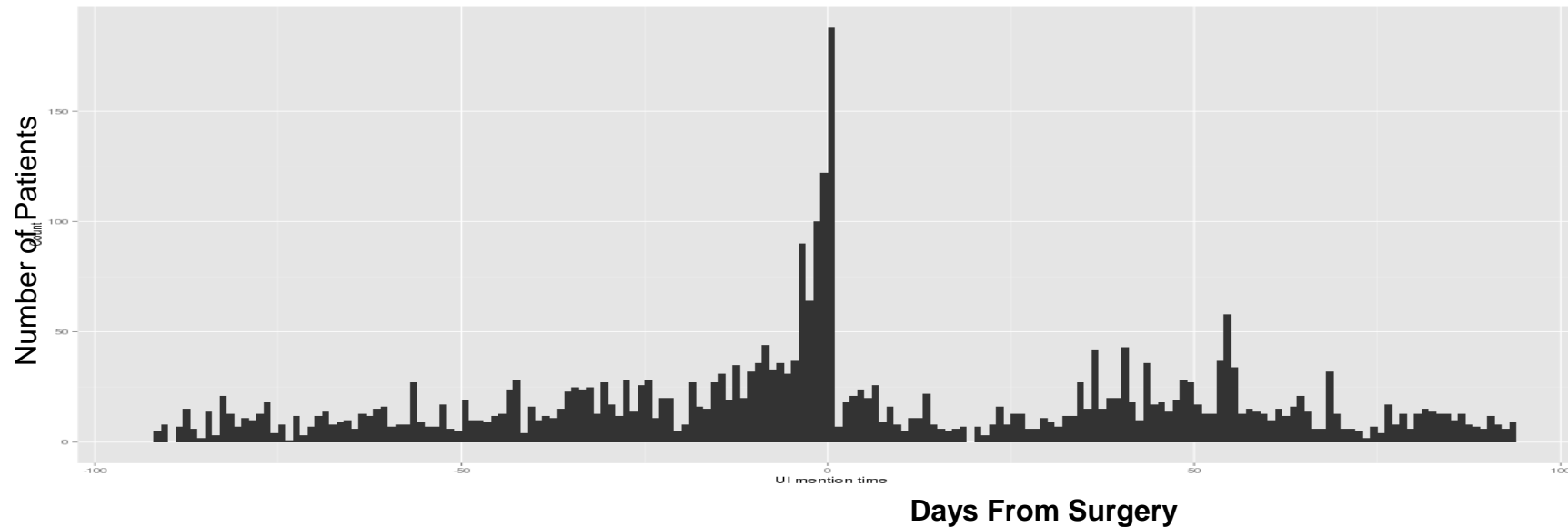
Workflow performance outcome: precision: 98%; sensitivity: 97%; F1: 98%
Workflow performance discussion: precision: 82%%; sensitivity: 93%; F1: 96%
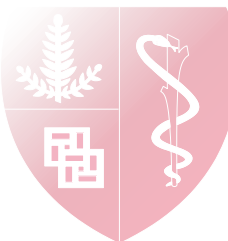
Conclusions

- EHRs offer opportunities to enhance quality measurement
  - Add capability to include metrics on patient-centered outcomes
- We overcome many obstacles to use EHRs
  - Enhance accuracy of data through development of EHR-database linked to patient registries
  - Developed tools to annotate EHR free-text
  - Create electronic phenotype algorithms to standardize EHR-measurements
- EHRs are an untapped source of data
  - Patient-centered outcomes research
  - Quality assessment
 - Provider documentation and adherence to guidelines
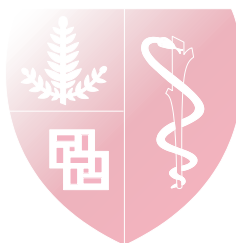
Discussion

- Evidence of Research feasibility

  ◦ Patient reported outcomes exist in EHRs

  ◦ Accuracy of our workflow

- Potential Impact

  ◦ Begin to reliably assess aspects of patient-centered care

  ◦ Generate evidence for important comparative effectiveness research

    • Previous studies on PCOs have had limited generalizability

  ◦ Identify value-based payments that are representative of patient values
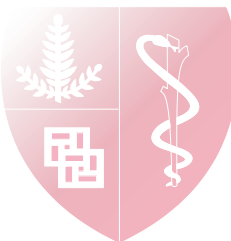
Stanford Team Members

- **Jim Brooks, Urology**

- **Doug Blayney, Cancer Center**

- **Nigam Shah, Biomedical Informatics**

  - **Shah Lab**

    - Anna Bauer-Mehren

    - Suzanne Tamang
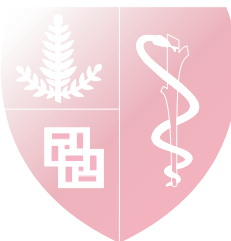
Thank you!

- Questions?
  - boussard@stanford.edu

- Funding support:
  - NCI: R01CA183962