Composer:
Visual Cohort Analysis
of Patient Outcomes

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Lower Back Pain is a Significant Health Burden

2.6 Million Emergency Room visits

Treatment exceeding $100 Billion
This is Frank. He has a herniated disc.
Intervertebral herniated disc

lower back pain
weakness in legs
bladder and bowel problems
Three treatment options to consider with his doctor.
Surgery *mostly* effective for persistent symptoms

Risk involved, takes time to recover

12% will need another one within 4 years.

43% of these will need fusion
Frank has some pre-existing conditions.

- Age 55
- BMI: 29
- Diabetic
- Tried physical therapy
Takes these into account along with past experience and clinical guidelines.
general population may not provide an accurate reflection of potential outcomes for patients with pre-existing conditions.
EHR for evidence based comparisons

Identify factors that can influence recovery and more accurately predict outcomes
Dataset of Prior Cases

Accurate Cohort Definition

Outcome Measures at Many Timepoints

Prognosis Under Different Treatment Options
Cohorts: subset of the general population shares defining characteristics
Effective for identifying influential factors.
Investigating

Patient Reported Outcomes as measure of well-being
PROMIS

Patient Reported Outcome Measurement Information System.

Evaluate and monitor physical, mental, social health.
Focus on PROMIS physical function scores.
Way to quantify the physical ability

32: Can stand for short time.

55: Can go on a short hike.

72: Can run 10 miles.
Collected over time
Track patient progression

34: 2 weeks after surgery

55: 1 month after surgery.

65: 2 months after surgery.
use PROMIS PF to more accurately evaluate progression

To compare outcomes
Lack tools that use PROMIS PF trajectories
Dataset

PROMIS PF scores for 6071 patients beginning in 2013
Range of 1 to more than 20 scores

ICD/CPT codes, demographic data, comorbidities
3 requirements for functionality

1. Define meaningful cohorts of patients
2. Compare outcomes of different cohorts
3. Compare outcomes of different treatments
1. Define meaningful cohorts of patients.
Domain Requirements

1. Define meaningful cohorts of patients.
2. Compare outcomes of **different cohorts**.
3. Compare outcomes of different treatments.
Related Work
Patient score trajectories in the context of a similar group of patients.

Iterative cohort refinement.

Contributions

Comparison of treatment options measured by patient score trajectories
Ability to normalize and adjust representation of trajectories
Flexible definition of multiple patient cohorts for comparison
Define a cohort for Frank by filtering based on attributes.

- Age 55
- BMI: 29
- Diabetic
- Tried physical therapy
Filter History.

Patient count of cohort at each filter stage
Filter History.

Remove and recalculate
Demographic Filters.
Score & CPT Filters.
Filtering by attributes to define a cohort like Frank
Cohort control panel.

Added
Cohort control panel.
Remove

Cohort control panel.
How did patients like Frank progress after surgery?
Realign scores to see trend after surgery

Aligned by first recorded PROMIS score

Aligned by surgery
Aligning by event
Patient score trajectories have **different baselines**

Small change (2-8) **clinically meaningful**
Hard to see measured change in scores
Changing scales to relative score change
This is messy.
We want to see the **general trend** in score fluctuation
Aggregation of scores
How did the patients with the most positive change in score progress?

What about the bottom quantile for score change?
Separation of Scores by Quantiles.

Adjust the day range to calculate average score change.
How did patients like Frank progress after surgery vs injection?
Compare cohorts in layer view
We find a patient line of interest

What other events are present in their medical histories?
Drill down into individual patient histories
Moving Forward

**Generalize** to a broader clinical base

Development of a **shared decision-making interface**
Thank You

Learn more about our lab:
http://vdl.sci.utah.edu/

Learn more on the project website:
Comparison of multiple treatment outcomes.

Separating
By quantiles
Utah Health
Using **PROMIS** scores longer than any other institution in the country.

**PROMIS physical function** scores.
Cohort control panel.

Cohorts can be added, branched and deleted.
Adding, Branching, Removing Cohorts