COMPOSER: Visual Analysis of Patient Outcomes

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Domain Space, Motivation, & Requirements

This project emerged from a collaboration with four medical researchers from the **Orthopaedic Research Center** and the **Department of Population Health Sciences at the University of Utah**, who are currently investigating the use of PROMIS scores as a measure of patient well-being and progression of physical function following various procedures for spinal ailments.

Motivation: Determining the best treatment options for patients involves an assessment of their medical histories and a comparison to similar patients. Such comparisons have relied on a physician's memory of related prior cases, which can be influenced by cognitive biases.

Domain Requirements:

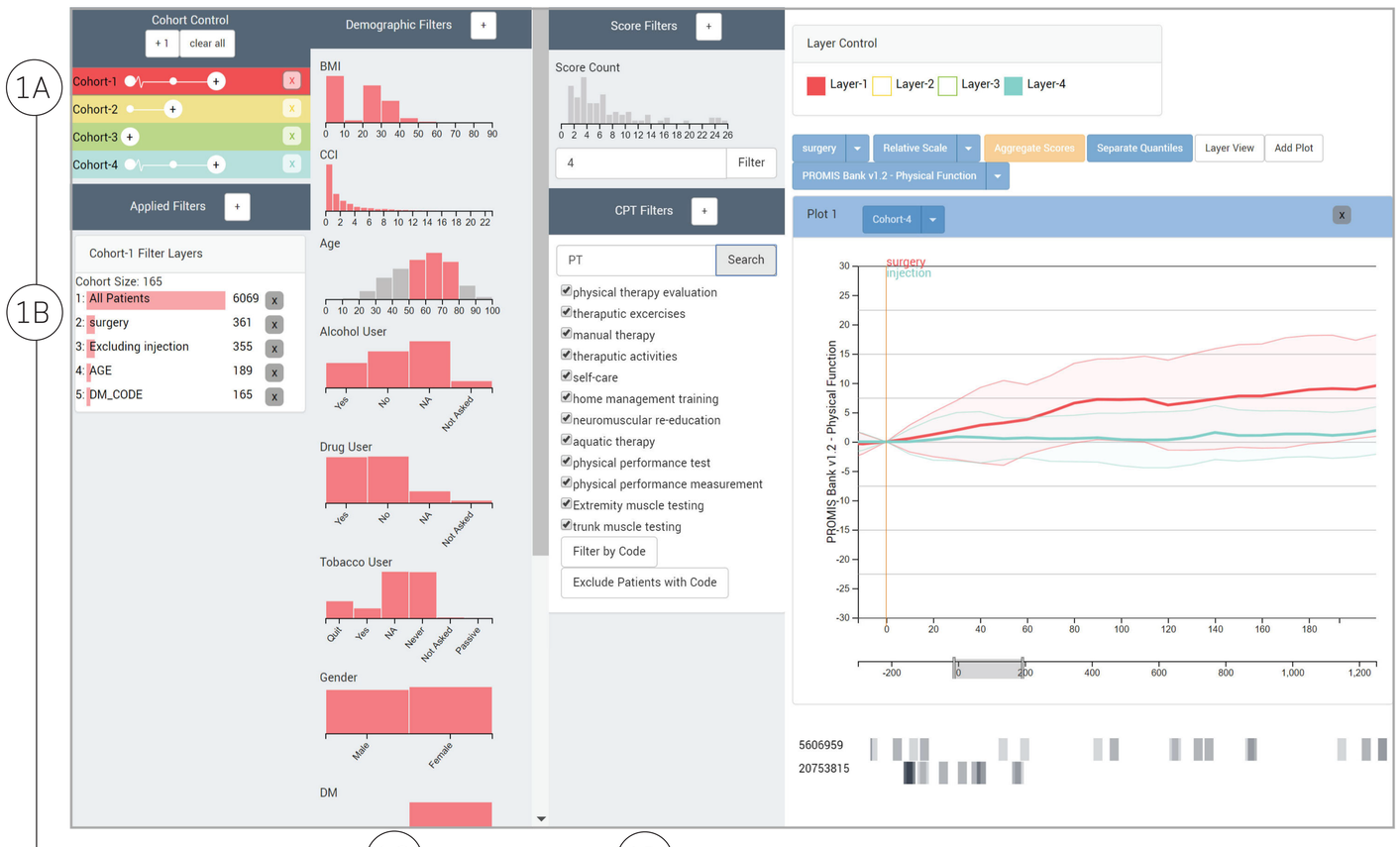
Define meaningful cohorts of patients. The clinicians need to be able to identify groups of people based on various characteristics, such as demographics information and medical histories.

Compare the outcomes of different cohorts. Once cohorts are identified, clinicians want to compare how they respond to different treatments, or see if they have other conditions in common.

Normalize Physical Function Scores in several ways to successfully analyze and compare cohort outcomes, following an event, such as surgery.

Design & Functionality

This plot compares patient physical function change after surgery or injection.



1 Cohort Definition

1A **Cohort control panel**.
Cohorts can be added, branched and deleted.

1B **Filter History**. All filters that are actively applied to the selected cohort along with the distribution of patients in the cohort at each filter stage.

1C **Demographic Filters**. Cohorts can be defined by demographic attributes. Quantitative values such as BMI can be brushed to a range. Categorical values can be selected.

1D **Score & CPT Filters**. Cohorts can be further refined by constraints added to score count and presence/absence of a procedural code (CPT) used to indicate a given procedure in the EHR.

2 Outcome Score Comparison

2A **Dynamic Score Scales and Normalization**. Patient scores can be normalized to show score change relative to a procedure or treatment.

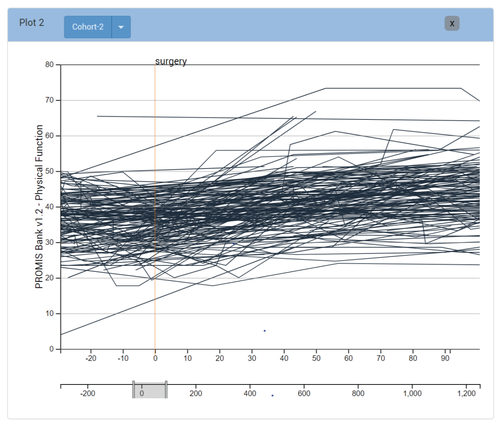
2B **Separation of Scores by Quantiles**. A cohort can be divided by quartiles. We calculate these quartiles by the average change in score over a customizable period of days following a given event.

2C **Aggregation of Scores**.
Scores can be aggregated to be centered on the median of the data.

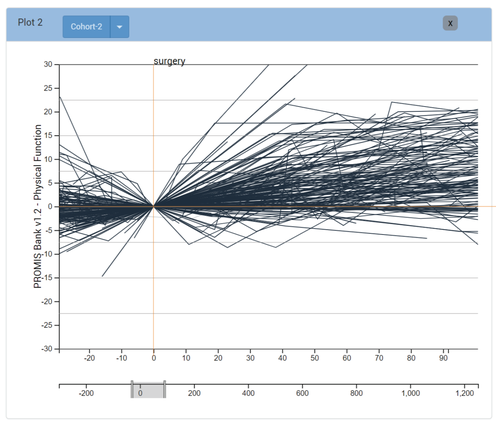
2D **Individual Patient CPT History View**. Patients procedure code histories can be viewed by selecting individual patients in the score chart.

2A Dynamic Score Scales & Normalization

Absolute Score Scale

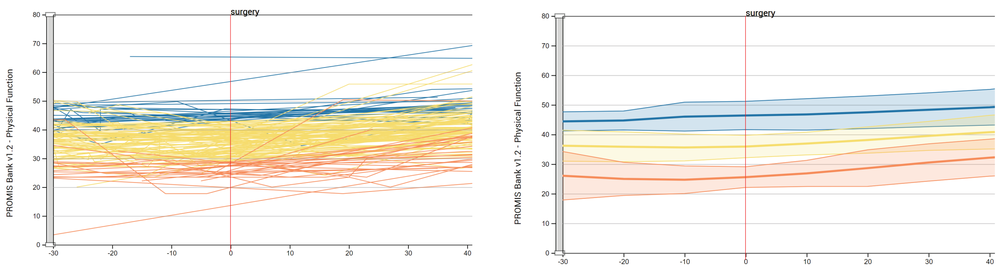


Relative Score Scale



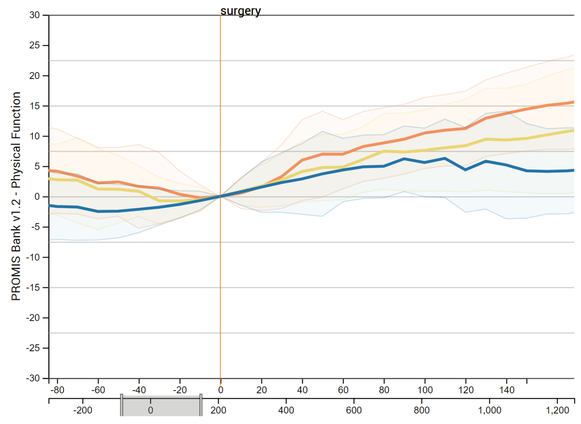
2B Separation of Scores by Quantiles

Individual and aggregated scores, aligned by a surgery code, separated into and color coded by quantiles.



2C Aggregation of Scores

Aggregated scores separated into quantiles



2D Individual Patient CPT History View

Showing events for selected patients. Each square represents an event in the patient's medical history

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

Learn more on the project website:
http://bit.ly/composer_paper

visualization design lab

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Read the paper:

Jen Rogers, Nicholas Spina, Ashley Neese, Rachel Hess, Darrel Brodke, Alexander Lex
Composer: Visual Cohort Analysis of Patient Outcomes
Workshop on Visual Analytics in Healthcare at AMIA (VAHC 2018), to appear, 2018.