Overview and Motivation:

Assessment and prediction of a patient's outcome following a given medical procedure is a combination of multiple, varied and complex health data. There has been significant interest in the use of visual analysis tools to assist in the synthesis of multivariate data for decision making (Fan et al. 2017). With this, is the challenge of developing meaningful visualization of temporal data (Gotz et al. 2014). This research endeavour is applied to the healthcare field with the development of tools to analyze patient cohorts and meaningful synthesis of EHR data (Bernard et al. 2015).

This project seeks to develop a visual tool for orthopedic surgeons that highlights patterns within patient records to better predict patient trajectories following a given procedure. This can be divided into 2 major tasks:
1. Dynamic formation of patient cohorts

2. Visualization of collective progression of physical function and pain levels of patient cohort

Related Work:

Anything that inspired you, such as a paper, a web site, visualizations we discussed in class, etc.

Questions:

Data:

The data used for the project is provided by the Orthopedic research center from their data warehouse. The data is provided in a series of CSV files and will need cleanup. Columns with empty values need to be filled with zeros. The patient entries need to be grouped in a meaningful way as the number of entries for patient visits are hundreds of thousands of lines long. Aggregation by patient ID and repeated codes will assist in the data bloat in the initial dataset. Binning of demographic information, specifically age and BMI groups will assist in developing initial groups within the body of patients. Length of groups and min/max values for patient visits and codes will provide insight on distribution of procedures in the EHR records.

Exploratory Data Analysis:

Initially filtering and analysis is done with parallel coordinate plots and a series of filters.

Design Evolution:

What are the different visualizations you considered? Justify the design decisions you made using the perceptual and design principles you learned in the course. Did you deviate from your proposal?
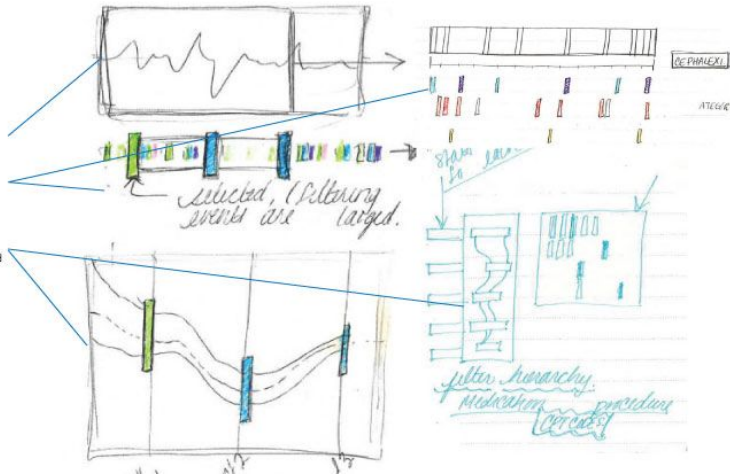
Primary sketches for interface.

Progression of ideas move from left to right and consist of:
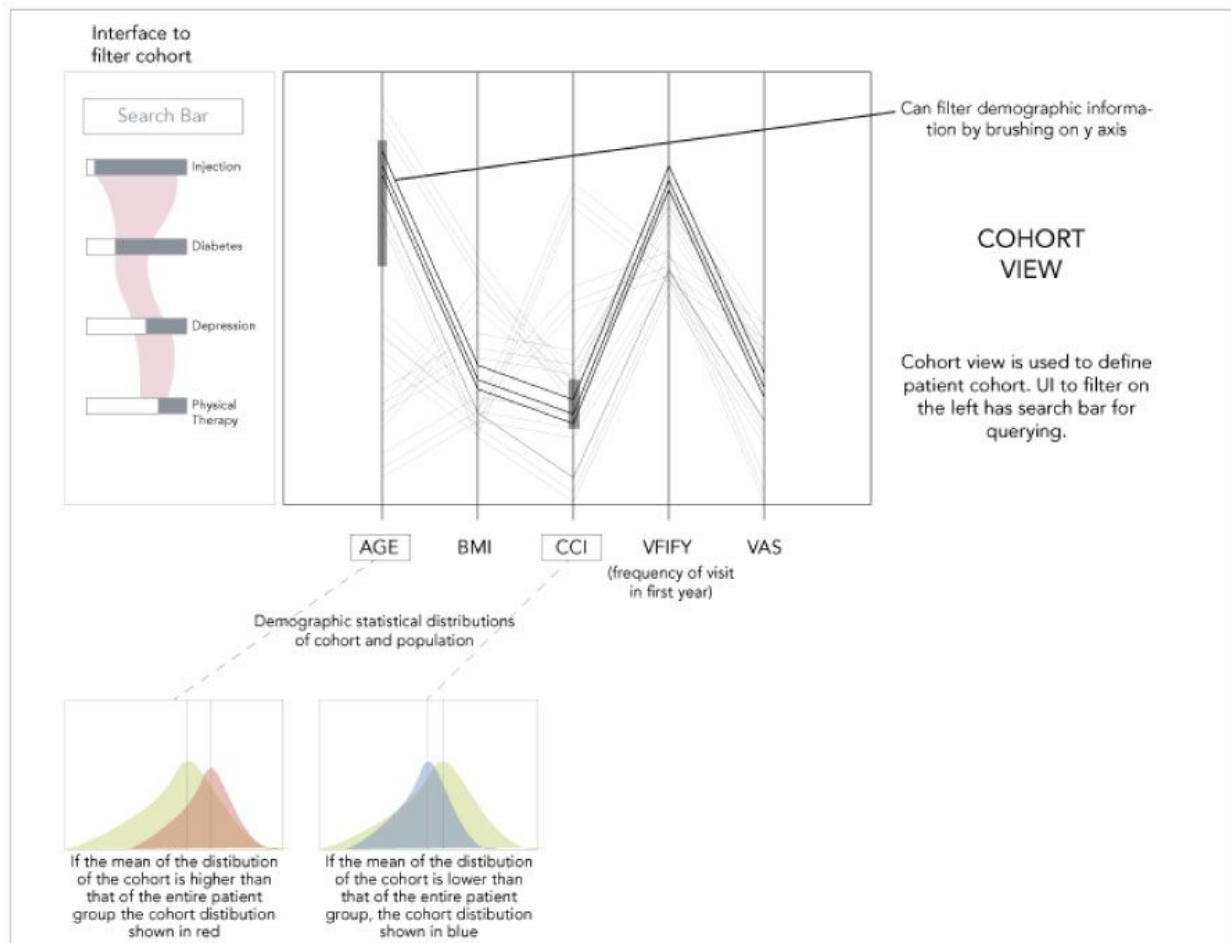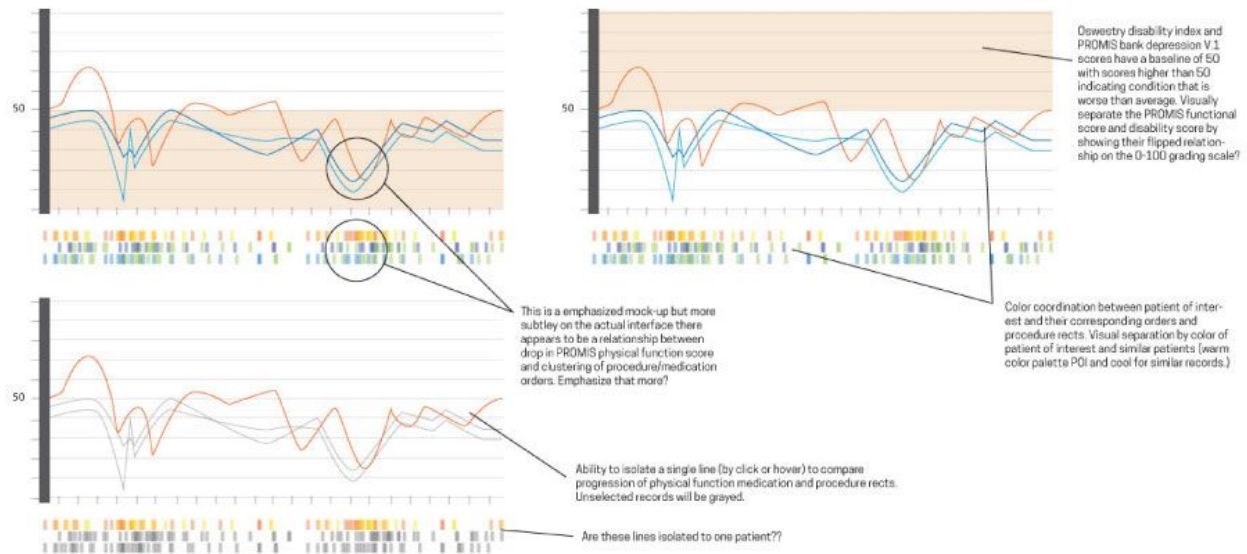
1. Physical function tracking of cohort.

2. Patient Order Hierarchy that breaks down orders by category/ distributed along timeline.

3. Visual feedback of cohort formation. (Later rotated and parallel coordinates added).

Initial hand drawn sketches were done to think through the necessary functionality of the app. This was further refined with mock-up prototypes done in illustrator.

Oswestry disability index and PROMIS bank depression V.1 scores have a baseline of 50 with scores higher than 50 indicating condition that is worse than average. Visually separate the PROMIS functional score and disability score by showing their flipped relationship on the 0-100 grading scale?

This is a emphasized mock-up but more subtley on the actual interface there appears to be a relationship between drop in PROMIS physical function score and clustering of procedure/medication orders. Emphasize that more?

Color coordination between patient of interest and their corresponding orders and procedure rects. Visual separation by color of patient of interest and similar patients (warm color palette POI and cool for similar records.)

Ability to isolate a single line (by click or hover) to compare progression of physical function medication and procedure rects. Unselected records will be grayed.

Are these lines isolated to one patient??

Interface to filter cohort

Search Bar

Injection

Diabetes

Depression

Physical Therapy

Can filter demographic information by brushing on y axis

COHORT VIEW

Cohort view is used to define patient cohort. UI to filter on the left has search bar for querying.

AGE   BMI   CCI   VFIFY   VAS
(frequency of visit in first year)

Demographic statistical distributions of cohort and population

If the mean of the distibution of the cohort is higher than that of the entire patient group the cohort distibution shown in red

If the mean of the distibution of the cohort is lower than that of the entire patient group, the cohort distibution shown in blue
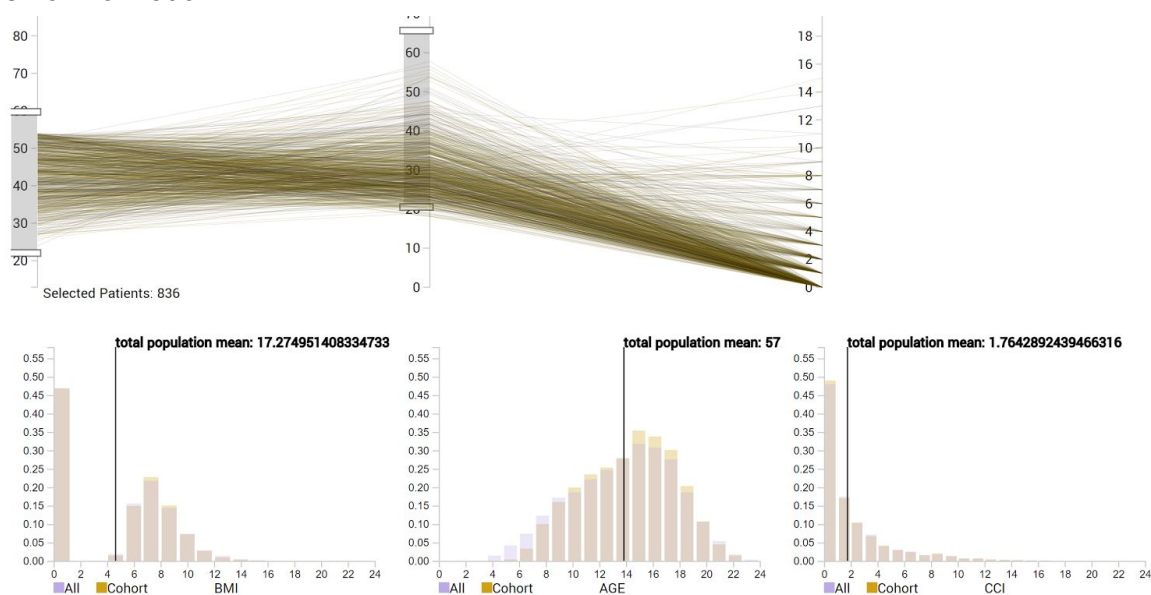
Milestone 1:

Have the initial filtering of the cohort with visual feedback. This was implemented with a parallel coordinate plot.
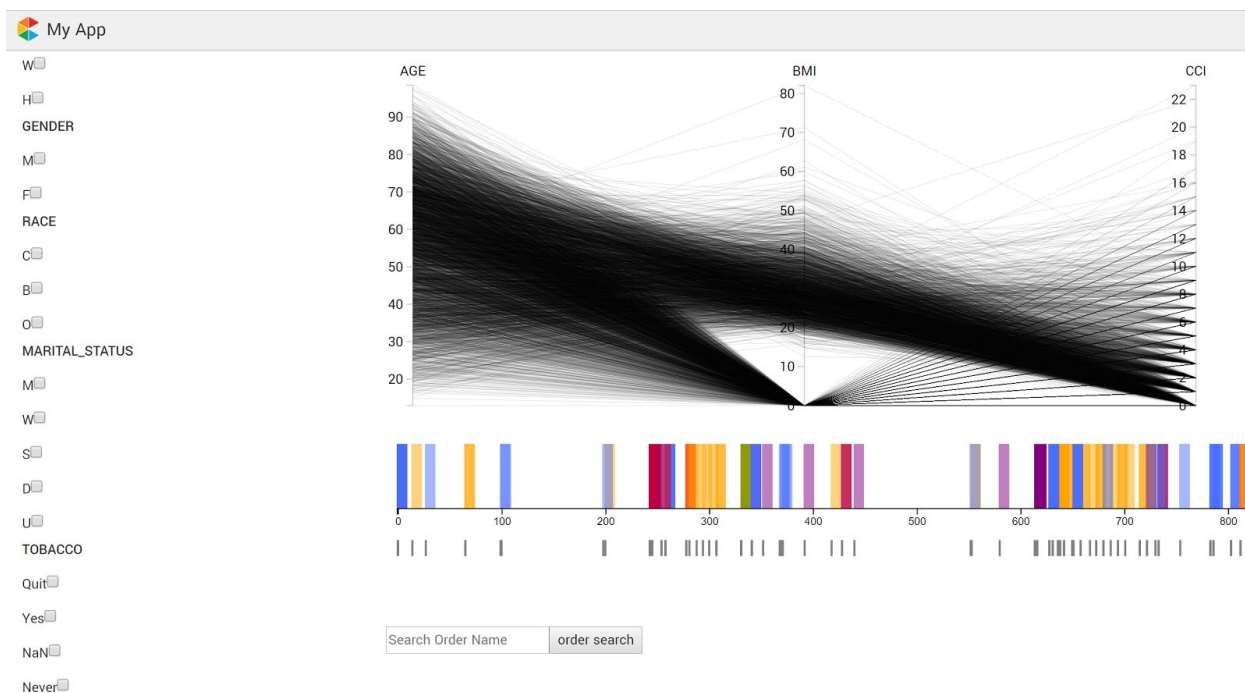
Distributions are shown with a histogram plot combining total population and cohort distributions for demo information.

Implementation: Describe the intent and functionality of the interactive visualizations you implemented. Provide clear and well-referenced images showing the key design and interaction elements.

Evaluation: What did you learn about the data by using your visualizations? How did you answer your questions? How well does your visualization work, and how could you further improve it?