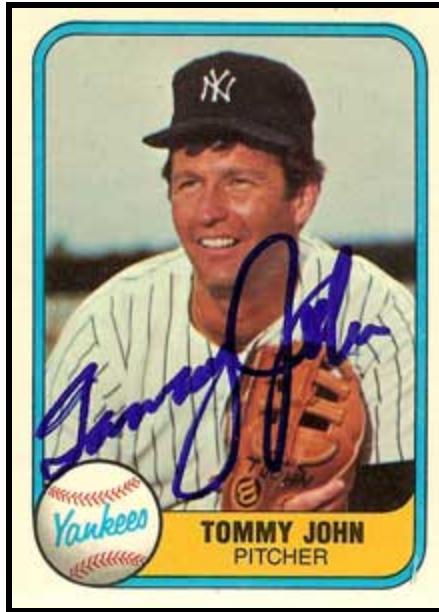


CS171 Final Project

Tommy John Visualization

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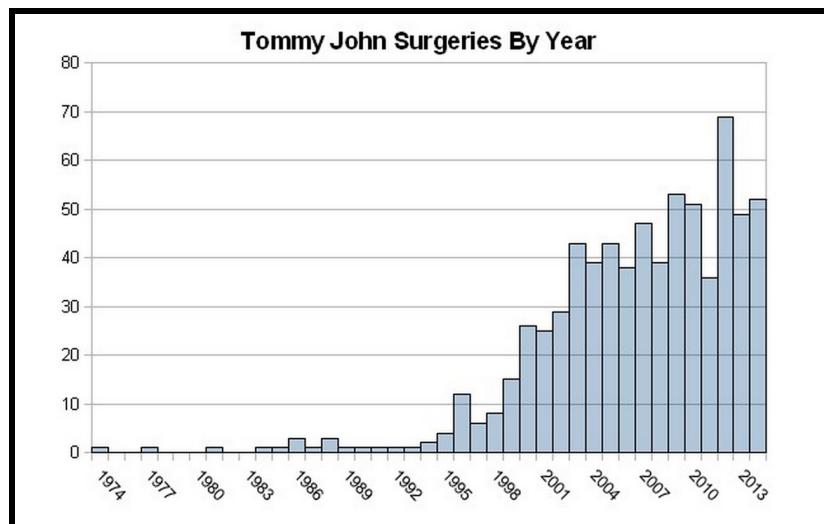
Background and Motivation

Los Angeles Dodgers lefty pitcher Tommy John's career came to a startling halt in 1974 when a nagging pain in his pitching arm forced him off the mound. Many thought this was the devastating end to a long and successful career for the 31 year old pitcher already with 124 major league wins. Tommy John was not convinced. He called up Dr. Frank Jobe, the Los Angeles Dodgers team physician. Due to the less sophisticated nature of surgery prior to the 1970s, the majority of injured baseball players avoided surgery at all costs and instead attempted to play through their pain. Understanding that without surgery he would never pitch again, Tommy John was not willing to settle. At John's insistence, Jobe proposed an idea for a new operation. According to Dr. Jobe the odds were stacked up 100 to 1 against Tommy John returning to pitch after the surgery. On September 25, 1974, Dr. Jobe performed the first ulnar collateral ligament reconstruction for Tommy John, replacing a ligament in the medial elbow with a tendon from elsewhere in the body.

After sitting out the entirety of the 1975 baseball season, Tommy John proved to all those who thought his career was over and returned to pitch for another fifteen years, earning another

164 major league wins to bring him up to 288, the seventh highest among all left-handed pitchers in major league history.

Now commonly known as Tommy John surgery (TJS), ulnar collateral ligament reconstruction now has a complete recovery rate of 85-92%. It has been reported that a third of all current major league pitchers have had the surgery.



In the last couple years, interest in Tommy John surgery has spiked. Nearly 100 baseball players decided to undergo the surgery in 2014 alone. Because it is such a big phenomenon in baseball today, our goals in completing this project are to raise awareness about Tommy John surgery and related trends, investigate the question of what is causing the recent surges in interest, and begin to understand whether this attraction is justified.

Project Objectives

As mentioned in the background section, a third of all current major league pitchers have undergone Tommy John surgery. Through this project, we hope to highlight trends associated with this recent rise in interest in TJS.

Questions we would like to answer include:

- How is player salary impacted as a result of opting to undergo TJS?
- What ages are most highly represented among players undergoing TJS?
 - Is the average age of players having TJS changing over time?
- Is improved pitching performance correlated with recovery from TJS?
 - One possible explanation for the surge in interest is the belief that pitchers can throw harder in the aftermath of recovery from Tommy John surgery. In fact, surgeons have been asked by the parents of young pitchers to perform the

surgery on their uninjured sons in the hopes of increasing their child's performance and future career prospects. We in turn intend to investigate whether improved pitching performance (measured along several different evaluation metrics) is correlated with recovery from TJS. This visualization project thus has the potential to dispel the potential misconception that Tommy John surgery directly causes improved performance.

- What baseball teams do the players that undergo TJS play for?
 - Are there any geographical trends that can be unearthed?

Benefits:

The benefits of this are both awareness and trend spotting. Baseball coaches across the country must be shown that this is a problem so that they can be more careful with their players' health. Hopefully as more people become aware, proper throwing regimens will be more widely developed and instituted. A second benefit is looking for trends. If we can find a certain team that has an excellent arm care system then more research can be done on copying their process. If it becomes clear that there is an optimal age to get the surgery, we could help players lengthen their careers.

Data

We will be pulling our data from the following public spreadsheet maintained by Jon Roegele, baseball analyst and writer for The Hardball Times (<http://www.hardballtimes.com/>):

<https://docs.google.com/spreadsheets/d/1gQujXQQGOVNaiuwSN680Hq-FDVscwvN-3AazykOBON0/edit#gid=0>

This continuously updated spreadsheet includes data on nearly 1,000 baseball players to undergo Tommy John surgery, beginning with Tommy John himself in 1974.

Because the above spreadsheet provides the mlbamid number of each player to undergo Tommy John surgery, we have the possibility to expand our dataset to include other baseball statistics for the players from the following exhaustive dataset included with Section 7:

<http://www.seanlahman.com/baseball-archive/statistics/>

Data Processing

All of the data we need is available to us in the aforementioned datasets. Our work here will thus involve extracting the information we feel is most important to our visualizations.

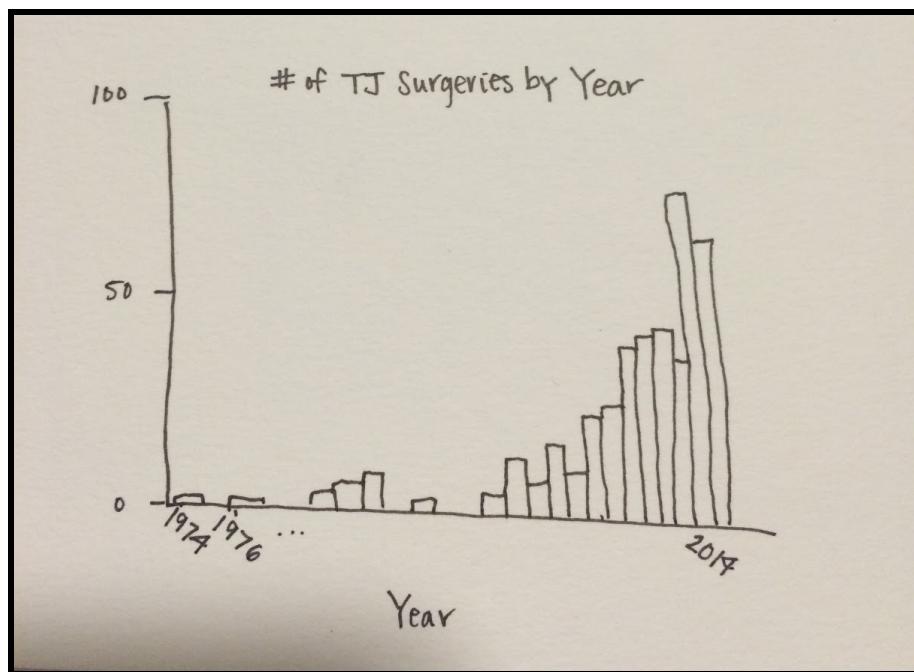
Because we already have a .csv file of the Tommy John surgery data, we do not envision data processing to give us many headaches.

The following is a non-exhaustive list of the values/quantities we plan to extract:

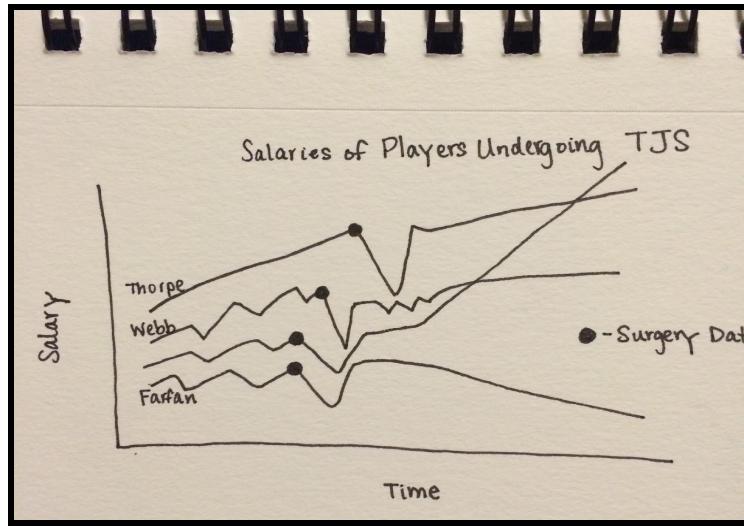
- Player

- TJ Surgery Date
- Return Date
- Team
- Age
- mlbamid
- Professional Return %
- Post-TJ MLB G
- Post-TJ MLB IP/PA
- Surgeon(s)

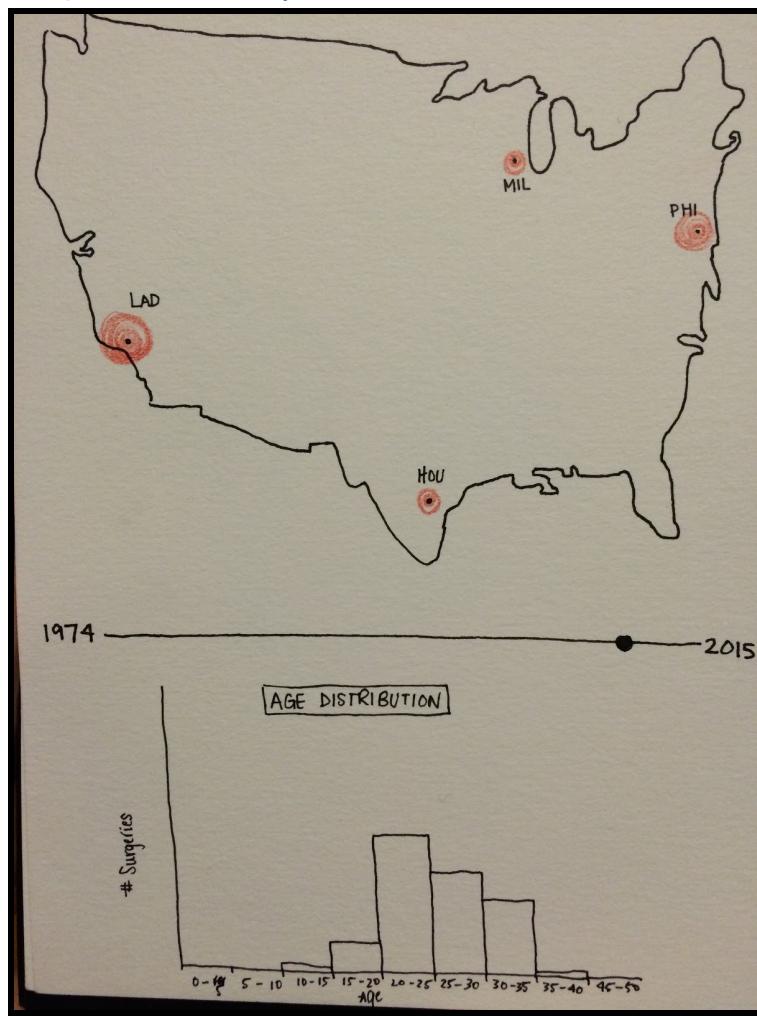
Visualization



Vis #1: A simple bar chart showing the number of Tommy John surgeries performed from 1974 to the current year.



Vis #2: A line chart showing the change in salary of players undergoing TJS (with the time at which the surgery was performed clearly indicated).



Vis #3 / 4: A map showing the geographical location of the teams of players undergoing TJS over time along with accompanying histogram displaying the age distribution of patients for the given year.

Additional Ideas:

- Possibly have the players be nodes. They can then be grouped by team, age, or put on a map
- Generate a visualization that animates the throwing velocity of pitchers before and after TJS surgery
- Visualize surgeon success across a number of different metrics (change in win/loss percentage of pitcher, change in throwing velocity, etc).

Must-Have Features

- Number of Tommy John surgeries performed over time
- Ages of players undergoing TJS over time
- Salaries of players undergoing TJS over time
- Geographical location of players undergoing TJS over time

Optional Features

- The average throwing velocity before and after surgery
- How well players did based on which surgeon they went to

Project Schedule

April 10

- Begin process book
- Complete data acquisition
- Delegate modules among team members
- Generate basic visualizations to get comfortable with the data and to inform our design

April 17 - **Milestone 1 due**

- Working visualization prototype - set up initial views
- Update process book

April 24

- Begin creating public website for project
- Add interactivity to designs

- Update process book

May 1

- Produce screencast showing a demo of visualization
- Continue iterating on designs
- Optional features
- Update process book

May 5 - Final Project due

- Finalize process book - include any findings

May 7 - Final Project Presentations