

# Understanding Patterns in the Utilization and Cost of Elbow Reconstruction Surgeries: A Healthcare Procedure that is Common among Baseball Pitchers

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## **ABSTRACT**

Elbow reconstruction surgeries are commonly utilized by athletes in sports such as baseball and softball. Research suggests that the rate of elbow reconstruction surgeries among professional baseball pitchers continues to rise. Given the trend found among professional pitchers, the current study looks to review patterns of elbow reconstruction surgery among the privately insured population.

The study examined trends (for example, cost, age, geography, and utilization) in elbow reconstruction surgeries among privately insured patients using analytic tools such as SAS® Enterprise Guide and SAS® Visual Analytics based on the Medical/Surgical claims data from the FAIR Health National Private Insurance Claims (FH NPIC®) database. The findings of the study suggested that there are discernable patterns in the prevalence of elbow reconstruction surgeries over time and across specific geographic regions.

## **INTRODUCTION**

Elbow reconstruction surgery, sometimes known as “Tommy John” Surgery, was pioneered by Dr. Frank Jobe in 1974 (Langer, Fadale, & Hulstyn, 2006). Tommy John, a star pitcher for the Los Angeles Dodgers, developed elbow problems in the middle of his career, which compromised his effectiveness as a pitcher. He was the first pitcher to have this surgery and within a year he was back to his normal levels of effectiveness. Without the surgery, his pitching career likely would have ended, but after the surgery he won an additional 164 games in the major leagues.

The surgery itself is a technique that removes the damaged ulnar collateral ligament and replaces it with a ligament from another part of the body or from a cadaver (Rohrbough, Altchek, Hyman, Williams, & Botts, 2002). In the medical billing world, the procedure is represented in the American Medical Association’s Current Procedural Terminology (CPT®) with procedure code 24346 (eORIF, 2014).

Since the advent of the technique, there have been nearly 900 major and minor league baseball players who have had the surgery and the numbers receiving this surgery appear to be steadily increasing by year (Rogele, 2014). In this paper, we will examine trends in elbow reconstruction surgery in a commercially insured population using the FAIR Health FH NPIC® database. To our knowledge, no other research paper has studied such trends.

## **METHODS**

### **FAIR HEALTH FH NPIC DATA**

FAIR Health is a national, independent, non-profit organization whose mission is to bring transparency to healthcare costs and healthcare insurance information. FAIR Health maintains a database that includes over 18 billion private healthcare claims from 2002 to present. The data were provided from private insurance companies and third party administrators throughout the United States, including all 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. The data cover a broad spectrum of service and setting types, including Medical/Surgical, Anesthesia, Dental, Inpatient Facility, Outpatient Facility, and Healthcare Common Procedure Coding System or HCPCS.

Each record in the database represents a claim line for a single person on a single day of service. Each claim includes a set of required data fields. Data contributors must provide the required fields on every claim that is submitted. Therefore, all of the required fields must be complete on the claim for the claim to be considered “valid” and included in the dataset. The required fields include the Current Procedure Terminology (CPT) code, rendering zip code, and billed charge amount. The Current Procedure Terminology (CPT) coding system is maintained by the American Medical Association. The rendering zip code refers to the location where the medical services were provided. For the purposes of this study, the first three digits of the five-digit rendering zip code was used. The billed charge amount refers to the undiscounted charge that is billed by the provider (doctor, medical facility, etc.).

Data contributors are also encouraged (but not required) to provide a set of optional fields on each claim that is submitted. The optional fields are available on approximately 66% of the claims included in the study. The optional field used in this study was patient’s age. Age was calculated based on the patient’s date of birth and rounded to the nearest whole number.

The data on each claim were processed using FAIR Health’s proprietary data validation software to help ensure that invalid data were removed prior to analysis. From the claims that passed FAIR Health’s data

validation process, a small convenience sample was selected for the current study. The final sample included in the current study consisted of **9,097** claims. The sample was selected based on the following criteria: 1) passed FAIR Health's data validation process, 2) have a date of service between **2002** and **2014**, and 3) have a CPT code of **24346**.

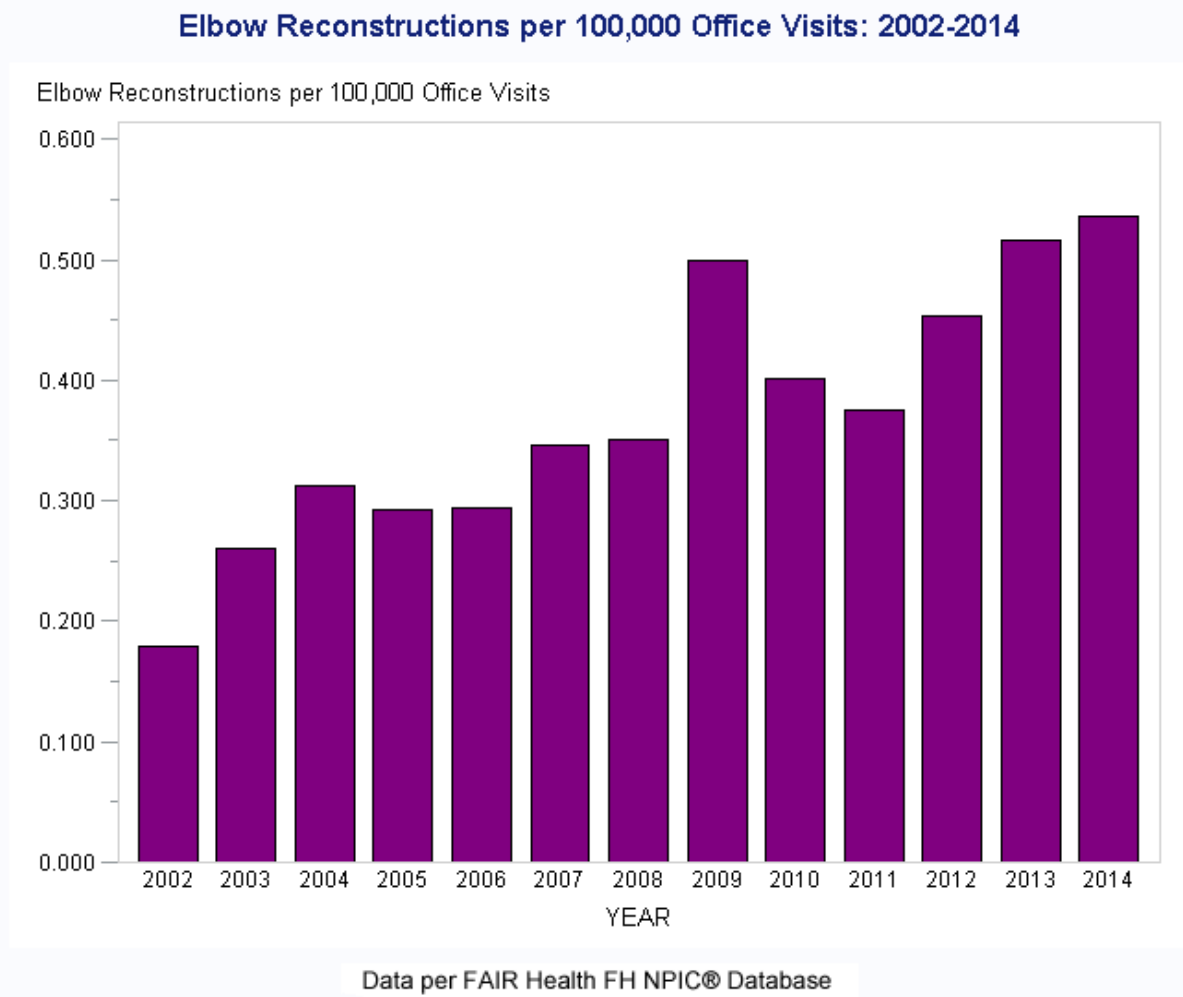
## **RESULTS**

### **TREND IN UTILIZATION**

As the surgery became more popular in the early 2000's in professional baseball, we observed similar increases in utilization amongst the insured population. To adjust the estimates for differences in the population, the raw number of surgeries in each year was divided by the number of office visits in that year.

Figure 1 shows the results of this calculation. For example, if there were 100 elbow reconstruction surgeries and 1 million office visits in 2012 included in the FAIR Health FH NPIC database, the statistic for would be 10 surgeries per every 100,000 office visits. Figure 1's y-axis indicates this figure, the x-axis represents the year.

**Figure 1: Elbow reconstructions over time; commercially insured population**

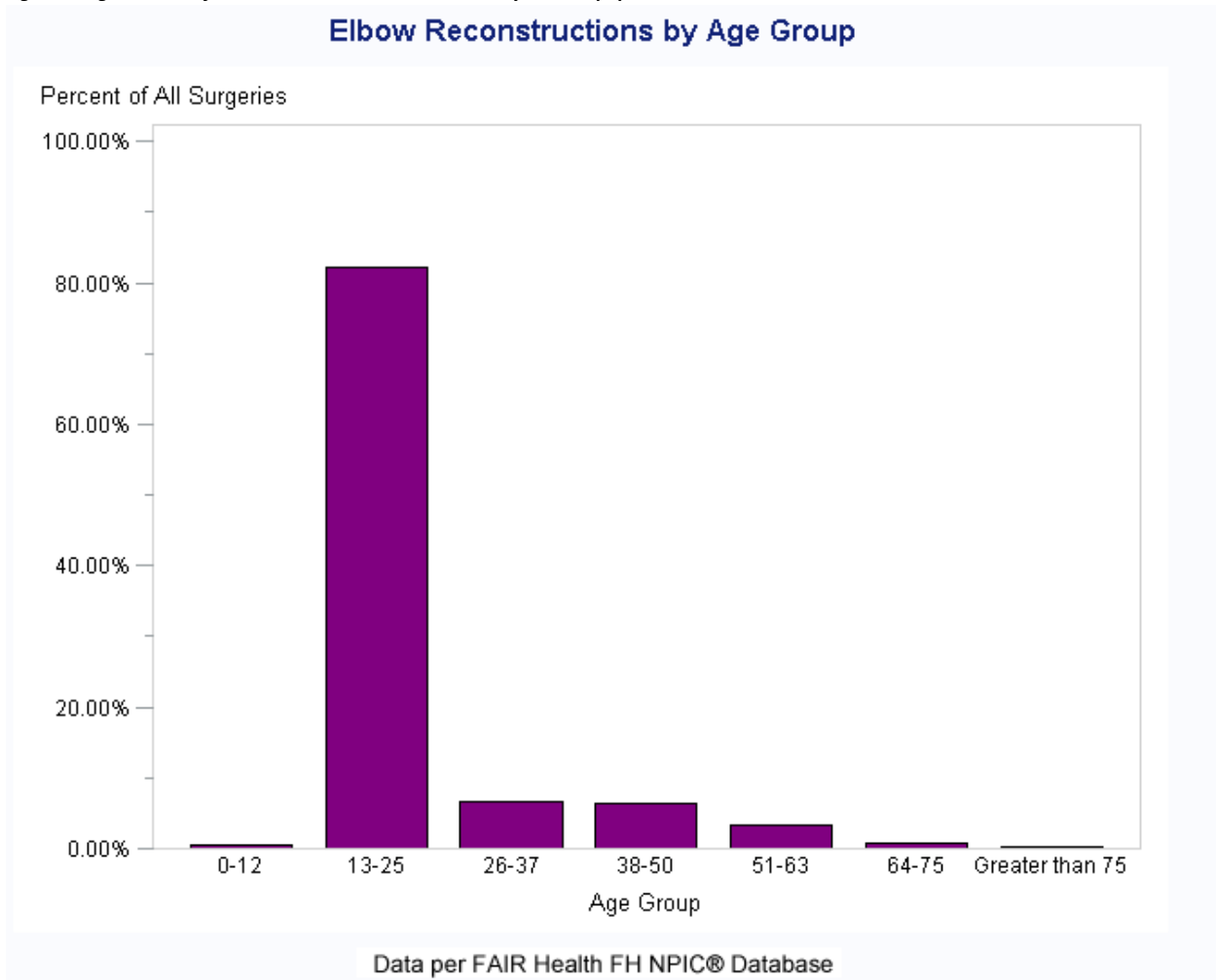


This adjusted measure shows a general increase in utilization of this procedure in the 2000's. There appears an initial peak in 2009 with a small drop off in 2010 and 2011, but in recent years, the upward trend continued.

### **DEMOGRAPHIC TRENDS**

The study investigated the trends in age at the date of service for the commercially insured population. Figure 2 shows that approximately 82% of all surgeries in the FAIR Health FH NPIC® database that include age on the claim are for patients between ages 13-25. The median age at date of surgery was 19 years. Patients in this age group are generally college-level or pre-professional, thus at the stage where they may be positioning themselves for a scholarship or professional contract.

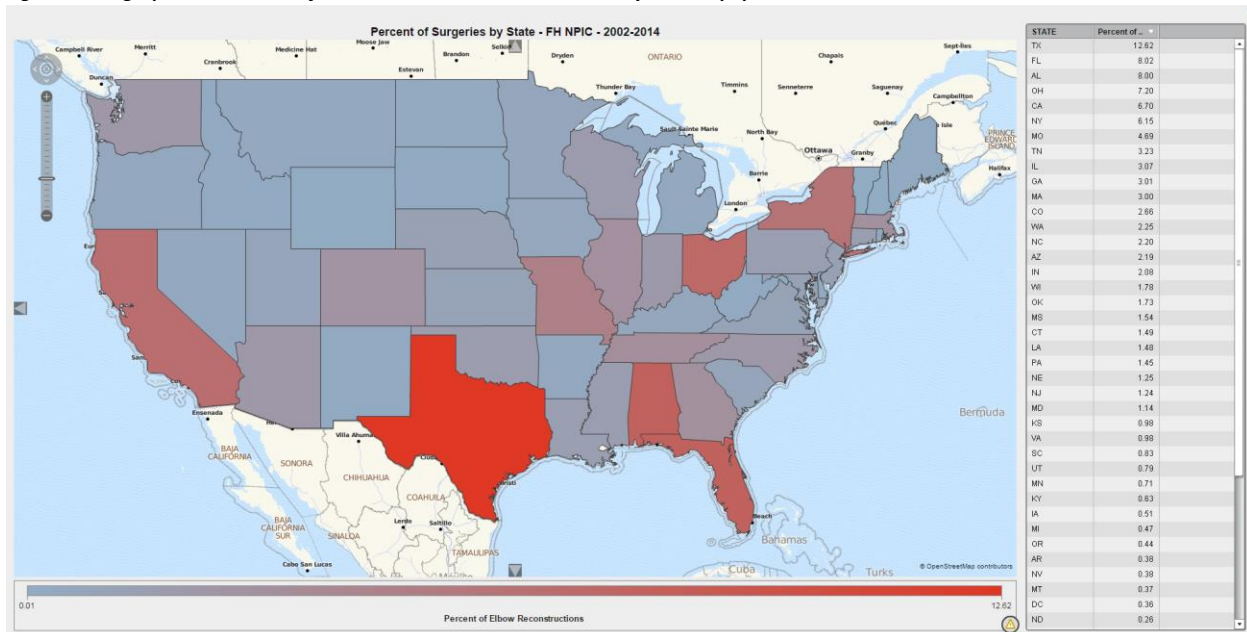
**Figure 2: Age on date of elbow reconstruction; commercially insured population**



### **WHERE IS THE SURGERY RENDERED?**

Next, we used the service rendering zip code (i.e. location where the medical services were performed) to see in what states the surgery occurred most frequently. Figure 3, rendered using SAS® Visual Analytics 6.3, displays each state on a scale of blue to red indicating the percentage of the nation's elbow reconstruction surgeries performed in that state. Deeper red colors indicate a higher percentage of the surgeries while deeper blues had fewer occurrences. While we would expect to see more surgeries in big population states like Texas, California, and New York, we also see larger proportions in states like Alabama, Florida, and Ohio where major providers of this surgery are known to be located (Rogele, 2014).

**Figure 3: Geographic breakdown of elbow reconstructions; commercially insured population**



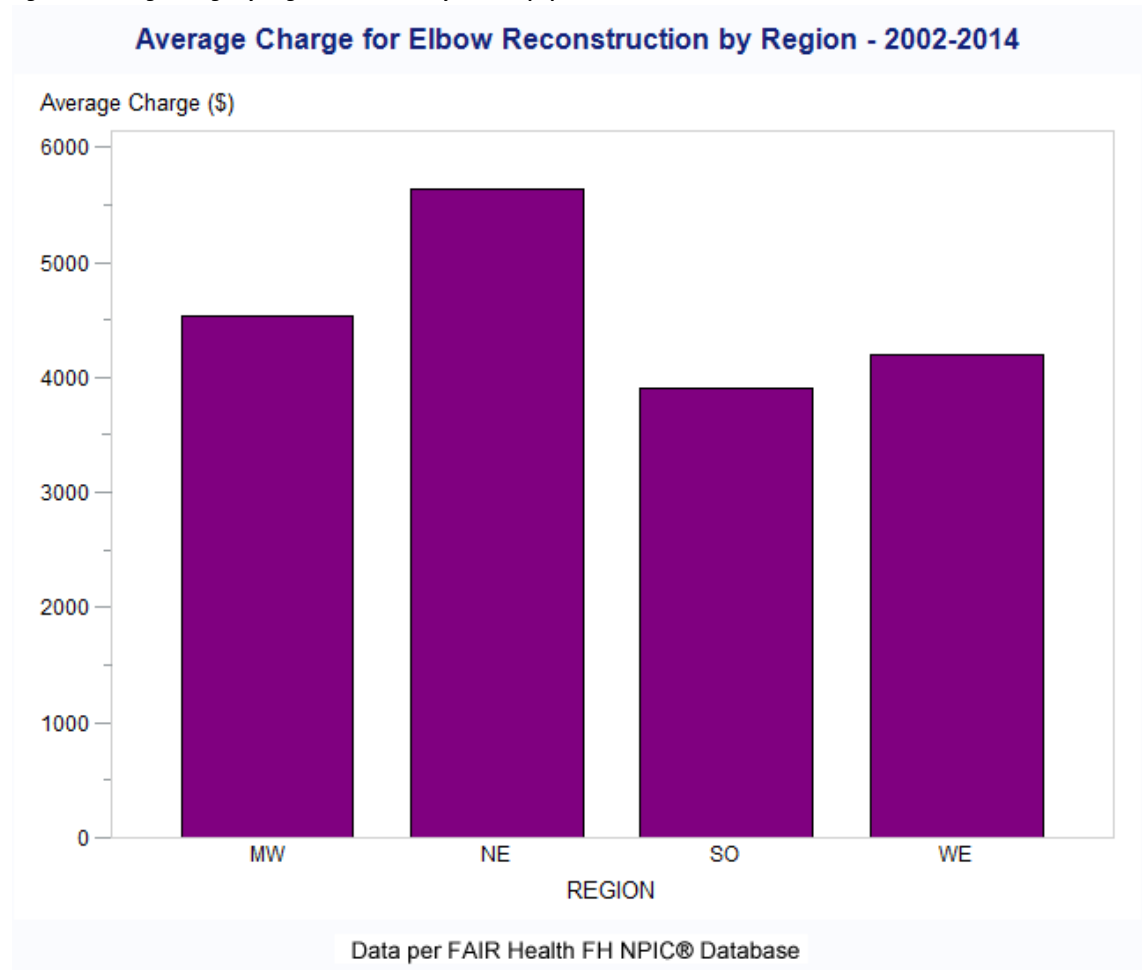
## COST

Last, the study assessed the professional costs of the treatment for the surgery itself. (These figures do not include related services such as anesthesia and radiology.) For this, we used all professional claims for CPT 24346 from 2002-2014, excluding those with unreliable charge values. The country was then divided into quadrants, with an average charge calculated for each quadrant.

The Northeast (CT, MA, ME, NH, NJ, NY, PA, RI, and VT) had the highest average professional cost for the procedure at \$5,632. With the higher cost of living in the larger cities of the northeast, this is typical of what is seen in the health care market. The Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, and WI) was second at \$4,538. West's (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, and WY) average was \$4,190. Finally the average charge in the South (AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, PR, SC, TN, TX, VA, and WV) was \$3,898.

A one-way between subjects ANOVA was conducted to compare the cost of elbow reconstruction in the four regions of the United States. The ANOVA results suggested that there were overall regional differences ( $F = 66.03, p < .01$ ). Specifically, a significant difference was found between the SO and MW ( $p < 0.05$ ), and SO and NE ( $p < 0.05$ ) but no significant difference between SO and WE ( $p > 0.05$ ).

Figure 4: Average charge by Region; commercially insured population



## CONCLUSION

In summary, trends found in the commercial insurance population were generally similar to those found among professional athletes (Rogele, 2014). The utilization of the surgery has trended upward while the median age of 19 years shows that the surgery is generally performed on younger patients-those closer to the age where one would be a college athlete or looking to become a professional. The surgery is performed in all parts of the country, but is most frequent in areas of high population and in states with known practitioners of the surgery (Rogele, 2014). There is little variety in charges in most areas of the country, but the charges are significantly higher in the northeast. It is important to note that analysis performed using the age variable may have been biased as almost a third of the claims did not include age. The claims without age were determined to have statistically significant differences in charge than the claims with age ( $t = -10.05$ ,  $p < .01$ ). However, there were no missing data for the other variables in the analysis (including zip code and charge amount).

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