Impact of New Surgical Procedures on the length of Hospital Stay of a Patient.

Introduction

In a hospital when a patients undergo current surgery procedure the average length of their stay in hospital is 8 days and their standard deviation is 1.6 days. After this, a new surgical procedure plan is developed in order to reduce the time span of patients spend in hospital following the heart surgery. The aim of this project is to investigate whether the new surgery procedure reduce the length of patient stay in hospital and if it does, what is the estimated length of reduction in days due to new surgical procedure. To evaluate this I used hypothesis testing using paired t-test and matched case-control study data to calculate the length of reduction in days.

Exploratory Data Analysis

The dataset provided consists of two groups New Surgery and Current Surgery. Both group contains 30 numerical data points indicating patients who underwent heart surgery. New Surgery and Current Surgery interpret the length of each patient stayed in hospital after doing heart surgery. When looking at the summary of the data, I can see the minimum and maximum values of each group, as well as the different means, medians, and their quartile ranges. Furthermore, I visualized the data distribution for each group using scatter plots and box plots (see Fig 1.1 for the Box Plot and Fig 1.2 for the Scatter Plot). I can see how well the data points are spread in two dimensional space and also, I can observe the differences in the mean values between both groups and each group has few outliers too using the box plot.
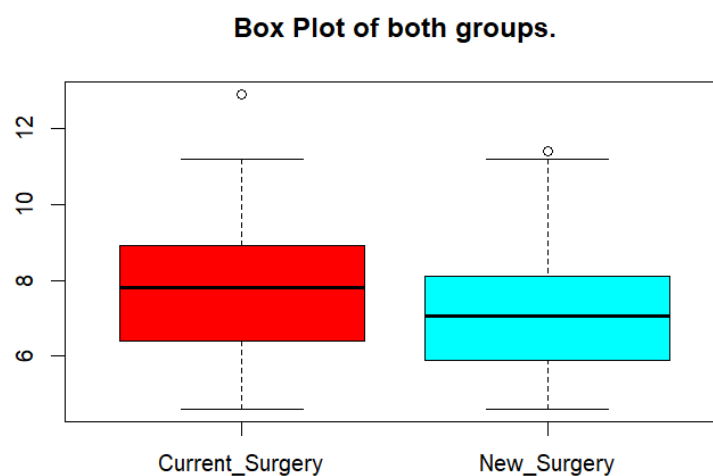

Fig 1.1 Box Plot

Scatter Plot of both groups.

Fig 1.2 Scatter Plot

Methods

I used paired t-test hypothesis testing and matched case-control study method to find out whether there is difference in the length of hospital stay for a patient when using current and new surgery procedure plan. If there is a change in length of stay, what is the approximate difference of length stay in days? In order to perform the hypothesis testing, I have to define the null and alternate hypotheses. Let μd represent the difference in the means between 'Current Surgery' and 'New Surgery.' Our Null Hypothesis (H0) is assumed that the average length of hospital stay after undergoing both 'Current Surgery' and 'New Surgery' is same, i.e., μd equals zero. On the other hand, the Alternative Hypothesis (H1) is assumed that there is difference in average length of hospital stay that is mean of difference (μd) is greater than zero.

$$H0: \mu d = 0$$

$$H1: \mu d > 0.$$

For this hypothesis test, I defined a confidence interval of 95 percentage, so α (the significance level) is set to 0.05.

Results

Based on the result obtained from paired t-test hypothesis testing, I can observe there are 29 degree of freedom and t-statistic value as 6.0402, and the corresponding p-value as 1.427e-06. Now we compare the p value with the significance level and found out that p value is less than the predefined level of significance (α) of 0.05. Since

p value is lesser I reject the null hypothesis, indicating that there is strong evidence to support the claim that the new surgical procedure significantly reduces the average length of hospital stays when compared to the average length of current surgery procedure. From the result of paired t-test we can see the confidence interval ranges from 0.5739 days to 1.0887 days with 95% confidence. The mean difference in hospital stay lengths between the current and new surgery groups is 0.8134 days. Therefore, I can determine that the new surgical procedure reduces the length of hospital stay of a patient by approximately 0.8 days.

Conclusions

In conclusion I can prove that our assumed null hypothesis is rejected because there is strong evidence that provides the new surgical procedure reduces the average length of hospital stays of a patient when compared to the current surgical procedure. Additionally, based on the confidence interval calculated using matched case-control study, I can estimate that the reduction in hospital stay length ranges approximately between 0.5739 days to 1.0887 days, with 95% confidence.