

Executive Summary

Liver Transplantation Project

Bridget Hanley, Danish Rai, Siddant Mehta

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1 Introduction

The study focuses on predicting patient survival time and classifying patient status one year post liver transplantation. There are on average 17,000 patients waiting at a given time to receive a liver transplant as there is no other cure for End Stage Liver Disease. Our study aims to help patients get a better understanding of their chances of survival for a prolonged time after a year of transplant. The insights from our study show that we are able to predict patient status and survival time accurately for different time intervals. Our models aid the patients in the decision making process such as financial, while they wait on the list to get a transplant.

2 Research Questions

1. Quantitative

Can we predict survival time for patients one-year after receiving a transplant.

2. Qualitative

Classifying if a patient survived one-year after receiving a transplant.

3 Data and Model Development

Using data from the Scientific Registry of Transplant Recipients (SRTR), we built various quantitative and qualitative predictive models using patient survival time and patient status (alive or dead) as our response variables. For linear models, two techniques were used; linear regression and neural network. Both models predicted patient survival time for 1 to 3 years and 1 to 5 years after a transplant using a set of significant variables. The variables were chosen after extensive research on what the important factors are in the liver transplantation process. The significant variables for linear models were, Final MELD Score, Region, and Malignancy for recipient, Alcohol Heavy for Donor and Liver Size for both recipient and donor.

For our classification models, we predicted the patients status 1-3 years and 1-5 years after their transplant occurs. We used the variables MELD score, diabetes in the donor, diabetes in the recipient, recipient and donor height, recipient and donor liver size, region, and if the recipient and donor shared the same gender. We ran seven different classification models (logistic, LDA, QDA, neural networks, naive Bayes, and random forest). Our results indicated that the LDA model performed the best with a 71.56% accuracy for classifying a patient as dead or alive 1 - 3 years after their transplant. For classifying a patients status 1-5 years after the transplant, our naive bayes model performed the best with a 72.65% accuracy. At the beginning of our analysis, we ran our logistic and LDA models with a variable that indicates the blood type match of the recipient and donor. The results showed that this variable was not significant in improving our prediction. This result was consistent with our research, as we found that blood type does not need to be an exact match when it comes to liver transplants, but rather the blood types only need to be compatible.

4 Results

Our results give us confidence that we can accurately predict the status of a patient and their survival time one year after they receive a liver transplant. We believe that this will give patients a better idea of their chances of survival for a prolonged period of time after their transplant. Using the information from these models, patients can make a more informed decision when it comes to their organ transplant based on their medical condition.