Report: Dialysis Center Star Rating

Problem

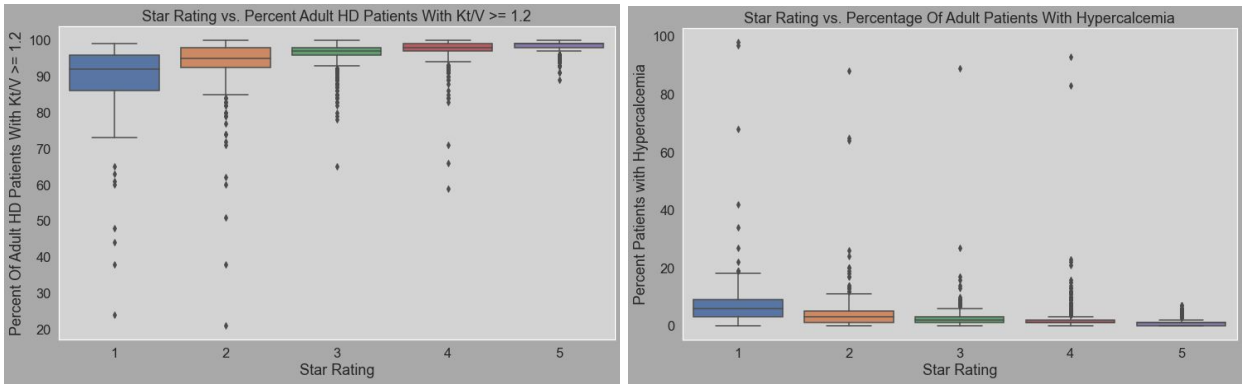
The Chronic Renal Insufficiency Cohort (CRIC) Study aims to examine the effects of a broad range of risk factors on the progression of Chronic Kidney Disease (CKD). One factor that has yet to be examined is an individual's choice of dialysis center. CRIC is curious to know how an individual's choice in dialysis center affects one's kidney health.

Approach

To see how a dialysis center affects patient kidney health, first must see how centers' differ from one another. One clear indicator of dialysis center performance is the Dialysis Facility Compare Star Program. The Star Program is a rating system developed by Medicare that assigns 1 to 5 stars to dialysis facilities by comparing the health of the patients in their clinics to the patients in other dialysis facilities. The rating system in based on nine separate health statistics: mortality ratios (deaths), hospitalizations, blood transfusions, incidents of hypercalcemia (too much calcium in the blood), percentage of waste removed during hemodialysis in adults and children, percentage of waste removed in adults during peritoneal dialysis, percentage of AV fistulas, and percentage of catheters in use over 90 days. The thought is to build a model using the rating system's health statistics to predict other dialysis centers' star ratings. This model can in turn show how dialysis center health statistics interact with one another and is a primer for directly linking individual patient demographics to dialysis centers.

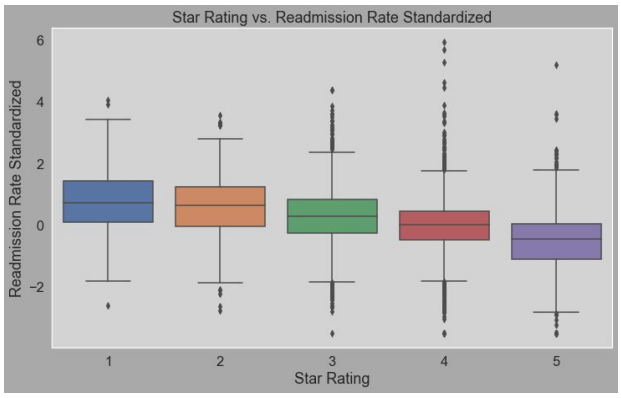
Findings

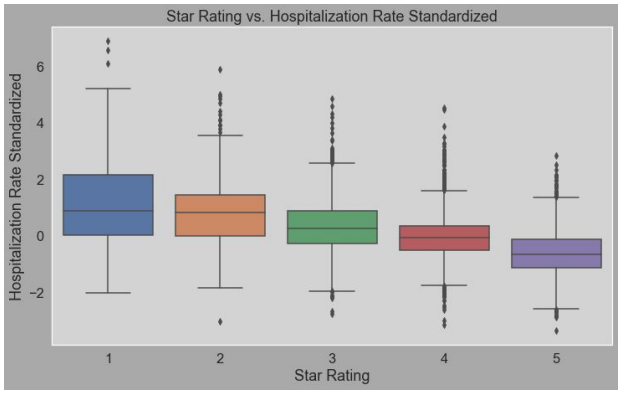
Blood measures of dialysis adequacy have wide ranges

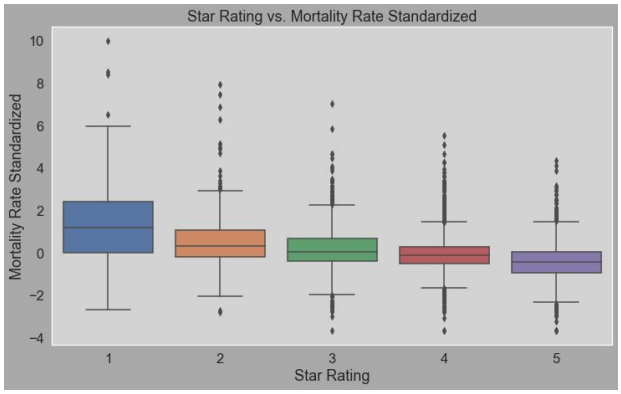


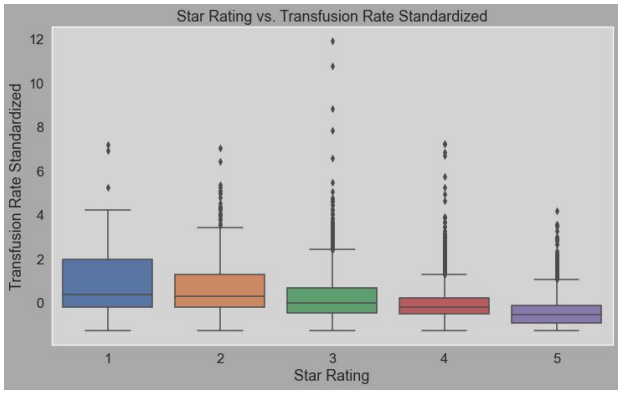
Kt/V is a measure of how effective dialysis is for an individual. Higher numbers indicate greater success. From the above figure on the left, the results show higher star ratings are correlated with a higher percentage of patients with high Kt/V while lower ratings have larger ranges. Hypercalcemia is a condition where a patient has more calcium in their blood than normal. From the above figure on the right, the results again show higher star ratings are correlated with a lower percentage of patients with hypercalcemia while lower star ratings have larger ranges.

Multiple features show lower rates with more stars but large ranges



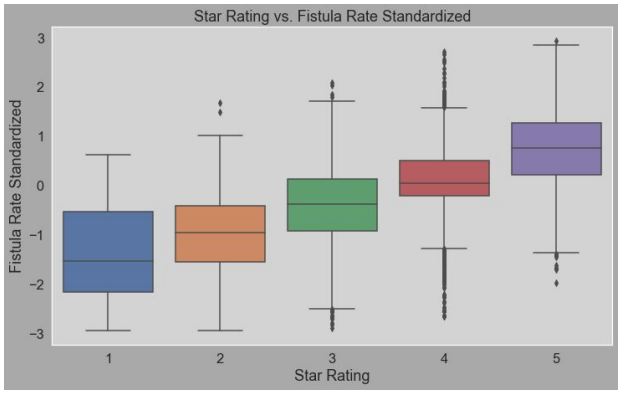


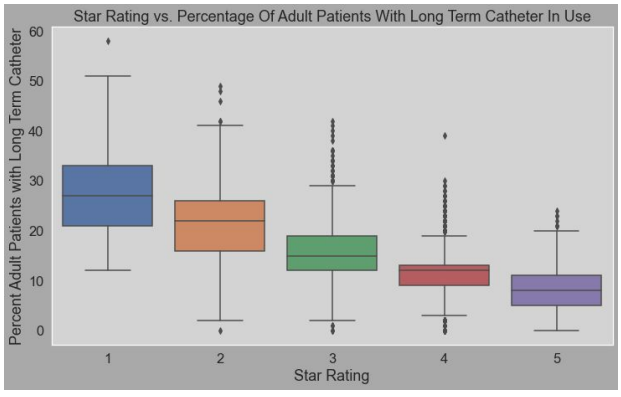




Readmission, hospitalization, mortality and transfusion rates all show negative correlation with increased star ratings. However, they all have large ranges of values that tend to narrow as star ratings increase.

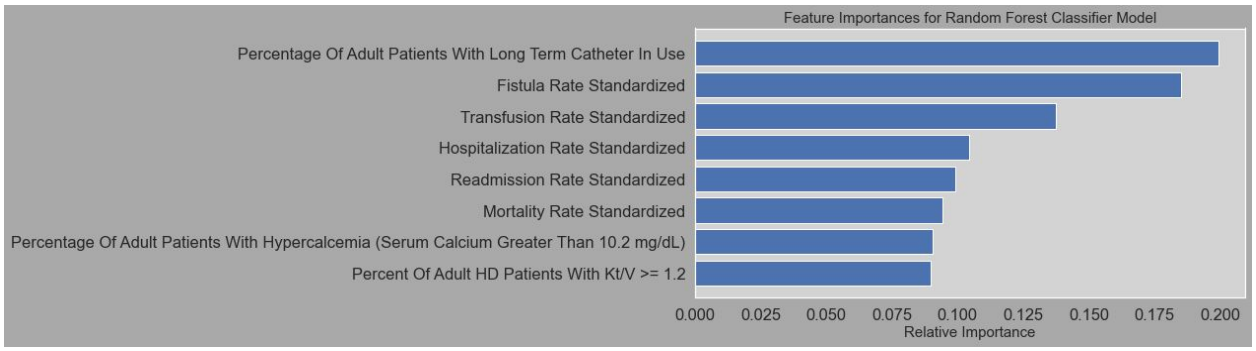
Fistula and catheter features show relatively strong correlation





Fistula and catheter statistics show relatively strong correlations with star ratings; fistula being positively and catheter being negatively correlated. Again, both features show wide ranges that tend to narrow as star ratings increase.

Feature importance differs between health statistics



Features weight differ in determining the predictive model. Long term catheter and fistula rates appear to be the most important features, while percentage of patients with hypercalcemia and high Kt/V numbers are less important.

Further research

This preliminary study opens the door for a wide range of future research. First, the independent features which determine star ratings can be further explored to examine why statistics differ between centers. Are differences in ratings due to centers' specializing in end-stage chronic kidney patients or funding related? Another way this data can be used is to create future models directly linking individual patients health demographics to dialysis centers' star ratings. Gathering the data for individual patients rather than using health statistic data might create a clearer picture of why ratings differ. A third way these findings can be used is to determine if patients' should switch dialysis centers based on a center's rating and a patient's demographics. Should all one-star dialysis centers be forced to close?

Summary

As expected, the features which determine dialysis centers star rating are correlated with star rating. The features weights differ in determining the predictive model. These findings can be used for further research into dialysis centers, such as, determining why statistics differ between centers, linking individual patient demographics to dialysis centers, and if patients should switch dialysis centers based on their health needs.