



Performance of hospital length of stay prediction after Congenital Heart Surgery generated from diagnosis and demographic data only



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Introduction

Developing a predictive model for hospital length of stay (LOS) aids in strategic scheduling, optimizing critical resource allocation and may avoid elective surgery cancellations and mitigate broader impacts on pediatric hospital care.

We previously developed a model capable of predicting prolonged LOS using granular data.

Here we create a model that relies on preoperative demographics, diagnosis and procedure data to predict prolonged hospitalization after congenital heart surgery.

Hypothesis

We can predict postoperative LOS after congenital heart surgery with good accuracy using preoperative diagnosis, procedure and demographic data.

Methods

Single-center database study using EMR data from the data warehouse at Stanford. R was used for data cleaning, formatting and analysis.

Stepwise regressions using maximum likelihood ratio test were used to model the relationship between known preoperative and demographic factors and length of stay after congenital heart surgery, using first using granular data, then only demographics and procedure codes.

Sensitivity, specificity and receiver operator characteristics (ROC) and area under the curve (AUC) analysis used to assess model performance.

Observed versus Predicted Length of Stay

Figure 1.

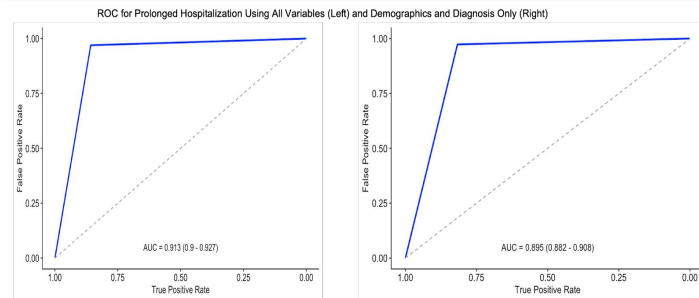


Table 1. Predicted Versus Observed LOS for Full Model

	LOS > 75 th Percentile	LOS ≤ 50 th Percentile
Predicted LOS > 75 th Percentile	410	154
Predicted LOS ≤ 50 th Percentile	13	928

Table 2. Predicted Versus Observed LOS for Abbreviated Model

	LOS > 75 th Percentile	LOS ≤ 50 th Percentile
Predicted LOS > 75 th Percentile	541	217
Predicted LOS ≤ 50 th Percentile	15	970

Results

Our full model predicted 410 out of 423 prolonged hospital stays, and our abbreviated model predicted 541 out of 556 prolonged hospitalizations. The AUC for our abbreviated model's prediction of mortality was 0.895 [0.882 - 0.908] compared to for the full model 0.913 [0.900-0.927] (Figure 1). The sensitivity for our abbreviated and granular models were 97.3% and 97.2% respectively. Specificity were 81.7% and 85.8%

Conclusions

Our model using demographics, diagnosis and procedure data predicts prolonged hospitalization after congenital heart surgery with good accuracy when compared to the model that also uses granular data.

References

- Jenkins KJ, Gauvreau K, Newburger JW, Spray TL, Moller JH, Iezzoni LI. Consensus-based method for risk adjustment for surgery for congenital heart disease. J Thorac Cardiovasc Surg. 2002;123(1):110-118.
- Alexander PMA, DiOriò M, Andren K, et al. Accurate Prediction of Congenital Heart Surgical Length of Stay Incorporating a Procedure-Based Categorical Variable*. Pediatr Crit Care Med. 2018;19(10):949-956.
- Hart SA, Tanel RE, Kipps AK, et al. Intensive Care Unit and Acute Care Unit Length of Stay After Congenital Heart Surgery. Ann Thorac Surg. 2020;110(4):1396-1403.