



Singapore Healthcare Management 2017

Analysis of Key Factors and Dashboard Reporting for the Hip Fracture Bundled Subvention Pilot

Lam Shao Wei Sean¹; Ang Boon Yew¹; Nguyen Ngoc Hoang Long¹; Chen Yonghui¹; Howe Tet Sen^{1,2}; Koh Suang Bee, Joyce^{1,2};
With special mention to NUS SDP Team: Sakib Bin Farooque Rahmatullah³; Ting Jun Yang³; Chee Jing Zhen³; Zhao Tianhao³; Peter Chandra Djasni³

¹SingHealth

²Singapore General Hospital

³Industrial Systems Engineering, National University of Singapore

Problem Definition

Problem Description

Singapore's aging population brings about complex challenges for the healthcare regulators. SingHealth has hence embarked on a project with MOH to study if the financing model would help to achieve the goal to optimize the organization of care across the patient's healthcare journey as well as to improve patient outcomes through better continuity of care. This project will be piloted for patients with hip fracture where patients are operated in the acute hospitals and where suitable, right-sited to the community hospital for rehabilitation.



Understanding

There is a need to better study and understand the Bundled Payments Model as well as the subvention allocation process.



Analyzing

There is a need to analyze the data from the patients in the pilot project to find the key indicators.

Key Requirements



Visualizing

Data visualization aids to illustrate the relationships and trends in the data.



Decision Making

All of the analysis and data analytics should come together to aid upper management in key decision making.

Methodology



Project Kick-off

Frequent meetings with the stakeholders are conducted to understand the problem background, stakeholders' needs and expectations.



Construction of Process Flow

To craft a full process flow, data regarding the bundled payment programme are collected by interviewing staff who are working in the system, studying SingHealth's documentation and researching on similar case studies in other countries.



Statistical Analysis

Using R, the dataset is analyzed using ANOVA, univariate and multivariate linear regression models to determine significant factors to the length of stay and net payable. These indicators can help in determining suitable hip fracture bundled payment subvention.



Building of Pilot Dashboard

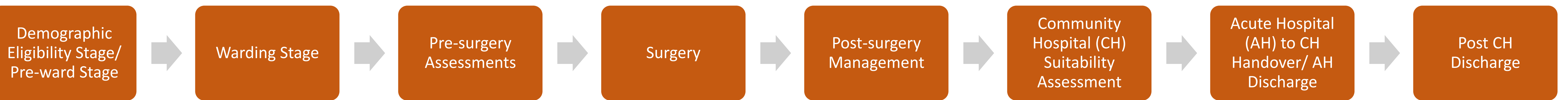
Agile method is adopted, meaning that the dashboard will be built in incremental iterations, integrating new sets of data and features in the various phases after user feedback from meeting with key stakeholders and end users.



Project Conclusion

Documentation of all the technical information and training with the staff are done to complete the handing over of the project to our sponsors.

Process Flow



The diagram is a simplified process flow which is used to understand the data sources and data relationships better. There is a need for deeper understanding of the Bundled Payments Model as well as the subvention allocation process.

Statistical Analysis

Statistical Analysis Methodology

- To determine significant factors affecting Length of Stay (LOS) and Net Payable
- Factors consists of patient characteristics e.g. Age, Gender, Diagnosis Code, Discharge Specialty Code
- Significant factors are selected when p-value < 0.05



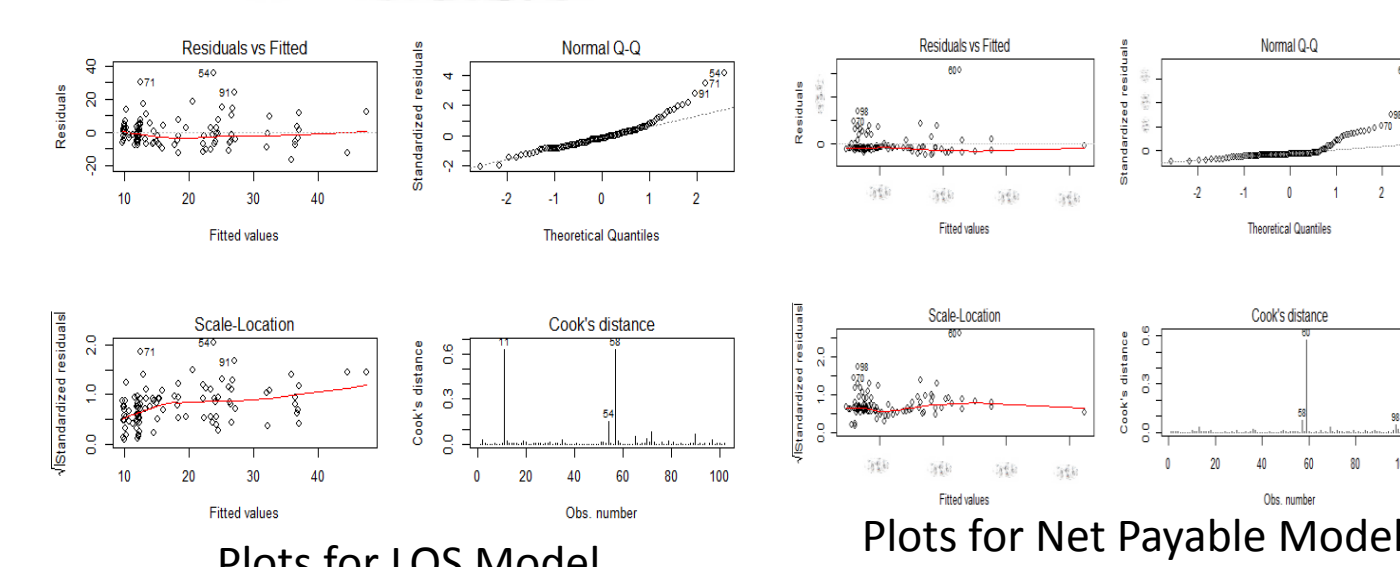
- Data Cleaning**
 - Combined multiple data sets of hip-fracture patients over 6 months
- Descriptive Statistics**
 - Categorical Variables: Proportions of different levels
 - Continuous Variables: Mean, median and standard deviation
- Univariate Analysis**
 - Categorical independent vs Continuous dependent variable: ANOVA test
 - Continuous independent vs Continuous dependent variable: Linear regression model
- Multivariate Analysis**
 - Multivariate regression model
- Model Diagnostics**
 - Performed model diagnostics based on independence, linearity, homoscedasticity and normality
 - Plots: (i) Residuals (ii) Q-Q (iii) Scale-location (iv) Cook's Distance

Results

*Analysis Results are preliminary and inconclusive and has not yet been incorporated in the dashboard

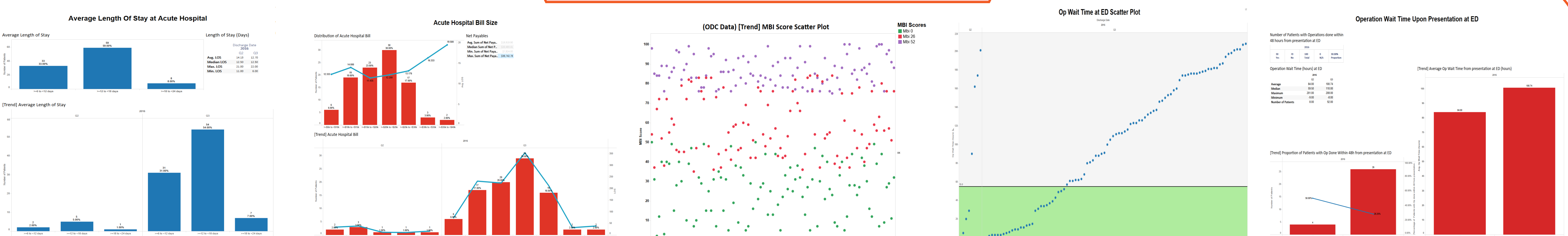
	LOS	Net Payable
Significant Factors		
p-value	1.851×10^{-12}	4.206×10^{-4}

Coefficients:		Estimate Pr(> t)	
(Intercept)	14.3619124	0.1354	
	0.0001997	0.0410 *	
	2.2156067	0.8074	
	24.0341696	0.0363 *	
	15.9124405	0.0881	
	-7.4394766	0.0297 *	
	4.5762023	0.2011	
	-5.4158649	0.0972	



- Residual plots, scale-location plot Points are randomly scattered.
- Q-Q Plot Points are generally scattered about a straight line.
- Cook's Distance Outliers are detected and removed.

Dashboard and Usage



Dashboard Characteristics

- Quarterly Reports on Hip Fracture Bundled Payments Subvention Project
- Data source from 3 Key Departments
- Allows monitoring of process quality levels and control levels
- Enables informed decision making regards to subvention model
- Highlights anomalies or scope for improvement in system
- Facilitates better understanding of Bundled Payments Model

Features

- Data Visualization
- Ability to drill down to different levels of data granularity
- Blending Data Sets
- Easy updates with new data
- Different levels of access to different user classification

Future Development

- Easily implementable for other subvention models
- Seamless integration of other newer sets

*The data in this poster are masked and are used for illustration purposes only