Model Details for Standardized Readmission Ratio

Introduction

To estimate the probability of 30-day unplanned readmission, we use a two-stage model, the first of which is a double random-effects logistic regression model. In this stage of the model, both dialysis facilities and hospitals are represented as random effects, and regression adjustments are made for a set of patient-level characteristics. From this model, we obtain the estimated standard deviation of the random effects of hospitals (Diggle, et. al., 2002).

The second stage of the model is a mixed-effects logistic regression model, in which dialysis facilities are modeled as fixed effects and hospitals are modeled as random effects, with the standard deviation specified as equal to its estimates from the first model. The expected number of readmissions for each facility is estimated as the summation of the probabilities of readmission of all patients in this facility and assuming the national norm (i.e., the median) for facility effect. This model accounts for a given facility's case mix using the same set of patient-level characteristics as those in the first-stage model.

More details about the SRR calculations are available on the Methodology page of DialysisData.org (https://dialysisdata.org/content/methodology).

Model for 2016 SRR

The table below shows the parameter estimates for the second stage model for the 2016 Standardized Readmission Ratio (SRR). The median of national facility effects from the second stage model is $\gamma_M = -1.998878$.

The results of this model are used to calculate facility SRR values for 2016 that are reported on Dialysis Facility Compare beginning in October 2017.

Table 1 Parameter estimates for second stage 2016 SRR model

Risk Factor	Beta	SE	p-value
Age (years)			
<25	0.50	0.04	<0.001
25–45	0.24	0.01	<0.001
45–60 (ref)	—	—	—
60–75	-0.02	0.01	0.001
>75	0.02	0.01	0.155
BMI (kg/m²)			
Underweight: 0<=BMI<18.5	0.005	0.02	0.904
Normal Weight: 18.5<=BMI<25(ref)	—	—	—
Overweight: 25<=BMI<30	-0.05	0.01	<0.001
Obese: 30<=BMI	-0.13	0.01	<0.001
Cause of ESRD: Diabetes	0.03	0.01	<0.001
Comorbidity (past year)			
CCs 177, 178: Amputation status	0.01	0.01	0.306
CC 108: COPD	0.22	0.01	<0.001
CC 79: Cardiorespiratory failure/shock	0.25	0.01	<0.001
CC 46: Coagulation defects & other specified hematological disorders	0.15	0.01	<0.001
CCs 51, 52: Drug and alcohol disorders	0.34	0.01	<0.001

CCs 25, 26: End-Stage Liver Disease	0.33	0.01	<0.001
CC 109: Fibrosis of lung or other chronic lung disorders	0.10	0.02	<0.001
CCs 67–69, 100, 101: Hemiplegia, paraplegia, paralysis	0.05	0.01	<0.001
CC 158: Hip fracture/dislocation	-0.04	0.02	0.009
CC 174: Major organ transplants (excl. kidney)	0.04	0.02	0.107
CC 7: Metastatic cancer/acute leukemia	0.37	0.02	<0.001
CC 44: Other hematological disorders	0.20	0.02	<0.001
CCs 6, 111–113: Other infectious disease & pneumonias	0.17	0.01	<0.001
CCs 10–12: Other major cancers	0.09	0.01	<0.001
CC 32: Pancreatic disease	0.24	0.01	<0.001
CCs 54–56, 58, 60: Psychiatric comorbidity	0.23	0.01	<0.001
CC 77: Respirator dependence/tracheostomy status	-0.01	0.02	0.665
CC 38: Rheumatoid arthritis & inflammatory connective tissue disease	0.06	0.01	<0.001
CC 74: Seizure disorders & convulsions	0.14	0.01	<0.001
CC 2: Septicemia/shock	0.11	0.01	<0.001
CCs 8,9: Severe cancer	0.14	0.02	<0.001
CCs 1, 3–5: Severe infection	0.10	0.01	<0.001
CCs 148, 149: Ulcers	0.15	0.01	<0.001
Length of Index Hospitalization (days)			
Quartile 1: 0 – 3 days(ref)	—	—	—
Quartile 2: 4 days	0.07	0.01	<0.001
Quartile 3: 5 – 8 days	0.13	0.01	<0.001
Quartile 4: 9+ days	0.25	0.01	<0.001
Presence of high-risk diagnosis at index discharge	0.49	0.03	<0.001
Sex: Female	0.07	0.01	<0.001
Time on ESRD (years)			
<1 (ref)	—	—	—
1 -2	0.11	0.01	<0.001
2< –3	0.13	0.01	<0.001
3< –6	0.11	0.01	<0.001
>6	0.08	0.01	<0.001

Reference:

1. DialysisData.org. Website: https://dialysisdata.org/
2. Diggle, P. J., Heagerty, P., Liang, K. Y. and Zeger, S. L. (2002). Analysis of Longitudinal Data, 2nd edition. Oxford University Press, New York.