

Sepsis Readmission Measure Score Calculation

The hospital-level 30-day all-cause risk-standardized readmission rate (RSRR) for each measure is estimated using a hierarchical logistic regression model. The RSRR is calculated as the ratio of the number of “predicted” readmissions to the number of “expected” readmissions at a given hospital, multiplied by the national observed readmission rate, as illustrated below:

$$RSRR = \frac{\text{Predicted Readmissions}}{\text{Expected Readmissions}} \times \text{National Observed Readmission Rate}$$

More specifically, using the set of risk factors in the hierarchical generalized linear model (HGLM), we fit the HGLM defined by Equations (2) - (3) and estimate the parameters

$$\hat{\mu}, \{\hat{\alpha}_1, \hat{\alpha}_2, \dots, \hat{\alpha}_I\}, \hat{\beta}, \text{ and } \tau^2.$$

We calculate a standardized outcome,

$$\hat{s}_i$$

for each hospital by computing the ratio of the predicted to expected mean outcomes, multiplied by the unadjusted national mean readmission rate,

$$\bar{y}.$$

Specifically, we calculate:

$$\text{HGLM: } h(Y_{ij}) = \alpha_i + \beta Z_{ij} \quad (2)$$

$$\alpha_i = \mu + \omega_i \omega_i \sim N(0, \tau^2) \quad (3)$$

$$\text{Predicted } \hat{y}_{ij}(Z) = h^{-1}(\hat{\alpha}_i + \hat{\beta} Z_{ij}) \quad (4)$$

$$\text{Expected } \hat{e}_{ij}(Z) = h^{-1}(\hat{\mu} + \hat{\beta} Z_{ij}) \quad (5)$$

$$\hat{s}_i(Z) = \frac{\sum_{j=1}^{n_i} \hat{y}_{ij}(Z)}{\sum_{j=1}^{n_i} \hat{e}_{ij}(Z)} \times \bar{y} \quad (6)$$

If more (fewer) cases than “expected” have the outcome in a hospital, then will be higher (lower) than the unadjusted average. For each hospital, we compute an interval estimates of

$$\hat{s}_i$$

to characterize the level of uncertainty around the point estimate. The point estimate and interval estimate can be used to characterize and compare hospital performance (e.g., higher than expected, as expected, or lower than expected).