

Neurological Severity of Illness Is Associated with Increased Resource Utilization

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Our objective was to investigate the association between neurological severity of illness, and hospital resource utilization on the first day of Intensive Care Unit (ICU) admission while controlling for confounding factors, including the severity of illness in other organ systems.

We extracted data from 52,420 unique intensive care unit stays from the publically available Multiparameter Intelligent Monitoring in Intensive Care Database (MIMIC). For each unique ICU stay, we computed the Sequential Organ Failure Assessment (SOFA) score on the first day of the visit. The SOFA score was then partitioned into its organ-level components: Neurological, Hepatic, Hematological, Renal, Cardiovascular, and Respiratory. Resource utilization was estimated as the total number of Current Procedural Terminology (CPT) codes recorded for the patient during their first day in the ICU. We also extracted the following confounding features for consideration in the analysis: Elixhauser Comorbidity Index, age, gender, ICU care unit type (medical/surgical). We excluded all patients which were less than one year in age, were missing feature data, or had zero recorded CPT codes on their first day in the ICU. We utilized a Negative Binomial regression to model the association between severity of neurological illness and resource utilization while controlling for the effects of our selected confounding factors.

Two of our selected features exhibited a statistically significant association with resource utilization on the first day of ICU treatment: neurological severity of illness (p-value = 0.013), and respiratory severity of illness (p-value = 0.024). The relative risk of resource utilization with respect to Neurological Failure (exponential of the model coefficient) was found to be 1.11 with a 95% confidence interval of 1.01 to 1.23.

Our results indicate that the severity of neurological impairment is a driver of ICU resource utilization on the first day of treatment, after controlling for demographic features, and the severity of illness in other systems. The large range of the confidence interval for relative risk, indicates that our model fails to capture important clinical nuance that drives utilization for some patients, but not others. Hence, while we have found evidence of an association between neurological impairment and resource utilization, further analysis will be required to understand the precise nature of the relationship.