Abstract 1007: Development of Tele-ICU Multidimensional Severity Adjusted PIRO Sepsis Model

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Development of Tele-ICU Multidimensional Severity Adjusted PIRO Sepsis Model
Predisposition, Insult/Injury, Response, Organ Dysfunction /Outcomes (PIRO)
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Introduction: The purpose of this study was to determine the effect of pre-existing health and acute illness characteristics on sepsis responses and outcomes in Intensive Care Unit (ICU) patients by leveraging data acquisition technology in large complex data bases, specifically inputs from Tele-ICU technology.

Hypothesis: Contributions of person level and pre-existing health and acute illness characteristics will estimate risk of sepsis severity, mortality, and acutely acquired organ dysfunction (AAOD).

Solution: Data Transformation Process. We utilized Informatica Data Warehouse Software and advanced methods of technologically mining clinical data in large complex data bases. Discrete data items were captured and compiled through a number of Interfaces, multiple data platforms, electronic medical record (EMR), and ICU documentation systems.

The data structure design was completed with the following steps: (a) determine primary keys; (b) assign tables; (c) design research database; (d) verify procedure to ascertain correct data variables and/or data parameters; (e) validate procedure to ensure the sourced information was what the research study required; (f) back-end server data transformed to flat files; and (g) mapped files into statistical software for analysis.

We acquired essential attributes required for study. Utility of the database was tested by creation of several sophisticated prediction models.

Materials and Methods: Observational cohort obtained at 6 hospitals from 2008 to 2013 (n = 10,232; 5,643 sepsis, 2,321 severe sepsis, 2,268 septic shock). Sampling method was validated with a subset of patients against a retrospective chart review (validity coefficient 0.88, 95% CI 0.71; 0.96) and prospective clinician identified (0.86, 95% CI 0.69; 0.94) blinded over same period.

Results: Age, gender, race, insurance and marital status, APACHE IV severity scores and hospital and ICU admit source were considered as predictors in models. Overall mortality 19%, Sepsis 10% (severity adjusted ratio 0.59), Severe Sepsis 20% (0.84) and Septic Shock 40% (1.17). APACHE scores were significant predictors in all models; average APACHE score 68.6; APS 5.9 that was higher than average ICU population (53.8; 40.9).

Although age was significantly associated with mortality (p = .001), it was not included multivariate models, contrary to sepsis literature; perhaps the difference in this study was due to more in depth information yielded stronger predictors or age is included in APACHE scores.

Conclusions: Complexity of big healthcare data provides solid basis to illuminate less frequently studied variables to identify disease sub-types using partitional and hierarchical clustering methods to heuristically uncover apriori differences and create PIRO sepsis risk models.

Lessons Learned: Building a team is of utmost importance. Research and field specialist must collaborate closely with IT including engineers, database, and data warehouse professionals. Biostatisticians and Telehealth Data Analyst/Architect are vital members of the team. To achieve future goals, we plan to continue to develop: Data mining methods to handle high dimensionality and large data volumes to advance novel predictors from mathematical models and computational intelligence.