Development of Tele-ICU multidimensional severity adjusted PIRO sepsis model (Winner of Critical Care Medicine’s Administration Specialty Award!)

Donna Lee Armaignac  
*Baptist Health South Florida*, donnawa@baptisthealth.net

Carlos Valle  
*Baptist Health South Florida*, CarlosValle@baptisthealth.net

Julie Lamoureux  
*West Kendall Baptist Hospital*, julieal@baptisthealth.net

Louis Gidel  
*Baptist Health South Florida*, LouisG@baptisthealth.net

Xiaorong Mei  
*Baptist Health South Florida*, xiaorongm@baptisthealth.net

See next page for additional authors

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Authors
Donna Lee Armaignac, Carlos Valle, Julie Lamoureux, Louis Gidel, Xiaorong Mei, and Emir Veledar

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Development of Tele-ICU Multidimensional Severity Adjusted PIRO Sepsis Model

Predisposition, Insult/Injury, Response, Organ Dysfunction /Outcomes (PIRO)

Donna Lee Armaignac PhD, RN-CNS, CCNS, CCRN; Carlos A. Valle RT; Julie A. Lamoureux DMD, MSc; Louis T. Gidel PhD, MD; Xiaorang Mei MS IT; Emir Veledar PhD

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 from 2008 to 2013 (n = 10,232; 5,643 sepsis, 2,321 severe sepsis, 2,268 septic shock. Although age was significantly associated with mortality (p < 0.001), 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.

Results: Hispanics higher risk sepsis severity (OR 1.16 p < 0.000). Although, endemic population was predominantly Hispanic 55.6% (white and black Hispanics), Hispanics have not been reported as the most vulnerable race.

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.

Development of Robust Multivariate Sepsis Related Data Base

Challenge: The conduct of high value applied epidemiologic research is contingent upon data sources. Baptist Health South Florida, a large healthcare organization, is in the midst of transformation of extremely high volume of data to best possible use. There was no market available product to seamlessly transform OLTP data to OLAP, so we organized internally to achieve this goal.

Solution: To define, organize, and visualize interrelationships among sepsis Predisposition, Insult/Injury, Response, and acutely acquired organ dysfunction (AAOD).

Factor Analysis: to identify the effect of Acute Diagnoses (Dx), Active Treatments (Rx), Past Health (PH) and APACHE IV ICU Admission Diagnosis on quality and predictability of PIRO model through the development of a complex Tele-ICU physiological and severity adjusted multidimensional database.

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