Deep Neural Network Analysis of Clinical Variables Predicts Escalated ICU Care in COVID-19 Patients

Lu, Joyce (School: Ardsley High School)

This study used deep learning neural networks to investigate the most important clinical variables that could be used to determine escalated care early on in COVID-19 patients. Hospitalized patients from the Stony Brook Hospital between February 7,2020 and May 4, 2020 were examined. Demographics, comorbidities, laboratory tests, vital signs, and blood gases were collected. I compared the data obtained at the time of general admission and the time of intensive care unit (ICU) for COVID-19 patients admitted to the general floor (N=1203) versus patients directly admitted to the ICU (N=104). I also compared patients not upgraded to the ICU (N=979) versus patients upgraded to the ICU from the general floor (N=224). A deep neural network model was constructed to predict ICU admission, with 80% of the data randomly split for training, and 20% for testing. I discovered that C-reactive protein, lactate dehydrogenase, creatinine, white-blood cell count, D-dimer, and lymphocyte count significantly improved in patients who were not upgraded to ICU, whereas those who were upgraded demonstrated more severe conditions. The deep-neural network consistently ranked these same set of laboratory variables to be predictive of ICU care. The AUC for predicting ICU admission was 0.791±0.013 for the test dataset, and adding vital sign and blood-gas data improved the AUC (0.822±0.018). Cutoffs of the top predictive variables and a risk score system were developed. These results could provide a guideline to help physicians better anticipate ICU needs early on and designate healthcare resources.

Awards Won:
Fourth Award of $500