ATS 2017: Machine Learning May Help to Identify Sepsis Early

Using electronic health records (EHRs) to identify patients in hospital at risk for sepsis is now possible using machine learning. Machine learning does not rely on rules, but is able to learn complex patterns in data without being programmed to do so. Researchers from the University of Pennsylvania Health System presented their study of a machine-learning algorithm at the 2017 American Thoracic Society International Conference.

Previous studies have used data from EHRs to trigger alerts to detect clinical deterioration in general. Lead author Heather Giannini, MD, of the Hospital of the University of Pennsylvania, said that this is the first machine-learning algorithm to predict severe sepsis and septic shock in a large academic multi-hospital healthcare system.

See Also: The AKIpredictor: An Online Calculator to Predict Acute Kidney Injury

The algorithm was developed in-house by a team of Penn data scientists, who trained a random forest classifier to sort through EHRs for 162,212 patients discharged between July 2011 and June 2014 from three University of Pennsylvania Health System acute care hospitals. The algorithm was able to examine hundreds of variables on a continuous basis. Patients with severe sepsis or septic shock were labelled as such 12 hours before the actual onset of severe sepsis or septic shock. Onset was determined based on lab results and physiological data, such as blood pressure. A total of 943 patients in the database met the assigned lab or physiological criteria.

Next, the algorithm was validated in real time between October and December 2015 with 10,448 patients while they were cared for in the study hospitals. Approximately 3 percent of all acute care patients screened as positive, and 10 alerts were sent each day across the three hospitals.

Dr. Giannini told *ICU Management & Practice* in an email that the threshold for triggering the alert of approximately 10 alerts per day across the healthcare system was determined with the goal of generating a manageable number of daily alerts requiring response, and minimising the number of false positive alerts. This configuration results in a 29% Positive Predictive Value (PPV).

Next Steps

Dr. Giannini said that the researchers are currently examining the data comparing the pre- and post-alert testing

periods. They developed the algorithm prior to the recent updates to sepsis definitions and will be considering updates during our evaluations of the current algorithm's performance. The team is actively investigating the algorithm's utility within their hospital system and working to improve upon how it is deployed to the provider and how best to align clinical need with the computer science capabilities of machine-learning.

"We were hoping to identify severe sepsis or septic shock when it was early enough to intervene and before any deterioration started," said senior author Craig Umscheid, MD, of the Hospital of the University of Pennsylvania. "The algorithm was able to do this. This is a breakthrough in showing that machine learning can accurately identify those at risk of severe sepsis and septic shock." He added that they will also be examining process and outcome changes resulting from the use of this machine-learning algorithm, and to see if the algorithm has an impact in clinical practice.

Source and image credit: American Thoracic Society

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