

A NOVEL MODEL FOR EARLY DETECTION OF PATIENT DETERIORATION IN ICU

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Introduction

Prompt recognition of patient deterioration allows early initiation of medical intervention with reduction in morbidity and mortality. ⁽¹⁾ This digital era provides an opportunity to harness the power of machine learning algorithms to process and analyze big data, automatically acquired from the electronic medical records. A number of sepsis prediction models, based on data extracted from EMR, were found effective in retrospective studies⁽²⁻⁴⁾, but have yet to be tested in real-time. CLEW Medical (Netanya, Israel) has developed a novel predictive model that detects early signs of any patient deterioration, and alerts physicians. In this study we prospectively validated the ability of the model to detect patient deterioration and alert physicians in real time.

Methods

The model was initially developed and validated using a retrospective cohort of 9246 consecutive patients admitted to the ICU in the Tel-Aviv Sourasky medical center – a tertiary care facility in Israel, between January 2007 and December 2015. In this study, we tested model performance in real time, on a cohort of 333 patients admitted to the same ICU between June 2016 and August 2017. Significant events that lead to major interventions (e.g. intubation, initiation of treatment for sepsis or shock, etc.) were tagged upon medical case review by a senior intensivist, blinded to model alerts. These tags were then compared with model alerts.

Results

A total of 136 patients suffered major events during study period, out of which 109 were detected by the model, resulting in a sensitivity of 0.80, specificity of 0.93 and a PPV of 0.89. The model's AUC-ROC was 0.86. System operation and algorithm execution were fluent and reliable. Figures 1 and 2 respectively are examples of a complete unit status and a single patient deterioration prediction in real time.

Study population characteristics

	POPULATION
Number of Stays	333
Mean LOS (hours)	186.24
Age -	59.1
% Female	35
% mortality	4.5%

Figure 1: Unit View - a dashboard display of patient status and alerts of a complete unit.

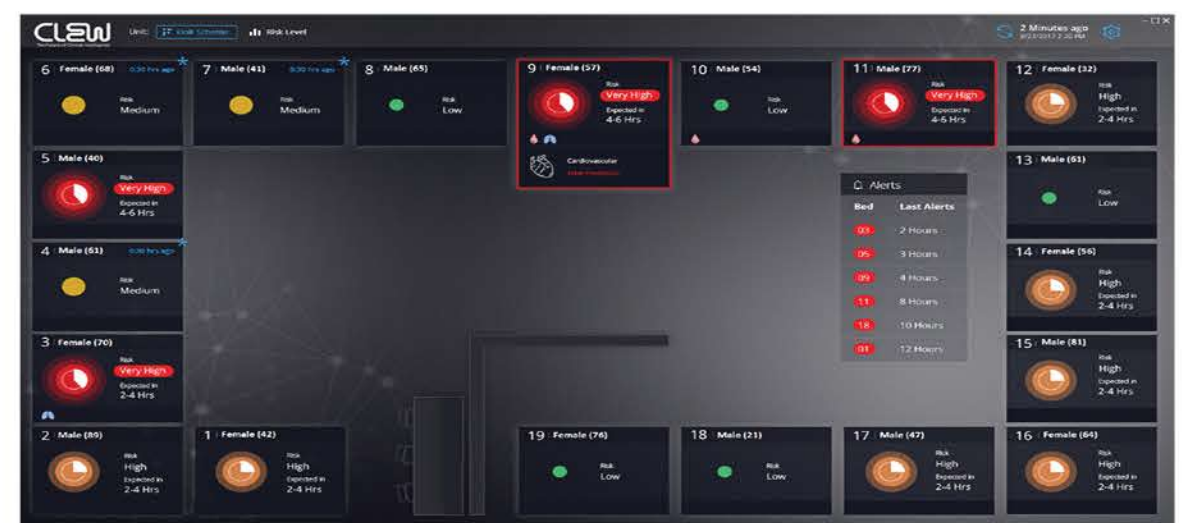


Figure 2: Patient view, display of the model prediction for deterioration. The view includes graphical display of the trends along with various vitals.



Conclusions

We developed a machine-learning model that can reliably recognize patient deterioration in real time. Ongoing research aims at showing improved model validity and verifying its ability to precede clinical detection. Future research is needed to demonstrate positive effect on patient outcome.

References:

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