Simulating Uncertainty of Early Warning Scores in Sepsis Detection

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ABSTRACT

Sepsis, a syndrome of acute organ dysfunction secondary to a systemic infection, has been recognized as a growing burden on healthcare systems and is responsible for nearly \$24 billion annually. Various early sepsis detection scores have been developed to quantify the risk of clinical deterioration. While the scores quantify risk, they often overlook the uncertainties associated with the scores, defined as a feature of a scoring system caused by any absence of a component in documented Electronic Health Records (EHR). Using a discrete-event simulation approach, we analyzed the simulated 1) composition of a selected early warning score, 2) timing of worst and best score values of sepsis population in the Emergency Department, and 3) changes over time in uncertainty throughout the hospitalization. Composition referred to simulated availability of score components and uncertainty was represented by the percent of components that are unavailable at a given time point. Data was collected from 15,982 patients with 22,968 visits meeting infection and sepsis criteria within subpopulations with different levels of severity of sepsis. Simulated trajectories indicated differences among the sub-populations. The first complete score and worst score values were found to be higher for those who died with sepsis compared to those that survived with infection and/or with sepsis. The findings from this study provide a framework to capture the stochastic nature of early warning scores and can inform implementation of scores in clinical practice with the goal of supporting early detection of sepsis.

CCS CONCEPTS: • Applied computing~Health informatics

KEYWORDS: Sepsis; Early Warning System; Uncertainty; Simulation; Emergency Department

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BIOGRAPHY

Ali Jazayeri is a Ph.D. candidate at The College of Computing and Informatics (CCI) at Drexel University and his dissertation focuses on mining frequent substructures and their evolution in temporal networks. Ali Jazayeri is an instructor in the MS in Data Science program at CCI and he is working in the Healthcare Informatics Research Laboratory under the supervision of Prof. Chris Yang.

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