Signaling Sepsis: Conveying severity through novel alert design

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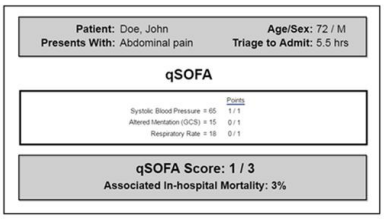
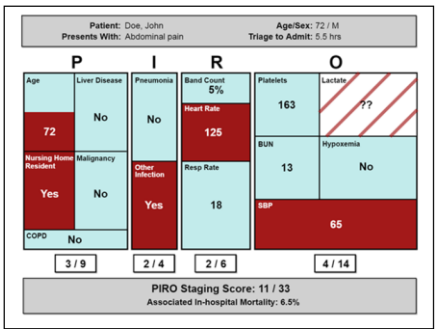
Problem Addressed

The current structure of electronic health record (EHR) systems allows clinical providers to access patient data and make impactful point of care decisions based on their significance. There are a wide range of patient alerts in the EHR that act as clinical decision support (CDS), aimed to assist in the early recognition of patient disorders; however, there are serious shortcomings in existing health information technology for alerting providers in a meaningful way.[1-3] Sepsis, a spectrum of organ dysfunction induced by infection4 with increasing incidence, [5-6] provides a unique lens in which we can further modify and evaluate CDS alerts. Clinicians subconsciously forecast each patient's clinical course with every decision they make. Because of this, clinicians are in need of improved EHR alerts to assist in early recognition of sepsis to combat high mortality rates. Currently, time pressure, competing demands, and ambiguous alert design reduce a user's opportunity to detect signals in the face of "noise" and may lead to inadvertent confirmation bias.[3-4] As a result, CDS developers, designers, and users aspire to improve alert management to achieve better acceptance rates and improved care delivery. The objective of our work is to leverage visualization techniques and human factors principals to design novel CDS interfaces of validated sepsis scores to support outcome forecasting and prediction.





Methods

Our research team developed four graphical model displays of two popular sepsis scoring systems that not only account for patient risk, but also indicate *severity* of symptoms and associated mortality rates, both through color and design. Our models use two visual display types (text display and figure display) and two levels of content where level of content refers to the number of components required to calculate the score. The alerts were designed using an adapted treemap to visually display a large amount of hierarchical data in a rectangular shape. Treemap is a type of visual display described as a space-constrained visualization of hierarchical structures.

Results

The intent of this work was to develop the models that will be used in future work to solicit performance and preference from clinicians. These models are currently being evaluated by physicians and nurses in a larger research effort to optimize alert design to improve the collective awareness of high-risk populations and develop a relevant point-of-care clinical decision support system for sepsis. Alert simulations orchestrated through a mobile usability lab assess the impact of enhanced visual display models and reveal more about the decision making process based on provider response. The ultimate purpose of this work is to inform EHR alert optimization and clinical practice workflow to support the efficient, effective, and timely delivery of high quality sepsis care. By providing timely patient-focused care and early intervention to support patient forecasting, we expect improved CDS will improve mortality, decrease organ failure, and reduce utilization of health care resources (e.g., hospital length of stay, long term care).

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