

Develop and Evaluate an Intelligent Clinical Decision Support (CDS) Tool to Predict New Onset of Delirium

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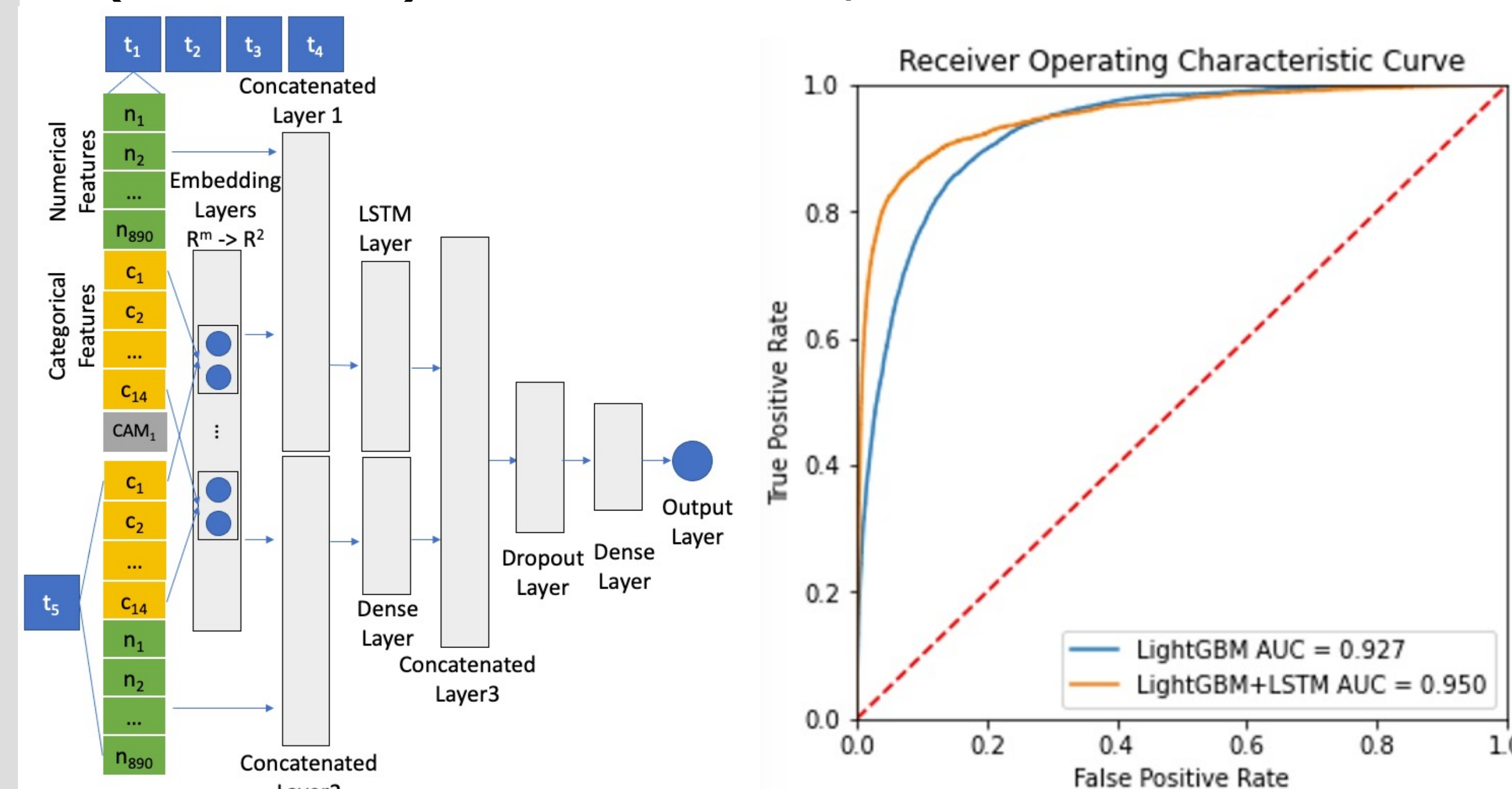
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INTRODUCTION

Delirium is an acute decline in cognitive function leading to confusion and emotional disorganization, which occurs in 29% to 65% of hospitalized older patients. Delirium is a serious problem, resulting in higher mortality, in-hospital falls, need for long-term care, and other adverse outcomes. Prevention is considered the most effective way to manage delirium, and more than two-thirds of delirium cases are preventable.

STAGE I – AI ALGORITHM

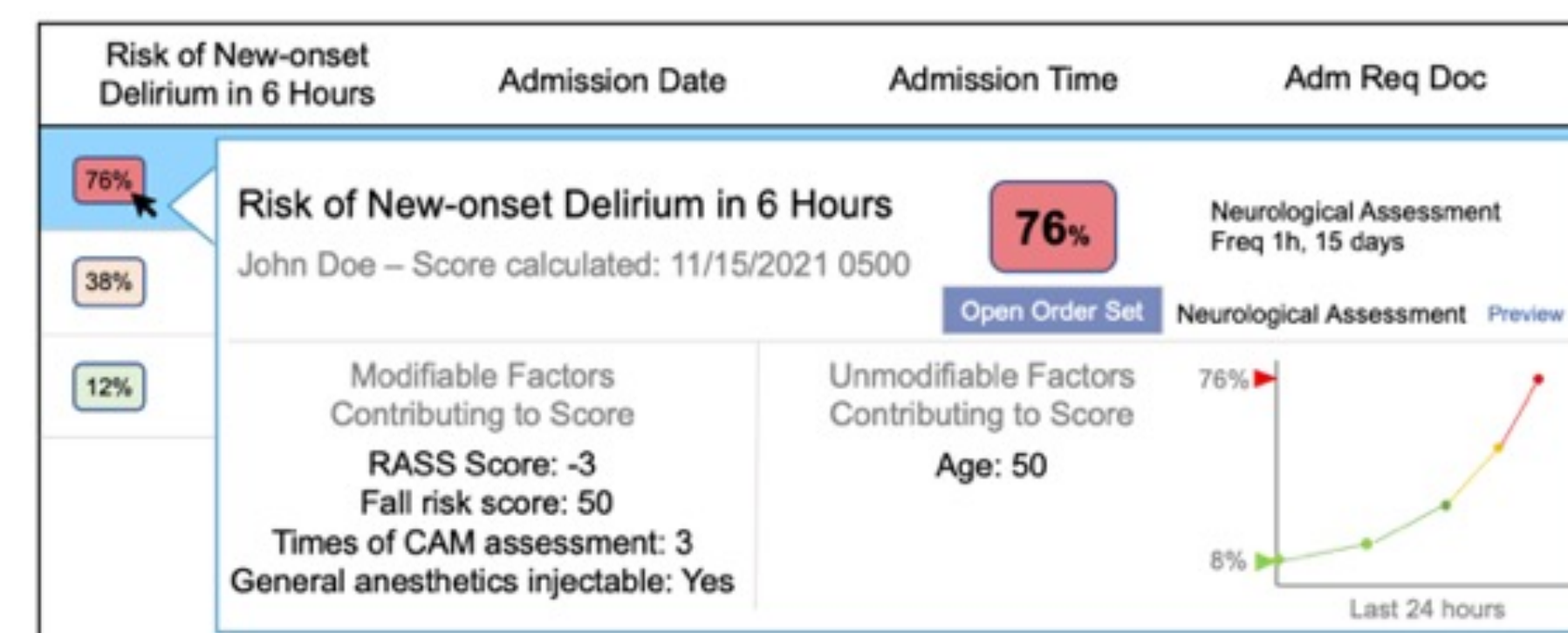
- Vanderbilt University Medical Center (VUMC); 2018-2021; 34,035 patients; 331,489 Confusion Assessment Method for the ICU (CAM-ICU) assessments; 896 features



- The precision value of the LightGBM+LSTM model improved from 0.497 to 0.751 with a fixed recall of 0.8.
- Shapley additive explanations (SHAP): age, heart rate, Richmond Agitation Sedation Scale (RASS) score, Morse fall risk score, pulse, respiratory rate, and level of care.
- Leveraging LSTM to capture temporal trends and combining it with the LightGBM model can significantly improve the prediction of new onset delirium, providing an algorithmic basis for the subsequent development of CDS for proactive delirium interventions.

STAGE II – USER-CENTERED DESIGN

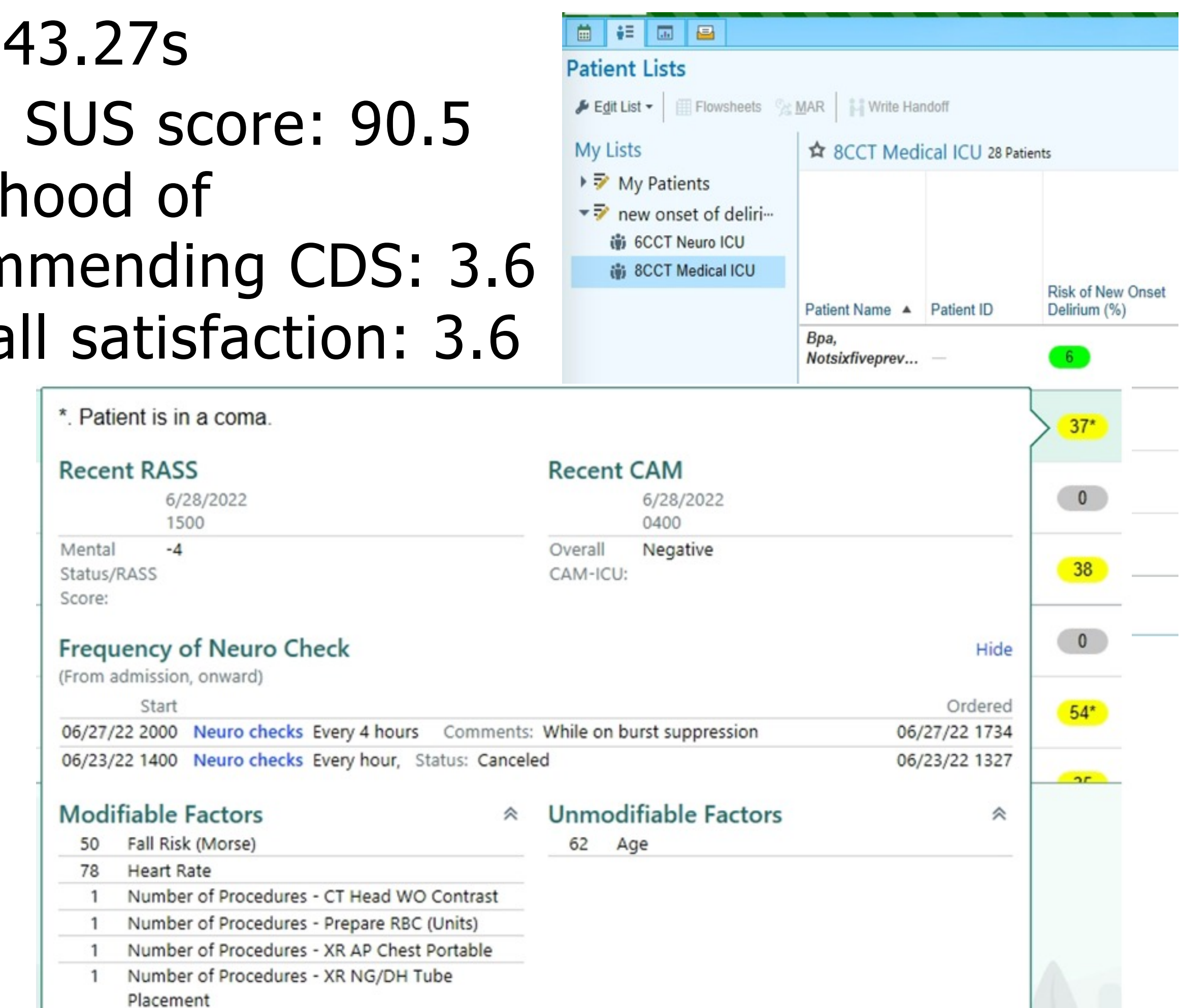
- User-centered review sessions
 - VUMC; February 2022; ICU care teams
 - ~0.5h; 1–3 participants; 4 sessions
 - Audio-record and transcribe all sessions
 - Qualitative data: thematically analyze; inductive approach; NVivo 12
- Final Prototype



- Reduce delirium in three ways simultaneously
 - Identify high risk patients
 - Identify low risk patients with a high frequency of neurological assessment
 - Assist in discharge or transfer
- Providers use explanations to justify their decisions which provides a good opportunity to develop CDS tools to incorporate explanations into the decision-making process.
- Using modifiable and unmodifiable features to present the explanations and providing actionable steps via CDS was a feasible approach to promote the use of predictive models in clinical settings.

STAGE III – EVALUATION

- Semi-structured interviews with follow-up questionnaires; System Usability Scale (SUS)
- Eight users accessed this CDS tool for a total of 6543.27s
- Mean SUS score: 90.5
- Likelihood of recommending CDS: 3.6
- Overall satisfaction: 3.6



- The current CDS tool achieved excellent usability and good user satisfaction.
- Highlight the importance of increasing clinician engagement, simplifying the CDS installation process, and providing actionable information.
- Presenting explainable machine learning through patient lists is a low-cost and rapid implementation approach that can effectively integrate predictions into the clinical workflow.

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