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Healthcare Enabled by Artificial Intelligence in Real-time

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HEALTHCARE ENABLED BY ARTIFICIAL INTELLIGENCE IN REAL-TIME

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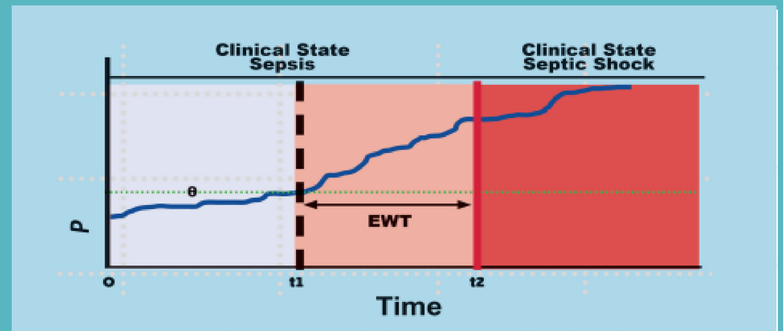
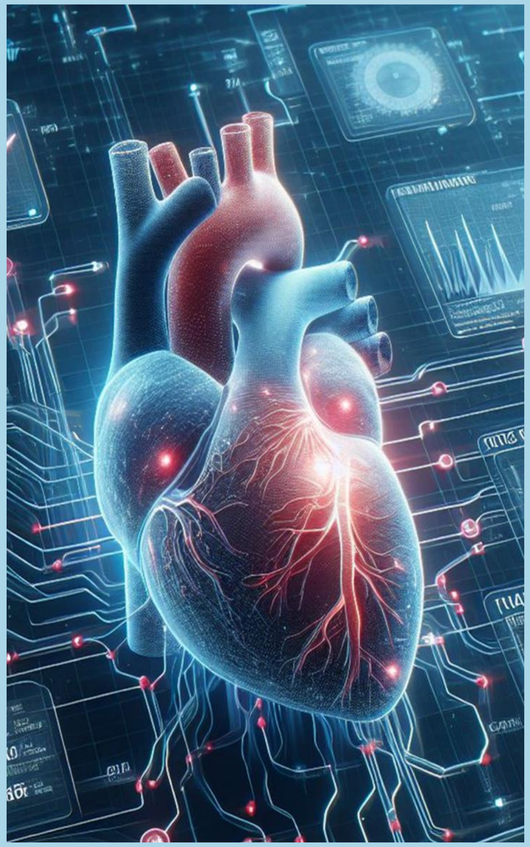
Real-time predictive analytics has the potential of contributing to **informed decision-making** for clinicians, more **consistent care** among patients, **advancing cardiac surgery recovery** and **reducing healthcare costs**



Conceptual illustration of the strategy for developing predictors based on time evolving data.

INTRODUCTION

The HEART (Healthcare Enabled by Artificial Intelligence in Real-Time) Project pioneers developing real-time machine learning (ML) predictive analytics to address the need to improve outcomes during recovery from open heart surgery. Our broad objective is to enhance patient outcomes by developing, validating and deploying predictive algorithms into the hands of clinical teams as an early warning and guidance system, allowing care teams an opportunity to be proactive.



METHOD

1. Develop highly accurate predictive algorithms by synergizing real-time high-frequency physiological time series and low-frequency vital signs data from patient monitors, electronic health record (EHR) data, as well as data from the Quantum Perfusion Systems Server to incorporate intra-operative insights.

2. This dynamic data will build upon and continue to train our previously trained ML model that we have validated with a cohort of over 9000 patients from a regional adult cardiac surgery database.

3. Additional EHR retrospective dynamic data will be used to further train the model.

4. Emphasize innovation in implementation by engineering user-friendly methods for seamlessly integrating real time predictive feedback from the machine learning model into clinical workflows.

5. Prioritize consumer input and addressing alarm fatigue, ensuring the practicality and acceptance of the technology to the clinical team.

RESULTS

1. Real-time collection of high frequency data from patient monitors went live 01/05/2024 using software interfaces from the EHR and Philips monitor for each CTICU bed

2. To date 80 Gigabytes of patient data in are in the HIPPA certified date warehouse

3. Plans in place to collect real time OR data in a similar fashion

CONCLUSION

Successful completion opens doors for a clinical trial.

Transformative Outcomes:

1. Enhanced patient recovery
2. Reduced adverse events
3. Potential cost savings
4. Recognition of unknown patterns

This project marks a pivotal step toward revolutionizing cardiac surgery recovery through real-time predictive analytics and underscores the pivotal role of technology within the healthcare team, contributing to informed decision-making and patient- care.

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*The blue line in this figure is the time-evolving risk score that is updated as new patient data becomes available. If the risk score for a given patient exceeds the threshold θ, it is more probable that this patient will transition to septic shock. This patient develops shock at time t2. The time interval t2 – t1 is the early warning time (EWT) associated with the prediction made at time t1 that this patient will transition to the state of septic shock. P=Probability

*Liu, R., Greenstein, J.L., Granite, S.J. et al. Data-driven discovery of a novel sepsis pre-shock state predicts impending septic shock in the ICU. Sci Rep 9, 6145 (2019). https://doi.org/10.1038/s41598-019-42637-5

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