AI-enabled solutions for predicting sepsis in ICUs: a systematic review

Christina-Athanasia Alexandropoulou, Ilias Panagiotopoulos, Charithea Stylianides, Styliani Kleanthous, George Dimitrakopoulos, Ioannis Constantinou, Stavri Vassiliou, Eleni Politi, Dimitrios Ntalaperas, Xanthi Papageorgiou, Nikos Ioannides, Lakis Palazis, Constantinos S. Pattichis, Andreas S. Panayides

Abstract—**Artificial Intelligence (AI) advances in healthcare require better data management so that prompt and informed decisions towards patients' care are taken. Life-threatening conditions like sepsis can benefit from this, as they demand immediate and appropriate clinical intervention. While studies involving the use of AI for sepsis prediction exist, systematic reviews on the topic are limited. In this study, AI-enabled solutions for septic shock prognosis are studied, while explainability techniques appear crucial and promising towards ethical data use and clinicians' trust and interventions.**

Key words: AI-enabled solutions, ethical AI, explainability, sepsis prediction, ICUs, systematic review

I. INTRODUCTION

Sepsis is a complex disease with high mortality rates, affecting millions every year. The timely availability and analysis of heterogeneous healthcare data are key prerequisites for its early efficient diagnosis, prognosis, or treatment. AI-enabled predictive systems can address this, while pointing to the need for better explainability techniques to tackle ethical issues and the opaque nature of AI.

II. METHODOLOGY

The literature search considered eligible articles published within the last five years. A final count of 19 papers related to ICU sepsis prediction models are presented.

III. AI SYSTEMS FOR THE EARLY PREDICTION AND DIAGNOSIS OF SEPSIS

Researchers are showing an increasing interest in the topic as every hour of delay in antimicrobial treatment increases mortality. Tree-based algorithms like Gradient Boosting Trees, as well as deep learning ones, like Convolutional Neural Networks are used. Clinical outcomes include sepsis diagnosis, septic shock prognosis and prediction of sepsis death or survival in ICU. The most used database is the Medical Information Mart for Intensive Care (MIMIC), along with features of demographics, vital signs, laboratory results and organ failure scores.

IV. ETHICAL CONCERNS OF USING AI IN SEPSIS

Healthcare research involves vulnerable people and potential biases, pointing to the need for Clinical Decision Support System (CDSS) protocols. However, data transparency challenges, like the need for consent, non-representative data due to medical needs and symptoms progression variability, and opaqueness of AI approaches, arise. Guidelines to deidentify and process data, updated datasets that reflect populations including demographic data, and trust of system predictions by healthcare providers are required, respectively.

V. EXPLAINABLE AI AND SEPSIS

Explainability and accountability in the context of ICU predictions are crucial towards professionals' interventions. Explainable Artificial Intelligence (XAI) can contribute to clinical acceptance of CDSS and translational potential of predictions with confidence, trustworthiness, causality and efficiency, if suitable explanation types and levels for ICU sepsis prognosis are explored.

VI. CONCLUSIONS

The study provides a systematic literature review of ICU sepsis prediction models and highlights the need for guidelines for sensitive data use, demographic data for accurate population representation and suitable explanations of predictions for transparency, and clinician's trust.

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Christina-Arhanasia I. Alexandropoulou, Ilias E. Panagiotopoulos and George J. Dimitrakopoulos are with the Department of Informatics and Telematics, Harokopio University of Athens, Greece
Stylianides Charithea, Kleanthous Styliani, Constantinos S. Pattichis and Andreas S. Panayides are with CYENS CoE, Cyprus
Ioannis Constantinou, Stavri Vassiliou are with the 3aHealth, Cyprus.

Eleni Politi, Dimitrios Ntalaperas, Xanthi Papageorgiou are with Ubitech, Athens, GREECE
Nikos Ioannides, Lakis Palazis are with the State Health Services Organization, Cyprus
Corresponding Author: Charithea Stylianides (c.stylianides@cyens.org.cy)