ICU MANAGEMENT & PRACTICE

The Promise of Artificial Intelligence in Critical Care

Computer-based technologies, including artificial intelligence (AI) applications like ChatGPT and DALL-E, are being increasingly used and can mimic human capabilities, even passing medical board examinations. Retrospective studies have shown that machine learning (ML) applications are especially valuable in the ICU due to their diagnostic and prognostic capabilities, leveraging the vast amount of available data. Some ML algorithms have reached or even surpassed human performance in specific tasks, such as predicting resuscitation strategies in sepsis, the need for mechanical ventilation, mortality in critically ill patients, and ICU length of stay.

Sepsis presents an attractive target for ML approaches due to its complexity, prevalence, high cost, and mortality rates. The number of ML algorithms aimed at improving sepsis care is rapidly increasing. However, there have been errors in sepsis prediction attributed to poor implementation approaches, rudimentary ML algorithms, using algorithms beyond their intended scope, or neglecting proper maintenance.

For predictive models to enhance sepsis care, timely data is crucial and should be the foundation for any model. Currently, most ML algorithms in clinical practice rely on input features already found in the electronic health record (EHR), including vital signs, demographic information, laboratory results, and imaging studies. Most data and accurate predictions are concentrated in cases where patients are already known to have sepsis or are at risk of developing it.

There are several potential solutions to improve sepsis care, but most of them have not been extensively studied in prospective settings. One approach is data enrichment, which integrates updated data elements from sources beyond the EHR, such as bedside monitors, IV pumps, mechanical ventilators, and imaging studies. The development of wearable biopatches could provide near-instantaneous data. Another solution involves actively involving AI in data generation. This could be achieved through the use of smart laboratories, where AI systems suggest or even order diagnostic studies during times of low predictive certainty. Additional nursing assessments may help enhance the accuracy of these algorithms.

The successful implementation of AI systems in the ICU requires clinical implementation, evaluation of safety measures, and continuous improvements. An implementation gap often exists between developed AI models and their actual use in clinical practice. To address this, three strategies for optimising the policy layer of AI implementation are proposed:

1. Real-time case reviews: Obtaining clinical feedback on AI system performance to fine-tune the policy layer of clinical decision support tools.
2. Silent trial: Integrating the AI model into the EHR for real-time evaluation without direct involvement in patient care. T
3. A/B testing or rapid-cycle randomised testing: Conducting controlled experiments where users are randomly exposed to different versions of the AI model, testing single isolated features.

Implementing these solutions involves multiple stakeholders, including patients, healthcare workers, AI developers, and administrators, with support from national funding agencies to provide appropriate incentives. The goal is for clinicians to view AI algorithms as trusted partners, offering opinions based on relevant data and deep knowledge of the institution and past patients.

Source: [Critical Care Medicine](#)

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