ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**
Vol 29(5); August 2025 DOI: 10.35975/apic.v29i5.2848

EDITORIAL VIEW **ARTIFICIAL INTELLIGENCE**

Artificial intelligence – new horizons in intensive care

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ABSTRACT

Analyzing and interpreting the massive volumes of data generated by intensive care units (ICUs) can be very laborious and time consuming. By increasing clinical decision-making, decreasing errors, and improving patient outcomes, artificial intelligence (AI) holds the potential to completely transform intensive care unit (ICU) care. One may wonder how AI can change critical care by making it possible to predict clinical deterioration and death in real time, assisting clinicians in making decisions regarding continuous patient monitoring and advanced therapies, that would enhance patient outcomes.

This editorial is aimed to analyze the existing literature on AI applications in ICU care, encompassing clinical decision support systems, predictive analytics, and machine learning techniques. We intend to create more awareness about the AI potential to greatly improve ICU care by improving patient monitoring, detecting clinical deterioration and assisting with clinical decision making.

Abbreviations: AI: Artificial intelligence, CDS: clinical decision support, HER: electronic health records, ICU: intensive care unit, NLP: natural language processing,

Keywords: Artificial intelligence; Clinical decision support; Critical care medicine; Intensive care unit; Machine learning

Citation: Naseer A, Kiran Q. Artificial intelligence – new horizons in intensive care. Anaesth. pain intensive care 2025;29(5):254-256. **DOI:** 10.35975/apic.v29i5.2848

Received: February 13, 2025; **Revised:** February 15, 2025; **Accepted:** February 25, 2025

Artificial intelligence (AI) is a simulation of human cognitive abilities, which include the capacity to sense, think, uncover significance, generalize, learn from previous experiences, resolve issues, or make choices. AI technologies used now a days are machine learning, speech recognition, natural language processing (NLP) and ability to visualize and identify objects (computer vision).[1] Machine learning now a days has become a dominant AI technology that is being used in almost every field. AI has been applied in healthcare areas such as molecular biology, bioinformatics, and medical imaging. It aids in managing population health, delivering personalized diagnoses and treatments, tracking patients, assisting in surgical procedures, and forecasting health outcomes. In the healthcare sector the potential of AI was acknowledged by many researchers. Over the ten years various scientific fields have shown an increasing interest with AI.[2-4]

Intensive care units (ICUs) have evolved a crucial component of every healthcare system. Intensive care is an organized framework intended to provide treatment to individuals in serious health related situations, providing targeted treatment, improved monitoring features, and various techniques of physiological organ assistance to maintain survival in case of severe organ system failure.[5]

Doctors in the ICU manage patients with complicated and critical health issues who frequently need life-saving procedures. Given the growing need for Intensive unit care, efficient and effective decision-making is essential in these settings.[6] The intensive care is the appropriate department within the hospital to initiate the shift

towards large datasets and the use of AI in both research and potential clinical applications in the future.

In ICUs, patients are carefully observed to identify any physiological alteration that could indicate a decline in their condition, necessitating a reassessment of the treatment strategy. The nursing staff in the intensive care diligently tracks patient conditions by documenting neurological status, fluid intake and output (including medication given), among other factors. Bedside monitors support this process by continuously providing significant volumes of data.

In ICUs, Artificial intelligence (AI) analyzes substantial volumes of patient data in real time, facilitating the early identification of complications, forecasting patient outcomes, and enhancing treatment approaches by delivering prompt alerts and insights to healthcare providers, with the ultimate goal of improving care and safety for critically ill patients. The used of AI in intensive care helps to improved patient outcomes, enhanced clinical decision making and efficient resource allocation.[7]

Over the past two decades, the ICU has become acknowledged as one of the hospital areas where the implementation of artificial intelligence (AI) tools could have the greatest impact on enhancing data utilization and assisting healthcare professionals in predicting patients' critical states.[8]

After a patient is admitted to the intensive care, two primary sources of information are accessible: the data present in electronic health records (EHRs) and the constantly recorded vital signs on monitors. While EHRs might have already been prepared by AI systems for quick diagnosis and prognosis, the use of AI to evaluate a patient's condition based on vital sign waveforms is still in the early stages and is primarily applied for real-time pathophysiological assessments. An effective integration of both data sources within an AI structure is anticipated to significantly enhance patient monitoring by shifting from sporadic to continuous observation, where software integrated into monitoring devices can consistently assess the patient's health status by utilizing all available data.[8]

Key areas of AI research in patient care is focused on identification of clinical decline, forecasting disease progression, assessing mortality risks, and evaluating disease prognosis. A study conducted in 2022 analyzed several conditions in critical care that are currently studied using the AI technology, such as sepsis, COVID-19, acute kidney injury, ARDS and cardiac arrest.[2,9]

ICU physicians frequently need to evaluate vast amounts of intricate and diverse data to make crucial healthcare decisions. When utilized properly, AI has the potential to alleviate this challenge by converting data into more useful insights. AI can assist in forecasting negative outcomes prior to their occurrence, enhance the management of highly complicated scenarios, and ultimately enable healthcare providers to dedicate less time to data analysis and more time to applying their expertise in patient care.[10]

The incorporation of AI in intensive care management is likely to lower expenses and enhance patient outcomes. Research exploring the application of AI in treating sepsis revealed that reinforcement-learning-driven AI offers accurate and medically understandable treatments that lead to better outcomes. A previous study used AI algorithm for early detection of sepsis at intensive care by using a real time data available in Intensive care through specialized EMR, achieving an accuracy exceeding 80%.[11]

Many organizations have acknowledged the importance of AI not just as a supplementary resource for faster diagnostics, particularly during times of staff shortages, but also in delivering more holistic care to patients. During COVID-19 pandemic, the World Health Organization (WHO) indicated that AI could play a crucial role in addressing the ongoing global health crisis and serve as a resource for the sustainable recovery of communities.[9]

AI also plays its role in neonatal care in neonatal intensive care unit (NICU) and is a promising technology in this scenario. A previous study suggested that AI is most effective when utilized as a hybrid intelligence model (such as human-in-the-loop or mixed intelligence) to enhance the practicality of neonatal care, improve diagnostic precision, and anticipate outcomes and potential diseases ahead of time.[12,13]

ICU doctors expressed a positive view about incorporating AI based clinical decision support (CDS) tools into the ICU environment, especially regarding a tool that forecasts a patient's likelihood of readmission and/or mortality within a week following discharge. The results of such survey can be utilized to enhance the implementation strategy and training for end users.[14]

However, integrating AI into the intensive care, involves numerous challenges and considerations. To begin with, it generates significant ethical and legal concerns about patient privacy, data sharing, algorithm transparency, and accountability. It is imperative that patient information is managed ethically, with a strong commitment to confidentiality. Furthermore, to facilitate the responsible and effective incorporation of AI in critical care, it is vital to confirm that the data is accurate, reliable, and represents the patient population well. Upholding methodological rigor is crucial in the creation and implementation of AI models to guarantee their accuracy, dependability, and reproducibility in clinical

settings. Lastly, thorough validation of all AI systems is necessary to ensure their safety and effectiveness.[15]

Although, AI has the capacity to improve clinical efficiency across various critical care situations, nevertheless, additional research and trials are necessary, particularly concerning reliability, consistency, and ethical considerations; before it can be widely implemented in mainstream critical care.[16] The Federal Drug Agency (FDA) has indicated that technologies based on AI could revolutionize healthcare by extracting valuable insights from the large volumes of data produced in daily healthcare delivery. Therefore, AI holds the potential to alter the current state of ICU.

The ICU is a complicated setting where patients often experience clinical instability and may be at a high risk of mortality. Making prompt and precise medical decisions is vital for providing the possible management to patients. AI has surfaced as a transformative tool in various medical domains, and its use in critical care medicine is especially encouraging. AI has the capacity to revolutionize and elevate patient care safety in the ICU.[15] AI models for predicting outcomes will prove to be important assets in critical care. Nonetheless, they need to undergo technical enhancements and must be implemented thoughtfully, following established medical ethics standards.

Conflict of interests

Nil declared by the authors.

Authors contribution

Both authors played equal part in the literature search, and drafting the manuscript.

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