

# The use of artificial intelligence in critical care medicine in 2025: A global perspective

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## Abstract

**In the year 2025, artificial intelligence (AI) has firmly established itself as a transformative force in critical care medicine, influencing patient care, diagnostics, decision-making, and resource management. The integration of AI into critical care settings has shown substantial promise, particularly in optimizing patient outcomes, streamlining healthcare workflows, and reducing the burden on healthcare professionals. This article**

**explores the multifaceted applications of AI in critical care medicine, focusing on its role in patient monitoring, clinical decision support, predictive analytics, personalized treatment, and telemedicine. We analyzed current trends, technological advancements, global disparities, challenges, and ethical considerations associated with AI in critical care. We present an optimistic yet cautious outlook for its future trajectory in diverse healthcare systems worldwide.**

**Key words:** Artificial intelligence, critical care, predictive analytics, decision support systems, telemedicine, patient monitoring, healthcare disparities, medical ethics.

## Introduction

Critical care medicine, characterized by the management of patients with life-threatening conditions, has long been a field requiring rapid decision-making, intensive monitoring, and highly specialized interventions. In the year 2025, artificial intelligence (AI) has become an indispensable tool in enhancing the capabilities of healthcare systems, pro-

viding support in critical care units (CCUs) and intensive care units (ICUs) globally. AI technologies such as machine learning (ML), natural language processing (NLP), and neural networks have significantly improved the accuracy and efficiency of clinical processes.

The integration of AI in critical care medicine holds the promise of revolutionizing patient management, reducing errors, and improving outcomes. (1) From continuous patient monitoring to predictive analytics that anticipate complications before they occur, AI's applications are diverse and profound. (2) However, as with any emerging technology, there are challenges in terms of infrastructure, data privacy, workforce adaptation, and the ethical use of AI in healthcare.

This article presents an overview of the current and anticipated role of AI in critical care medicine in 2025, examining its impact on patient care, healthcare professionals, and global health systems. We explored AI's applications in clinical decision support, predictive modeling, personalized medicine, and patient monitoring, and discussed the opportunities and challenges that come with this technological evolution.

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## **AI in patient monitoring and early detection**

### *Continuous patient monitoring*

AI-enabled systems for patient monitoring have become a central feature of intensive care units worldwide. These systems are designed to continuously collect, analyze, and interpret patient data in real-time, allowing clinicians to make timely decisions about interventions. By 2025, AI technologies such as machine learning algorithms and deep learning models will be capable of processing vast amounts of physiological data (heart rate, blood pressure, oxygen levels, etc.) and identifying subtle patterns that might be missed by human observers.

AI-powered monitoring systems can detect early signs of deterioration, predict events like sepsis, cardiac arrest, or respiratory failure, and trigger alerts for clinical intervention. Such systems integrate data from various sources, including electronic health records (EHR), wearable sensors, and bedside devices, to provide a comprehensive view of a patient's condition. By learning from historical data, AI systems can identify the unique risk factors of individual patients, offering predictive insights into the likelihood of adverse events.

### *Early detection of sepsis and cardiac events*

In critical care, the early detection of life-threatening conditions such as sepsis and cardiac events is crucial. AI has proven to be particularly effective in identifying these conditions earlier than traditional methods. For example, AI algorithms designed to recognize the early signs of sepsis can analyze data from vital signs, lab results, and clinical observations to trigger alerts that prompt timely interventions. (3)

In the case of cardiac events, AI-based systems have advanced to the point where they can predict arrhythmias, heart attacks, and other cardiac complications by analyzing electrocardiograms (ECGs) and other patient data. In 2025, integrating AI with wearable devices, such as smartwatches and ECG patches, enables continuous monitoring outside of the hospital, contributing to the prevention of cardiac events and the early identification of high-risk patients.

## **Predictive analytics and clinical decision support**

### *AI-driven predictive models*

One of the most significant contributions of AI to critical care is its ability to generate predictive models that forecast patient outcomes. By analyzing historical patient data, machine learning algorithms can predict the likelihood of a range of outcomes, such as survival, organ failure, and recovery trajec-

tories. These predictive tools are becoming invaluable for clinicians in assessing the potential effectiveness of treatments and making informed decisions. (4)

In 2025, predictive analytics will support clinical decision-making in real time, offering personalized treatment plans based on an individual patient's condition and response to prior interventions. For example, AI systems can predict which patients are likely to respond to certain medications or therapies based on their genetic profiles and medical histories, leading to more tailored approaches to care.

### *AI in decision support systems*

Clinical decision support systems (CDSS) powered by AI have transformed the way healthcare professionals make decisions in critical care settings. AI-driven CDSS utilize a combination of patient data, clinical guidelines, and advanced algorithms to assist doctors in diagnosing conditions, choosing the most appropriate treatments, and managing complex cases. (5)

By processing and analyzing vast amounts of clinical data, AI systems can provide evidence-based recommendations for treating critically ill patients, reducing the cognitive load on healthcare providers and mitigating human error. These systems are also equipped to adapt to changing clinical conditions, learning from new data to provide up-to-date recommendations that align with the latest medical advancements.

## **Personalized medicine and AI in treatment optimization**

### *Tailored treatment approaches*

Personalized medicine, which aims to tailor treatment plans to individual patients based on their genetic, environmental, and lifestyle factors, is a field that has been significantly enhanced by AI. In 2025, AI will be central to developing precision treatments, allowing critical care physicians to optimize interventions for conditions like cancer, organ failure, and autoimmune diseases.

For instance, AI-driven platforms analyze genetic data, biomarkers, and patient histories to recommend the most effective drug therapies for patients with complex conditions. In critical care settings, AI helps identify the optimal combination of interventions for patients with multi-organ failure or severe trauma, improving recovery rates and reducing the duration of ICU stays.

### *Genomic medicine in critical care*

Incorporating genomic data into critical care is be-

coming increasingly common. AI technologies that analyze genomic sequences and identify potential gene-environment interactions are playing a key role in developing individualized treatment plans. AI systems are now being used to predict how a patient's unique genetic profile might influence their response to medications or therapies, allowing for more effective and personalized care.

This integration of AI into genomic medicine represents a paradigm shift in critical care, enabling healthcare providers to predict which patients are at higher risk for complications based on genetic markers and to tailor treatment protocols accordingly.

### **The role of AI in telemedicine and remote critical care**

#### *Remote monitoring and teleICU*

Telemedicine has become an essential tool in critical care, particularly in resource-limited settings or rural areas where specialized medical staff may not be readily available. In 2025, AI-driven remote monitoring systems, often referred to as "Tele-ICUs," are enabling real-time monitoring of critically ill patients from remote locations. (6)

AI is used to analyze data from patient monitors, wearables, and diagnostic equipment, alerting healthcare professionals about potential issues and enabling them to provide immediate interventions from a distance. This innovation has been particularly valuable during the coronavirus disease 2019 (COVID-19) pandemic and continues to play a crucial role in extending critical care services globally, particularly in underserved areas. (7)

#### *AI in virtual consultations and diagnostics*

Virtual consultations, facilitated by AI-powered telemedicine platforms, allow patients to receive expert advice and care without leaving their homes. AI systems are integrated into telemedicine platforms to help diagnose conditions, interpret medical images, and provide recommendations for further care. These AI systems are particularly effective in low-resource settings, where access to specialized care is limited. (8,9)

The use of AI in telemedicine is expected to expand significantly in the coming years, enabling healthcare professionals to provide high-quality care remotely, even in cases that would traditionally require an ICU admission.

### **Global perspectives: Disparities and challenges**

#### *Global disparities in AI access*

While AI's applications in critical care have shown immense promise, there are significant global disparities in access to these technologies. In high-income countries, AI systems are widely adopted in advanced healthcare settings, but in low- and middle-income countries (LMICs), access to AI-driven tools remains limited due to financial, infrastructural, and technological barriers. (7)

Efforts are underway to bridge this gap, with initiatives aimed at making AI-powered critical care tools more accessible to underserved populations. These include the development of affordable, scalable solutions and partnerships between tech companies, governments, and healthcare providers in LMICs to promote the widespread adoption of AI.

#### *Ethical considerations and AI in critical care*

As AI systems take on increasingly important roles in patient care, ethical concerns surrounding data privacy, accountability, and algorithmic biases have emerged. Ensuring that AI systems are transparent, interpretable, and free from bias is critical to their success in healthcare. In 2025, ongoing efforts to develop ethical guidelines for AI in healthcare aim to ensure that these technologies are used responsibly and in ways that prioritize patient welfare.

### **Conclusions**

In 2025, artificial intelligence has become an essential component of critical care medicine, offering unprecedented opportunities for improving patient outcomes, enhancing clinical decision-making, and optimizing healthcare workflows. The integration of AI in patient monitoring, predictive analytics, personalized treatment, and telemedicine has already transformed critical care practices, providing significant benefits to patients and healthcare providers alike.

While challenges remain, particularly in addressing global disparities in AI access and addressing ethical concerns, the continued advancement of AI technologies offers great promise for the future of critical care. As AI continues to evolve, it will undoubtedly play an even larger role in shaping the landscape of global healthcare, ensuring that critically ill patients receive the most timely, accurate, and personalized care possible.

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