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The Infinite Potential of Artificial Intelligence in the ICU

How AI technology can supplement EHR systems to reduce clinician stress and improve patient outcomes

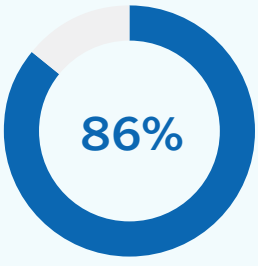
In a hospital, the intensive care unit (ICU) is the nucleus of the most complex clinical situations. Vital signs need to be closely monitored, and changes in cardiovascular, respiratory, neurological, renal, and liver status must be accounted for in real time, as a patient's clinical state can change by the minute. Critical care clinicians need constant access to meaningful, up-to-date information to provide each patient with the right care at the right time.

Due to the stressful nature of critical care, it's common for ICU clinicians to experience burnout at an above-average rate. Burnout is a state of emotional, mental, and physical exhaustion caused by excessive prolonged stress. Critical care professionals experience one of the highest rates of burnout, with nearly half of the workforce exhibiting symptoms. When surveyed, up to **45% of critical care physicians** and **71% of pediatric critical care physicians** reported severe burnout, and an astounding **86% of critical care nurses** reported at least one symptom of burnout.[1]

Physicians agree that administrative responsibilities contribute to burnout. In a recent report, **60% of physicians surveyed** stated they have too many bureaucratic tasks; as one physician explained, "I barely spend enough time with most patients, just running from one to the next, and then, after work, I spend hours documenting, charting, and dealing with reports."[2] Physician burnout alone costs healthcare systems more than **$4.6 billion per year**.[3] Critical care workloads consist of stressful, complex tasks that have a high mental, physical, and temporal demand. The effort required to perform the tasks overloads the working memory, leading to burnout, and puts clinicians at risk for making medical errors.[4]

To help alleviate symptoms of burnout associated with caring for the most complex and highest acuity patients, critical care clinicians can utilize technology to manage the demands being placed on them and help them perform at the top of their game. While technological advancements continue to emerge, it's important to understand which software and systems will help ICU clinicians rather than create more administrative tasks for them, thereby taking them away from their patients.

In a fast-paced environment, ICU clinicians don't have time to analyze copious data points — they need easy access to actionable insights. There's a high demand for consolidated data visualization with an intuitive user interface that can help detect subtle trends toward an adverse physiological state, bringing timely awareness to avoid patient harm. Hospitals can benefit from implementing technology that streamlines workflows and complements clinical expertise, helping to reduce the cognitive workload of care teams and manage the constant noise of information.



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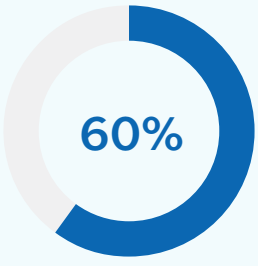

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The Challenges of EHRs and Clinical Decision-Making

Since the Health Information Technology for Economic and Clinical Health (HITECH) Act was signed into law in 2009, electronic health records (EHRs) have increasingly been implemented in hospitals worldwide to promote the adoption and meaningful use of health information technology.[5] Overall, this widespread adoption initiated positive performance, including improved integration and availability of patient data, enhanced efficiency and cost-effectiveness, shared patient care across the healthcare team, and better management of complex and rapidly changing environments.[6]

Patients in critical condition generate thousands of data points each day.[7] ICU clinicians depend on the EHR to accumulate digitized clinical data that aids in making timely decisions at the point of care. However, further research has revealed certain limitations with EHR implementation and use in the ICU. Multiple studies reported decreased efficiency, frustration with EHR workflows, and longer documentation times.[8] While EHRs collect and contain a high volume of patient records, they are also riddled with irrelevant data, leaving clinicians overwhelmed with insignificant information that adds to their mental workload. Data in the EHR can become out-of-date often, with 15-minute gaps in key physiological parameters from some connected devices, and other data points that are only documented if a care team member records them. These gaps in data collection create risk, leaving a lot up to clinicians' imagination when evaluating critical care patients, where a trajectory can change in an instant.

In the ICU, access to data without context can cause more harm than good. Studies have shown that the EHR can poorly represent the clinical condition of critically ill patients and may signify an increased risk of error.[8] In fact, whether the use of the EHR improves overall efficiency in the ICU remains controversial among critical care clinicians. Many have described the current display and representation of patient data in the EHR as suboptimal.[7] Further studies have demonstrated that the current state of EHR usability in ICUs has had negative consequences on clinicians, including decreased job satisfaction, fatigue, and burnout — all factors that contribute to patient safety risks.[7]

Conversely, EHRs are frequently coupled with clinical decision support tools that harness the wealth of information in the system of record with actionable insights; this happens in many areas of the hospital, including the radiology, pharmacy, and laboratory departments. Hospital executives and information technology (IT) teams need to look beyond EHRs and consider applicable solutions that can improve decision-making in the ICU.

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Improving Data Aggregation and Visualization with AI

In the ICU, real-time data continually streams from multiple devices for each patient, yet access to easy-to-consume data remains challenging as EHRs are static and have varying degrees of interoperability with other clinical devices. Documented physiological data is equally important for both the retrospective review of a patient's clinical status and point-of-care evaluations, which occur often in critically ill patients.[8] Especially in a critical care environment, clinicians require tools that synthesize and streamline data to make their jobs easier. As Jessica Sweeney-Platt, Vice President of Research and Editorial Strategy at Athenahealth, explained, "Physicians need and deserve tools that deliver an interoperable experience: the right information, in the right place in their workflow, in a format that is immediately usable."[9]

Enriching the EHR with supplemental capabilities can address the current gaps in data aggregation and visualization to provide a more holistic, up-to-date view of a patient's condition. Technology can reduce the workload demands on clinicians by reviewing data and identifying trends that signal patients need immediate care. Artificial intelligence (AI) is a state-of-the-art technology that can be applied in these types of fast-paced clinical environments to support the care management of critically ill patients.

The adoption of AI technology has the potential to benefit patients, clinicians, and the healthcare system. When used to augment clinical expertise, AI can help improve the quality of care, alleviate workload demands, and lower costs. According to researcher Abhimanyu S. Ahuja, "AI is poised to play an increasingly prominent role in medicine and healthcare because of advances in computing power, learning algorithms, and the availability of large datasets (big data) sourced from medical records and wearable health monitors."[10]

Increasingly, hospitals are looking to AI solutions to help automate risk assessments and standardize protocol usage in critical care environments. IT departments can deliver an interoperable, AI-powered data aggregation and visualization tool that both complements the EHR and offers high clinical value and improved provider satisfaction. An expert vendor can deploy resources to do the heavy lifting and complete implementation in as little as two months. The vendor can work with existing architecture and integration protocols and perform all the necessary customizations to simplify the implementation process for busy IT teams.

After implementation, the AI solution is easy for IT departments to maintain, especially when experiencing resource constraints. Once the solution is up and running, the ICU will quickly realize the return on investment, including improved quality measures such as shorter lengths of stay and fewer readmissions, which can reduce costs and increase throughput.

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Data Is Important, Context Is Crucial

At Etiometry, we help clinicians cut through the noise and navigate the deluge of data to find critical clinical insights that empower rapid and informed decisions in the ICU. The AI-powered Etiometry platform arms the care team with a fully customizable, shared view of each patient by continuously aggregating high-fidelity data from disparate clinical systems into one easy-to-interpret display. This consolidated view helps the care team detect pathways of deterioration and coordinate patient care. Based on patient-specific conditions, the interoperable platform synchronizes up-to-date information, including medication data, from connected systems such as patient monitoring devices, lab information systems, peripheral devices, and EHRs.

Ensuring adequate tissue oxygenation and carbon dioxide ventilation are fundamental principles in critical care. Having collected over 150 million hours of physiological data signals, Etiometry is the only company that has developed four FDA-cleared, model-based risk algorithms that alert clinicians to subtle physiological changes indicating increased risk for adverse events to avoid patient harm. Early warning signs of patient deterioration can be visualized at a glance, without having to hunt-and-peck for relevant parameters in separate systems, thereby providing a safety net for clinicians caring for critically ill patients.

Advanced analytics offer guidance to clinicians when managing clinical protocols and assessing a patient's risk of deterioration. Digitally embedded, hospital-specific protocols improve clinical workflows by ensuring that each patient receives the appropriate care and by minimizing variations. The protocols can also reduce manual intervention by automatically screening eligible patients based on customized physiological parameters, and they can track patient performance based on criteria defined by the hospital to keep a patient's trajectory on track and to achieve desired outcomes.

Every member of the care team has access to a holistic view of a patient's clinical status at their fingertips — from a wall-mounted monitor, a workstation on wheels, a desktop computer, or remotely using a modern internet browser. The user interface allows care team members to easily access relevant information customized by a patient's condition, either in a unit surveillance view or a detailed patient view. The platform helps clinicians chart more efficiently, prioritize patient care, and communicate with the care team.

Overall, the Etiometry platform's technology addresses major clinical needs in critical care settings. By displaying relevant data in an easy-to-consume format, the technology enables ICU clinicians to lighten their mental workload and instantly retrieve actionable insights to make care decisions.

Ensuring the Right Information at the Right Time

At one time, EHR systems were viewed as cutting-edge health information technology and served many needs for clinicians. However, they remain limited as a key tool for clinical decision support — a critical process in critical care environments. As technology continues to advance, hospitals are urged to integrate clinical decision support tools to improve quality measures and optimize patient outcomes.

The Etiometry platform adheres to the five "rights" of clinical decision support, as defined by the American Health Information Management Association (AHIMA): the platform delivers the ***right*** information, to the ***right*** person, in the ***right*** intervention format, through the ***right*** channel, and at the ***right*** time in the workflow.[11] To decrease clinician burnout and improve patient care, IT departments and clinicians should prioritize clinical decision support solutions like the Etiometry platform, as it can be implemented quickly and make a major impact immediately.

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