etiometry

WHITEPAPER

Smarter Shock Care:
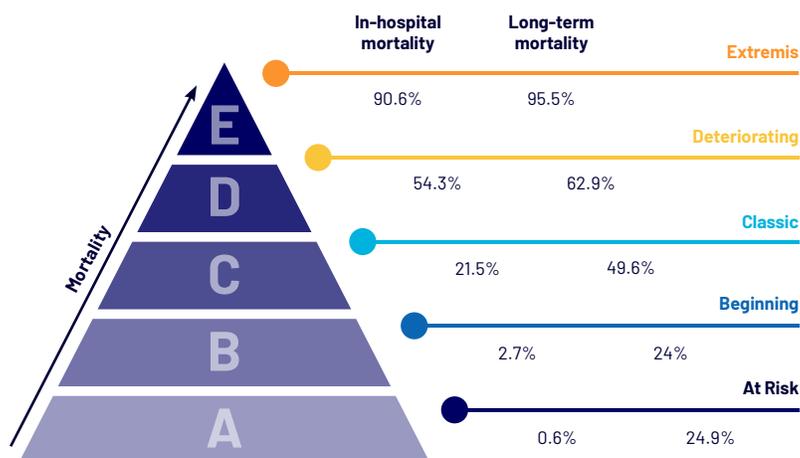# How AI Is Set To Transform The Management Of Cardiogenic Shock

INTRODUCTION: THE URGENCY OF CARDIOGENIC SHOCK

Cardiogenic shock (CS) remains one of the most fatal complications in cardiac care, characterized by critically reduced cardiac output and subsequent end-organ hypoperfusion. Despite advances in interventional cardiology, mortality remains high.

Short-term mortality ranges from 30% to 40%, and 1-year mortality approaches or exceeds 50%.[1] These outcomes are often linked to delayed detection, inconsistent staging, and variations in treatment protocols across healthcare institutions.

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A recent paper published in The Lancet highlights the fragmented nature of CS care and strongly advocates for a unified approach to staging and management, explicitly endorsing frameworks such as the updated SCAI (Society for Cardiovascular Angiography and Interventions) classification.[2] The SCAI guidelines offer a well-structured and comprehensive system for standardizing shock severity assessment, clearly defining patient conditions from those who are merely "at risk" to those in "extremis."[1]

	In-hospital mortality	Long-term mortality
Extremis	90.6%	95.5%
Deteriorating	54.3%	62.9%
Classic	21.5%	49.6%
Beginning	2.7%	24%
At Risk	0.6%	24.9%

This standardization significantly enhances clinical communication, facilitates consistency in patient management, and provides clarity across diverse clinical settings.

Adhering to guidelines, such as SCAI Stages of Cardiogenic Shock, demands rigorous and meticulous monitoring of specific clinical parameters, including detailed

[1] 2025 Concise Clinical Guidance: An ACC Expert Consensus Statement on the Evaluation and Management of Cardiogenic Shock: A Report of the American College of Cardiology Solution Set Oversight Committee https://www.jacc.org/doi/10.1016/j.jacc.2025.02.018

[2] The Lancet: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2824%2901818-X/fulltext

hemodynamic profiles, timely interpretation of biochemical markers like lactate and renal function, and frequent comprehensive clinical assessments to detect subtle shifts in patient status. The dynamic and rapidly evolving nature of cardiogenic shock means that patient status can change quickly, requiring clinicians to closely track subtle changes and respond swiftly. Failure to manage these variables closely can lead to delays in recognizing deterioration, underscoring the importance of vigilance in adhering to the framework.

The complexity of cardiogenic shock demands an integrated response, with early warning signs often hidden behind normal variability in patient status. This difficulty underscores the necessity for continuous surveillance and rapid, structured intervention protocols. Furthermore, inconsistency in how institutions approach diagnosis and treatment exacerbates variability in patient outcomes.

THE ROLE OF AI IN PREDICTING CARDIOGENIC SHOCK

AI has been shown to be uniquely suited to help clinicians identify patients on the path to cardiogenic shock.

A 2023 systematic review and meta-analysis by Popat et al., found that AI, through machine learning (ML) models, have shown promise in predictive medicine.[3] The researchers found ML models effective, with high accuracy, sensitivity, and specificity in predicting cardiogenic shock. Six studies were considered in the analysis. The pooled mean Area Under Curve (AUC) was 0.808 (95% CI, 0.727-0.890), demonstrating strong predictive power. The models use a combination of physiological data streams to analyze thousands of data points in real-time, detecting patterns of deterioration long before overt clinical signs emerge.

> **Popat et al. concluded that** "AI has the potential for early prediction of CS, which may lead to a decrease in the high mortality rate associated with it."[4]

[3] Artificial Intelligence in the Early Prediction of Cardiogenic Shock in Acute Heart Failure or Myocardial Infarction Patients: A Systematic Review and Meta-Analysis https://pmc.ncbi.nlm.nih.gov/articles/PMC10783597/

[4] Literature references included for context; not reflective of Etiometry's current regulatory labeling.

[5] Real-time machine learning model to predict in-hospital cardiac arrest using heart rate variability in ICU. https://pmc.ncbi.nlm.nih.gov/articles/PMC10665411/

When deterioration can be predicted hours in advance, the window for intervention is longer. Teams can proactively initiate treatment pathways, rather than having to manage reactively.
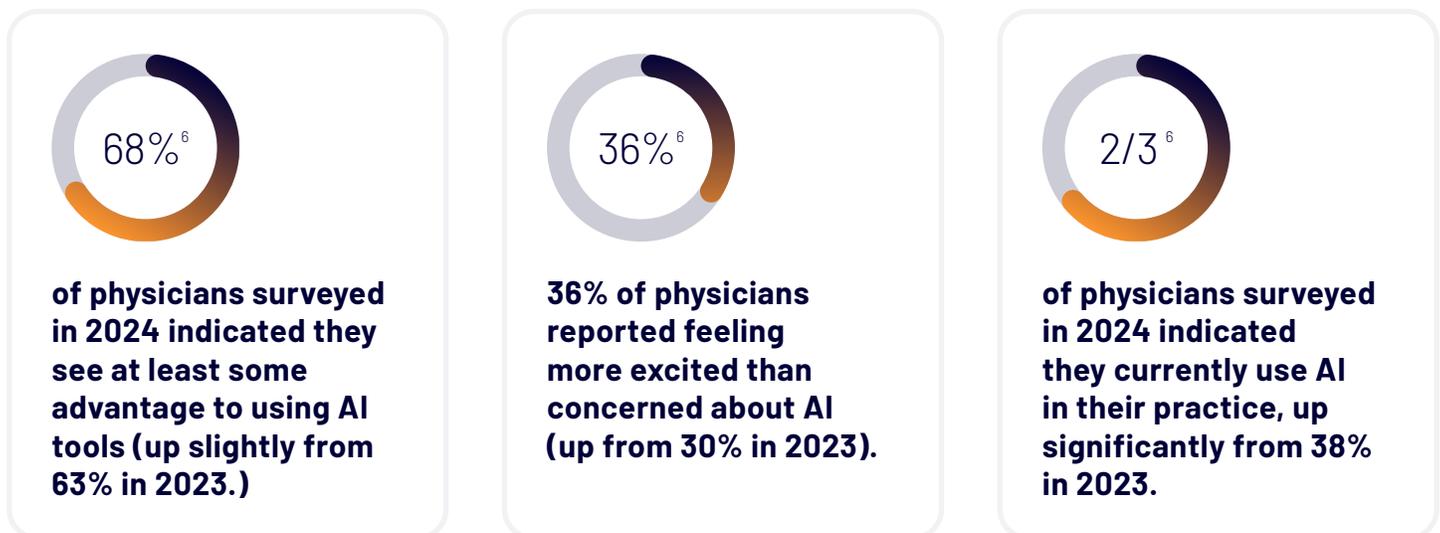
In another 2023 study, by Lee et al., a real-time machine learning model was trained to predict in-hospital cardiac arrest using heart rate variability (HRV) data from ECG monitoring[5]. A light gradient boosting machine (LGBM) algorithm was used to develop the proposed model for predicting in-hospital cardiac arrest within 0.5 to 24 hours. The LGBM model using 33 HRV measures achieved an area under the receiver operating characteristic curve (AUROC) of 0.881 (95% CI, 0.875-0.887) demonstrating excellent predictive qualities.

This study showed that the researchers had successfully developed and validated an ML-based real-time model to predict in-hospital cardiac arrest in critically ill patients.

CLINICIAN TRUST IN AI IS GROWING

A major barrier to AI adoption in the past has been clinician skepticism. But that's changing quickly.

The American Medical Association (AMA) released new data in February 2025 tracking physician sentiment from 2023 to 2024. The findings showed that attitudes toward healthcare AI are shifting[6]. Their survey found:

68%[6]

of physicians surveyed in 2024 indicated they see at least some advantage to using AI tools (up slightly from 63% in 2023.)

36%[6]

36% of physicians reported feeling more excited than concerned about AI (up from 30% in 2023).

2/3[6]

of physicians surveyed in 2024 indicated they currently use AI in their practice, up significantly from 38% in 2023.

[6] Physician sentiments around the use of AI in heath care: motivations, opportunities, risks, and use cases https://www.ama-assn.org/press-center/ama-press-releases/ama-physician-enthusiasm-grows-health-care-ai

The survey showed that physicians still have some concerns around the adoption of AI tools but growing trust is underpinned by real-world impact. As AI tools demonstrate day to day utility, not just in theory but in practice, clinicians are increasingly seeing them as allies rather than threats.

AI IN PRACTICE: THE 3 BENEFITS PHYSICIANS VALUE MOST EFFICIENCY, DIAGNOSIS, CLINICAL OUTCOMES

The survey also showed that physicians aren't looking for AI to replace their decision-making. Rather, they want AI to enhance their judgement and reduce burden. 75% of study participants believe that AI could help increase work efficiency with 72% believing it could help their diagnostic ability.

The appetite for the practical use of AI in diagnosis is also very noteworthy. 31% report that they already use AI to assist with diagnosis, with an additional 49% expecting to adopt AI for diagnosis in the next 5 years.

The survey also highlights that physicians want AI solutions that are easy to use, seamlessly integrated into existing clinical workflows, and rigorously validated with transparent evidence of clinical benefit. 62% believe that AI could support clinical outcomes in the future.

> "The AMA survey illustrates that physicians are increasingly intrigued by the assistive role of health AI and the potential of AI-enable tools to reduce administrative burdens, enhance diagnostic accuracy, and personalize treatments," noted AMA past president Jesse M. Ehrenfeld.

This growing interest is evident in both attitudes and adoption rates.

HOW HOSPITALS CAN USE AI TODAY TO IMPROVE CARDIOGENIC SHOCK CARE

Hospitals can start benefiting from AI advancements in cardiogenic shock care today. AI platforms, such as the solution from Etiometry, are already providing real-time decision support that enhances the management of cardiogenic shock across entire healthcare systems.

Etiometry's platform integrates with existing EHR systems and bedside monitors, ensuring minimal disruption to current workflows while maximizing data utility. The Etiometry technology uses its customers' own practices and standards to stage shock progression and to continuously report physiologic risks associated with cardiogenic shock. For example, it supports clinician awareness of patient trends by flagging when pre-configured hospital criteria are met, and aids clinician review and timely intervention following hospital protocols.

Key Etiometry platform capabilities, leveraging the hospital's cardiogenic shock identification and staging criteria, include:

Real-time SCAI and other shock staging protocols: Enables teams to monitor patient progression and regression through stages of cardiogenic shock.

Hospital-wide surveillance: Extends monitoring beyond the ICU, ensuring early detection of deterioration on general wards

Informational Flags: Identifies patients who meet criteria for risk review based on hospital protocols.

Team-wide coordination: Ensures that interdisciplinary teams are aligned, from cardiologists and intensivists to emergency physicians and nurses.

PROVEN IMPACT: HOW ETIOMETRY'S AI PLATFORM IS DRIVING EFFICIENCY AND OUTCOMES

The impact of Etiometry's AI platform in critical care is already established. Studies have shown significant improvements in operational efficiency and patient outcomes.

41%
Up to 41% reduction in ICU readmissions.[7]

36%
Up to 36% decrease in ICU length of stay.[8]

30%
30% reduction in ventilator days.[9]

These patient outcome benefits also translate into substantial cost savings. By reducing complications, preventing readmissions, and optimising ICU resource use, hospitals can reinvest savings into patient care, staffing, and technology upgrades. Clinicians also report higher job satisfaction when equipped with decision-support tools that reduce cognitive load and enable faster, evidence-based decisions.

In summary, early interventions supported by Etiometry's AI platform is associated with better patient experiences, shorter stays, fewer complications, and faster recovery times, which are increasingly critical measures of hospital performance and reimbursement.

[7] Gaies, M. (2023) Methods to enhance causal inference for assessing impact of Clinical Informatics Platform Implementation. Circulation: Cardiovascular Quality and Outcomes.

[8] Salvin, J. et al. (2017) The Impact of a Real-Time Physiologic Data Analytic Index on Length of Stay in Neonates Following Surgery for Congenital Heart Disease, Circulation.

[9] Borasino, S. et al. (2023) Automated Extubation Readiness Tool is Associated with Improved Outcomes Following Pediatric Cardiac Surgery. World Congress of Pediatric Cardiology and Cardiac Surgery

[10] Lowry, A. NASA TLX survey analysis from PCICS (2020) abstract

LOOKING AHEAD: SMARTER CARE, DRIVEN BY AI AND CLINICAL INSIGHT

The convergence of AI technology, structured shock classification, and increasing clinician AI confidence marks a new era in critical care medicine. AI is not about replacing human judgement; it is about empowering clinicians with better, faster information to improve outcomes.

In cardiogenic shock management, where minutes matter and early intervention saves lives, AI offers a powerful lever to transform outcomes. By blending clinical expertise with advanced data analytics, hospitals can deliver smarter, faster, and more personalised care to their most vulnerable patients.

The future of cardiogenic shock care is here, and it is smarter, safer, and more collaborative than ever before.

ABOUT ETIOMETRY

Founded in 2010, Etiometry is the leader in clinical decision-support software designed to help clinicians in the intensive care setting make data-based decisions regarding their patients' care and treatment. The company's technologies provide valuable clinical insight and analysis to support early recognition of subtle changes in patients' conditions to avoid complications and speed recovery.

Etiometry has ten FDA clearances and four Health Canada approvals and CE markings. Etiometry is utilized by some of the world's top academic medical centers as well as leading children's hospitals ranked by US News and World Report and Newsweek. Etiometry is committed to improving patient outcomes, increasing clinical efficiency, and lowering the cost of care through the more effective use of data.

The Etiometry Platform is the only critical care software solution, supported by published clinical outcome data, that leverages AI to reveal deep insights into patient physiology. It helps critical care teams deliver standardized and individualized care, and supports visibility into patient state changes. helping clinicians manage escalation or de-escalation of care. It is designed to facilitate the use of all available data to support the anticipation and management of the dynamic condition of patients requiring intensive care.

Note: Etiometry's platform is a clinician-configured decision-support tool and does not independently identify or treat cardiogenic shock.

Learn more at **Etiometry.com**