Earlier sepsis detection

Improve health outcomes with real-time, point of care diagnostics

Machine learning can help answer complicated questions to detect sepsis faster.

▸ What are predictive risk factors for a patient developing sepsis?

▸ Does a patient with systemic inflammatory response syndrome (SIRS) have sepsis?

▸ When should antibiotic treatment begin for the best outcome?

▸ Did sepsis precede organ dysfunction?

Red Hat solutions support data science

Red Hat OpenShift

Red Hat OpenShift Data Science

RedHat OpenShift Streams for Apache Kafka

AI/ML offerings from the Red Hat Marketplace

Challenges of timely sepsis detection

One in three people who die in a hospital has sepsis, a life-threatening reaction to infection. Sepsis can damage tissues and lead to organ failure, so prompt diagnosis is critical. Each hour of delay—from emergency room arrival to antibiotic administration—increases the odds of one-year mortality by 10%.[1]

But diagnosing sepsis at the bedside is often difficult. Clinicians need to evaluate a large volume and variety of data, including clinical signs, lab results, medical images, prior use of antibiotics, and more. When every minute counts, real-time diagnostic tools can help to deliver better health outcomes for patients with sepsis.

Real-time diagnostics at the bedside, at home, and in outpatient facilities

Hospitals can help clinicians detect sepsis sooner and more accurately using machine learning (ML), a field of artificial intelligence (AI). After learning the signs of sepsis from a large data set, ML applications can gather and analyze new patient data in real time. When sepsis is detected, the application can then immediately notify the care team. ML applications can also analyze historical data about interventions and outcomes to improve future treatment recommendations.

With distributed, edge computing, healthcare organizations can deploy an AI model close to the patient—often at the bedside—which saves on cloud egress costs due to large patient data transfers.

Figure 1. ML applications retrieve and analyze medical data to assess patients for potential sepsis.
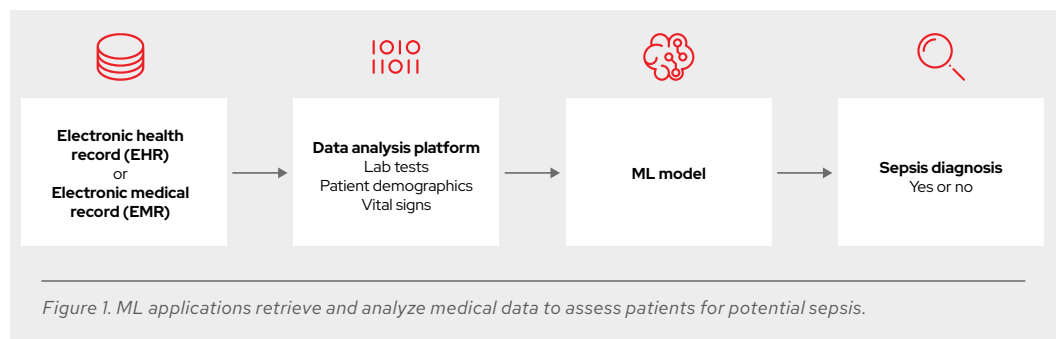
Enable healthcare providers with clinical decision support

Near real-time patient diagnostics equips clinical teams with AI-calculated, patient-specific risk stratification. Red Hat provides the technologies data scientists need to develop, train, test, and deploy data analysis applications that use ML models. See how you can use data science capabilities to detect sepsis and other diseases faster:

1 Cheney, Christopher. *"Every hour matters: delaying sepsis antibiotics in ER increases odds of mortality."* *Health Leaders*, June 7, 2019.

An edge platform built for AI/ML

Red Hat, HPE, and NVIDIA joined forces to create KubeFrame, a fast edge platform for AI/ML that can be deployed in hospitals and clinics. Starting with a proven-capable platform frees time for data scientists to focus on disease-detection algorithms instead of infrastructure.

Gather data from patients previously diagnosed with sepsis. Data might include blood tests, respiration rate, oxygen saturation, vital signs, level of consciousness, medical images, and patient medical history from electronic medical records. Take care to include patients with different genders, races, ethnicities, ages, and socioeconomic status. To protect healthcare privacy, do not associate the patient's name with the data.

Develop ML models for sepsis detection using Red Hat OpenShift Data Science. An add-on to Red Hat® OpenShift®, this managed service provides a sandbox environment for data scientists to develop, train, and test ML models for accuracy and performance.

Deploy the model in the cloud or on-premise. Wherever the application is deployed, the ML model monitors patient data that is collected throughout the day, alerting the right people and teams when sepsis is detected. Healthcare providers can also provide treatment recommendations, which become data the ML model can use to improve its analysis. The type of deployment that is best for specific use cases — cloud or edge — depends partly on the location's network bandwidth.

Continually improve sepsis detection and recommendations by retraining the model with new data on interventions and outcomes. Sepsis detection in action: HCA Healthcare

About Red Hat

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Figure 2. ML application life cycle with continuous integration/continuous development (CI/CD).

Gather and prepare data	Develop model	Deploy models in an application	Model monitoring and management
Data storage Data lake Data exploration Data preparation Stream processing	Machine learning (ML) notebooks ML libraries	Model life-cycle CI / CD	Monitor / alerts Model visualization Model drift
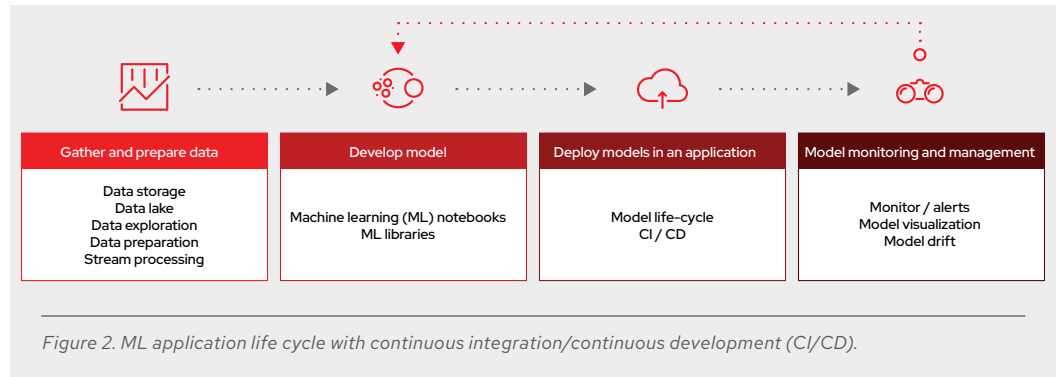
Sepsis detection in action: HCA Healthcare

Using Red Hat's open source technologies, HCA Healthcare developed a standardized, digital approach to sepsis detection that has saved thousands of patients.

Challenge: Traditional sepsis diagnosis required manual chart review, potentially delaying diagnosis of a condition that becomes 4% to 7% more deadly every hour.

Solution: HCA clinicians, data scientists, and IT professionals collaborated with Red Hat to build Sepsis Prediction and Optimization of Therapy (SPOT). Deployed in a distributed environment, SPOT automates the collection and analysis of clinical data such as patient location, vital signs, and laboratory results. When the data indicate potential sepsis, SPOT coordinates workflow between the patient's nurses and the sepsis team so they can initiate care. Data scientists retrain the models for continual improvement.

Benefits: HCA Healthcare now detects sepsis indicators up to 20 hours earlier, saving lives. The hospital can use the same platform to improve other aspects of patient care. To learn more, read the HCA Healthcare success story.

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