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CASE STUDY · MARLUC SYNOPSIS

Johns Hopkins TREWS sepsis early warning

IMPLEMENTED 2015–2026 · HEALTH AND LIFE SCIENCES · US · BAND C · PARTLY PROVED

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A machine-learning sepsis alert ran in the electronic health record at five Johns Hopkins hospitals. Two peer-reviewed studies linked prompt clinician confirmation of alerts with faster antibiotics and lower mortality. The system received US FDA clearance in 2026.

ABOUT THIS SYNOPSIS

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Facts and figures are as reported by the sources listed below, which may be incomplete, self-reported or out of date. Check the original source before relying on any figure.

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NOTICE WORDING LAST UPDATED 16 NOVEMBER 2026

AT A GLANCE

Frontier case: AI used for a scientific, medical or engineering breakthrough. The transformation is potential and unproven; MarLuc grades what has changed in practice so far.

AI used: Machine-learning early warning model for sepsis, built into the electronic health record.

Implemented: 2015–2026. Grade: band C, Process change, Partly proved.

Headline result, as reported: Patients whose sepsis alert was confirmed within three hours had an adjusted 18.7% relative reduction in in-hospital mortality, in an observational study at five hospitals

1 · The case

The facts, as reported by the 5 sources listed at the end. Where a source is silent, the field says "Not reported".

Organisation

Johns Hopkins Medicine, with Bayesian Health. Academic health system in Baltimore, Maryland. The Targeted Real-time Early Warning System (TREWS) was developed in a Johns Hopkins University lab and is commercialised by Bayesian Health, a company founded by the lab's director. Canvas block: 4. Operations and process. Also 6. Data and technology, 5. People and skills.

Business challenge

The challenge. Sepsis can kill within hours and is easily missed because early signs such as fever and confusion are common. Existing rule-based alerts produced so many false alarms that clinicians turned them off, per Scientific American.

How it was addressed. TREWS scans electronic health records, combining known risk factors with current vital signs and lab results to score sepsis risk. When it fires, a note appears in the patient record with the reasons; a physician or advanced practice provider then evaluates the alert and can confirm or dismiss it. It was built into the workflow of about 2,000 providers at five Johns Hopkins sites over two years. Under FDA Breakthrough Designation from 2023 it was deployed at other health systems, and FDA clearance was reported in May 2026. [1] [2] [3] [4] [5]

Who implemented it

Johns Hopkins University (Machine Learning and Healthcare Lab) (University or research lab): Developed the algorithm and led the evaluations.
Bayesian Health (Software vendor): Commercialises the system and further developed it.

Technology (SEAM pillar E)

SEAM types: T8 Predictive / ML models. Deployment: Not reported. Vendors and products: Bayesian Health, Targeted Real-time Early Warning System (TREWS).

Where it was built in: Runs on electronic health record data and flags at-risk patients with a note and reasons in the record; providers confirm or dismiss the alert in the system.

What changed

Before: rule-based sepsis alerts that clinicians often ignored, per Scientific American. After: a risk alert in the record that providers evaluated in 89% of cases. Where an alert was confirmed within three hours, the median time to the first antibiotic order fell by 1.85 hours and adjusted in-hospital mortality was lower, compared with patients whose alerts were dismissed, confirmed later or never addressed. [1] [2] [3] [4] [5]

What it cost

Not reported

What it saved

Not reported in money. Clinical outcomes: adjusted absolute reduction in in-hospital mortality of 3.3 percentage points (relative 18.7%) among patients whose alert was confirmed within 3 hours, with lower organ failure and length of stay. Johns Hopkins later described an 18% reduction in sepsis mortality across dozens of hospitals, as relayed by Medical Dialogues. [1] [2] [3] [4] [5]

Governance and control

Providers evaluate each alert and can disagree; the system does not block other work. Adoption and outcomes were measured in a prospective study. The FDA cleared the system in 2026, as reported. Accountable owner inside the hospitals: Not reported.

S2 · Accountable owner · Not reported
Not reported.

A1 · Safe use · Not reported
Not reported.

A2 · Human in the loop · Evidenced
Peer-reviewed studies show providers evaluated 89% of alerts and confirmed or dismissed them; the developer says clinicians can choose to disagree. [2] [3]

A3 · Monitoring and assurance · Evidenced
A prospective multi-site study measured adoption, treatment timing and outcomes after deployment. [1] [2]

A4 · Vendor AI · Not reported
The system is commercialised by Bayesian Health, founded by the lab director; contract and vendor controls are not reported. [3]

A5 · Agent controls · Not reported
No agents described.

A6 · Standards and regulation · Outside scrutiny (a regulator, court, auditor or similar body acted)
The US Food and Drug Administration cleared the system for clinical use in 2026, as reported, after a 2023 Breakthrough Designation. [4] [5]

What worked, what did not, what is unproven

WORKED

– High adoption: 89% of alerts were evaluated by a physician or advanced practice provider.

– Faster treatment where alerts were confirmed within three hours: median time to first antibiotic order 1.85 hours shorter.

– Lower adjusted in-hospital mortality, organ failure and length of stay for patients whose alert was confirmed promptly.

DID NOT

– 38% of evaluated alerts were confirmed by a provider, so most alerts did not lead to a confirmed sepsis response.

– The system identified 82% of sepsis cases, so about one in five was not flagged.

– Benefit depended on clinicians acting on alerts; emergency department providers and those with earlier alert experience were more likely to engage.

UNPROVEN

– Causal effect: the studies compare confirmed and unconfirmed alerts within an observational cohort, with no randomised control.

– Whether results hold at other health systems with different records software and resources; published outcomes for the 2023 to 2026 deployments were not found in sources opened.

– Cost and return on investment for hospitals.

Timeline

2015 Work on the algorithm begins in Suchi Saria's lab at Johns Hopkins University [3]

Jul 2022 Nature Medicine publishes the outcomes and adoption studies from five hospitals [1]

2023 Under FDA Breakthrough Designation, the system is deployed at health systems including Cleveland Clinic, MemorialCare and the University of Rochester [4]

May 2026 FDA clearance for clinical use is reported [5]

2 · Grade and SEAM assessment

MarLuc's opinion, made on the evidence above. How cases are graded: marluc.co.uk/case-studies/how-we-rate

Level of change and impact

Claimed: A. Grade: C, Process change. Proof: Partly proved. Level of change: Process change.

Process change (Level 2, band C), claimed as transformational (band A). Sepsis detection and first response were redesigned around an AI alert at five hospitals, with outcome data; a field-wide change in sepsis care is not yet shown.

Graded C, claimed A. The alert changed how sepsis is flagged and acted on in the hospitals that use it, with peer-reviewed outcome data. An emergency physician quoted by Scientific American said the approach may prove as vital to sepsis care as the EKG is to heart attacks; that wider transformation is potential and unproven.

The SEAM view and lessons learnt

The model only mattered when a clinician acted on it: the benefit sat at the join between an alert and a human decision. Engagement was high, and the alert set out its reasons in the patient record. For larger organisations, the transferable point is to measure adoption and the speed of response alongside model accuracy.

1. Measure how often clinicians act on an alert, as well as how accurate it is.
2. Show the reasons behind an alert and leave the decision with the clinician.
3. Seek independent or randomised evaluation before scaling a clinical model widely.

Evidence

Score 3 of 4. Independent peer review: two prospective multi-site cohort studies in Nature Medicine, observational and co-authored by the developers; FDA clearance reported by trade press.

Evaluation method. Prospective multi-site cohort study comparing patients whose alerts were confirmed within 3 hours with those whose alerts were not, adjusted for presentation and severity; peer-reviewed.

Sources disagree. The outcomes paper reports an 18.7% adjusted relative reduction in mortality for one subgroup; Scientific American's headline says nearly 20 percent; Johns Hopkins, as relayed by Medical Dialogues, says 18% across dozens of hospitals. Scientific American gives more than 760,000 patient encounters, where the outcomes paper gives 590,736 patients monitored. A Duke researcher told Scientific American he hoped for standardised trials with external partners who have no stake in the results.

Status. Ongoing: FDA clearance reported in May 2026; deployed at several health systems beyond Johns Hopkins, per reports.

3 · Original sources

Read these in full. To challenge a fact or a grade, use the contact form at marluc.co.uk or the link on https://marluc.co.uk/case-studies/johns-hopkins-trews-sepsis-early-warning

[1] Nature Medicine: Prospective, multi-site study of patient outcomes after implementation of the TREWS machine learning-based early warning system for sepsis (2022)
https://www.nature.com/articles/s41591-022-01894-0

[2] Nature Medicine: Factors driving provider adoption of the TREWS machine learning-based early warning system and its effects on sepsis treatment timing (2022)
https://www.nature.com/articles/s41591-022-01895-z

[3] Scientific American: Algorithm that detects sepsis cut deaths by nearly 20 percent (August 2022)
https://www.scientificamerican.com/article/algorithm-that-detects-sepsis-cut-deaths-by-nearly-20-percent/

[4] Medical Dialogues: FDA approves early warning system for sepsis (May 2026)
https://medicaldialogues.in/amp/critical-care/news/fda-approves-early-warning-system-for-sepsis-170548

[5] HospiMedica: FDA-cleared AI system detects sepsis earlier and reduces mortality (May 2026)
https://mobile.hospimedica.com/ai/articles/294810500/fda-cleared-ai-system-detects-sepsis-earlier-and-reduces-mortality.amp.html

Johns Hopkins Medicine, with Bayesian Health website: https://www.hopkinsmedicine.org

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VERSION HISTORY

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