CalmWave® Deployment at Wellstar Kennestone CICU

A Case Study

Executive Summary

This case study examines how the CalmWave® Transparent AI platform solved the problem of alarm fatigue, stemming from alarm overload, in Wellstar Kennestone's Cardiac ICU. Here, excessive non-actionable alarms, often beeping hundreds of times per patient daily, caused clinician fatigue and burnout, developments that then increased patient safety risks. A major driver of the alarm overload and fatigue problem was a fragmented data system.

Although the Philips IntelliBridge's bedside monitoring devices and the Epic EHR each collected massive amounts of patient data, they operated in silos. Without a holistic view of the data, uniform alarm thresholds were set, based on population-level data and not individual patient status. This practice set off numerous false alarms. A fragmented data architecture also meant that clinicians were compelled to toggle between the platforms to manually reference data, a practice that wasted valuable minutes and eroded clinician attention.

The deployment of the CalmWave® Transparent AI platform addressed these issues by acting as a middleware layer integrating real-time physiologic and clinical data without replacing existing infrastructure. Its CalmWave Optimized™ (CWO) engine generated patient-specific alarm thresholds with clear, explainable rationales, enabling clinician oversight and trust. The system also incorporated medication context and advanced pattern recognition to reduce false alarms and detect early deterioration.

A retrospective pilot demonstrated a 58% reduction in non-actionable alarms, leading to live CICU deployment. The results of the CICU deployment included a >50% drop in daily alarms, earlier detection of deterioration by 15 minutes, and reduced noise exposure for patients. Clinicians reported improved workflow efficiency, faster response times, and enhanced care quality, validating the platform's clinical and operational impact.

Introduction

Alarm fatigue in healthcare settings, particularly in intensive care environments, has been historically labeled as an "unsolvable problem." Excessive alarms adversely impact clinical performance and patient safety by creating sensory and work overload and inducing fatigue among clinicians. Wellstar Kennestone, one of Southeast USA's largest health systems, tackled this problem by collaborating with CalmWave® to deploy an AI-powered solution.

Challenges

Alarm Overload and Siloed Data

The World Health Organization recommends that hospital noise levels should not exceed 35 dB during the day and 30 dB at night. However, in reality, ICU noise levels are between 50 and 70 dB. That is comparable to heavy traffic or a loud vacuum cleaner. In a space that is supposed to support healing.

And alert noises are nearly constant in cardiac intensive care units.

ICUs are one of the most digitized of all health care spaces. The number of novel physiologic devices is increasing, with each device having its own alarm. Across the industry, these monitored settings can generate, on average, as many as 700 alarms per patient per day. There are more false alarms, which do not require medical attention or intervention, than true ones. But they still disrupt focus and drain attention.

Across the Wellstar Kennestone's CICU, this number multiplied to thousands of beeps, every shift, every day.

At the Wellstar Kennestone, the alarm problem was majorly driven by the fragmentation between Phillip's clinical systems and Epic EHR, the hospital's information system. They functioned as two separate data environments, which meant that physicians had to manually toggle between platforms to align real-time vitals with medication records, care instructions, and patient history.

A siloed architecture also meant that alarm thresholds were applied uniformly without taking into account the unique situation of a patient. For instance, as reported in this study, a patient with persistent atrial fibrillation generated 15,296 atrial fibrillation alarms and 15,433 high heart rate alarms. Across their 6-day ICU stay, this amounted to an average of 211 alarms per hour! All because the high heart alarm threshold was kept at the hospital default setting of 130 instead of increasing it to, say 150, which would have aligned more with the patient's medical status.

Clinician Fatigue, Burnout, and Patient Safety

According to a 2014 report by the Emergency Care Research Institute (ECRI), clinical alarms are at the top of their Top Ten Healthcare Technology Hazards List. Unnecessary alarms increase clinician workload. Long-term exposure to alarm-dense environments causes alarm fatigue or desensitization. It is a dangerous condition where clinicians begin to trust the alarms less. They disable or ignore alarms and do not respond or respond slowly to the actionable ones because, in their experience, the majority of them are irrelevant or non-

actionable ones. A classic cry-wolf situation. But with serious patient safety risks, because alarm fatigue can lead to missed care.

Distrust of AI Solutions

Despite growing clinical-specific AI adoption in healthcare settings, clinicians, especially in North America and Europe, tend to be skeptical of black-box AI systems, according to the 2025 Clinician of the Future Report by Elsevier. Algorithmic tools are not readily understood by non-technical persons. For example, they cannot see how algorithms arrived at a diagnosis or why they made a recommendation. They cannot question or validate the output, so they have no way of knowing if a recommendation reflects the situation of the patient in front of them or if the bot is distorting data taken from a different patient.

The incident with IBM's "Watson for Oncology" is well-documented. The system was reported to have recommended the drug taxane for a patient whose specific medical history contraindicated the use of that drug, as noted in this paper. The error was noted by an oncology specialist. It could have been missed by a non-specialist clinician.

Medical staff hesitating to act on AI-generated outputs creates an institutional barrier that can limit adoption and clinical impact.

Solution Overview

CalmWave® Transparent AI Platform as Clinical Middleware

CalmWave® Transparent AI platform was deployed at Wellstar Kennestone's CICU as a middleware layer to bridge the gap between the real-time physiologic data from Philips IntelliBridge's bedside devices and the clinical data stored within Epic EHR. No existing infrastructure needed to be dismantled or replaced because the system interfaced with FDA-approved monitors and EHRs.

CalmWave® is a passive middleware layer that ingests and synthesizes data from two fragmented systems. It collects inputs from both systems continuously and processes the data to construct a dynamic and patient-specific medical picture. This is what a clinician does. But only after toggling between the two platforms, multiple times, to manually cross-reference information. That's precious time and mental energy lost that they could have spent by the patient's bedside.

CalmWave® pulls live data, such as blood pressure, heart rate, oxygen saturation, and ECG waveforms from bedside monitors, and also incorporates data from EHR, such as lab results (e.g., troponin levels), medication orders (e.g., vasopressors, beta-blockers), and clinical history (e.g., prior MI, current smoker status, ejection fraction). It then processes this information to generate thresholds and trigger audible alarms only for anomalies that

necessitate medical intervention, such as sustained ventricular tachycardia that lasts more than 30 seconds.

Two data systems working in silo cannot achieve this level of deep insight.

CalmWave® Optimized (CWO) Threshold Recommendations

The "CalmWave Optimized™" (CWO) recommendation engine is central to the platform's clinical functionality. For every patient, the system analyzes the aggregated data and generates individualized alarm threshold suggestions. It is critical to note here that these suggestions are not generic population-level defaults. Instead, they are highly individualized because they are calibrated to align with a patient's unique physiology and medical status. The information shows up as overlays on the vitals display familiar to nursing staff.

Alongside every CWO recommendation is an explicit and understandable rationale. This is information that provides clinicians with a clear understanding of why the suggestion was made.

Unlike black-box systems, which make decisions without visible logic.

This explainability framework reflects a human-in-the-loop workflow approach. Specifically, it is a clinician-aligned design feature. Clinicians can review, question, and approve or override recommendations before any threshold is modified. They thus remain in control without having to expend mental energy trying to read the mind of an AI system.

Medication-Aware Alarms and Early Deterioration Detection

The CalmWave® alarm logic learns continuously.

It continuously integrates medication administration records from Epic with physiologic data from Philips IntelliBridge. It is trained to analyze vast amounts of data to identify patterns and understand context, like why the hemodynamic numbers from two patients who have undergone the same procedure are different or what the presence of a cluster of symptoms indicates. As Calmwave® continues to learn, its alarm logic becomes contextually aware in ways that generic monitoring tools--which weren't designed to learn--cannot evolve. For example, patients receiving vasoactive drugs have hemodynamic profiles that differ meaningfully from baseline. CalmWave® takes into account this information to generate alarm thresholds that align with the specific pharmacologic context. This reduces the number of false positives.

This data fusion architecture also enables earlier detection of deterioration signals, which in turn, activate protocols like rapid response or sepsis bundles.

For example, take the case of a post-CABG patient in the CICU with a history of heart failure. CalmWave® generates real-time hemodynamic data (e.g., cardiac index dropping to 2.0 L/min/m² from a pulmonary artery catheter), live vitals (e.g., tachycardia at 120 bpm), recent

labs (e.g., creatinine rising to 1.8 mg/dL), and dosing instructions (e.g., dobutamine infusion at 5 mcg/kg/min).

While a cardiac index (CI) of 2.0 L/min/m² from a pulmonary artery catheter is generally alarming, a chronic heart failure patient might operate at a lower baseline. Hence, their specific alarm threshold might be set to a lower value, so no alarm was triggered in this case. A 120 bpm is a common threshold for an alarm to activate. But clinicians are also aware that movement or detached leads can cause 120+ bpm, and so, might ignore the alarm.

CalmWave® can access data in real-time, and like a clinician, it has "learned" to correlate the data to form the whole picture of what is happening right now with the patient. It creates a patient-specific dashboard that displays trends like the onset of or worsening shock by correlating falling cardiac index, tachycardia, and a rise in creatinine. The data is overlaid with patient history (e.g., EF 30% pre-op, which presents a high risk for post-op cardiac complications). The system then automatically triggers an alert for echo or fluid challenge.

In a siloed data architecture, no single system would have connected these bits of data, and the deterioration would have gone unnoticed, till the patient was already in crisis.

Implementation Process *(Note: Text provided by client.)*

Phase One: Retrospective Validation

Before any live clinical deployment, CalmWave® conducted a retrospective pilot using historical CICU patient data to validate the platform's alarm optimization logic in a risk-free environment. This phase demonstrated that CWO threshold recommendations could reduce non-actionable alarms by 58% without suppressing clinically significant alerts. This demonstration established the safety and efficacy required to gain institutional trust and secure approval for live deployment.

The retrospective results were reviewed by CalmWave's technical team as well as Wellstar physicians, nursing leadership, and biomedical engineers. This ensured that clinical stakeholders had direct visibility into and understanding of the model's behavior before the system went live.

Phase Two: Live CICU Deployment

The live deployment phase commenced in December 2024, with the CICU selected as the initial unit given its high monitoring density and acuity profile. The integration took place parallelly across two technical workstreams.

First, Philips IntelliBridge devices were configured to feed continuous physiologic data directly into CalmWave's middleware layer. Second, Epic EHR connectivity was established to

allow CalmWave® to draw medication administrations, laboratory results, and demographic data on a continuous basis. These integrations together created a unified data environment.

Clinician onboarding was included in the deployment timeline. Nursing staff and intensivists received structured training on interpreting CWO recommendations and incorporating threshold review into existing rounding and handoff workflows. Feedback was gathered during early live use to refine recommendations and prioritize alerts, so they aligned with established clinical rhythms.

Results and Metrics

The six-week live deployment produced measurable and meaningful improvements across both clinical and operational dimensions. Daily alarms at Wellstar Kennestone's CICU fell from 1,635 to 873, which is more than 50% and consistent with the 58% decrease in non-actionable alarms demonstrated during the retrospective pilot. Nurses received deterioration alerts an average of 15 minutes earlier, and patients experienced 10 fewer hours of alarm noise per stay.

According to Ryan Saunders, AVP of BioMed, Wellstar, “Partnering with CalmWave® has allowed our Biomedical Engineering team to proactively address alarm issues, significantly improving our operational efficiency and patient safety.”

Medication overlays on the vitals display eliminated the blind spots created by fragmented data. This eliminated the need to toggle between platforms and wade through extensive data to cross-check, thereby saving precious minutes during alarm assessment. In the words of a CICU nurse, Wellstar Kennestone, “Having medication information overlaid directly with patient vitals is game-changing. This visibility streamlines my workflow, letting me spend more time on patient care instead of data navigation.”

Qualitatively, nursing staff reported higher satisfaction, faster critical response times, and a measurably calmer care environment. Wellstar Kennestone's CICU has since been recognized as the world's first designated Calm CCU™.

Metric	**Pre-CalmWave**	**Post-CalmWave**	**Reduction**
Daily Bedside Alarms	1,635	873	47%
Clinician Interruptions (per hour)	68	36	30+
Noise per Patient Stay (hours)	25	14.4	10+ hours

Metric	Pre-CalmWave	Post-CalmWave	Reduction
Deterioration Alert Time	Baseline	-15 min	15 min earlier

Source: A Catalyst by Wellstar report "CalmWave's pilot demonstrates 58% reduction in non-actionable ICU alarms" (https://catalyst.wellstar.org/casestudies/calmwave/)