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Healthcare Technology Safety Institute

Safety Innovations

Plan, Do, Check, Act: Using Action Research to Manage Alarm Systems, Signals, and Responses

The Beth Israel Deaconess Medical Center

Provide opportunities for front-line workers to identify and help solve alarm system challenges.

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About the Healthcare Technology Safety Institute (HTSI)

Founded within the AAMI Foundation, the 501(c)(3) charitable arm of AAMI, the HTSI is a community of leaders throughout the healthcare system that are dedicated to one common vision, "No patient will be harmed by medical technology."

HTSI's mission is "To engage the entire healthcare community in multi-disciplinary safety initiatives that strengthen the development, management, and use of medical technology for improved patient outcomes." HTSI engages the healthcare community in research, education, consensus, and partnerships related to the challenges facing healthcare technology industries, regulatory and accrediting bodies, clinicians, caregivers, and patients.

Plan, Do, Check, Act: Using Action Research to Manage Alarm Systems, Signals, and Responses

At a Glance

Subject: Beth Israel Deaconess Medical Center
Location: Boston, MA
Size: A 631-bed teaching hospital of Harvard Medical School with two campuses, the East Campus and West Campus, plus clinical partnerships with other institutions

Introduction

In the aftermath of two sentinel events in inpatient rooms at the Beth Israel Deaconess Medical Center in Boston, MA, the hospital's leadership, and the physician, nursing, and clinical engineering staff focused comprehensively on alarmed medical devices. The healthcare center discovered inconsistent cardiac telemetry alarm system management—and proliferation of monitoring had resulted in overwhelmed clinicians who had developed an inflated sense of security in the ability of the monitors. A center-wide journey to make technology work to their advantage and support better patient outcomes was begun and continues today.

A targeted initiative to tame alarm signals in the Emergency Department has built on the work of the center-wide effort—with a "Lean" twist.

Inpatient Alarm Systems

The Challenge

The two sentinel events involved two types of alarm signal messages—one physiological (ventricular tachycardia) and one technical ("leads off"). There were delayed responses to both, for different reasons. In the first, the clinical alarm signal in a distant patient room on a large and busy unit was not audible at the central nursing station. In the second, there was a delayed response to "leads-off" alarm signals. This delay coupled with the frequency of these signals, caused responders to treat them as insignificant. That was the situation, when Beth Israel Deaconess first began its critical look at alarmed cardiac monitors.

It didn't take long for the multidisciplinary team investigating these events to identify opportunities for improvement, including some low-hanging fruit. "The intense evaluation took about a month," says Pat Folcarelli, director of patient safety. "But we were able to respond with some of the corrective actions within a matter of days."

"We found simple things," she says. "The electronic clocks in our devices were all different, so that the time stamps on the monitoring equipment didn't match the time stamps on the wall clocks, which didn't match the time stamps on our defibrillators. So even in reconstructing events, we knew that there was something amiss. Probably within two weeks, we were able to list many of our vulnerabilities and we recognized what we could reasonably do in the short term to fix the problem. We also created a longer-term strategy to improve our alarm system management and cardiac monitoring systems over time."

In many hospital systems it has taken major events to draw attention to alarm system shortfalls. Once multidisciplinary teams are in place, immediate, short-term solutions can be developed.

Food for Thought

What can your hospital do to make technology work to your advantage? What types of "best practices" have been successfully implemented? What are your vulnerabilities?

Assessment

Beyond the immediate incident investigation described above, the team then took the time to evaluate then-current practice and use of cardiac alarm technology, using Failure Mode Effects Analysis—a step-by-step approach for identifying possible failures or errors and studying their potential consequences. They let no aspect of alarm system management escape their scrutiny, from nurse education to the many different types of equipment to the volume and visibility of alarm signals, even to the electrocardiogram (ECG) electrodes used to secure monitor leads to patients.

For example, every inpatient medical–surgical unit and intensive care unit (ICU) had cardiac monitoring capability, ranging from units with the ability to monitor eight patients to units with capacity to monitor 32 patients. There was evidence of "scope creep," with increasingly sophisticated technology with more and more bells and whistles, whether or not they helped improve patient safety and care. The Beth Israel Deaconess team found that between 40 percent and 50 percent of patients on general medical and surgery units were monitored on cardiac telemetry. On one cardiac unit alone, the team observed more than 1,200 cardiac auditory alarm signals from the unit's 32 telemetry bedside monitors in a 24-hour period. Other devices with auditory alarm signals added to the noise.

"We went to each of the units, we watched, we listened, we talked to staff. We looked at how each of the central stations for telemetry was configured. We found that they weren't configured the same. The alarm systems parameters were different on different units."

— Tricia Bourie, nurse manager, Cardiology, and chair of the telemetry task force at Beth Israel Deaconess Medical Center

In addition to a large number of auditory alarm signals, "there was inconsistency in criteria for which patients were placed on cardiac telemetry monitoring," Bourie says. "I think there was a false sense of security that we were making it safer by having people on cardiac monitoring. It was an opportunity for the institution to take a pause and say, 'What can we do to make this technology, which we've now become very dependent on, work to our advantage to improve patient outcomes?'"

The team also found that the education of nurses charged with caring for patients on cardiac monitors was inconsistent. Taken together, "we found a lot of things that led us down the road of trying to make everything more standardized," Bourie says.

Short-term fixes to a multifaceted problem

Beth Israel Deaconess made some short-term fixes immediately. The team synchronized all of the clocks and developed a process for a periodic reassessment of these device times. They tested and then adjusted all monitored systems to make alarm signals audible and consistent in volume on every unit. In some large "racetrack"- or H-shaped units with nursing stations centrally located, remote speakers were installed in the ceilings so that alarm signals could be heard consistently throughout the units.

Beth Israel Deaconess also standardized the default alarm parameter settings on all devices on all units (e.g., heart rate parameters set between 50 and 120. Staff was allowed to make individual adjustments to alarm limits for some patients, a continuation of then-current practice. For example, if the baseline heart rate of a healthy marathoner drifted to the 40s at night, the nurse could adjust that alarm limit with a documented physician order.

"We also totally eliminated some alarm conditions that were responsible for a lot of the noise. For example, "paired PVCs," says Pat Folcarelli, director of patient safety, referring to premature ventricular contractions, a common heart rhythm abnormality that are often benign and require no treatment. "If we looked at those 1,200 alarm conditions that Tricia described, a significant percentage of them weren't contributing at all to any clinical signifi-

cance. We suppressed them from being able to alarm.

"The other thing that we did immediately was not a hardware fix but a personnel fix," Folcarelli adds. "There was a diffused responsibility about who was responding to the alarm signals, notably technical leads-off alarm conditions. We assigned a nurse or a patient care assistant on every shift who was primarily responsible for keeping an ear open to alarm signals and responding to them. In the short term they were relieved of other duties and were in the role of 'primary alarm responder' [PAR]. Somebody was responsible on that shift for watching the backs of their colleagues and making sure that alarm signals weren't going off and off and off. We were confident in our response to high-priority alarm conditions that everybody would run into the room. But it's these lower-priority, auditory alarm signals that just became background noise."

The main role of the PAR was to ensure continuous monitoring by responding to the patient to assess and resolve technical alarm conditions, such as "leads-off" or "no signal" alarm conditions.

Longer-term solutions and innovations

Longer term, Beth Israel Deaconess established its telemetry task force, which now guides any decisions around alarm system management standards, guidelines, and equipment upgrades. The multidisciplinary task force, which is made up of physicians, nurses, and clinical engineering, health care quality, facilities, and supply management staff, supported an upgrade of cardiac monitoring hardware. This upgrade included the installation of visual marquees in the hallways of all patient units. All high priority (three-star) alarm conditions—the most urgent—and leads-off and no signal alarm conditions are displayed on the marquees.

Now, the medical center is in the midst of a more extensive, multi-year equipment upgrade. Beginning in the summer of 2012, all telemetry monitors, hardware and software, and central monitoring stations were replaced. Beth Israel Deaconess is working with its vendor to tailor alarm conditions to institutional preferences. "We're looking at new telemetry equipment and we've made a recommendation to the vendor around the ability to tailor the alarm system so that we can escalate alarm conditions that the vendor configures as lower-priority, technical alarm conditions to high-priority alarm conditions," Bourie says. "A leads-off technical alarm condition in this institution is treated as urgently as a high-priority physiological alarm condition and yet our equipment still treats it like a low-priority alarm condition." While leads-off visual alarm signals are displayed on the marquees, the auditory alarm signal still indicates a low priority.

"We're also focusing on which patients we apply cardiac telemetry monitoring to, recognizing that if we unnecessarily place monitors on individuals we're going to increase the frequency of false or unnecessary alarm conditions," says Julius Yang, a physician and hospitalist who serves on the telemetry task force. "This detracts from our ability to respond to real alarm conditions."

Criteria for ordering cardiac telemetry monitoring historically had been physician preference. Beth Israel Deaconess has adapted existing guidelines (American College of Cardiology ACC Policy Statement on Recommended Guidelines for

RECOMMENDATIONS

At Beth Israel Deaconess, the short-term solutions were:

- Resetting all clocks with the correct time
- Adjusting all monitored systems to make alarm signals audible and consistent in volume on every unit
- Installing remote speakers on large units
- Standardizing default settings on all alarmed devices
- Eliminating some "nuisance" alarm conditions—those with no clinical significance
- Designating a nurse or patient care technician on every shift as the point person for attending to and responding to alarm signals, particularly the low-priority technical alarm conditions

Food for Thought

What types of short-term fixes could be implemented at your facility? Could any of those listed above be useful?

Food for Thought

Is "scope creep" in monitoring patients overwhelming clinicians with alarm signals—or providing a false sense of security?

In-Hospital Monitoring of Adults for Detection of Arrhythmia. *Journal of the American College of Cardiology,* 18(6), Nov. 15, 1991, 1431–3) to guide daily review of patients on telemetry according to indication, with the intended outcome of discontinuing telemetry for patients for whom such monitoring was no longer indicated.This effort reduced the overall number of patients ordered for cardiac telemetry monitoring.

In an effort to reduce the technical "leads-off" alarm conditions, Beth Israel Deaconess also evaluated the ECG electrodes, used to attach cardiac monitor leads to patients. After piloting options on different floors, the institution switched to ECG electrodes that more securely and comfortably adhered to patients' skin.

Training

Beth Israel Deaconess also upgraded its human capacity to manage alarmed devices and respond to alarm signals. "We realized that we needed additional resources for two of our cardiac units where every patient is connected to telemetry monitors," Bourie says. For these units the medical center instituted a unit-based telemetry technician program.

Every year, all clinical nurses have to take a telemetry competency assessment to make sure their skills are up to date.

"There's 24–7 coverage of the monitoring by a trained telemetry technician who can respond to alarm conditions, consult with the staff around arrhythmias and rhythms, and actually go to the patient bedside and put leads on, replace batteries, and perhaps be a first responder to a code event," she says. "We developed a new specialty for our hospital. It's not a role that's commonly used here in Massachusetts or the Boston area."

The telemetry technician program curriculum, which was developed in-house, includes equipment orientation, heart rhythm identification, basic arrhythmia detection, lead placement, alarm condition response, patient care, and hand hygiene. People who have been emergency medical and electrocardiogram technicians, or who have worked in stress test or ambulatory cardiac monitoring labs, are good candidates to become telemetry technicians, suggests Bourie.

Beth Israel Deaconess also developed an in-house, three-level telemetry education program for nurses. Every newly employed nurse at the medical center goes through an introductory class on telemetry monitoring and, within the first six months of employment, a full-day "Beyond the Basics" class. Later, they can take a two-day intermediate course.

Clinical engineering has supported this alarm system management initiative at every turn. "My role is to provide hardware and operational support and answer questions on how to interpret data presented in the system," says Jeff Smith, lead clinical engineer specialist who serves on the telemetry task force. The clinical engineering perspective and technical expertise were important early on in testing the acoustics and placing the speakers and visual marquees and in developing a process for standardizing the default alarm settings on devices. And clinical engineering continues to be closely involved in the equipment upgrades.

Improvements to alarm systems are expected to further reduce alarm signal noise. "Some alarm conditions are just a result of the patient moving around," Smith says. "The newer systems may be sensitive enough to filter this so that the alarm signals actually sound only for heart rate activity."

The Results

Beth Israel Deaconess has realized a number of quantitative and qualitative results from its center-wide cardiac alarm system management initiative:

- A 30 percent decrease in alarm signals
- A decrease in the amount of time it takes to respond to critical alarm signals, from an average of 45 seconds to an average between 10 and 15 seconds
- A decrease in the amount of time it takes to respond to leads-off alarm signals, from an average of more than three minutes to an average between one to two minutes

Food for Thought

What types of long-term solutions could be implemented at your facility? Could any of those listed on the next page be useful?

RECOMMENDATIONS

Use lessons learned to develop longer-term solutions. Beth Israel Deaconess has done much more than correct the immediate factors that contributed to the sentinel events, including:

- Establishing a multidisciplinary telemetry task force, which now guides any decisions around alarm system management standards, guidelines, and equipment upgrades
- Upgrading its cardiac monitoring hardware, including installation of visual marquees in the hallways of all patient units. All high-priority alarm signals—the most urgent—and leads-off alarm signals are displayed on the marquees.
- Planning a more ambitious equipment upgrade, which is under way now, to replace all telemetry monitors, hardware and software, and nursing stations
- Working with its equipment vendor to tailor alarm signals to the institution's clinical requirements. For example, a leads-off alarm condition is a high-priority alarm condition.
- Carefully considering which patients should be on telemetry monitors
- Selecting ECG electrodes that adhere to patients' skin securely and comfortably
- Instituting a telemetry technician program for 24–7 coverage of monitored patients and devices—an innovation in the region, with a curriculum developed in-house
- Developing an in-house, three-level telemetry education program for nurses
- Involving front-line personnel in improvements

- All nurses are now assessed in telemetry competency every year
- Alarm system parameters defined to meet "actionable" alarm thresholds and baseline parameters are standardized
- Defined goals and responsibilities for response to alarm signals
- Standard volumes of auditory alarm signals
- Attention to best practices, exemplified by the medical center's adoption of The Johns Hopkins Hospital's pioneering practice of changing ECG electrodes daily to reduce technical alarm signals (a practice highlighted in AAMI's *Clinical Alarms*, the report of the 2011 Medical Device Alarm Summit)
- A culture of action research for auditing the standard of care and patient outcomes and continuing to adjust alarm system parameters to meet clinical practice standards

"We're constantly tweaking," Smith adds. "That's the culture of the organization," Bourie says. "It hasn't always been this way, but it's definitely this way over the last 10 years. We are more consistent with our approach and metrics so we know if we've made a difference. And we involve the front-line as well." Now, Beth Israel Deaconess is expanding its focus on center-wide cardiac alarm system management to include other medical technology with alarm systems.

"We have a lot of cycles of plan–do–check–act, over and over and over and over. That's what we do here."
— Pat Folcarelli, director of patient safety, Beth Israel Deaconess Medical Center

RECOMMENDATIONS

Leverage incident investigations.

At Beth Israel Deaconess, two adverse events led to a system-wide examination of cardiac monitors, which included:

- A month-long intensive investigation and reconstruction of the incidents
- Evaluation of then-current practice for telemetry monitoring and cardiac alarm system technology
- Use of Failure and Effects Mode Analysis—a step-by-step approach for identifying possible failures and their potential consequences
- Scrutiny of every aspect of alarm system management, from nurse education to the many different types of equipment to the volume and visibility of alarm signals to the ECG electrodes used to secure monitor leads to patients
- Prioritization of short-term fixes and longer-term solutions

Emergency Department Alarm Systems

The Challenge

The 54-bed Emergency Department at Beth Israel Deaconess sees 53,000 patients a year. The big department, with four discrete zones, was a "loud, chaotic, noisy place with auditory alarm signals going off all the time," says Carrie Tibbles, an emergency physician.

That nurse likely would not have spoken up, had Beth Israel Deaconess not adopted the "Lean" philosophy of front-line providers engaging in process improvement to create a better work environment for staff, improve patient satisfaction, improve efficiency, and reduce waste.

Clinicians in the Emergency Department accepted this chaos as part of the daily soundtrack playing in the environment. Low-priority alarm signals were frequently ignored or silenced.

In addition, the department had an index case—one that drew attention to alarm system management as an issue—in which a monitored patient was sent to radiology and, upon return, was not reconnected to the monitor. In that case, "we think somebody is being monitored and then we realize they're not," Tibbles says.

It took the fresh eyes and ears of a new nurse to call out the issues and risks of alarm fatigue. A nurse who had been working in an ICU transferred to the Emergency Department. "Obviously, being a much more controlled environment, the ICU is a lot quieter," Tibbles says. "He heard all the constant alarm signals that we took for granted and knew we could do better. He found it very overwhelming with all of the auditory alarm signals that were sounding."

The Lean approach has its roots in manufacturing. Automaker Toyota is legendary for empowering front-line workers to identify and help solve problems—and add value to products, services, and the company. In a manufacturing plant running "Lean," any worker can stop production if there is a concern that quality standards are not being met.

The Solution

The "Lean Team" in the Emergency Department, which had been trained in the

Lean philosophy, applied the Lean approach to the nurse's "great" callout on auditory alarm signal noise. Tenets of the approach that resonated for the team include:

- Respect for people. Employees are the most valuable resource.
- Involvement of a multidisciplinary team, including front-line workers, in identifying and finding solutions to problems
- Direct observation to understand the problem you are solving, known by the Japanese term "gemba," which means "actual place"
- Defined outcome measures with the collection of pre- and post-data

During the rapid improvement event with front-line staff, the Lean Team facilitated conversations with staff to identify their concerns and potential solutions to address alarm fatigue.

The Lean Team started its investigation of the devices incorporating alarm systems with a one-month study of alarm signal frequency. In that time period, more than 900,000 alarm signals, or 30,000 alarm conditions per day, were recorded in the department. Table 1 shows the alarm condition frequency for the one-month study period.

The team dug deeper into the data, dissecting the causes of two specific types of alarm conditions: medium priority technical alarm conditions or "Hard InOp" and high priority physiological alarm conditions or "Red." The team was concerned about the sheer number of occurrences with the medium priority technical alarm conditions as well as the nature or criticality of the high priority physiological alarm conditions. What the team found was that the vast majority of medium priority technical alarm conditions were reportedly due to "SpO2 Sensor Off," "Respiratory Leads Off," and "ECG Leads Off." Those three types of alarm conditions accounted for more than 50 percent of the total medium priority technical alarm conditions recorded in March 2011.

For the most urgent, high-priority alarm signals, "far and away the alarm condition that was happening the most, about 5,000 times, was our apnea alarm condition,

Beth Israel Deaconess Medical Center has been on its Lean journey since 2008. In 2011 the Emergency Department developed a Lean callout flag allowing front-line staff to identify issues interfering with patient care in real time.

Food for thought

Does your health system have an alarm system management team? What types of individuals would you expect to be on this team?

Alarm	Frequency—March 2011
Hard Inop	**590,063**
RhySta	224,613
Yellow Inop	35,969
Yellow	26,151
Short Yellow	19,751
Red	**8,572**
Temp	3,258
Severe Inop	976
Trect	744
T	4
Total	**910,097**

Source: Beth Israel Deaconess Medical Center

Table 1. Alarm Signals and Frequency, March 1–31, 2011

"If you have that many alarm signals, it's really hard to decide which ones are important."
— Carrie Tibbles, emergency physician, Beth Israel Deaconess Medical Center

saying the patient wasn't breathing," Tibbles says. "You can imagine we didn't have 5,000 patients that weren't breathing. We also were getting a lot of monitoring alarm conditions, about 2,000, indicating that the patient was desaturating," or experiencing declining oxygen levels. Table 2 shows the alarm conditions indicated by high-priority alarm signals during the one-month period.

Red Alarm Condition	Frequency	Percent
Apnea	4,654	54.29%
Desat	1,751	20.43%
Tachy	835	9.74%
Brady	742	8.66%
Asystole	590	6.88%
ABP Disconnect	0	0.00%
TOTAL	**8,572**	**100.00%**

Source: Beth Israel Deaconess Medical Center

Table 2. High-Priority Alarm Conditions, March 1–31, 2011

The baseline data prompted Lean Team members to make educated guesses about why so many monitored devices were signaling in the Emergency Department, and what could be done about it.

"Initially we had thought there was a high likelihood that we were monitoring a number of patients who simply did not require that level of observation," says Shelley Calder, the clinical nurse specialist for the Emergency Department, "and that the nurses may not be using patient specific profiles or parameters appropriately.

"I remember when we first started looking at the problem, I thought we were going to have to hire somebody to watch the monitors and develop some central telemetry monitoring, and visual marquees, which I think is a viable solution in certain areas," Calder says. In fact, that solution has worked well for general medical–surgical units at Beth Israel Deaconess, but it's expensive.

"But what we found is that wasn't the main problem at all" in the Emergency Department, Calder says. The solutions, once the problem was fully defined, would turn out to cost nothing at all.

The Lean Team came to that realization fairly quickly and painlessly by taking the time to carry out all the steps of the Lean improvement process. Through direct observation, team members went to Gemba walks in their department to observe the process real time. They observed the decision process for patients placed on monitors, the method by which this was done, the frequency of alarm conditions, and, finally, clinicians' response to the alarm signals. Team members were instructed to write down what they saw and heard, says Maile Blackburn, MSW, Lean project coordinator.

"The idea is not to change what's happening, it's just to watch what's happening," Blackburn says. "You don't want to make it too formalized or announced." This process defied the conventional mindset of Emergency Department clinicians.

When the Lean Team regrouped to discuss their observations, it turned out that the evidence they had gathered did not support many of their initial instincts about the department's alarm system management challenges and potential solutions. First of all, the Gemba walks dispelled the notion that patients were being monitored inappropriately and that nurses weren't adjusting parameters correctly.

"As a member of the emergency medicine leadership team, we used to feel great pride in our ability as a management team to identify issues and rapidly implement change. Unfortunately, all too often these changes did not last or address the true issue. Using Lean principles, leadership has engaged front-line staff as partners in identifying opportunities for improvement and working collaboratively to resolve issues."
— Shelley Calder, clinical nurse specialist, Beth Israel Deaconess Medical Center

OBSERVATIONS

Instead, the observations uncovered other, unanticipated issues. Tibbles summarizes the findings:

1. **Lead placement and low thresholds on apnea monitors.** "We found far and away that the apnea lead was incorrectly placed on the patient most of the time." The Lean Team attributed that to switching vendors. This resulted in new apnea monitors that required different lead placement. "We also realized that the alarm conditions on apnea monitors were set at very low thresholds signaling clinically insignificant events."

2. **Dropped signals on oxygen saturation monitors.** "We realized that on the desat, 70 percent of the time, the blood pressure cuff and the oxygen saturation monitor were being put on the same arm of the patient, because they're just closer to the monitor." In addition, for patient comfort, clinicians try to keep patients with one arm free of monitoring paraphernalia. However, "we realized that every time the blood pressure cuff was pumped up, the oxygen saturation monitor was alarming that the patient was desaturating because the oxygen monitor was losing its signal. We recognized that as a human factors issue."

3. **Responses to alarm signals.** "We realized that when staff hears the monitor alarm signal going off, all that they really know how to do is just pause (silence) the signal. Particularly as physicians, we're the biggest culprits. That basically gives you a reprieve of about two minutes and then it beeps again. So you really haven't solved the problem." Alarm fatigue contributed to clinicians' desire to get rid of the noise from seemingly nuisance alarm signals expeditiously.

Food for thought

Would refresher training for proper lead placement help at your facility?

The team realized that many of the issues were simply due to an education problem and thus the "Silence is Not a Solution" educational initiative was born.

"Silence Is Not a Solution."

First, the Lean Team defined the roles and responsibilities of physicians, nurses, and technicians for responding to high-, medium-, and low-priority alarm signals. **Second**, they pulled together a quick bedside reference chart, which was placed in all patient rooms. The chart details roles and responsibilities and offers quick trouble-shooting tips on how to adjust the monitors as well as a correct lead placement diagram.

Third, two nurses on the team then developed an educational video to communicate this information to all emergency clinical staff. The nurses shot a seven-minute video highlighting the main alarm system management issues in the Emergency Department, including lead and monitor placement, response to alarm signals, and alarm fatigue.

Finally, the video was rolled out to the department's 100 nurses, 60 technicians, 40 attending physicians, and 36 resident physicians in the spring of 2012. The video is now included in the new resident orientation every year.

Food for thought

There are many structured approaches to identifying and solving problems and improving processes. Can you apply effective practices from other industries to alarm system management challenges?

True to the Lean philosophy, data will be collected to examine the impact of the education program and make further improvements, if necessary. "I'm anxious to see how we're going to bring our total numbers down," Bournie says, referring to the frequencies of alarm signals.

The Results

Beth Israel Deaconess is tracking the results of the Emergency Department changes and will compare them with the baseline data. Preliminary results indicate:

- Fewer alarm signals and less noise in the Emergency Department
- Fewer clinically insignificant alarm conditions
- Reduction in waste—a goal of the lean philosophy—in terms of time wasted responding to alarm signals and alarm conditions
- A commitment to the lean philosophy and continuous improvement process

Table 3 shows the comparison data on alarm signal frequency in March 2011 and March 2012.

Alarm Condition	Frequency—March 2011	Frequency—March 2012
Hard Inop (Low priority technical)	590,063	74,997
RhySta (Information message)	224,613	213,135
Yellow Inop (Medium priority technical)	35,969	5,534
Yellow (Medium priority clinical)	26,151	61,465
Short Yellow (Low priority clinical)	19,751	2,890
Red (High priority clinical)	8,572	4,795
Temp (Medium priority clinical (assuming they refer to the temperature limit alarms))	3,258	775
Severe Inop (High priority technical)	976	73
Trect (Medium priority clinical (assuming they refer to the temperature limit alarms))	744	883
T (Medium priority clinical (assuming they refer to the temperature limit alarms))	4	2
TOTAL	910,097	364,547

Source: Beth Israel Deaconess Medical Center

Table 3. Alarm Frequency Data March 2011 vs. March 2012

RECOMMENDATIONS

Provide opportunities for front-line workers to identify and help solve challenges. Beth Israel Deaconess:

- Adopted the "Lean" philosophy to empower front-line workers.
- Applied the Lean philosophy using Gembas and process improvement events to engage front-line staff—to talk about their jobs, encourage them to share any concerns, and participate in developing processes that work.
- Listened and decided to act when a nurse who was new to the Emergency Department called attention to the environment and noise from devices with alarm systems.

Contact Us

Has your healthcare organization implemented any of the strategies discussed in this publication?

Do you know of a healthcare facility that has dealt with a technology-related issue and has a story to share?

If so, we would love to hear from you! Please email slombardi@aami.org.

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