

CASE STUDY

Customer: Hamilton Health Sciences Centre

Imagine a Hospital Without Code Blue Alarms

When “code blue” is called over the public-address system at a hospital, staff members immediately jump to action – as the emergency notification typically means that a patient is in very dire condition. In fact, in the overwhelming majority of code blue cases, the patient’s heart has stopped.

“Once the code blue is called, you will typically see lots of staff members and physicians running. These physicians get themselves all ramped up but they don’t always do the best job of preventing deaths,” said Alison Fox-Robichaud, BSc, MSc, MD, FRCPC, Department of Critical Care at Hamilton Health Services.

In fact, according to the medical literature, the survival rate from in-hospital cardiac arrest is only about 10 to 15 percent. “So, it’s a huge problem,” said Dr. Fox-Robichaud.

To successfully address this problem, Dr. Fox-Robichaud recognized that Hamilton Health Services would need to prevent the code blues in the first place. “Imagine a hospital in which code blue is a rare occurrence and you very rarely have the spectator sport that comes along with 50 people watching a team trying to resuscitate a patient whose heart has stopped,” said Dr. Fox-Robichaud.

As such, she realized that the health system should leverage an early warning system (EWS) that could help keep patients from deteriorating to the point where code blues are necessary. With an EWS, a score is computed after a nurse enters a patient’s vital signs.

When the vital signs deviate from what is considered normal, the EWS escalates and triggers clinical staff to pay increasing attention to patients who are in decline. As such, nurses and other clinicians can intervene and return patients to normal before their condition deteriorates and necessitates the dreaded code blue alarm.

It’s a return-to-fundamentals approach that is especially effective. “Vital signs have been the basis of good healthcare for hundreds of years. It’s the very first thing you are taught when you enter the medical profession,” Dr. Fox-Robichaud said. “Think about it. When patients go to the doctor’s office, the clinicians measure their blood pressure and take their pulse. When patients come into the hospital, the clinical staff measures their pulse, oxygen and respiration levels. The clinicians can tell if a patient is not well simply by looking at how their body is responding,” Dr. Fox-Robichaud said. “So, with early warning systems, we are bringing healthcare back to basics to improve the safety of patients in the hospital.”

Shortcomings: Manually Monitoring Vitals

Such manual early warning systems, however, are limited in their effectiveness due to several factors. First, nurses often do not enter the vital signs into the EMR system in a timely manner – and, as such, the early warning scores are not produced in a timely manner.

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Unfortunately, the lag could mean the difference between implementing an intervention that could prevent the patient from deteriorating into a life or death situation. Secondly, transcription errors pop up as the vitals are transposed from paper notes to the EMR. Lastly, the human responses to early warning scores are often varied based on individual bias, experiences and training. As a result, the responses often fall short as well.

Something Better

Dr. Fox-Robichaud and other leaders realized they needed a technology solution that could overcome some of these limitations associated with the manual EWS. Moving in this direction required Hamilton staff to turn to ThoughtWire's Ambient software, which utilizes machine intelligence to enable automation and real-time interactions between medical staff, systems and devices.

With this electronic Hamilton Early Warning System (HEWS) in place, nurses use smart phones to scan barcodes on a patient's wristband to verify the patient's identity. As vital signs are captured and logged using the ThoughtWire mobile application, they automatically populate the Hamilton electronic medical record (Meditech) while the ThoughtWire agent calculates the HEWS score in real-time leveraging complex algorithms and machine intelligence. ThoughtWire then autonomously initiates a collaboration workflow that was designed by Hamilton Health Sciences to bring the right level of care to the bedside. For example, if the score is five or above, the rapid assessment of critical events (RACE) team is notified. The team is then able to intervene and, in many cases, prevent the patient from traversing down the code blue path.

"We needed to find a way to do this in real time. We wanted to find a way to move all of this data that nurses capture and turn it into actionable knowledge, and we needed something that would allow them to do it at the bedside. So, we needed a device that was light and easy to carry, but we didn't want them to have to document vitals in their smart phone and then turn around and have them reenter the data back into the EMR," said Mark Farrow, CIO at Hamilton, when speaking about the decision to enter vital signs through a HEWS app loaded onto smartphones.



Mobile HEWS created on ThoughtWire's Ambient Health Platform

- Real-time vitals collection & immediate reporting to EMR - EWS calculated immediately on device and at desktop

- Clinical workflow automation - without bias or human decision making - Visibility into patient status & care team involvement

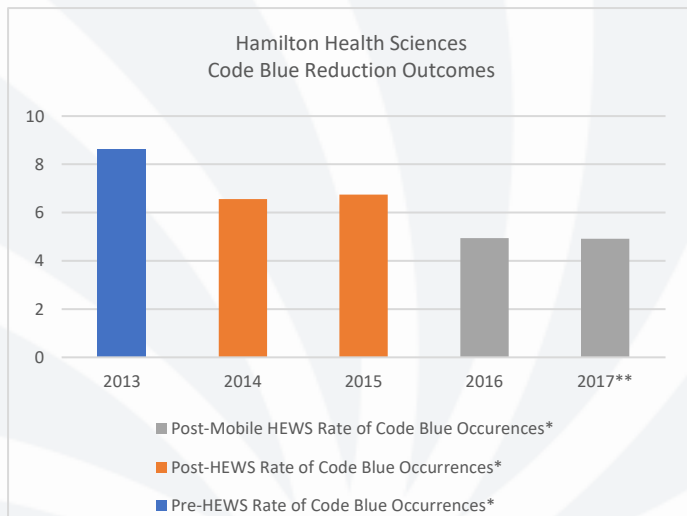
- Task list "nudges" applied to help care team comply

significant different in the number of code blues that Hamilton clinical staff need to deal with. In fact, the number of code blues have decreased from 8.61 per 1,000 admissions prior to the implementation of HEWS to just 4.92 per 1,000 during the 2017-2018 fiscal year (through June), a reduction of 43.9%.

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The following chart shows the rate of code blue admissions at Hamilton Health Sciences comparing the pre-HEWS baseline (FY2013/FY2014) to the subsequent post HEWS implementation from FY2014 thru July 2017.



The impact of these reductions is compelling from a clinical care perspective. Indeed, by avoiding a code blue and the frequent ICU admissions. The team is then able to intervene and, in many cases, prevent the patient from traversing down the code blue path. that follow, lives are literally saved. Consider the following: Hamilton estimates that only 25% of code blues that flatline (no heart beat) will ever get back to a normal rhythm and only 3% of patients who flatline will ever leave the hospital alive. What's more, only 19% of those patients who do survive a code blue are discharged from the hospital and the six-month survival rate of those patients is 15.6%.

The cost savings of code blue reduction is also potentially significant. In Canada, the second highest cost of insurance payments is for the failure to recognize the deteriorating patient, which is also called the failure to rescue. In the United States, the costs associated with code blues are estimated to be at \$17 - \$29US billion annually.

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HEWS could have other uses beyond preventing code-blues. For example, according to research recently conducted by Hamilton clinicians and published in the *Canadian Journal of Emergency Medicine*, HEWS could be useful in the early identification of sepsis among emergency department patients. The study found that HEWS had fair discriminative ability for predicting likelihood of meeting criteria for sepsis and good discriminative ability for predicting likelihood of experiencing a critical event among patients meeting criteria for sepsis¹. Hamilton also is looking to develop a pediatric version of HEWS to alert clinicians of respiratory and other ailments that require immediate attention.

Going Beyond Code Blue Alarms

In the final analysis, the wider use of a HEWS-like system could not only save many thousands of lives be but also improve clinical efficiencies, reduce costly ICU admissions, shorten overall length of stay for many patients and enhance the overall quality of care delivered in the hospital setting.

“The possibilities are really endless. Developing and implementing these electronic early warning systems is a great way to simultaneously get back to the basics of good quality care while leveraging modern technology – and, in the process, significantly improve all important patient outcomes,” Dr. Fox-Robichaud concluded.