Safety Innovations

Healthcare System Takes Bold Step with Continuous Monitoring

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About the Author

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Community Health Network prides itself on excellence in clinical care, high standards, continuous drive for improvement, and evidence-based and data-driven practices. Based in Indianapolis, IN, the community healthcare system performs more than 12,600 inpatient surgeries annually. In 2013, Community Health Network noticed a worrisome trend in the data, which showed an increased frequency in interventions for patients experiencing opioid-induced over-sedation following inpatient surgery.

Clinical leaders and quality assurance and risk management staff acted decisively. With executive support, they began rolling out continuous electronic monitoring for all patients after inpatient surgery, in an effort to safeguard patients from the potentially harmful effects of oversedation. Continuous monitoring was seen as a high-quality practice—one that not many healthcare systems had implemented.

Community Health Network now is on track to implement the solution in all five of its six hospitals that perform inpatient surgeries. Continuous monitoring had resulted in a clear turnaround, with marked declines in opioid-related interventions, including Code Blue rapid response, opioid reversal medications, and transfer of patients to more intensive levels of care. The healthcare system had turned its attention to potential applications of this method to surgical obstetric patients, emergency departments, and procedural areas.

Challenge

About 10 years ago, Community Health Network began using patient-controlled analgesia (PCA) infusion pumps with some postsurgical patients. PCA allows patients to self-administer their pain relief medication. As long as PCA pumps are used as intended—by patients only, and not by anyone else—they are unlikely to deliver overdoses of medication.

Even so, as an extra precaution, the healthcare system also implemented continuous electronic monitoring for all patients on PCA, using capnography. Capnography is the noninvasive monitoring of ventilation as measured by end-tidal CO_2—the concentration of CO_2 in exhaled breaths.

Monitoring end-tidal CO_2 detects changes in ventilation and perfusion (blood flow to the lungs) and can detect respiratory depression, which is a sign of oversedation. Typically, end-tidal CO_2 monitoring detects respiratory compromise well before it is noticeable to even the most diligently watchful clinicians. This empowers them to intervene well before respiratory distress turns into a crisis.

"This is the state of the knowledge," said Julie Painter, RN, MSN, OCN, clinical nurse specialist at Community Health Network. "The technology is so accurate that it can help clinicians understand what is happening to a patient's lungs, body, and perfusion long before they stop breathing, so we can intervene."

In 2013, clinical leaders and quality assurance and risk management staff grew concerned about data coming in from the network's largest campus for inpatient surgeries, Community Hospital North in Indianapolis. Data revealed a high number of overly sedated postoperative patients, as well as a number of calls for Code Blue rapid response for respiratory compromise. Many patients also required reversal agents for opioids, with some requiring higher levels of care (e.g., mechanical ventilation) and longer lengths of stay.

However, these trends did not pertain to patients on PCA and continuous electronic capnography monitoring. It was the patients who were not on PCA and who were not being monitored electronically for end-tidal CO_2 who were experiencing serious problems. These patients were receiving pain medication via standard intravenous administration.

The providers at the bedside already had the authority to use continuous electronic monitoring for any patient, for any reason, as it is noninvasive and can enhance early detection of ventilation compromise. This authority applied to any patient not using a PCA pump and, therefore, not already subject to the required monitoring of patients on PCA. Attending clinicians could order continuous monitoring for patients with known risk factors for oversedation and respiratory depression, or they could use their professional judgment.

"But the patients we saw who became overly sedated and had bad outcomes and longer lengths of stay—and thank goodness we have had no one die over the years from this—they haven't been the people you suspected," Painter said. "It's not who you think. We were seeing events on people you would not think to be problematic."

Of note, the oldest or sickest patients (i.e., those with known and managed risk factors) weren't the ones experiencing the majority of opioid-related problems. Rather, seemingly healthy, fit, and younger patients, including "opioid-naive" patients and those with undiagnosed or undisclosed conditions (e.g., heart or lung ailments) or sleep apnea and sleep disorders, were having the most problems. Unlike many oncology or infectious disease patients, for example, "people with heart disease and lung disease often

don't look bad when they come in," Painter said. "You can't judge who is at risk by what you see in the moment."

That observation syncs with the conclusions of many professional organizations and patient safety advocates, including the National Coalition to Promote Continuous Monitoring of Patients on Opioids,[1] which is managed by the AAMI Foundation.

Solution

Continuous Monitoring for All Postoperative Patients

A multidisciplinary team, including anesthesia, nursing, surgical, acute care, pharmacy, and quality assurance and risk management leaders, moved quickly to investigate the problem. The inquiry was led by Painter and, at Community North Hospital, by Marci Jones, RN, operating room (OR) director; Brian Scott, manager of the postanesthesia care unit (PACU); and anesthesiologists Michael Caldwell, MD, and Scott Vore, MD.

The team analyzed the records of patients who had become overly sedated or experienced respiratory difficulty after surgery. They considered the unique characteristics of each patient and looked for underlying conditions or risks that might have been missed in presurgical screening. In addition, in reviewing the medications and dosages used in the PACU, they realized that the effects of strong opioids might not show up until patients are moved from the PACU to acute care.

After examining the data and patient records, the clinical leaders concluded that continuous monitoring was necessary for *all* patients following inpatient surgery. "The decision was made based on quality and outcomes related to patient care and safety," Painter said. "We said, 'We have to do this. There is no option.'"

In fact, the clinical leaders did not even consider other options, such as changing sedation assessment scales or more frequent "spot checks" of patients on opioids. Pulse oximetry, which measures oxygen saturation in the blood, also was not considered.

"So many hospitals just want to use pulse oximetry on everybody," Painter said. "Healthcare providers have a false sense of

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— *Julie Painter, clinical nurse specialist at Community Health Network in Indianapolis, IN*

security when using oximetry. We are fooled by thinking that the oxygen level tells us all we need to know about ventilation and perfusion. For patients on opioids, it's about perfusion and ventilation status and detecting sedation earlier, when we can intervene and turn the situation around."

The team recognized that continuous monitoring of end-tidal CO_2 was the single best way to ensure that no postoperative patient on opioids would fall through the cracks inherent in other methods. "The device is very accurate," Painter said. "It is statistically valid. The next most valid method would be drawing an arterial blood gas out of your artery or wrist. And we'd like not to have to do that."

Considering the available data, the hospital president and chief nursing officer supported the team's strong recommendation. "We shared the data, and then there was no convincing needed," Painter said. "We're a very data-driven organization. That helps. Data talks, and safety is always more fiscally responsible than harm."

With executive sponsorship, the team worked with the Community Health Network's value analysis team, which includes clinical experts across service lines, financing and purchasing experts, and clinical engineering professionals. The team developed a procurement package to add to its fleet of wireless continuous monitoring devices at Community Hospital North.

Beginning in 2013, the same year when the problem was discovered, Community Health Network began rolling out universal continuous monitoring for all postsurgical patients at Community Hospital North, starting in the recovery period in the PACU and continuing in acute care settings.

Within the first month of implementation, considerable improvement was observed for the leading indicators of oversedation: Code Blue consults, use of opioid reversal agents, and transfers of patients to higher levels of care. These positive trends continued for the next 6 to 12 months, to the point where oversedation following inpatient surgery was

Keys to Successful Continuous Monitoring

Although Community Hospital North had been using continuous monitoring for postsurgical patients on PCA for a number of years, the team in charge of implementing it for all postsurgical patients on opioids did not take for granted that all would go smoothly. They planned thoroughly. Here are a few highlights:

Planning. The original team of nursing, anesthesia, OR, and acute care leaders and clinicians expanded to include clinical engineering, clinical education, and materials management professionals. They determined how many end-tidal CO_2 modules would be needed and did a cost-benefit analysis of the new devices.

The implementation process the team planned was much more than "go live," Julie Painter, clinical nurse specialist, said. The process encompassed changes in practice within the postanesthesia care unit (PACU), the plan for educating and training all PACU nurses, and handoff communications between PACU nurses and the receiving acute care nurses.

Education and training. Painter and the clinical educators believed that educating clinicians on the reasons for continuous monitoring was just as important as training them on how to use the technology. Painter is

a fan of SBAR (situation, background, assessment, recommendation)—a communication tool popular in healthcare. SBAR is described as follows:

- **Situation:** Clearly and briefly define the situation.
- **Background:** Provide clear, relevant background information that relates to the situation.
- **Assessment:** Present a statement of your professional conclusion.
- **Recommendation:** Propose an action or response to address the situation.

During training, Painter explained why the technology would be used, shared data about the problem, presented the case for the accuracy and validity of the end-tidal CO_2 continuous monitoring, and worked one on one with clinicians to show them how to use the technology to enhance patient care.

Evaluation. Each day, the team reviewed data on opioid-related patient outcomes and shared these data with clinicians. Within a month, the data pointed to marked improvement in preventing respiratory depression caused by opioids and reduced interventions. The team continued that level of scrutiny for a full year.

no longer a major patient safety challenge at the hospital.

"Any patient requiring reversal agents during a postoperative recovery or procedure who received sedation has their care reviewed to see if there were any missed opportunities," Painter said. "We then take the lessons learned and incorporate them into our practice."

Expanding to Other Hospitals

Following its success at Community Hospital North, the Community Health Network turned its attention to expanding continuous monitoring to other hospitals in the network.

"In 2014, we began to say, 'We need to look at how we spread this to every one of our campuses,'" Painter said. The team maintained its focus on keeping patients safe, even though other hospitals were not experiencing the same level of opioid-related problems as those seen at Community Hospital North.

Community Health Network's Lean Sigma methodology for performance improvement was a driving factor in that mindset. The network standardizes policies, practices, and technology across the network, which improves quality and reduces variability and inefficiencies.

By 2014, in addition to the positive data from Community Hospital North, Community Health Network also had some influential wind in its sails. In March 2014, the Centers for Medicare & Medicaid Services (CMS) recommended "appropriate monitoring" for all patients receiving opioids.[2] Although some patient safety advocates criticized CMS for not specifying continuous electronic monitoring of end-tidal CO_2, awareness seemed to be growing nationwide that hospitals needed to do more to keep all patients on opioids safe.[3] In addition, hospitals have to report to state and federal agencies each time they have an adverse drug event and use reversal agents related to opioids,[4] which was another incentive to the healthcare system's team.

Community Health Network staged the rollouts of continuous monitoring of end-tidal CO_2 at the next three hospitals gradually and sequentially, using the same implementation routine of planning, education and training, and evaluation. Each process was evaluated for months, with the same daily review of data, before the next implementation began. Again, the results were positive.

The clinical process for continuous monitoring was honed so that every postsurgical patient leaves the PACU with the end-tidal CO_2 monitor in place—a responsibility of the attending PACU nurse. This PACU nurse takes each patient to the receiving nurse on the floor—a best practice that had always been in place but was formalized. This nurse handoff, along with the nurse-to-nurse communication about the patient's condition, ensured a smooth transition from surgery to recovery.

Community Health Network's sustained patient safety initiative has increased staff awareness of the dangers of oversedation from opioid use.

By spring 2015, five of six Community Health Network hospitals that perform inpatient surgeries had implemented continuous monitoring on all postsurgical patients. The sixth hospital, a more recent addition to the healthcare system's portfolio of facilities, began using the network's standard smart infusion pumps. Painter expected that staff at that hospital would be ready to integrate end-tidal CO_2 continuous monitoring for all patients within a few months. Already, however, clinicians had the authority and equipment to use this monitoring with any patient—postoperative or otherwise—if they were concerned about oversedation.

Expanding Beyond Surgical Patients

Community Health Network's sustained patient safety initiative has increased staff awareness of the dangers of oversedation from opioid use. Continuous monitoring has been expanded to obstetrics units, where a number of cesarean sections occur among the nearly 8,000 annual births.

The team charged with implementing and evaluating continuous monitoring for postoperative patients began hearing from clinicians in other patient care areas.

"We've had questions from our cardiac catheterization lab and from our emergency departments where clinicians are seeing a lot more sedation than they did historically," Painter said. "We're beginning to see where sedation monitoring and ventilation monitoring impacts an entire network outside of postanesthesia or opioids."

The team is working to increase the inventories of end-tidal CO_2 monitoring devices in emergency departments, which often perform procedures requiring sedation medications. The emergency departments and cardiac catheterization labs do not have a sufficient number of these monitoring devices to use on all patients receiving opioids.

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Community Health Network also began looking at data from other procedural areas. To that end, Painter offered the following cautionary advice: "When we look at data related to reversal agents for sedative medications, we must be clear to note that many procedural areas have historically used sedation medications and then used reversal agents at the end of the procedure. Thus, it is important to know where your reversals for sedation are and what specifically caused the need for reversal. Procedural reversal versus postoperative reversal due to oversedation are very different scenarios."

The team continues to mine the data to inform decisions on continuous monitoring in different patient care areas.

Lessons Learned

Painter shared the following lessons learned from implementing continuous monitoring of end-tidal CO_2 in five hospitals:

Be methodical. Mine the data, review the literature, and stay on top of evidence-based best practices. Plan every aspect of implementing new technology and practices.

Cultivate champions. No one person can be responsible for a major change in practice. The team actively identified and trained champions and unit experts as "building resources" to support their colleagues.

Enhance, don't replace, best practices. Clinicians in surgical suites, PACUs, and acute care units continue to use sedation assessment scales, including the Aldrete score[5] and Pasero Opioid-Induced Sedation Scale,[6] to monitor patients on opioids. Continuous monitoring complements these scales and supports safer practice.

Hold everyone to high standards. A few clinicians wanted to make exceptions to the "all-means-all" standard of monitoring postoperative patients. Painter responded with an analogy from a pharmacist who had been deeply engaged in reviewing data on oversedation: "When we get a diabetic patient admitted, do we look at them and say, 'They are doing well with their diabetes. We're not going to give them their diabetes medications while they are here. I think we can try going without them.' We would never do that. Then, why would we give these severely sedating medications to people who we have *not* previously seen except for their outpatient visit and *not* put this safety standard on everyone?"

That pharmacist's statement put the issue into perspective for Painter. "It's not negotiable," she said.

It helps that all hospitals use the same infusion pumps and continuous monitoring devices, as well as the same policies, practices, and standards. "If you look at performance improvement and Lean Sigma, standardizing a process and reducing variation can also reduce harm. That's really what we've been about—doing what is best for every patient and always striving to improve."

Communicate peer to peer and leverage data. Overcoming skeptics and instilling changes in practice requires communication. Painter has found that physician-to-physician or nurse-to-nurse communication is most effective and that data make those conversations even more powerful. "Sometimes we assume people know data, or they know about their patients, but they don't always know what happens to their patients after they leave the surgical floor or the PACU," she said.

Over time, in fact, the implementation team realized that communication between one care provider and care unit and the next can be inadequate. They involved the network's anesthesia quality experts to enhance understanding and practice around opioids. So if an opioid-related problem occurs in an acute care unit, that information is shared with OR and PACU staff. The communication goes full circle because safety is about a process.

Take advantage of teachable moments. During one education session, Painter put the end-tidal CO_2 monitor on herself so that the nurses could see how it worked. "I speak really fast and most people don't think I'm from the Midwest, but I'm a Hoosier born and bred," she said. The nurses noticed that the respiratory rate on the monitor display showed a "3"—a very low rate. They thought that meant the device was inaccurate.

Her colleagues in the room pointed out that Painter was not taking deep breaths while she talked. "The monitor measures respiratory rate, too," Painter explained. "Often people think they see the patient breathing and talking just fine, but they're actually not inhaling and ventilating."

For patients and family members who ask or complain about the monitoring device, Painter trains nurses to take a moment to explain that it can be lifesaving. A statement such as, "We have to know you're going to leave here alive," is eye-opening for patients, she said.

Manage alarm signals. Alarm signals can annoy nurses, patients, and family members. Painter refuses to allow nurses to adjust alarm settings, though many have asked to do so.

"I won't waver on that," Painter said. What would happen if each of the 3,500 registered nurses in the network could tweak "the most stringent safe levels" of the alarm parameters, based on their intuition or different perspectives as intensive care unit, postsurgical, or oncology caregivers? "If it was your loved one, would you want me to waver?"

Instead, Painter doubles down on the importance of the alarm signals. "If it's bothering you, there's a reason it's bothering you," she said. Nurses and their team can check on patients and encourage or remind them to take deep, cleansing breaths to eliminate CO_2. If a patient is compromised in any way, they can intervene.

Stay focused on results. Every Community Health Network hospital campus using continuous monitoring now reviews patient data daily to spot any problems, followed by monthly reviews to identify trends. The original team comes together as needed to conduct deep analysis of any opioid-related incident, but the safety initiative has been so successful that they don't have to meet often for this.

Conclusion

The overarching result of implementing continuous monitoring at Community Health Network has been a shift from reactive to proactive care for postoperative patients on opioids. Clinicians no longer have to scramble to intervene

with intensive measures, such as Code Blue consults. They now can spot and reverse oversedation and respiratory depression much earlier and, as a result, the interventions required are less intensive.

At the time of this writing, the Community Health Network had noted continual decline in oversedation events in postoperative patients and was continuing to monitor doses of reversal agents administered, with an eye toward continuous quality improvement. ∎

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