



## **ANTHOLOGY**

Continuous Monitoring Solutions for Patients on Opioids

2014–18

**AAMI**  
FOUNDATION

## About AAMI

The Association for the Advancement of Medical Instrumentation® (AAMI) is a nonprofit organization founded in 1967. It is a diverse community of 9,000 professionals united by one important mission—the development, management, and use of safe and effective health technology.

AAMI is the primary source of consensus standards, both national and international, for the medical device industry, as well as practical information, support, and guidance for healthcare technology and sterilization professionals. AAMI helps members:

- Contain costs
- Stay on top of new technology and policy developments
- Add value in healthcare organizations
- Improve professional skills
- Enhance patient care

AAMI provides a unique and critical forum for a variety of professionals including clinical and biomedical engineers and technicians, physicians, nurses, hospital administrators, educators, scientists, manufacturers, distributors, government regulators, and others with an interest in healthcare technology. AAMI fulfills its mission through:

- Courses, conferences, and continuing education, including certification programs.
- Collaborative initiatives, including summits with the FDA.
- A rich array of resources, including peer-reviewed journals, technical documents, books, videos, podcasts, and other products.

## About the AAMI Foundation

Over its 50-year history, the Foundation has worked closely with its affiliate, the Association for the Advancement of Medical Instrumentation (AAMI), the world-renowned membership organization driving consensual standards in medical instrumentation.

The AAMI Foundation is committed to reducing preventable patient harm and to improving outcomes with complex healthcare technology. In addition to awarding scholarships, a research grant and its national coalition work, the Foundation works to support and promote the healthcare technology management and sterilization professionals to help drive improvements in patient safety.

# Anthology

## Continuous Monitoring Solutions for Patients on Opioids 2014–18

### Contents

<b>Speaking Up About a ‘Silent Danger’</b> .....	1
By the Numbers .....	3
<b>The Call to Action</b> .....	4
The Business Case for Continuous Electronic Monitoring of Patients on Opioids .....	5
How One Patient Became an Advocate .....	6
<b>How the AAMI Foundation Selects and Builds National Coalitions</b> .....	7
<b>From a Vision Statement to Best Practices, Education, and Advocacy</b> .	8
Strategies to Overcome Financial, Cultural, Educational, and Workflow Barriers .....	10
Making an Impact .....	11
Reflections from the Field .....	12
<b>A Robust Collection of Knowledge</b> .....	13
The Call to Action .....	14
AAMI Foundation Safety Innovations Series .....	14
Spreading the Word .....	15
Education and Knowledge Sharing .....	16
Patient Safety Seminars .....	18
Going Deeper .....	20
<b>Conclusion</b> .....	22
<b>National Coalition for Continuous Monitoring of Patients on Opioids</b> . . .	23
<b>Acknowledgments</b> .....	26





Promoting Continuous Monitoring  
of Patients on Opioids  
**Speaking Up  
About a ‘Silent Danger’**

Pain has been called “the oldest medical problem” and “a constant companion for humanity.”<sup>1</sup> For patients in pain, opioids can ease suffering and promote healing. Opioids are now “the first choice of analgesic drugs used to manage moderate to severe pain in hospitalized patients.”<sup>2</sup>

For some patients, however, opioids can trigger respiratory depression, a potentially devastating patient safety risk. For many years, the healthcare community has been warned about adverse events associated with opioids. Yet widespread adoption of continuous electronic monitoring of patients on opioids—a viable strategy for reducing preventable harm from opioids—has not been a priority.



Continuous electronic monitoring of patients on intensive care and general medical–surgical units can detect early changes in respiration and subtle respiratory trends indicating progressive decline—and alert clinicians in time to intervene.

There are known risk factors for opioid-induced respiratory depression, which can lead to brain injury or death. Risk factors include obesity, low body weight, chronic obstructive pulmonary disease, asthma, advanced age, complex medical conditions, and the use of other medications that produce sedative effects. Many patients also have undiagnosed sleep apnea, another risk factor. The use of patient-controlled analgesia (PCA) machines, which allow patients to self-administer pain medications at the push of a button, has introduced more opportunities for adverse drug events. Programming errors and “PCA by proxy,” which means someone other than the patient pushes the button to administer opioids, have resulted in adverse events.

Risk assessment protocols can help clinicians identify patients with risk factors associated with opioid-induced respiratory depression—but these tools are not failsafe. Young, healthy patients with no known risk factors have succumbed to respiratory failure, a tragic event for families and clinicians alike.

<sup>1</sup> Collier, R. (Jan. 8, 2018.) Collier, R. “A Short History of Pain Management.” *Canadian Medical Association Journal*.

<sup>2</sup> Williams, J.S. (2015.) Opioid Safety & Patient Monitoring: Conference Compendium. AAMI Foundation.

Continuous electronic monitoring of all patients on opioids takes the guesswork out of risk assessment and “spot check” monitoring, a commonly used protocol in which clinicians monitor patient vital signs every two to four hours. Patients in respiratory distress can decline quickly between these spot checks. This is a deadly, silent danger. But it is preventable. Continuous electronic monitoring of patients on intensive care and general medical–surgical units can detect early changes in respiration and subtle respiratory trends indicating progressive decline—and alert clinicians in time to intervene.

### A Broad Coalition with a Unique Goal

As a safety-focused organization, the AAMI Foundation has taken the mantle to advance patient safety initiatives from our affiliate, the Association for the Advancement of Medical Instrumentation (AAMI). Over its 50-year history, the Foundation has worked closely with AAMI, the world-renowned membership organization that leads global collaboration in the development, management, and use of safe and effective health technology. As AAMI’s charitable arm, the Foundation is committed to reducing preventable patient harm and improving outcomes with complex healthcare technology.

The Foundation has a track record as a consensus-building organization to address seemingly intractable challenges in healthcare. Following multidisciplinary summits convened by AAMI, the Food and Drug Administration, and other prominent organizations, the AAMI Foundation launched National Coalitions to address safety challenges related to infusion therapy, clinical alarm management, and complex healthcare technology. These multidisciplinary coalitions conducted research, shined a spotlight on important safety issues, and developed practical solutions for healthcare organizations and clinicians.

The Foundation’s National Coalition to Promote Continuous Monitoring of Patients on Opioids, which launched in 2014, was different. The fundamental component of any meaningful solution to respiratory depression—continuous electronic monitoring—was already available. It has proven to be successful in safeguarding patients in many hospitals.

Therefore, unlike past patient safety initiatives, this National Coalition had a more targeted goal: to establish the business case—demonstrated with strong financial justification and improved patient outcomes—to educate

and encourage hospitals to adopt continuous monitoring for all patients on parenteral opioids.

Seventeen organizations signed on as co-conveners of this National Coalition, and 12 partners supported the coalition’s work. In November 2014, the Foundation convened patient safety-focused healthcare professionals, patient advocates, industry partners, professional societies, and regulators to share knowledge, data, and experiences about continuous monitoring technology. This kickoff meeting focused not on whether to adopt continuous electronic monitoring, but on how to do so successfully without causing undue financial burden on hospitals or alarm burden for front-line caregivers.

Energized by their shared concerns about patients on opioids, the National Coalition went on to build the business case for continuous electronic monitoring and to develop practical resources for making it work in clinical settings.

This Anthology aggregates the deliverables of the National Coalition to Promote Continuous Monitoring of Patients on Opioids, which is freely and publicly available to ensure all healthcare organizations have access to this critical information. We encourage you to take advantage of the collective knowledge and practical tools and to share them with your colleagues. We hope you will consider this Anthology a living reference to inform your efforts to improve the care of patients on opioids in your healthcare organization.

Finally, we celebrate the fact that our knowledge about caring for patients safely continues to grow, as this and other AAMI Foundation initiatives have sparked keen interest in the field.



Steve Campbell

*Executive Director*  
AAMI Foundation

*Acting President  
and Chief Operating  
Officer*  
AAMI

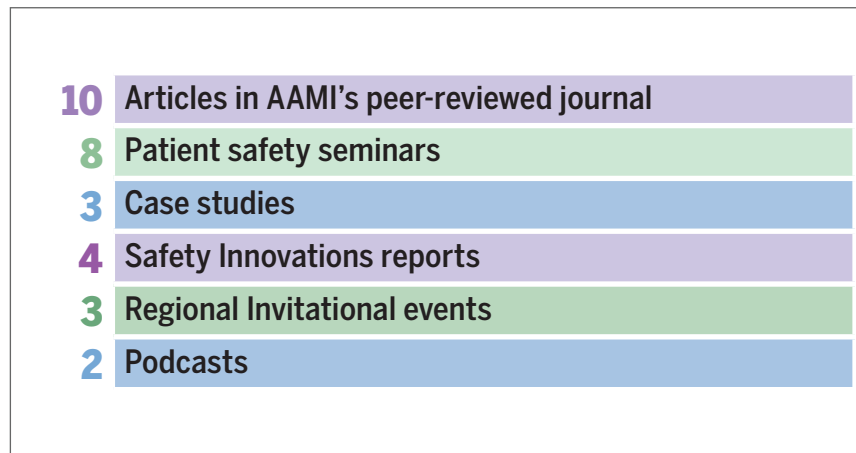
# By the Numbers

AAMI Foundation Opioid Safety Initiative

AAMI Foundation  
National Coalition for  
Continuous Monitoring  
of Patients on Opioids •  
2014–18

Call to Action  
November 2014

Deliverables



## The Call to Action

2014–18

“Let’s stop spending money on treatment of in-hospital arrests and start preventing them instead.”

—Frank Overdyk, MSEE, MD,  
chair of the National Coalition for the  
Continuous Monitoring of Patients on Opioids



The AAMI Foundation launched the National Coalition to Promote Continuous Monitoring of Patients on Opioids with a clear understanding of both the safety hazards for patients on opioids and the opportunities and challenges for taking action to keep patients safe.

In fact, warnings about the risk of adverse events for patients on opioids had been sounded for years, from organizations representing medical professionals, healthcare and patient safety advocates, accreditors, and regulators:

- The **Institute for Safe Medication Practices** issued warnings in 2003 and 2012, and recommended continuous monitoring using pulse oximetry to monitor oxygenation and capnography to monitor ventilation. Capnography measures carbon dioxide in a patient’s exhaled breath over time; the measurement is known as end-tidal carbon dioxide (EtCO<sup>2</sup>).
- The **Joint Commission** issued a sentinel event alert in 2004 associated with patient-controlled analgesia (PCA) by proxy, recommending “careful monitoring” with oximetry and/or capnography as “appropriate in some cases.” A second Joint Commission sentinel event alert in 2012 issued a stronger warning pertaining to all patients receiving opioids, again recommending pulse oximetry and capnography to monitor these patients.
- In 2006, 2009, and 2011, the **Anesthesia Patient Safety Foundation** recommended continuous monitoring for all patients receiving patient-controlled analgesia (PCA).
- The **Centers for Medicare & Medicaid Services** (CMS) in 2013 called for “appropriate monitoring” of patients receiving PCA. A year later, CMS published stronger guidance to promote electronic monitoring of patients.
 

Continuous electronic monitoring prevents adverse events by detecting respiratory trends, analyzing and interpreting data, and providing clinicians with actionable information. Yet adoption of continuous monitoring technology lagged.

Thus, the kickoff event of the National Coalition in 2014 brought together industry professionals familiar with the technology, hospital leaders who had improved patient safety by adopting this technology, clinicians with experience using the technology, and researchers who had studied the return on investment of various monitoring technologies. Patient safety advocates, and patients and family members with personal stories to tell about adverse events, drove home the overarching message that a commitment to patient safety requires adoption of continuous electronic monitoring.

The kickoff event highlighted the evidence for improving patient safety with continuous electronic monitoring, probed the reluctance to adopt this solution, and focused on the business case for broader adoption. The presentations at this event cut to the heart of matter:

  - The latest scientific evidence on opioids and cardiopulmonary arrest.
  - Case studies, best practices, and lessons learned



from hospitals that had implemented continuous electronic monitoring, with insights into adoption and implementation challenges, patient safety results, impact on clinical workflow, and implications for clinician education, return on investment, and financial sustainability.

- Perspectives from a wide array of stakeholders—including hospitals, clinicians, researchers, technologists, healthcare technology managers, procurement

experts, patient safety advocates, and patients and family members—as well as national professional organizations and industry partners.

The AAMI Foundation's *Opioid Safety & Patient Monitoring: Conference Compendium* provides full coverage of the presentations and breakout sessions at the kickoff event.

## The Business Case for Continuous Electronic Monitoring of Patients on Opioids



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Cost is always a factor when healthcare systems consider new technology. Hospitals that have implemented continuous electronic monitoring realized both patient safety gains and positive returns on investment. A number of healthcare systems developed business cases for continuous monitoring.

Here's a summary of the business case and evidence presented at the National Coalition kickoff event by George Blike of Dartmouth-Hitchcock Health:

**The Problem:** Opioid-related respiratory deterioration and adverse events cost not just lives, but also time and money. Specialists are required for rapid response teams, code teams, mechanical ventilation, opioid reversal medications, and other rescue measures. Escalation of care results in unanticipated transfers to ICUs, where care is much more expensive. Lawsuits after adverse events can cost hospitals millions of dollars.

**The Solution:** Continuous electronic monitoring minimizes unwitnessed patient deterioration and arrests, reduces

emergency team activation and other rescue measures, and decreases opioid-related transfers to the ICU.

**Results:** Ten months after implementing continuous electronic monitoring in a 36-bed orthopedic unit, Dartmouth Hitchcock reduced transfers to higher levels of care by 50% and reduced rescue events by 60%.

**Return on Investment.** Dartmouth Hitchcock spent \$167,993 in fixed costs to purchase 36 bedside continuous electronic monitoring devices and accessories, install the equipment, and train staff. The annual variable cost for the surveillance system is \$58,261. But the opportunity costs are significantly higher. If 30 patients avoided transfers to ICU care, the annualized business return would be \$817,000 in the startup year and \$1,295,000 in subsequent years.

The healthcare system subsequently expanded this technology adoption to all surgical units, medical units, and pediatrics.



“Even though I am not involved in the healthcare industry, I still speak to groups to promote the monitoring of patients on opioids, I would like to see more press and conferences dedicated to this important crisis. I would tell my story and speak to any group to make a difference.”

—**Matt Whitman**, law enforcement instructor, Van Buren Tech, Lawrence, MI

### How One Patient Became an Advocate

When he nearly died of opioid-induced respiratory depression, Matt Whitman was 39 years old and in “terrific health.” At the time, he was a state trooper who had neck surgery to repair worsening effects from injuries suffered when a drunk driver struck his squad car more than a decade earlier.

The surgery went well. In recovery, Whitman was placed on a morphine pump, with only vital signs monitoring every few hours. But 15 minutes after a nighttime check, a nurse happened to walk by his room and noticed he was not breathing. She called a “Code Blue.” Miraculously, he survived—even though he had been without oxygen for six minutes.

Whitman was not a high-risk patient. But his story, which he shared at the kickoff conference of the National Coalition for Continuous Monitoring of Patients on Opioids, exemplifies why hospitals must implement this life-saving technology.

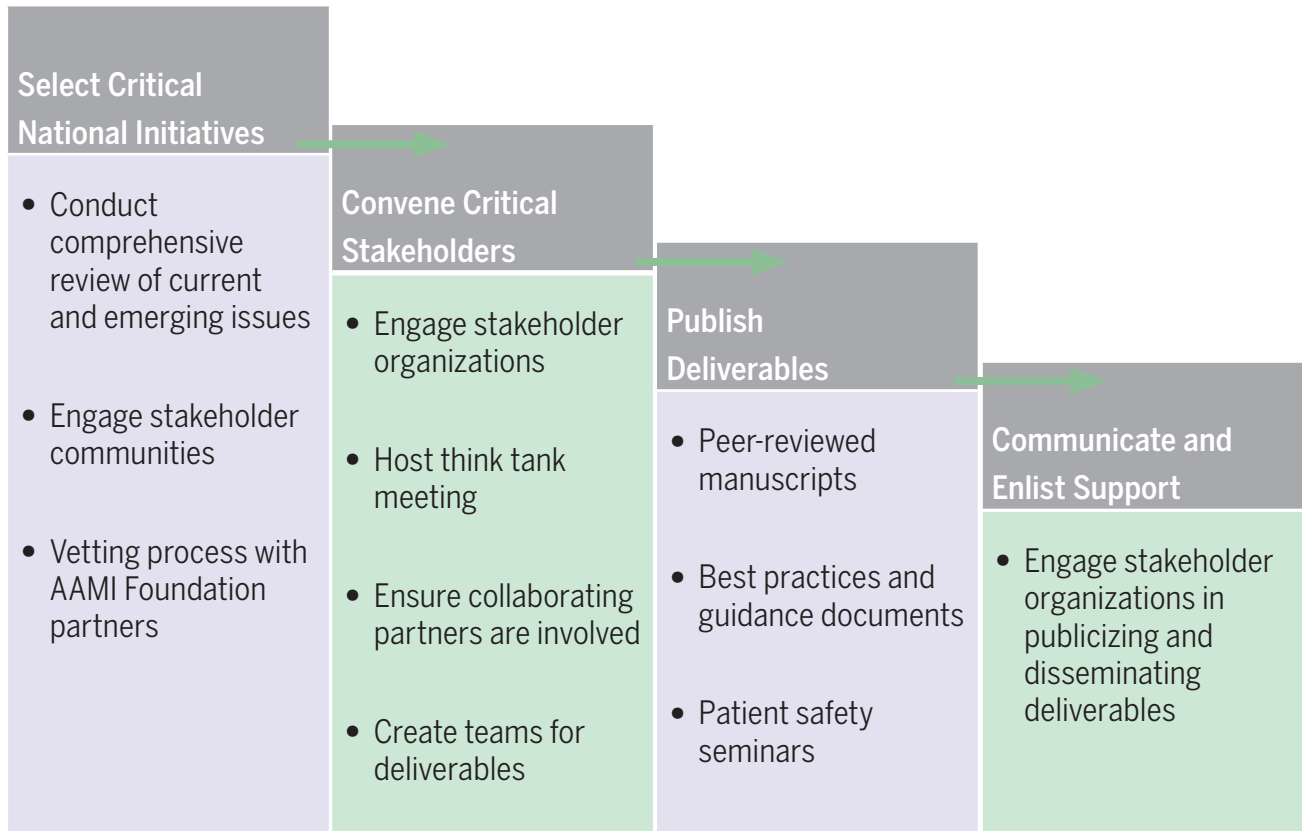
Whitman was fortunate: He told his own story as a near-miss survivor and an advocate for continuous monitoring. For

others—15-year-old Lewis Blackman, 11-year-old Leah Coufal, 18-year-old Amanda Abbiehl, and John LaChance, a retired naval officer and Sunday school teacher—it was left to their families to bear witness to the tragic, but preventable, deaths of their loved ones. They, too, pressed hospitals to implement continuous electronic monitoring to protect all patients on opioids.

Whitman, who is now a law enforcement instructor at Van Buren Tech in Lawrence, MI, found the work of the National Coalition “eye-opening.” “It gave me a better understanding of what is possible and some of the challenges that healthcare providers face,” he said. “More importantly, I learned how long changes take! That is the most troubling.

“Even though I am not involved in the healthcare industry, I still speak to groups to promote the monitoring of patients on opioids,” Whitman added. “I would like to see more press and conferences dedicated to this important crisis. I would tell my story and speak to any group to make a difference.”

# How the AAMI Foundation Selects and Builds National Coalitions



## From a Vision Statement to Best Practices, Education, and Advocacy



“The majority of stakeholders agree that continuous electronic monitoring must be made available to ALL patients on parenteral opioids and not just those meeting risk criteria.”

—*Opioid Safety & Patient Monitoring:  
Conference Compendium*

### Vision Statement of the National Coalition to Promote Continuous Monitoring of Patients

Shortly after the kickoff event, the National Coalition finalized a vision statement, which focused on patients receiving parenteral opioids, such as PCA and neuraxial opioids, as a first step toward monitoring all patients on opioids using a staged approach. Sixteen organizations immediately supported the statement:

“We recommend improving the safety for non-do-not-resuscitate (DNR)\* patients receiving parenteral opioids by supplementing ongoing assessments of sedation level and respiratory status with continuous electronic monitoring and opioid-sparing strategies (i.e., multimodal analgesia) for timely detection of respiratory decompression. Experience from early adopters demonstrates that continuous respiratory monitoring combined with education, culture change, and process improvements—including effective management of clinical alarms—increases the quality of patient care in a financially sustainable manner.”

**“Staging the approach:** Hospitals may implement this vision by using a staged approach to address the necessary components, cited above, that are key to success, and by implementing continuous electronic monitoring for patients involved under The Joint Commission’s Sentinel Event 49.

“\*When deemed appropriate by hospital policy.”

Endorsements for the National Coalition's Vision Statement	
1	American College of Clinical Engineering (ACCE)
2	American Association of Nurse Anesthetists (AANA)
3	American Association for Respiratory Care (AARC)
4	American Society for Pain Management Nursing (ASPMN)
5	Anesthesia Patient Safety Foundation (APSF)
6	A Promise to Amanda
7	Consumers Advancing Patient Safety (CAPS)
8	Hospital Quality Institute (HQI)
9	Infusion Nurses Society (INS)
10	Institute for Safe Medical Practices (ISMP)
11	Leah's Legacy
12	Mothers Against Medical Error
13	Physician-Patient Alliance for Health & Safety (PPAHS)
14	Premier Safety Institute
15	CHI Health–St. Francis
16	San Diego Patient Safety Council



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“We look forward to partnering with all stakeholders toward a comprehensive solution to achieve the goal of zero patient deaths due to opioid-induced respiratory depression.”

—**Mary Logan**, AAMI president and CEO emeritus,  
**Marilyn Neder Flack**, executive director emeritus of the AAMI Foundation, and  
**Sarah Lombardi**, former program director of the AAMI Foundation,  
*Opioid Safety & Patient Monitoring: Conference Compendium*



## Strategies to Overcome Financial, Cultural, Educational, and Workflow Barriers

The National Coalition kickoff event featured breakout sessions to acknowledge and develop strategies for overcoming four barriers to adopting continuous electronic monitoring:

1. Financial barriers
2. Cultural barriers
3. Educational barriers
4. Workflow barriers

A key message emerged from these sessions: One size does not fit all. Healthcare systems must consider how continuous monitoring fits within their real and perceived environments—and purposefully address the challenges. After the event, the National Coalition committed to promoting strategies shared by leading healthcare systems to help them do just that. A synopsis of the ideas:

- **Measure return on investment.** Before implementing continuous electronic monitoring, collect baseline data on opioid-related rescue events, patient transfers to ICUs, and, if possible, the cost of transferring patients to higher levels of care. After implementation, collect and compare clinical and financial outcomes. Leverage payment models and reimbursements that reward quality care.
- **Resolve cultural concerns.** Verify the reliability of network connectivity and information systems to effectively support continuous electronic monitoring. Mitigate the ergonomic impact of alarm signals on clinicians and patients by using alarm management strategies.
- **Educate clinicians—and patients.** Develop the competencies of multidisciplinary teams of caregivers so they understand how continuous monitoring technology works, why to use it, and how to interpret data, assess patient sedation levels, and manage alarm system limits. Educate patients and family members to counter resistance to wearing monitoring devices. Explaining that the technology can save lives is a powerful incentive for them.
- **Clarify policies around workflow changes.** Develop communication models for how clinicians receive and respond to alarm signals and alerts. Ensure that there is clear understanding about who responds to primary and secondary alarm messages, whether these messages come from a central monitoring system or via pagers.

## Educating and Advocating for Patient Safety

The National Coalition made a two-year commitment, later extended by two years, to educate and advocate for continuous electronic monitoring. With the Foundation, the National Coalition engaged healthcare provider professional societies to raise awareness about this solution. The message was amplified with case studies and a Safety Innovations series of publications that present the experiences, outcomes, best practices, and insights of leading healthcare systems that had adopted the technology.

The AAMI Foundation also convened three annual regional events for healthcare system leaders to advocate for action on a range of patient safety issues, including opioid-related safety. The Foundation engages the healthcare community in solving healthcare issues that are complex and multidisciplinary, and that require a systems approach. In this vein, the Foundation also engaged health system leaders at these three regional events in its other initiatives with National Coalitions: alarm management and infusion therapy safety.

In the final two years of this National Coalition, the Foundation also presented a series of monthly patient safety seminars (webinars) to educate practitioners about opioid-related adverse events, the continuous monitoring solution, and strategies to overcome barriers to successful adoption. Continuing education credits were awarded as an incentive to participate in these seminars.

Unique to this National Coalition, the AAMI Foundation also created a national campaign to raise awareness about opioid safety and promote continuous electronic monitoring among patients and families.

## Making an Impact

In 2016, the AAMI Foundation won a “Power of A” Gold Award from the ASAE (American Society of Association Executives), which recognizes associations that go above and beyond their everyday mission to undertake initiatives that benefit America and the world. The award recognizes the achievements of the National Coalition to Promote Continuous Monitoring of Patients on Opioids.

In 2017, the AAMI Foundation awarded a \$40,000 Mary K. Logan Research Grant to a team at the Cincinnati Children’s Hospital Medical Center in Ohio to fund a project aimed at developing evidence- and consensus-based guidelines for the use of continuous pulse oximetry and cardiorespiratory monitoring in hospitalized children. This was the inaugural year of funding for the grant program, which honors AAMI’s president and CEO emeritus.

The Cincinnati team won a second Mary K. Logan Research Grant in 2019 to engage clinician stakeholders using qualitative and survey methodologies to inform the design of an implementation and diffusion strategy for pediatric monitoring guidelines. They also will create and

assess the acceptability and usability of a stakeholder-informed toolkit for implementing pediatric monitoring guidelines.

“In the long term, we intend to apply the findings from this project to children’s hospitals across the nation,” said Amanda C. Schondelmeyer, MD, the project lead and assistant professor of pediatrics at the University of Cincinnati. “We have a series of recommendations for using continuous cardiorespiratory and pulse oximetry monitors for children, for which we will develop a toolkit and a dissemination plan. We are then poised to implement these recommendations through existing pediatric hospital research networks, like the Pediatric Research in Inpatient Settings Network, and at children’s hospitals across the country.”

“We have a series of recommendations for using continuous cardiorespiratory and pulse oximetry monitors for children, for which we will develop a toolkit and a dissemination plan. We are then poised to implement these recommendations...”

—Amanda C. Schondelmeyer, MD  
Assistant Professor of Pediatrics  
University of Cincinnati



## Reflections from the Field

### Learning About Risk

“ My work with this coalition introduced this risk to me—I hadn’t heard about it before! I shared this risk during capital planning at our hospital. I am based in Canada, so capital funding allocations are more closely scrutinized. They can’t be charged back to the patient or insurer, so we have to build a strong business case.”

—**Sonia Pinkney**, manager of medical engineering at University Health Network in Toronto

### A Big Focus for Leaders

Opioid monitoring challenges are a “really big focus” for leaders at SmithsMedical.

“ I think one never knows how bad this crisis really is until folks are impacted directly while we care for patients or it impacts us personally. This crisis is huge and the coalition work definitely reinforces what I have learned over the past several years. Our government affairs team is very much in Congress’s ear about this issue and problem-solving ideas.”

—**Kathy Puglise**, clinical manager at SmithsMedical in Albuquerque, NM

### Outcomes that Matter

“ It’s great that AAMI keeps the focus on outcomes that matter—alarm fatigue, telemetry, and especially reducing the tragic outcomes of opioid-induced respiratory depression. We are taking steps to improve monitoring. We are about to expand use of capnography to the bedside by means of wireless technology.”

—**Paul Mulligan**, system medical safety pharmacist at BJC HealthCare—St. Louis

## A Robust Collection of Knowledge

2010–18

The AAMI Foundation is a great source of knowledge for improving patient safety and quality. Within our own patient safety collaborative, we have leveraged speakers and materials from the Foundation's Patient Safety Initiatives, including getting updates on the initiatives at our annual conference. We again added the AAMI Foundation to the annual conference agenda because a member hospital wanted to hear the latest on the continuous monitoring of patients on opioids."

—**Rich Zink**, Managing Director of Operations  
Purdue University



### The Call to Action

Call to Action and Practical Strategies  
for Executives, Risk Managers,  
and Clinical Leaders

#### [Opioid Safety & Patient Monitoring: Conference Compendium](#)

Williams, J.S. (2015)

This report summarizes the presentations, breakout sessions, and proceedings of the November 2014 kickoff meeting of this National Coalition. The 68-page report includes:

- Eight case studies from healthcare systems and hospitals that have successfully implemented continuous electronic monitoring—and other tools to detect physiological deterioration in hospitalized patients.
- Stakeholder perspectives on the challenges of adopting continuous electronic monitoring.
- Financial, educational, cultural, and workflow barriers to consider—and advice for overcoming them.
- Patient stories that illustrate the human tragedies of preventable harm.

[\*Safeguarding Patients with Surveillance Monitoring\*](#)

Dartmouth-Hitchcock Medical Center (2013)

A series of adverse events led clinicians and researchers at Dartmouth-Hitchcock Medical Center to a humbling conclusion: Healthcare professionals were handicapped by their limited ability to detect signs of patient deterioration and to predict which patients were at risk of adverse events in the first place. Dartmouth-Hitchcock responded with stopgap measures to safeguard patients. Then, the medical center seized on new technology to implement universal surveillance monitoring systemwide.

[\*Implementing Capnography in Low-Acuity Settings\*](#)

Virtua (2016)

Virtua, a healthcare system with more than 1,000 beds across three hospitals, prioritized narcotic safety in 2013. This paper details Virtua's journey of implementing noninvasive capnography, highlighting how barriers were overcome, sharing key factors for success, and describing the ongoing challenges of effectively monitoring patients receiving intravenous opioids for pain management.

[\*Healthcare System Takes Bold Step with Continuous Monitoring\*](#)

Vockley, M. (2017)

Community Health Network in Indianapolis noticed an increased frequency of interventions for patients experiencing opioid-induced over-sedation following inpatient surgery. The health network first implemented continuous monitoring for all patients using patient-controlled analgesia pumps—and later extended this solution to all postoperative patients and other patient populations.

[\*Vital Signs Monitoring Leads to Increased Patient Safety and Workflow Efficiency\*](#)

Vockley, M., & Kloewer, T. (2017)

Methodist Specialty and Transplant Hospital in San Antonio cares for many high-acuity patients. Historically, the hospital had monitored bariatric patients with identified risk factors for deterioration. A planned upgrade of pulse oximeters turned into an unexpected opportunity to monitor all bariatric and transplant patients—and many other patients—comprehensively. A workflow analysis demonstrated continuous electronic monitoring reduced the time nurses spent on traditional vital signs monitoring, giving them more time to spend on patient care.

**National Educational Video**



The National Coalition to Promote the Continuous Monitoring of Patients on Opioids ended with a bang in 2018 with a national educational video, [\*Pain Management in Hospitals: What Patients and Families Need to Know\*](#). The seven-minute video urged patients and families to ask their healthcare providers whether they would be monitored continuously if they were given opioids for pain management in the hospital. Major national and local television network aired the video, which reached over 50 million households.



## Spreading the Word




**On Social Media**

News media and social media are key to informing all those who are concerned about patient safety that there are tools developed by national experts to assist in reducing harm with infusion therapy. Over the four years of this effort, AAMI and the AAMI Foundation have made use of Facebook, Twitter, and video platforms to get the word out about the recommendations and solutions available to the clinical community.

## Outreach to Healthcare Technology Managers

Healthcare technology management (HTM) professionals are the people who help evaluate health technology before it is purchased, and then help train clinicians, collaborate with information technology specialists to install the equipment, and monitor and service the equipment throughout its life cycle.

The National Coalition's messages about continuous electronic monitoring reached HTM professionals through AAMI Foundation and AAMI publications and communications, and in targeted messages like this:



**Education and  
Knowledge Sharing**  
AAMI Foundation Annual  
Regional Events  
2015–17

The AAMI Foundation provided live, interactive learning experiences during three annual regional events, where sessions highlighted continuous electronic monitoring and work by the Foundation's National Coalition for Infusion Therapy Safety and National Coalition on Alarm Management.

**Continuous Electronic Monitoring Presentations**

**Boston • Oct. 15, 2015 • 85 participants**

**Developing a Successful Program for the Use of Capnography Monitoring During Opioid Administration**

**Harold Oglesby**, manager of pulmonary medicine at St. Joseph's/Candler Health System

**Continuous Patient Monitoring in an Academic Medical Center**

**Michael Fraai**, executive director of biomedical engineering and device integration at Brigham and Women's Hospital

**Continuous Monitoring**

**Candice Friestad**, director of clinical informatics at Avera McKennan Hospital & University Health Center

**It's Not Just About the Alarms: Reducing Failure to Rescue**

**Christina Taylor**, nurse manager, and **Kristina Foard**, nurse practice specialist at Wake Forest Baptist Health

**Surveillance Monitoring at Dartmouth-Hitchcock**

**George Blike**, chief quality and value officer, professor of anesthesiology, and medical director of the Patient Safety Training Center at Dartmouth-Hitchcock Health, and **Susan McGrath**, director of patient surveillance research and development in the Department of Anesthesiology at Dartmouth-Hitchcock Health

**Successful Strategies to Implement Continuous Respiratory Monitoring in Low-Acuity Hospitalized Patients**

**Frank Overdyk**, chair of the National Coalition to Promote Continuous Monitoring of Patients on Opioids; **Susan McGrath**, director of patient surveillance research and development in the Department of Anesthesiology at Dartmouth-Hitchcock Health; and **George Blike**, chief quality and value officer, professor of anesthesiology, and medical director of the Patient Safety Training Center at Dartmouth-Hitchcock Health

**Continuous Patient Monitoring at Dartmouth-Hitchcock: Business Case**

**George Blike**, chief quality and value officer, professor of anesthesiology, and medical director of the Patient Safety Training Center at Dartmouth-Hitchcock Health

### It's All About People: Optimization of Continuous Monitoring in the Hospital

**Perry An**, hospitalist and clinical associate professor of medicine at Tufts University School of Medicine; physician director of Epic implementation and chief operating officer in the Division of Hospital Medicine, and cochair of the Department of Medicine Quality Improvement Committee at Newton-Wellesley Hospital

### Enhancing Recovery After Surgery: We Are Building a Cathedral

**Philip Corvo**, chairman of surgery, director of surgical critical care, and designated institutional office at St. Mary's Hospital in Waterbury, CT; governor at large at the American College of Surgeons; and president and cofounder of the Connecticut Surgical Quality Collaborative

### Continuous Monitoring of Patients on Opioids

**Paul Milligan**, system medication safety pharmacist at BJC Healthcare

### Continuous Vital Sign Monitoring in Low-Acuity Hospital Settings: Why and How

**Frank Overdyk**, chair of the National Coalition to Promote Continuous Monitoring of Patients on Opioids

### What System, Structural, and Technological Changes Are Necessary to Capture Real-Time, Critical Data of Early Deterioration in Adult Postoperative Inpatients, to Prevent Failure to Rescue?

**Bradford Winters**, medical director of postgraduate critical care residency for physician assistants and associate professor of anesthesiology and critical care medicine at Johns Hopkins Medicine; **Tim Xu**, research fellow at Johns Hopkins Medicine; **Maria Cvach**, director of policy management and integration at The Johns Hopkins Health System and clinical safety specialist at the Armstrong Institute for Patient Safety and Quality, and **Sue Carol Verrillo**, nurse manager of Zayed 11 East at The Johns Hopkins Hospital

Continuous Electronic Monitoring Presentations

San Diego • Nov. 18–19, 2017 • 95 participants

**Continuous Vital Sign Monitoring: It's Not Just for ICUs Anymore!****Frank Overdyk**, chair of the National Coalition to Promote Continuous Monitoring of Patients on Opioids**The Weak Link in the Rapid Response System****Michael DeVita**, director of critical care at Harlem Hospital Center and past president of the International Society for Rapid Response Systems**Use of a Wireless Continuous Pulse Oximetry System for Improved Patient Safety****Robin Evans**, unit director of the 9 North orthopaedics unit at UPMC Presbyterian**Respiratory Compromise Capnography Performance Improvement: Barton's Journey****Mary Kay Sennings**, pulmonary services manager at Barton Memorial Hospital, and **Dawn Evans**, director of patient safety at Barton Health Healthcare Engineering at Purdue University**Patient Safety Seminars**  
2015–18

Beginning in 2015, the AAMI Foundation hosted a series of patient safety seminars (webinars) that showcased research, best practices, and case studies of initiatives in healthcare organizations to promote continuous monitoring of patients on opioids. The Foundation offered Certificates of Participation as a continuing education credit for each seminar.

**Successful Strategies to Implement Continuous Respiratory Monitoring in Low-Acuity Hospitalized Patients** • November 2015**Frank J. Overdyk**, MSEE, MD, chair of the National Coalition to Promote Continuous Monitoring of Patients on Opioids, **Susan McGrath**, PhD, director of patient surveillance research and development in the Department of Anesthesiology at Dartmouth-Hitchcock Medical Center, and **George T. Blike**, MD, MHCDS, chief quality and value officer and professor of anesthesiology at Dartmouth-Hitchcock Medical Center**Saving Lives in the Medical Surgical Unit and Establishing a Successful Capnography Monitoring Program for Patients Receiving Opioid Medications** • March 2016**Tina Tucciarone**, RN, MSN, CPHRM, corporate director of risk management at Virtua, and **Harold Oglesby**, RRT/RCP, manager of pulmonary medicine at St. Joseph's/Candler Health System**What System, Structural, and Technological Changes Are Necessary to Capture Real-Time, Critical Data of Early Deterioration in Adult Post-Operative Inpatients, to Prevent Failure to Rescue?** • May 2016**Bradford Winters**, MD, PhD, FCCM, associate professor of anesthesiology and critical care medicine at Johns Hopkins Medicine; and **Sue Carol Verrillo**, RN, MSN, CRRN, nurse manager of Zayed 11 East at The Johns Hopkins Hospital

### Continuous Monitoring of Patients on Opioids: Initiatives at Methodist Specialty and Transplant Hospital and Community Health Network

• August 2016

**Theresa Kloewer**, MSN, RN, vice president of nursing at Methodist Specialty and Transplant Hospital, and **Julie Painter**, MSN, RN, ONC, clinical nurse specialist at Community Health

### Continuous Monitoring of Patients on Opioids: Initiatives at Evergreen-Health • September 2016

**Nancee Hofmeister**, MSN, RN, BE-BC, vice president of nursing and chief nursing officer at EvergreenHealth, and **Debra Ghazan**, BSN, RN, CNML, clinical nurse manager on the ortho, spine, and neuro unit at EvergreenHealth

### Continuous Monitoring of Patients on Opioids: Initiatives at BJC Healthcare • October 2016

**Paul Milligan**, PharmD, medication safety pharmacist at BJC Healthcare

### Respiratory Compromise: Capnography Performance Improvement

• June 2017

**Christine O'Farrell**, BSN, CPHQ, CPHRM, director of quality management, **Mary Kay Sennings**, RRT, pulmonary services manager, and **Dawn Evans**, MSN, RN, PHN, CPP, director of patient safety and clinical education at Barton Health

### Using Continuous Monitoring for Early Recognition of Patient Deterioration in the Post-Op Population ... It Just Makes Sense • January 2018

**Jessica Gabriele**, BS, MSN, RN-BC, CNL, South 6 nurse, and **Lynn Janksy**, MSN, RN-BC, professional development specialist at Middlesex Health





## Going Deeper

Articles and Case Studies from  
AAMI and the AAMI Foundation  
2013–18

### **BI&T (Biomedical Instrumentation & Technology), AAMI's peer-reviewed journal**

[\*Silent Danger: Opioids, PCA Pumps, and the Case for Continuous Monitoring\*](#)  
Vockley, M. (November/December 2013)

[\*Saving Lives, Saving Families: Continuous Monitoring for Patients on Opioids\*](#)  
Williams, J. (January/February 2015)

[\*Case Study: Implementing Early Detection of Patient Deterioration in Medical and Surgical Units\*](#)  
Miller, P.J. (November/December 2016)

[\*A Centralized Monitoring Approach to Pulse Oximetry for Patients on Opioids\*](#)  
Miller, P.J. (September/October 2017)

[\*Case Study: Continuous Monitoring of Patient Vital Signs to Reduce 'Failure-to-Rescue' Events\*](#)  
Miller, P.J. (January/February 2017)

[\*Research: Continuous Surveillance of Sleep Apnea Patients in a Medical-Surgical Unit\*](#)  
Supe, D., Baron, L., Decker, T., Parker, K., Venella, J., Williams, S, Beaton, K., & Zaleski, J. (May/June 2017)

[\*Case Study: Continuous Bedside Capnography Monitoring of High-Risk Patients Receiving Opioids\*](#)  
Milligan, P.E., Zhang, Y., & Graver, S. (May/June 2018)

[\*Review: Continuous Monitoring to Detect Failure to Rescue in Adult Postoperative Patients\*](#)  
Verillo, S.C., & Winters, B.D. (July/August 2018)

### **Horizons, AAMI BI&T biannual supplement**

[\*Improving Patient Safety through the Use of Nursing Surveillance\*](#)  
Guiliano, K.K. (Spring 2017)

[\*Using Middleware to Manage Smart Alarms for Patients Receiving Opioids\*](#)  
Zeleski, J., Venella, J. (Spring 2017)

### **AAMI Podcasts**

[\*Episode 7: Continuous Electronic Monitoring\*](#)  
(Feb. 19, 2015)

[\*Episode 26: Building a Case for Continuous Electronic Monitoring\*](#)  
(May 30, 2018)

**AAMI News, AAMI's Monthly Newsletter**

[Industry Leaders Describe Barriers and Solutions to Continuous Monitoring](#)  
(Aug. 1, 2015)

[AAMI Foundation Launches Campaign to Promote Continuous Monitoring of Patients on Opioids](#)  
(Nov. 6, 2014)

[Remote Patient Monitoring Shows Significant ROI, Report Says](#)  
(Sept. 1, 2018)

[Mary K. Logan Research Grant Supports Continuous Monitoring Research](#)  
(Dec. 1, 2019)

## Conclusion

It takes leaders and advocates to challenge the status quo. The National Coalition to Promote Continuous Monitoring of Patients on Opioids exemplified leadership and advocacy at its best.

Rather than ignoring the silent danger of patient harm from respiratory depression, National Coalition participants sounded a warning. Leading healthcare systems and practitioners examined the evidence, explored the risks, and identified continuous electronic monitoring as a fundamental component of any meaningful solution to mitigate the risk of respiratory depression.

“I truly feel like my life was spared so I can take on an advocate role for continuous electronic monitoring. I do this to draw attention for all the patients who died such a preventable death.”

—Matt Whitman, patient advocate



When they implemented this solution in their healthcare settings, they documented their experiences from many vantage points, including:

- Patient safety, outcomes, and quality of care
- Decision support for clinicians
- Impact on clinical practice
- Clinician education and training
- Alarm parameters and alarm burden
- Clinician satisfaction
- Opioid dosages
- Technology integration
- Insurance liability costs
- Financial return on investment

This work represents a resounding affirmation that continuous electronic monitoring is indispensable for keeping patients on opioids safe. Equally important, a powerful business case is truly a call to action.

There is no one-size-fits-all way of implementing continuous monitoring technology. Every healthcare institution needs to select equipment and tailor configuration to their size and patient populations. But the accomplishments of the trailblazers in the National Coalition mean that institutions considering this solution do not have to start with a blank slate.

AAMI and the AAMI Foundation thank everyone who participated in championing continuous electronic monitoring to reduce preventable patient harm. We invite you to share this Anthology with your colleagues and peers—and to advocate for new C-suite champions of this solution.

# National Coalition for Continuous Monitoring of Patients on Opioids

2014–18

## Co-Convening Organizations

- American Association for Respiratory Care (AARC)
- American Association of Critical-Care Nurses (AACN)
- American Association of Nurse Anesthetists (AANA)
- American College of Clinical Engineering (ACCE)
- American Society for Healthcare Risk Management (ASHRM)
- American Society for Pain Management Nursing (ASPMN)
- Anesthesia Patient Safety Foundation (APSF)
- Consumers Advancing Patient Safety (CAPS)
- CHI Health
- ECRI Institute
- Healthcare Technology Foundation (HTF)
- Hospital Quality Institute (HQI)
- Infusion Nurses Society (INS)
- Institute for Healthcare Improvement (IHI)
- Institute for Safe Medication Practices (ISMP)
- Leah's Legacy
- Mothers Against Medical Error
- Physician-Patient Alliance for Health & Safety (PPAHS)
- Premier Safety Institute
- Promise to Amanda
- Regenstrief National Center for Medical Device Informatics (REMEDi)
- San Diego Patient Safety Council
- The Joint Commission
- VA National Center for Patient Safety

## Corporate Partners

### *Diamond Level*

- BD
- CU Medical

### *Platinum Level*

- Baxter
- B. Braun Medical Inc.
- Ivenix
- Smiths Medical

### *Gold Level*

- Cerner

### *Bronze Level*

- Fresenius Kabi
- Safen Medical Products
- Zyno Medical

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