



Preventing Opioid-Induced Respiratory Depression (OIRD) in Medical Surgical Patients: From Near Miss to a Technology-Enabled Interprofessional Process Leading to Improved Outcomes

Thomas P. Cleary, BSN, RN
Scott D. Alcott, MSN, RN

- Each year approximately 730,000 in-hospital cardiopulmonary arrests occur
 - ~ 50% received opioids prior to the arrest (Overdyk, 2011).

- Patients' pain management needs and satisfaction must be balanced with safety. (Milligan E., Zhang, Y., & Graver S., 2018, p.208).

Overdyk, F. (2011) Improving outcomes in med-surg patients with opioid induced respiratory depression. *American Nurse Today*, 6(11).

Milligan E., Zhang, Y., & Graver S. (2018). Continuous bedside capnography monitoring of high-risk patients receiving opioids. *Biomedical Instrumentation & Technology*, 52(3), 208-217

Why etCO₂ Monitoring - Literature

- Pulse Oximetry has historically been the standard measure of oxygenation
 - Often a LATE indicator of hypoxia

(Felhofer, 2013; Hutchinson & Rodriguez, 2008; Overdyke, 2011; The Joint Commission, 2012).

- Post-orthopedic surgery patients
 - etCO₂ detected respiratory depression in 146 patients
 - Pulse oximetry detected respiratory depression in **only** 6 patients

(Hutchinson & Rodriguez, 2008).

- “The most severe adverse OIRD events were reduced when capnography was implemented on a high-risk group of patients receiving supplemental oxygen and having a concurrent order for a parenteral opioid”

(Milligan E., Zhang, Y., & Graver S., 2018, p.216).

Felhofer, K. (2013). Developing a respiratory depression scorecard for capnography monitoring. *Innovations in Pharmacy*, 4(3).

Hutchinson R., & Rodriguez L. (2008). Capnography and respiratory depression. *American Journal of Nursing*, 108(2), 35-39.

Milligan E., Zhang, Y., & Graver S. (2018). Continuous bedside capnography monitoring of high-risk patients receiving opioids. *Biomedical Instrumentation & Technology*, 52(3), 208-217.

Overdyk, F. (2011) Improving outcomes in med-surg patients with opioid induced respiratory depression. *American Nurse Today*, 6(11).

The Joint Commission (2012). Sentinel Event Alert Issue 49. http://www.jointcommission.org/assets/1/18/SEA_49_opioids_8_2_12_final.pdf

Why etCO₂ Monitoring – Professional Standards & Guidelines

Professional Standards & Guidelines

“End-tidal carbon dioxide monitoring is more likely to detect hypercapnia and respiratory depression”

– *American Society of Anesthesiologists*

“Capnography is a superior way to evaluate ventilation...”

– *American Society for Gastrointestinal Endoscopy*

“Guidelines recommend quantitative waveform capnography for adults to confirm endotracheal tube placement, to monitor CPR quality and to detect ROSC “

- American Heart Association Guidelines for CPR and ECC.

“Continuously monitor oxygenation, ventilation, and circulation during procedures that may affect the patient’s physiological status” ... “Improve recognition and response to changes in a patient’s condition”

– *The Joint Commission*

“Use capnography to detect respiratory changes caused by opiates...”

– *Institute for Safe Medication Practice*



“...non-anesthesiologist practitioner shall be familiar with the use and interpretation of capnographic waveforms to determine the adequacy of ventilation during deep sedation”

– *California Society of Anesthesiologists (CSA) 2009, Guidelines for Deep Sedation by Non-anesthesiologists*

Case Study – Near Miss

Why etCO₂ Monitoring

- A young patient was admitted to the general/medical surgical unit at EMCM.
- The patient was known to be opioid tolerant based on her H&P. Her symptoms required the administration of opioid analgesics.
- At the time of her admission to the floor she was placed on continuous pulse oximetry. A 4mg dose of IV dilaudid was given for pain.
- The patient was accompanied by her significant other. As anticipated, the patient was sleeping and resting comfortably. Her initial assessment and vitals were within normal limits.
- About 45 min later, the significant other noticed a change in the patient's complexion and cognition. He called for the nurse.
- The nurse arrived to find the patient unresponsive and cyanotic. Upon further assessment she was found to be asystolic and a code was called.
- It was determined by a RCA that this patient became hypercapnic due to respiratory depression secondary to the opioid analgesia.
- This patient ultimately was sent to the ICU and successfully resuscitated and recovered despite the event.

Outcome Objectives

1. Reduce and/or eliminate unplanned administration of a reversal agents for OIRD
2. Reduction of Rapid Response Team (RRT) calls and/or Code Blues (cardiac arrest) related to OIRD
3. Reduction of patients needing to be transferred to the ICU related to OIRD.

How? - Show me the Money!

- One of the biggest challenges teams face when initiating a new pilot program is... Who is going to pay for this?
- Does your organization have a grant program to apply for funding?
 - In January 2016 we applied for an Albert Einstein Society Innovative Program Grant to fund our project.
 - Allowed us to purchase 10 Medtronic Cap 20i machines.
- Capital funding
- Training cost
- On-going operational expenses
- Bake Sale...?

Proposed Project Budget

Income / Revenue	
Patent Charges	NA
Outside Contracts	NA
Total Revenue	NA

Expenses			
Personnel / Position	% of Time Spent on Project	Total Salary	Amount to be met through AES Funding
Nurse Educator	10%	\$82,000	\$8,200
Total Personnel			\$8,200
Non Personnel	Description	Total	Amount to be met through AES Funding
Professional fees (contract, consultant)	NA		
Supplies	Naunl Canulas for ETCO ₂	\$1000	\$0
Travel and Meetings	NA		
Training	45 RNs for 1 hour of training	\$1,575	\$1,575
Evaluation	Included as part of Nurse Educator salary		
Equipment	ETCO ₂ - Monitors - 15 @ \$2195 ea	\$32,925	\$32,925
Other (please describe)			
Total Non-Personnel			\$34,500
Total			

Total Revenue	\$0
Total Expenses	\$43,700
Total Grant Request	\$43,700

- To Risk Stratify or Not?
- How to Risk Stratify
- How frequent is frequent enough for vital signs and assessment
- Role of Pulse Oximetry
- Role of Capnography
- Available tools

**Respiratory Monitoring of
Patients Outside the ICU
Guidelines of Care Tool Kit**
June 2014

San Diego Patient Safety Council



Inclusion Criteria for Protocol/ OIRD Assessment in Interactive IView

Criteria

High Risk: Patients that meet 2 or more of six criteria-- **Monitor etCO₂**

Moderate Risk: Patients that meet at least 1 of the six criteria– **Consider etCO₂ Monitor**

Low Risk: Patients that do not meet any of the six criteria– **etCO₂ NOT indicated**

- 1) Opioid Infusion Therapy—PCA (with and without Basal), CADD pump or Epidural infusion.
- 2) Recent Unplanned Administration of Reversal Agents.
- 3) Known or Suspected OSA/Sleep Disorder as assessed by STOP-BANG score ≥ 6
- 4) Opioids and/or Concomitant sedatives.
- 5) Stacking (i.e. multiple modalities used with overlapping half-life and potencies) repeat IV/IM opioids, addition of PRN benzodiazepine/sedative.
- 6) General Anesthesia in the past 1 to 24 hrs.

- Multifaceted Approach (Blended Learning)
- Included RNs and Respiratory Therapy
- Online HealthStream module created and to be completed prior to the hands-on class.
 - ANCC Course with CEs for Nursing (Basic & Advanced)
 - AARC Course with CEs from Respiratory Therapy (Basic and Advanced)
 - Product-specific training through vendor web link
- Two 1-hour hands-on training class led by Einstein Nursing Education and Medtronic's clinical team.
 - **Key – Case Study Approach**
- Providers – Memo written by Chair of Anesthesiology disseminated to all medical staff through Medical Staff affairs
 - Chairs discussed at Medical Staff Board and Divisional Meetings

- Discuss with patient the purpose & procedure
- Provide card and review key points
- Show video on Get Well Network
- Reinforce as needed
- Remain patient-centered, remove if patient refuses & document education

MONITORING YOUR BREATH MATTERS. **HERE'S WHY.**

Microstream™ Capnography



Breath monitoring can help save lives

Breath monitoring, or capnography, measures how much you're breathing. Some medications can slow down your breathing and heart rate. If that happens, an alarm will let your doctor or nurse know they should come and help.

How breath monitoring works

The plastic tubing on your face is connected to a capnography monitor. The monitor measures your breath each time you breathe out. An alarm will let your doctor or nurse know if your breathing:

- Becomes shallow
- Speeds up
- Slows down

Why the scoop over your mouth is important

The scoop over your mouth monitors breath from your mouth. The prongs in your nose measure breath from your nose. So if you switch between breathing through your nose and breathing through your mouth, you're always monitored.

The alarms are noisy — but necessary

The alarms let your doctor or nurse know if your breathing changes. Use the alarms as a reminder to take a deep breath.

Drinking liquids with breath monitoring

Sipping water or eating ice chips doesn't interfere with breath monitoring. However, your doctor or nurse will let you know when it's okay to do so.

How long your breath will be monitored

This is different for every patient. Generally, you'll be monitored until your doctor thinks your breathing is stable.



Visit VerifyEveryBreath.com to learn more about why monitoring with Microstream™ capnography is important.

- OIRD assessment – Every patient/every shift
- Medtronic's Clinical Product Specialist
 - Rounding on the floor for real-time clinical support and tracking
 - Continuing real-time education
 - Patient feedback
- Nurse Educators rounding on floor for first 24 hours and then daily for the 1st week
- Nursing and Respiratory leaders rounding
- Go-live support Job Aids
- Hard copies and electronic copies of the protocol
- Data Tracking tool

Alarm Management

- Alarm Fatigue
- IPI – is it useful in this patient population?
- When to act?

Vendor Choice

- Partnership
- Dedication to success of the pilot/initiative
- Collaborative education
- Active Dashboard

Data Collection

- How long can data be stored
- Method by which data is downloaded
- Are the results of the data distinct

Outcome/Process Measures – Success!!

- 80-85% compliance with the OIRD screening in real-time (first 90 days)

- July 2017 - December 2017
 - 100% reduction in Narcan administration.
 - 100% reduction in unplanned intubations.
 - 37% reduction in transfers to the ICU from GMF.
 - 58% total reduction in measured adverse outcomes.
 - Estimated \$144k in cost savings from the prevention of harm.

- Alarm fatigue was addressed by limiting or alleviating the High and Low false alarms that were being triggered by patients due to their mobility, independence and tolerance of opioids.

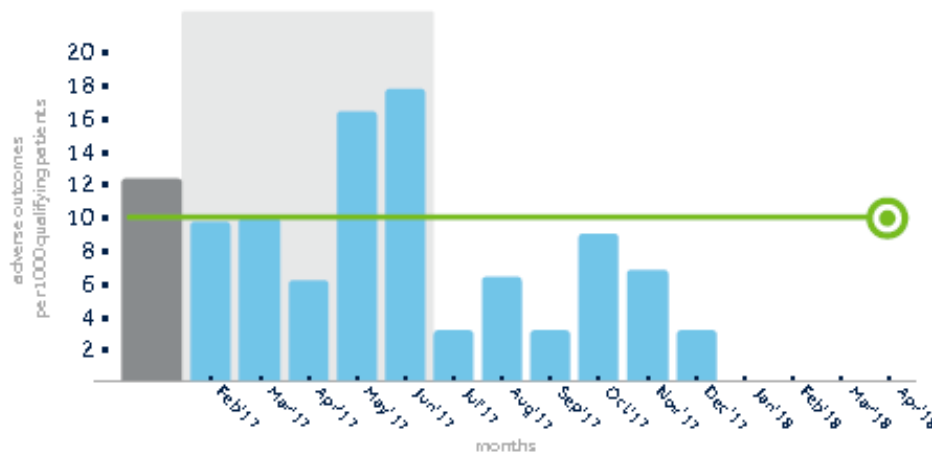
Outcome/Process Measures – Success!!



ADVERSE OUTCOMES TREND

6 months of participation since start of the measurement period

- Baseline average over 15 months
- Measured adverse outcomes
- 20% reduction target
- Grace period



\$36,994.80

GRANT DOLLARS SPENT ON 10 MEDTRONIC CAP20p MONITORS

\$2k

TOTAL SPEND ON GCF CAPNOGRAPHY CONSUMABLES

total spend includes any spend on GCF Capnography consumables since the start of the measurement period

\$ 144k

ESTIMATED SAVINGS BASED ON PATIENTS WHO DID NOT SUFFER AN ADVERSE OUTCOME

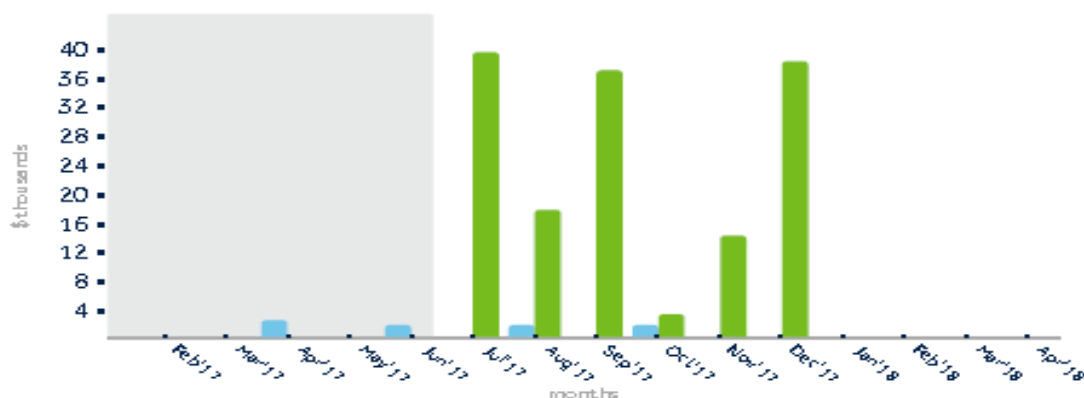
\$ 18k

Cost per patient to your hospital (default is \$18k^{1,3})

FINANCIAL SAVINGS TREND

6 months of participation since start of the measurement period

- Estimated savings based on patients who did not suffer an adverse outcome
- Spend on GCF Capnography consumables
- Grace period



June 2018 - Case Study

- Patient was brought to the floor at change of shift from an uneventful recovery in PACU.
- Reported from PACU nurse that the patient did require IV narcotics in PACU for comfort, which she received before coming to the floor.
- After report was given, the day shift nurse and night shift nurse on the floor proceeded to do a bedside handover.
 - Upon entering the room, the night shift nurse assessed that the patient was very somnolent and difficult to arouse.
 - Based on our current OIRD assessment process for all patients admitted to 3 East (and now 3 West) the patient ruled-in for etCO₂ monitoring via capnography which was initiated.
 - The initial reading on the monitor showed a CO₂ level of 72 (which is critical).
 - A rapid response was called and when the rapid response team arrived, with just the results from the capnography monitor the team was able to intervene with Narcan and BiPAP.
 - The patient slowly became arousable and her CO₂ dropped back down to a more normal level, allowing the patient to remain on the med/surg floor to continue her recovery and was eventually discharged in the expected time.

- Without capnography, this story could have had a much different outcome.
 - The patient could have needed difficult and painful needle sticks, additional labs, possibly a CT scan to rule out a stroke, intubation and a transfer to the ICU.
 - These interventions would have caused a great deal of stress to the patient and her family, a longer stay, and an extreme increase in the cost of her care.
- The bedside handover process utilized by our highly-skilled team led to immediate assessment using the OIRD protocol, and initiation of this essential intervention, **capnography monitoring**, saving this woman's life!

- First Place Winner – Delaware Valley Quality and Patient Safety Award – November 2018
- HAP-HIIN - Pennsylvania Patient Safety Authority Statewide Webinar Presenter in collaboration with Institute for Safe Medication Practices (ISMP), September 19, 2018.
[http://collab.hapquality.org/HAP/media/Archive/HiIN/ADE/Webinars/09.18.18%20ADE%20Preventing%20OIRD%20in%20Med.%20Surg.%20Patient/9-18-18_ADE_Preventing-Opioid-Induced-Respiratory-Depression-\(OIRD\)-in-Medical-Surgical-Patients_recording.mp4](http://collab.hapquality.org/HAP/media/Archive/HiIN/ADE/Webinars/09.18.18%20ADE%20Preventing%20OIRD%20in%20Med.%20Surg.%20Patient/9-18-18_ADE_Preventing-Opioid-Induced-Respiratory-Depression-(OIRD)-in-Medical-Surgical-Patients_recording.mp4)
- IHI National Forum December 2018 – Orlando, FL – Poster presentation
- IHI Patient Safety Congress 2019 – Houston, TX – Poster presentation
- Invited Panel Discussion –Vizient (PSO), Dallas, TX, April 2019
- Pennsylvania Patient Safety Summit – Seven Springs, PA – Poster Presentation, May 2019
- Invited Presentation - Premier Breakthrough Conference, June 2019
- Podium Presentation – AACN Trends in Critical Care, October 2019, Atlantic City, NJ

