Actionable Patient Safety Solution (APSS) #1: 
FAILURE TO RESCUE: POST-OPERATIVE RESPIRATORY DEPRESSION

The Performance Gap

Complications are inevitable and they are not always avoidable or the result of errors. However, when a patient dies because of a complication that was not recognized in a timely manner or treated appropriately, that death is preventable and is called "Failure to Rescue." In hospital mortality after surgery is higher than anticipated and has multiple factors that can be systematically addressed. Healthcare leadership is largely unaware of significant improvement in quality and safety of healthcare as well as cost savings that can be realized by actively addressing failure to rescue post-operative respiratory depression.

After the Institute of Medicine described failure to rescue as a key issue in healthcare quality in 2001, failure to rescue was identified as a key area for improvement in patient safety. A decade later, a study looked at patient safety indicators for 40 million hospitalized patients and concluded that many deaths and permanent disabilities could still be avoided if hospitals adopted safe practices and implemented systems that facilitate patient safety. The following patient safety indicators accounted for 68% of all failure-to-rescue patient safety events: death among surgical inpatients with serious treatable complications, pressure ulcer, post-operative respiratory failure, post-operative sepsis. The study further identified that the cost associated with post-operative respiratory failure alone in the U.S. Healthcare System is $2 billion.

While opioid use is safe for most patients, opioid analgesics are associated with adverse effects and cause respiratory depression in 0.5% of post-surgical patients, who often receive them for pain management. Of opioid-related adverse drug events – including deaths – that occurred in hospitals and were reported to The Joint Commission’s Sentinel Event database (2004-2011), 47% were wrong dosing medication errors, 29% were related to improper monitoring of the patient, and 11% were related to other factors including excessive dosing, medication interactions, and adverse drug reactions.

Failure to Rescue post-operative respiratory depressions can be prevented through appropriate pain management and dosing approaches, surveillance to identify patients at risk for Failure to Rescue, notification to providers of significant changes in patient condition, and automated decision support to ensure appropriate therapies are initiated in a timely manner. A landmark study published in January 2010 by Dartmouth-Hitchcock Medical Center demonstrated that clinicians using Masimo SET® measurement motion and low perfusion pulse oximetry and Patient SafetyNet Remote Monitoring and Clinician Notification System identified patient distress earlier, which decreased rapid response team activations by 65%, ICU transfers by 48%, and reduce ICU days by 135 days annually. A follow up report by Dartmouth in 2012 reported that since December 2007 no patients have died or had serious brain injuries as a result of respiratory depression from opioids. In addition, expanding monitoring to all general and thoraco-vascular post-surgical units produced similar results to those seen in the original orthopedic unit. They also reported savings of $58,459 saved per patient who was not transferred to the ICU in the original orthopedic unit ($76,044 vs. $17,585), equating to $1.48 million in annual opportunity cost savings in this one unit alone.

In 2011, the Anesthesia Patient Safety Foundation recommended that all patients receiving parenteral narcotics be monitored continuously and a notification system be used to indicate to caregivers when alarming conditions occur. In August 2012, the Joint Commission issued a sentinel event alert, urging all hospitals to introduce measures to improve safety for patient receiving opioids, including systematic
protocols to assess pain and appropriate opioid dosing, as well as continuous monitoring of oxygenation and ventilation. In 2012, the Center for Medicare and Medicaid Services (CMS) proposed a quality measure #3040, calling for "appropriate monitoring of patients receiving PCA [patient-controlled analgesia]" on "all patient admissions with initiation of an opioid via an IV PCA device that is active for more than 2.5 continuous hours" that these patients be monitored for "respiratory rate, sedation score and pulse oximetry".

Obstructive sleep apnea (OSA) is a common risk factor that should be addressed pre-operatively and in worse case, post-operatively, while the patient is in the hospital. Up to 81% of hospitalized patients are at risk for OSA and undiagnosed OSA may be associated with increased risk of complications in hospitalized patients. In addition to post-operative respiratory depression, other notable and addressable causes of failure to rescue include sepsis and occult bleeding. Sepsis is a common, expensive and frequently fatal. The Surviving Sepsis Campaign is a collaborative effort among European and American Critical Care Societies to disseminate best practices and they have published bundles that include the major components for the treatment of sepsis. It is essential that sepsis be identified early and treated aggressively with early goal directed therapy. Occult bleeding is common and costly and at times challenging to assess. Low and/or dropping hemoglobin levels identify the vast majority of patients with bleeding, but laboratory hemoglobin measurements are often taken at long intervals. The Joint Commission has called on hospitals to develop specific protocols to assess hemorrhage to avoid sentinel events for high risk populations such as obstetric patients.

In spite of the calls to address failure to rescue for post-operative respiratory depression, pain assessment and opioid dosing approaches are variable, and a high percentage of post-surgical patients on parenteral narcotics are not monitored continuously. The lack of a systematic approach to prevent failure to rescue of post-operative respiratory depression poses significant patient safety, quality, and cost of care implications. Closing the performance gap will require hospitals and healthcare systems to commit to action in the form of specific leadership, practice, and technology plans.

Leadership Plan

- The plan should include fundamentals of change outlined in the National Quality Foundation safe practices, including awareness, accountability, ability, and action.
- Hospital governance and senior administrative leadership must commit to become aware this major performance gap in their own healthcare system.
- Hospital governance, senior administrative leadership, and clinical/safety leadership must close their own performance gap by implementing a comprehensive approach to addressing the performance gap.
- A goal date should be set to implement the plan to address the gap with measurable quality indicators - “Some is not a number. Soon is not a time.”
- Specific budget allocations for the plan should be evaluated by governance boards and senior administrative leaders.
- Clinical/safety leadership should endorse the plan and drive implementation across all providers and systems.

Practice Plan

- Formally assess opportunities to improve pain management and prevention of adverse events due to respiratory depression from pain medications.
- Implement systematic protocols to assess pain.
• Implement multi-modal pain strategies to ensure the proper amount of opioids and short-acting narcotics delivered to patients.
• Adhere to Anesthesia Patient Safety Foundation and Joint Commission practices for continuous monitoring of all patients who are receiving parenteral narcotics.\textsuperscript{12,13}
• Implement an effective system to accomplish continuous monitoring and notification.
  o Continuous oxygenation monitoring (not spot check monitoring) with pulse oximetry through an adhesive sensor.
  o Remote notification system that provides alarm notification to the care provider.
  o A system of alarm escalation if the primary nurse does not respond in a timely manner.
  o Set SpO2 alarms at 80\% with an alarm delay of 15 second delay (to reduce non-actionable alarms), plus a 15 second notification delay.
  o Continuous ventilation monitoring for reduced respiratory rate for patients on supplemental oxygen.
  o Set respiration rate alarms at 6 breaths per minute with a 30 second delay, plus a 15 second notification delay.
  o Continuous electronic monitoring systems should integrate multiple physiologic parameters in the form of an index to identify clinically significant changes earlier and more reliably.
• Formalize transfer protocols from surgery and intensive care unit to post-operative general floor unit.
• Formalize workflows for patient admits and discharges from continuous monitoring.
• Rapid response team
  o Identify the opportunities for implementation of rapid response teams and protocol for initiating a rapid response call for post-operative respiratory depression.\textsuperscript{3}
• Additional risk and failure to rescue areas to consider:
  o Analysis and reporting from overnight monitoring to identify patients with sleep disordered breathing requiring diagnostic sleep testing (home sleep testing or in hospital sleep testing).
  o Monitoring and notification of factors related to sepsis (SIRS criteria).
  o Monitoring and notification of factors related to hemorrhage.\textsuperscript{21}

\textbf{Technology Plan}

\textit{Suggested technologies are limited to those proven to show benefit or are the only known technologies with a particular capability. Other technology options may exist, please send information on any additional technologies, along with appropriate evidence, to info@patientsafetysummit.org.}

• Continuous pulse oximetry
  o Adhesive pulse oximetry sensor connected with pulse oximetry technology proven to accurately measure through motion and low perfusion to avoid false alarms and detect true physiologic events, with added importance in care areas without minimal direct surveillance of patients (Masimo SET\textsuperscript{\textregistered} pulse oximetry\textsuperscript{10,24}, in a standalone bedside device or integrated in one of over 100 multiparameter bedside monitors).
• Continuous ventilation monitoring
  o Ability to accurately measure changes in respiratory rate and cessation of breathing with optimal patient tolerance and staff ease of use in order to avoid false alarms, with added importance in care areas without minimal direct surveillance of patients (such as Masimo rainbow\textsuperscript{\textregistered} Acoustic Monitoring\textsuperscript{25} or sidestream end tidal carbon dioxide monitoring such as Oridion\textsuperscript{\textregistered}, Phasein\textsuperscript{\textregistered}, or Respironics\textsuperscript{\textregistered}).
• Remote monitoring and notification system
Remote monitoring with direct clinician alert capability compatible with pulse oximetry technology compatible with recommended pulse oximetry technology (Masimo Patient SafetyNet™, or comparable multiparameter monitoring system).

Direct clinician alert through dedicated paging systems or hospital notification system.

Network
- Medical-grade wireless network suitable to permit reliable, continuous remote monitoring and documentation during ambulation and/or transport.
  - Alternatively, a wired network can be used which allows surveillance of patients while they are in bed but not while they are ambulating.
- Additional risk assessment and failure to rescue areas to consider:
  - Risk factor of OSA – pre-operative OSA risk assessment and referral to sleep testing center or home sleep testing, or in-hospital, post-operative monitoring and reporting (such as Masimo Patient SafetyNet™ or comparable multiparameter monitoring system).
  - Failure to rescue sepsis – Ability identify SIRS criteria automatically (such as St. John Sepsis Agent from Cerner or comparable system, enterprise level EHR dashboard to measure the compliance with Sepsis Bundles, and notifications based on established criteria).
  - Failure to rescue occult bleeding – Ability to continuously monitor for dropping hemoglobin (such as with noninvasive and continuous monitoring of hemoglobin by Masimo SpHb®).

References
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