

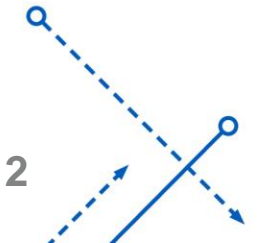
The background of the slide features a complex network of blue lines and arrows. Some lines are solid, while others are dashed. The arrows point in various directions, creating a sense of movement and connectivity. The overall design is modern and technical, with a focus on geometric patterns.

SAFE AND EFFECTIVE PAIN MANAGEMENT FOR THE HOSPITALIZED PATIENT

Carla R. Jungquist, PhD, ANP-BC, FAAN
Associate Professor

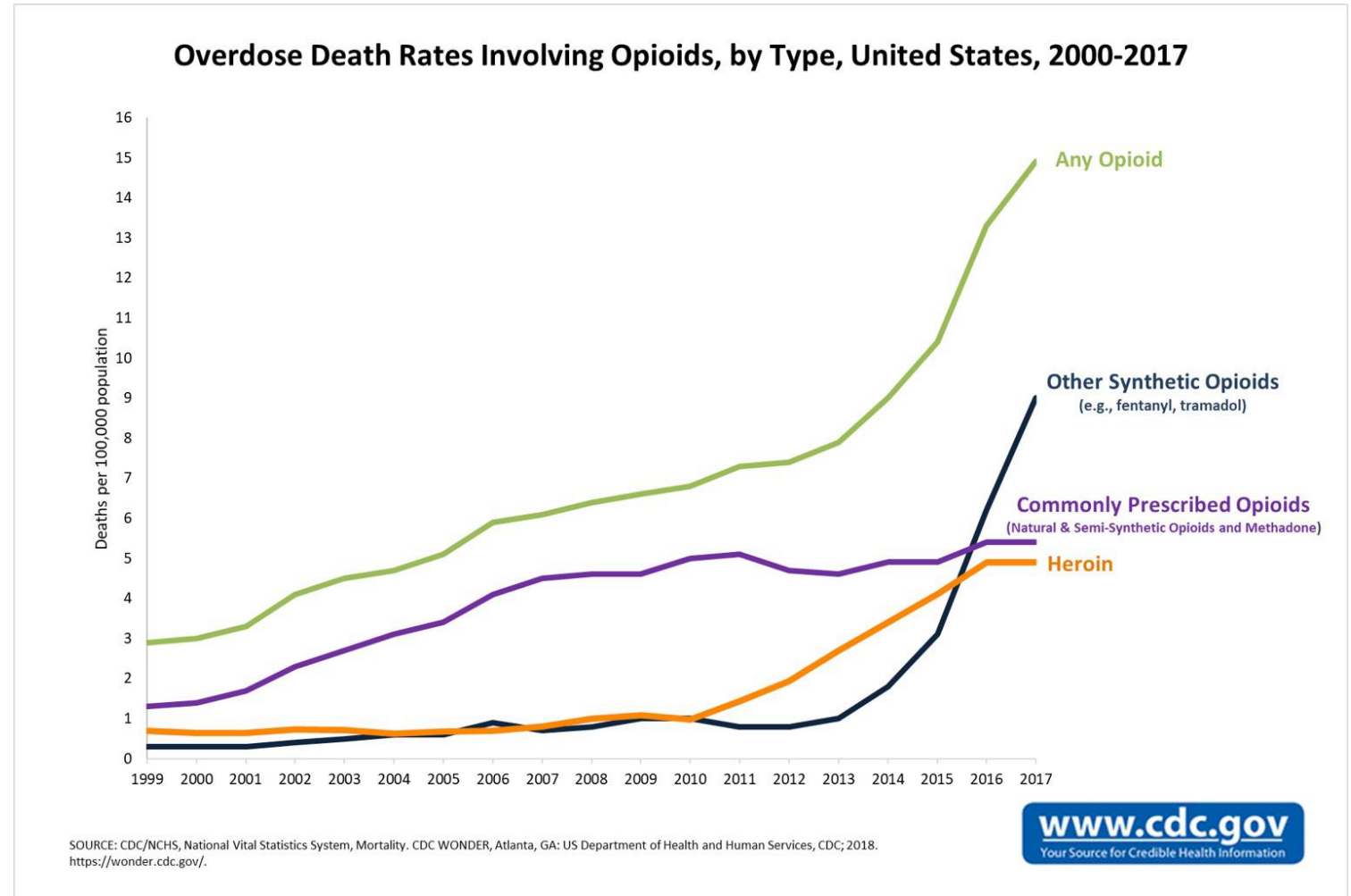
Disclosures

- Medtronic Nurse Advisory Board
- Medtronic Research Funding as PI for the multisite PRODIGY trial



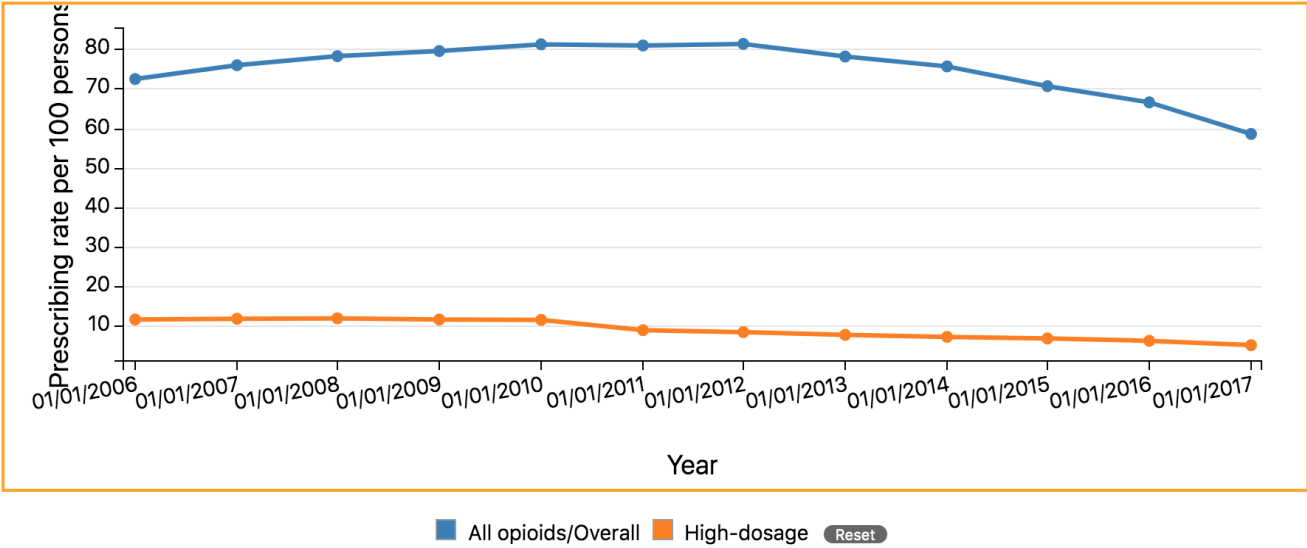
Opioid Epidemic

- From 2006 to 2015 the average duration of opioid prescription increased by a third from 13.3 to 17.7 days.
- Data from 2000 – 2005 showed that patient taking opioids for more than 90 days, even at low doses had substantially higher odds of developing opioid use disorder. (OR 14.92 compared to not prescribed opioids).



Trends in Annual Opioid Prescribing Rates by Overall and High-Dosage Prescriptions

- In 2017 there were 58 opioid prescriptions written for every 100 Americans.
- More than 17% of Americans had at least one opioid prescription filled, with an average of 3.4 opioid prescriptions dispensed per patient.
- Per prescription, the average daily amount was more than 45.3 MME.
- The average number of days per prescription continues to increase, with an average of 18 days in 2017.³



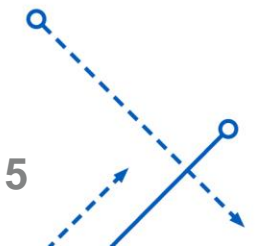
Source: IQVIA® Transactional Data Warehouse

Data Table										
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
All opioids/Overall	72.4	75.9	78.2	79.5	81.2	80.9	81.3	78.1	75.6	70.6
High-dosage	11.5	11.7	11.8	11.5	11.4	8.8	8.3	7.6	7.1	6.7

Transition from Acute to Chronic Pain

- 10 – 50% of patients that undergo surgery will develop chronic pain.
- Factors that contribute to chronic pain
 - preexisting pain
 - female sex
 - younger age
 - depression and anxiety
 - presurgical pain sensitivity/genetic
 - anesthetic technique
 - open versus laparoscopic
 - location of surgery
 - severe postoperative pain

Chapman & Vierck (2017)



Preventing the transition from acute to chronic pain

- Thoracotomy – overall rate of decline in chronic pain is around 17% per year over the past 7 years.
 - Multimodal pain management
 - Enhanced Recovery After Surgery
 - Surgical techniques
 - Epidurals can prevent the development of chronic pain in 1 out of every 4-5 patients.

Opioids are not going away

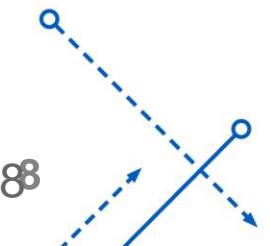
In a survey of 70,000 physicians that provide peri-operative care

- Opioids remain a key component of multimodal perioperative analgesia, and strategic opioid use based on clinical considerations and patient-specific needs represents an opportunity to support improved postoperative outcomes and satisfaction.

Jahr, J. S., Bergese, S. D., Sheth, K. R., Bernthal, N. M., Ho, H. S., Stoicea, N., & Apfel, C. C. (2017). Current Perspective on the Use of Opioids in Perioperative Medicine: An Evidence-Based Literature Review, National Survey of 70,000 Physicians, and Multidisciplinary Clinical Appraisal. *Pain Medicine*. doi:10.1093/pm/pnx191

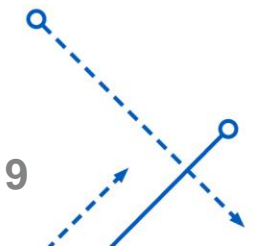
Significance of the problem

- Up to 4.2% of all hospitalized patients administered opioids for acute pain will experience some type of opioid related adverse events
- Postsurgical patients experiencing opioid-related adverse drug events have
 - 55% longer hospital stays
 - 47% higher costs associated with their care
 - 36% increased risk of 30-day readmission
 - 3.4 times higher risk of inpatient mortality compared to those with no opioid-related adverse drug events
- Opioid-related sentinel events cost the healthcare system \$2.5 million per claim on average



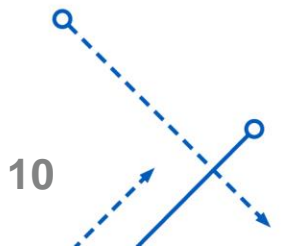
2019 ASPMN Membership Survey of Current Monitoring Practices

- 111 Hospitals Nationwide
- Nurses were:
 - 92% >10 years work experience
 - 45% RN, 55% APN
 - 63% AACN certified pain management nurses
- Hospitals:
 - 86% had written policies for assessment at peak effect
 - 32% used ETCO2 with PCA
 - 58% used PO with PCA
 - 28% continuous PO with all high risk patients
 - 10% using MV in PACU and 2% MV on GCF
 - 45% intermittent PO with all IV/oral opioids
 - Only 18% of hospital using PCA had ETCOs turn off with alarms
 - 35% PO alarms only at bedside
 - Determining Risk is really variable but 91% reported OSA.



American Society for Pain Management Nursing

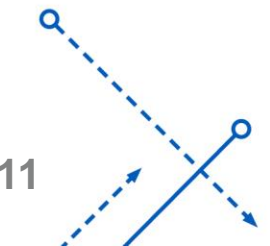
- Evidence Based Guidelines for Monitoring Hospitalized Patients for OIRD – 2011
- Evidence Based Guidelines for Monitoring Hospitalized Patients for OIRD – Revisions 2019 (in press Journal of Pain Management Nursing)
 - 15 member workgroup
 - 11 external reviewers



Recommendation 1

- The panel recommends that pain management strategies be individualized and aligned with peer-reviewed published evidence-based guidelines and The Joint Commission current pain standards (strong recommendation, high-level evidence).

(Chou et al., 2016; The Joint Commission, 2017)



Recommendation 2

- The panel recommends that clinicians recognize that all hospitalized patients receiving systemic (e.g., transdermal, IV, oral) or neuraxial opioids for acute pain management are at risk of opioid-induced unintended advancing sedation and opioid-induced respiratory depression. Some patients are at high-risk for opioid-induced adverse events (see Table 2) (strong recommendation, high level evidence).

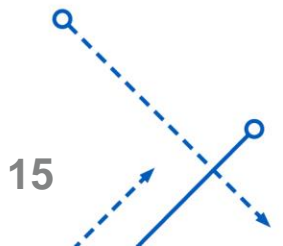
TABLE 2. Factors That Increase Risk for Opioid Induced Respiratory Depression
Patient-Specific
Obesity Hypoventilation Syndrome (OHS) <ul style="list-style-type: none"> BMI \geq 30 kg/m² and Arterial Blood Gas PaCO2 > 45 mmHg (normal 35-45) or Serum HCO3 > 27 mmol/L [without other cause of metabolic alkalosis]
Known or suspected sleep-disordered breathing <ul style="list-style-type: none"> STOP-BANG total score >3 of 8 Diagnosis of obstructive or central sleep apnea
Comorbidities <ul style="list-style-type: none"> History of cardiac and/or pulmonary disease (previous or current smoker and/or need for supplemental oxygen) Impaired renal function (blood urea nitrogen >30 mg/dL) Impaired hepatic function (albumin level <30 g/L) Obesity – BMI > 30 Substantive functional limitations
American Society of Anesthesiologists (ASA) Physical Status Classification System > 2
Substance Use Disorder (tobacco, alcohol, opioids, or other illicit substances)
Prior history or current (observed in the PACU) opioid-related sedation and/or respiratory event
Requirement for aggressive titration and dosing of opioids to manage pain
Treatment-Related
Continuous opioid infusion in opioid-naive patients (e.g., IV PCA with basal rate)
Concomitant administration of sedating agents (e.g., benzodiazepines, antihistamines)
General anesthesia (especially if prolonged) as opposed to regional anesthesia
Surgical site (head, neck, chest, upper abdomen)
First 24 hours of initiating opioids (e.g., first 24 hours after surgery is a high-risk period for surgical patients)
Naloxone administration: Patients who are given naloxone for clinically significant opioid-induced respiratory depression are at risk for repeated episodes of respiratory depression
Environment of Care
Inadequate hand-off communication of pertinent information related to risks for opioid-induced sedation and respiratory depression and monitoring requirements
Ineffective interprofessional communication of pertinent information related to risks for opioid-induced sedation and respiratory depression and monitoring requirements
Inadequate staffing that limits frequency of observations and safe monitoring practices

Recommendation 3

- The panel recommendations that all patients who will receive opioids undergo a comprehensive assessment of level of individual risk prior to initiation of opioid therapy. Ongoing re-assessment of risk that continues through the trajectory of clinical care is essential (strong recommendation, moderate level evidence).

Recommendation 4

- The panel recommends that ongoing individualized patient-centric plans of care be based on the patient's level of risk, which may change over the course of hospitalization, be developed, revised as needed, and communicated among all members of the patient care team (strong recommendation, moderate level evidence).



Recommendation 5

- The panel recommends that clinicians identify patients at high-risk of opioid-induced unintended advancing sedation and opioid-induced respiratory depression by using evidence-based criteria which includes the use of validated assessment scales/instruments (strong recommendation, high level evidence).

<https://www.drugabuse.gov/sites/default/files/files/OpioidRiskTool.pdf> (ORT)

[https://www.jopan.org/article/S1089-9472\(15\)00070-2/pdf](https://www.jopan.org/article/S1089-9472(15)00070-2/pdf) (MOSS)

PRODIGY Risk Prediction Tool (under review)

STOP-BANG Questionnaire

How to screen for OSA – STOP BANG Questionnaire

- **S** Snoring
- **T** Tiredness / sleepiness / fatigue
- **O** Observed apnea
- **P** BP (>140/90) Rx or no Rx
- **B** BMI >35
- **A** Age >50
- **N** Neck circumference >40 cm
- **G** Gender male

SCORING: 3 / 8 positive for OSA

Chung et al. Anesthesiology 2008; 108:1-10

Sensitivity and Specificity for Moderate to Severe OSA (AHI > 15/hr)		
	Sensitivity %	Specificity %
≥ 5	56	74
≥ 6	28	88
≥ 7	12	96
≥ 8	0	99

Screen for OSA – overnight oximetry

- Overnight oximetry is not diagnostic but is ok for screening
 - Average oxygen level over the night <93%
 - Oxygen desaturation events > 29/hr.
 - More than 7% of the night at less than 90% saturated
- If patient meets any of these criteria, they are 2.2 times more likely to experience a post-op complication.

Recommendation 6

- The panel recommends that clinicians employ evidence-based pain management that incorporates opioid-sparing and multimodal analgesia therapies (strong recommendation, high level evidence)

American Journal of Nursing. 2017 Mar;117(3 Suppl 1): S27-S35. PMID: 28212147. doi:10.1097/01.NAJ.0000513528.79557.33

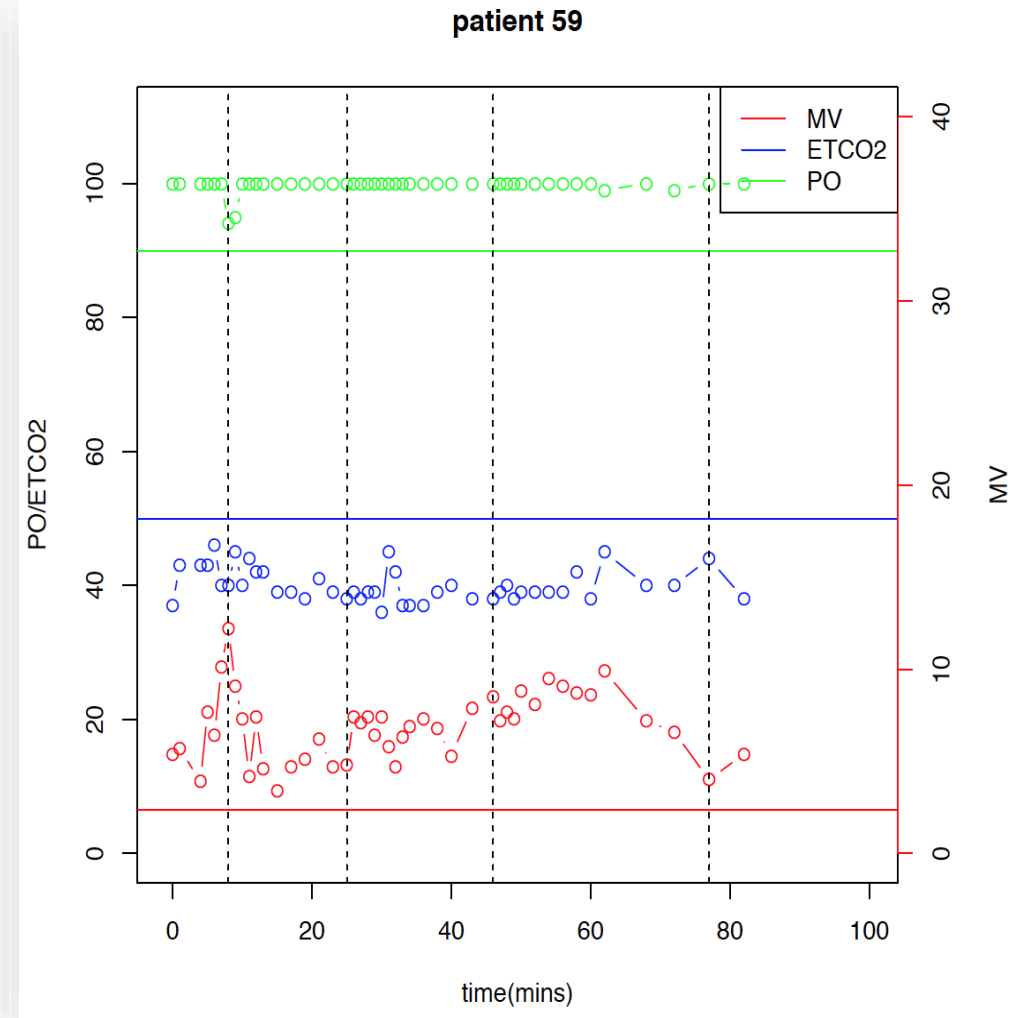
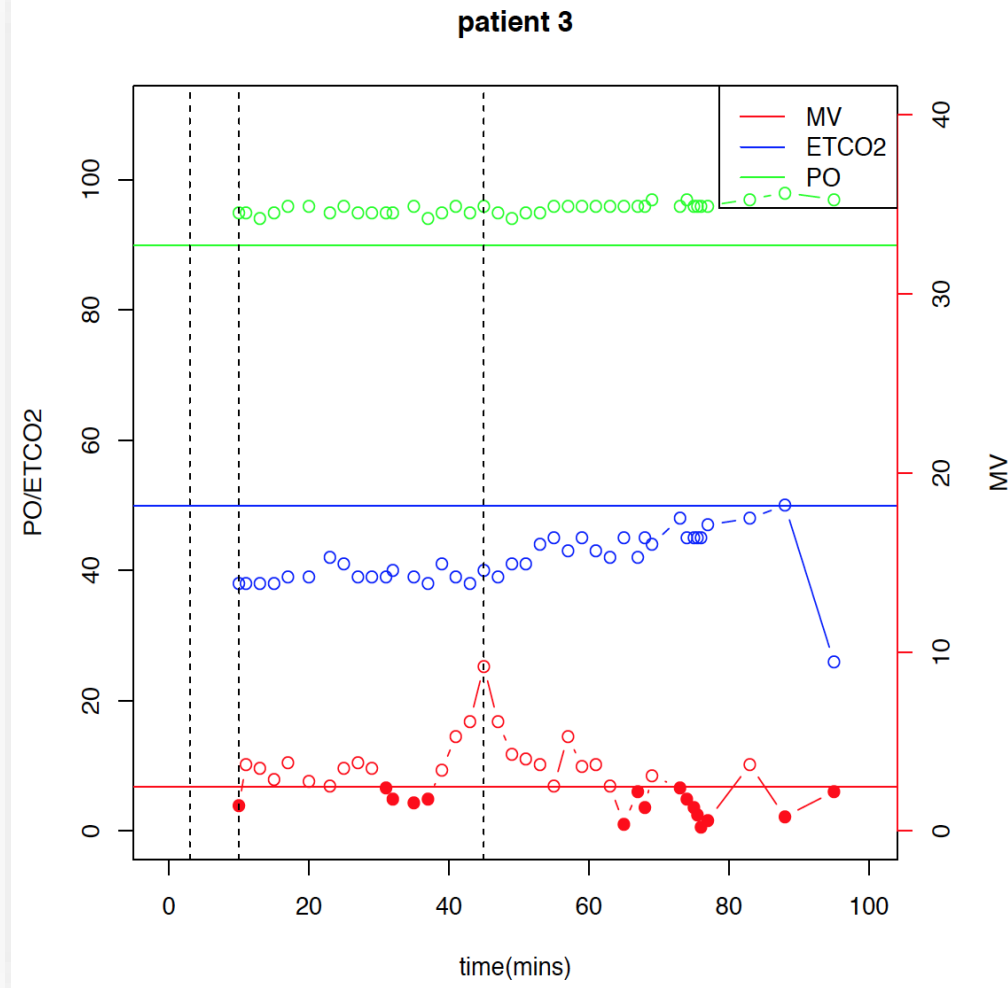
Recommendation 7

- The panel recommends that hospital policies and procedures reflect evidence-based and nationally published standards and ensure 1) effective communication among all members of the patient care team, 2) adequate and safe staffing ratios, and 3) purposeful hourly rounding by nursing staff (strong recommendation, weak to high levels of evidence)



Recommendation 8

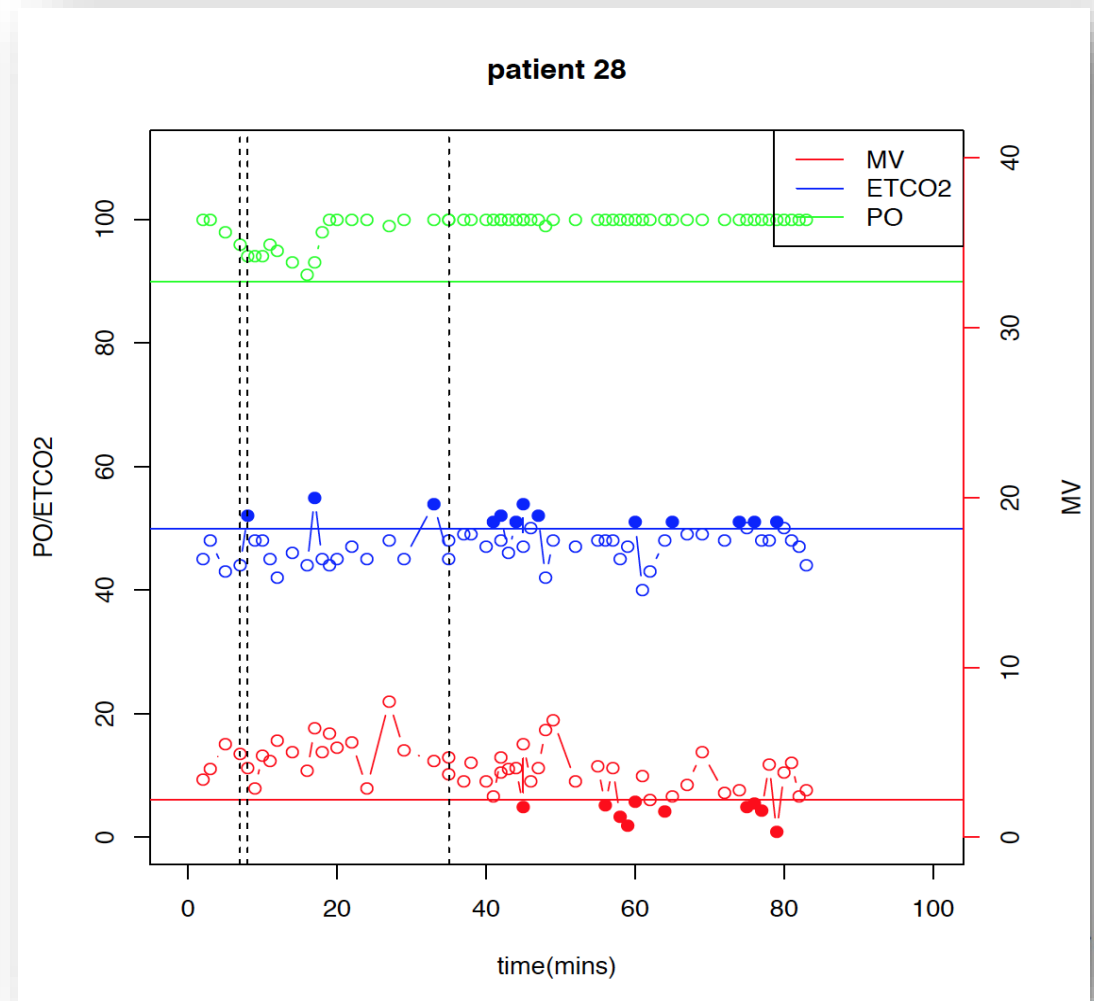
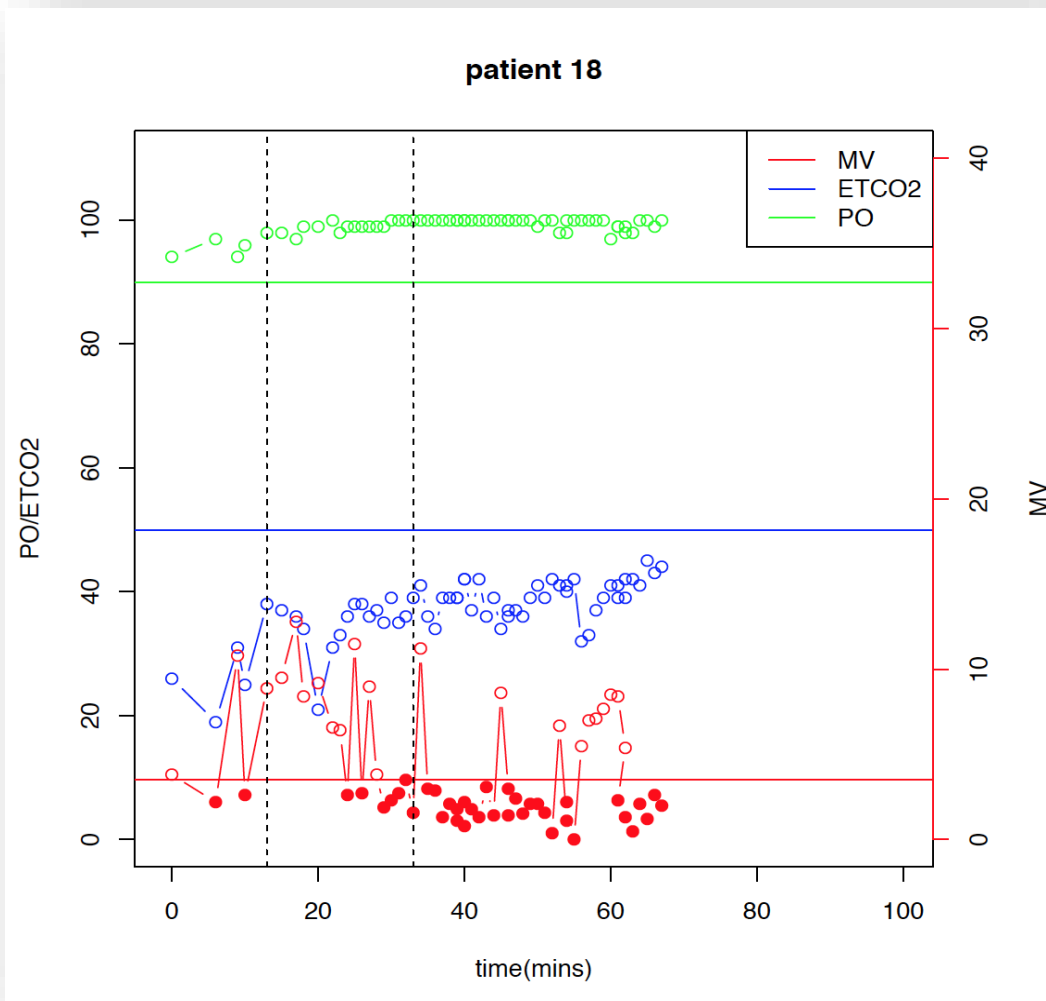
- The panel recommends that the nature, timing, frequency, and intensity of monitoring practices be based on ongoing nursing assessment and re-assessment of patient's risks and response to pain therapies. Adaptations to the plan of care are driven by iterative assessments (strong recommendation, moderate level of evidence).



PACU study -- Slashed vertical lines are doses of opioid

Jungquist, C.R., Chandola, V., Spulecki, C., Nguyen, K.V., Crescenzi, P., Tekeste, D. (2019) "Identifying Patients Experiencing Opioid Induced Respiratory Depression during Recovery from Anesthesia: The application of electronic monitoring devices. World View in Evidence Based Nursing, 16 (3) 186-194. <http://dx.doi.org/10.1111/wvn.12362>

What happens when we add supplemental O₂?



Recommendation 9

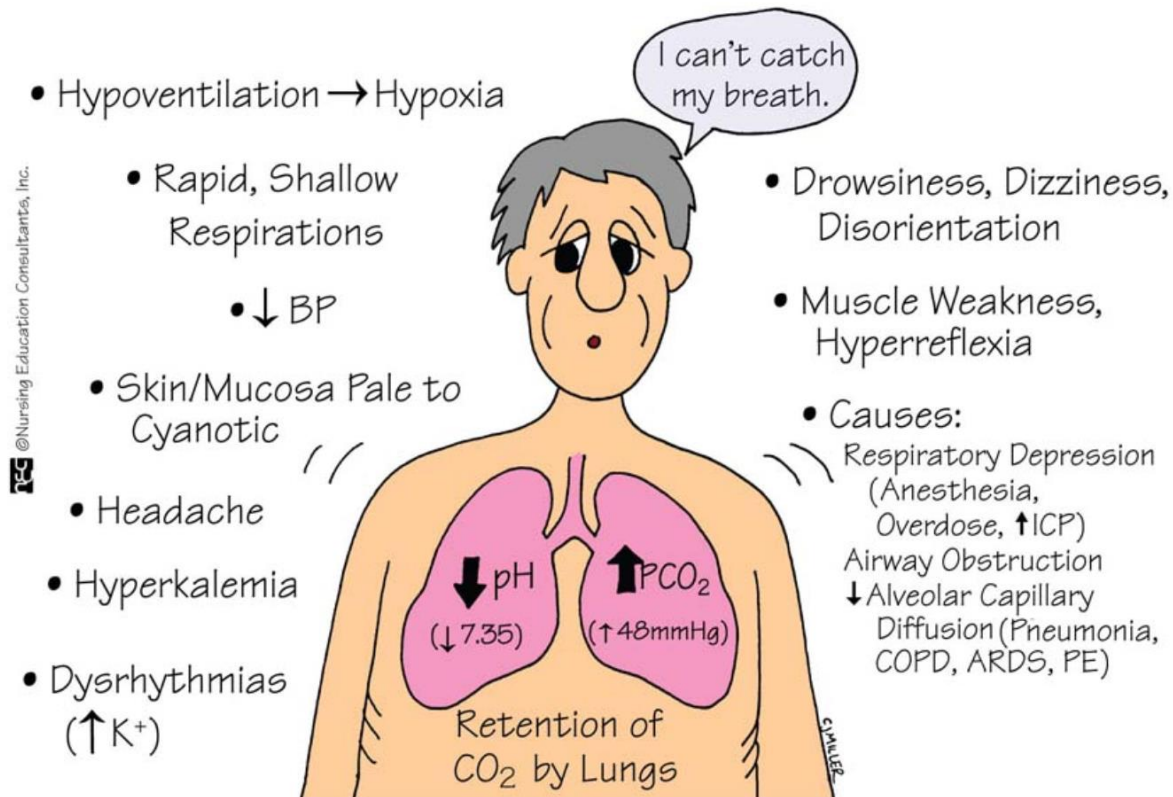
- The panel recommends evidence-based systematic nursing assessments for opioid-induced unintended advancing sedation and respiratory depression inclusive of **1) level of sedation, 2) respiratory rate and quality, and 3) oxygen saturation prior to initiation of opioid therapy, before administering an opioid dose, and at peak effect of opioid and/or other sedating medication co-administered within the therapeutic window of an opioid. Systematic nursing assessments should not be replaced with continuous electronic monitoring** (strong recommendation, moderate level evidence).
- PCA????

Obstructive Sleep Apnea – noisy breathing



Signs and Symptoms

RESPIRATORY ACIDOSIS



Medicare and Medicaid Guidelines for home supplemental oxygen

While awake:

- O₂ saturation < 89%

During Sleep:

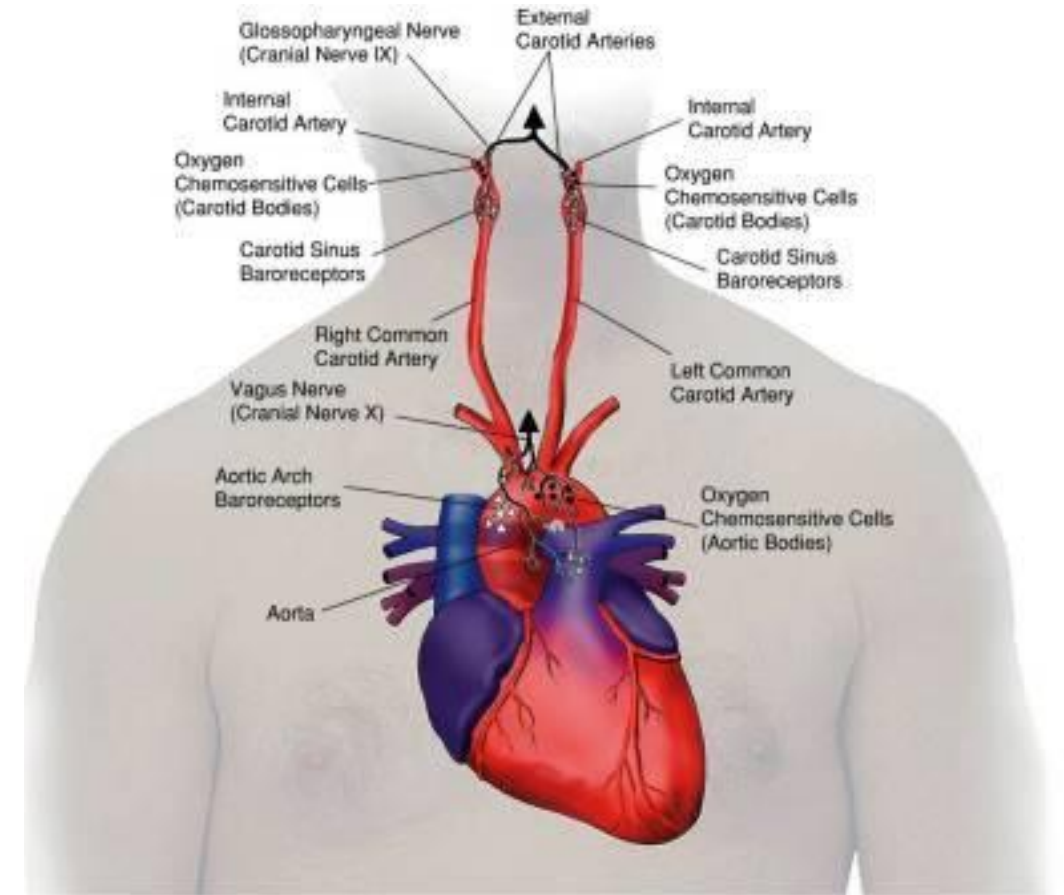
- O₂ saturation below 88% for at least 5 minutes.

Recommendation 10

- The panel recommends, that all patients deemed to be at risk for opioid-induced unintended advancing sedation and opioid-induced respiratory depression **be evaluated for continuous electronic monitoring** (see Table 2); and that **the type of electronic monitoring be appropriate to the condition of the patient, presence of supplemental oxygen or positive airway pressure therapy, patient's response to care, patient comfort and adherence to monitoring device, and the detection capability of the technology** (strong recommendation, weak level evidence).

Review of Respiratory Physiology

- Chemoreceptors regulate breathing by detecting rising CO₂ levels
 - Central receptors in medulla
 - Peripheral receptors in carotid and aortic bodies
- CO₂ crosses the BBB, changes the pH via H⁺ ions that causes increase in respiratory rate to normalize the pH.



Opioids effect respiration in several ways:

- Diminish hypercapnic and hypoxic responses
- Decrease pharyngeal dilator and reflexes to collapsing airway
- Diminish arousal/awakening response

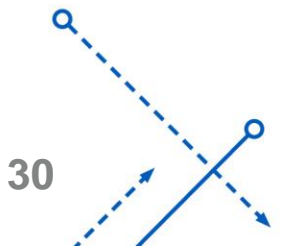
Sasaki et al 2013

Ladd et al 2005

Li & vanDen pol, 2008

Pattinson et al, 2009

RESPIRATION IS THE MOST VULNERABLE DURING SLEEP!!

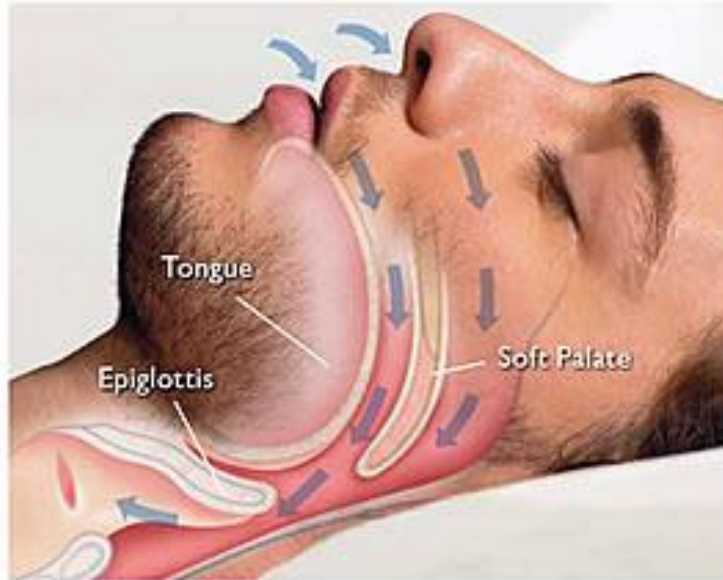


During Sleep

- We lose the muscle tone in our pharyngeal airway
- Our wake respiratory drive is gone

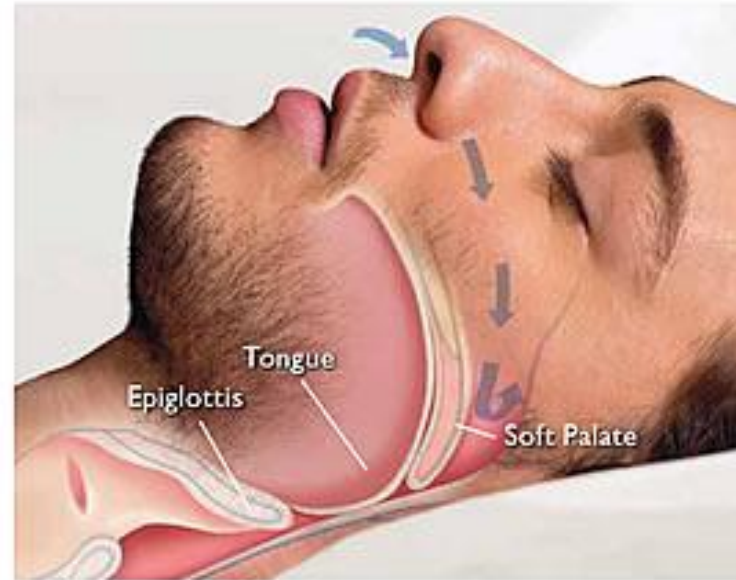


Obstructive Sleep Apnea



Normal breathing

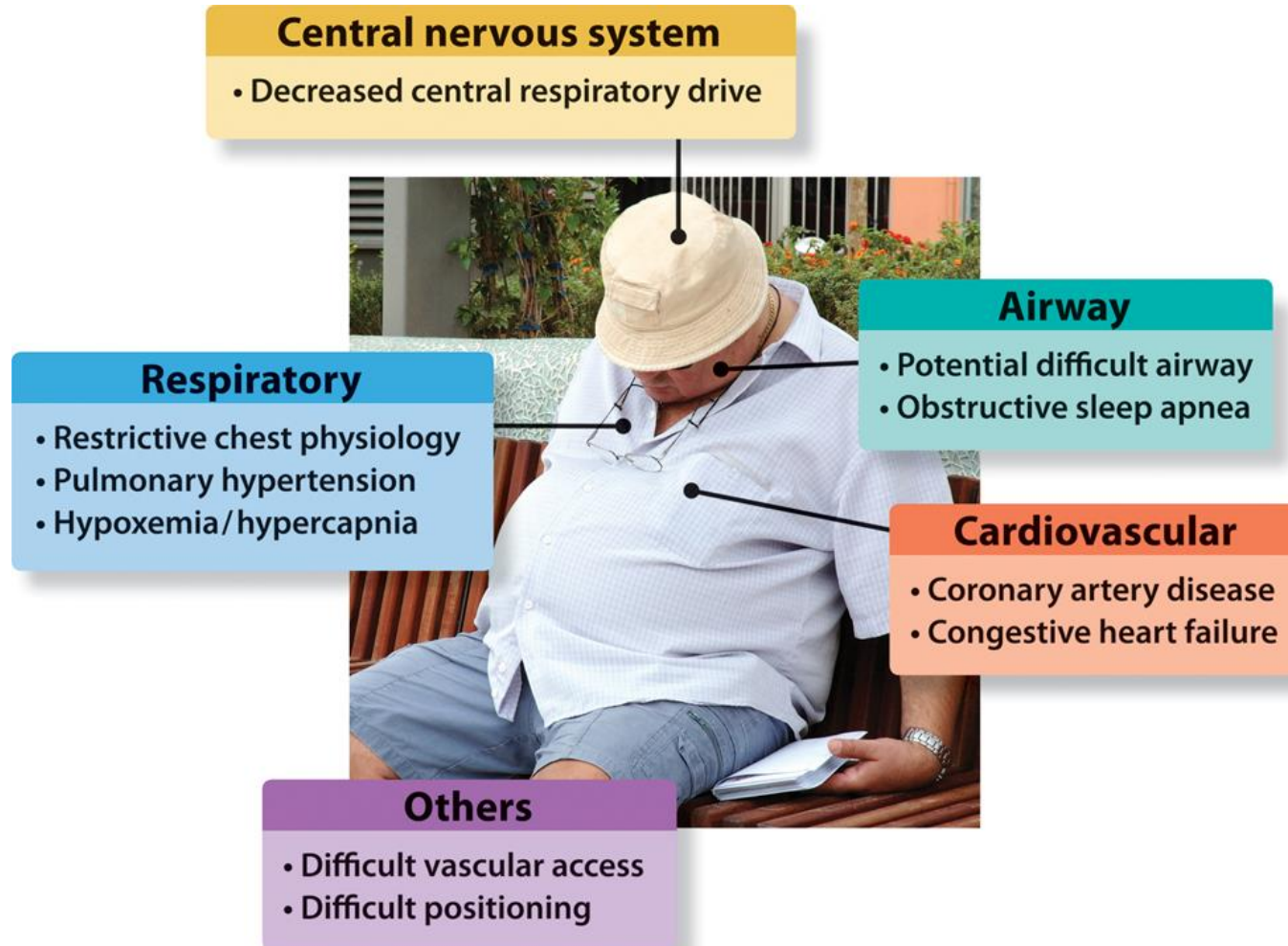
During sleep, air can travel freely to and from your lungs through your airways.



Obstructive Sleep Apnoea

Your airway collapses, stopping air from traveling freely to and from your lungs and disturbing your sleep.

Obesity Hypoventilation Syndrome

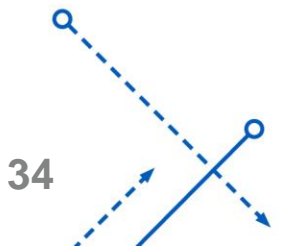


Obesity Hypoventilation Syndrome – Risk of Post Op Complications

Compared with OSA, pts with OHS were more likely to develop:

- Postop ICU transfer OR:10.9
- Tracheostomy OR: 3.8
- Higher ICU and hospital length of stay

Kaw R et al. Chest 2016;149:84-91



Recognizing Obesity Hypoventilation Syndrome

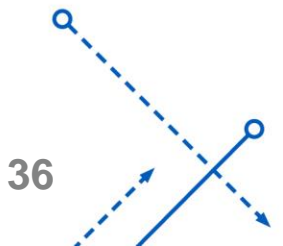
- BMI ≥ 30
- ABG PaCO₂ >45 mm Hg (normal 35-45)
- or
- Serum HCO₃ > 27 mmol/L [without other cause of metabolic alkalosis]

Hart N. et al. Thorax 2014 Manuel AR et al. Chest 2015



Recognizing Obesity Hypoventilation Syndrome – ($\text{HCO}_3^- < 27$)

- During sleep, patients with OHS hypoventilate. This causes higher than normal carbon dioxide levels
- Carbon dioxide levels return to normal during wakefulness in most patients
- HCO_3^- (bicarbonate) levels found on chemical profiles represent the renal retention of HCO_3^- in response to higher than normal carbon dioxide levels
- The normal range is 23 to 29 mEq/L (milliequivalents per liter).



Nursing Screen for OHS

- BMI ≥ 30
 - Elevated HCO₃ (>27)
 - Room air hypoxemia ($<95\%$) while awake
 - Persistent hypoxemia ($<93\%$) during sleep
-
- Remember that most all patients with OHS will have OSA and about 10% of patients with OSA will have OHS.



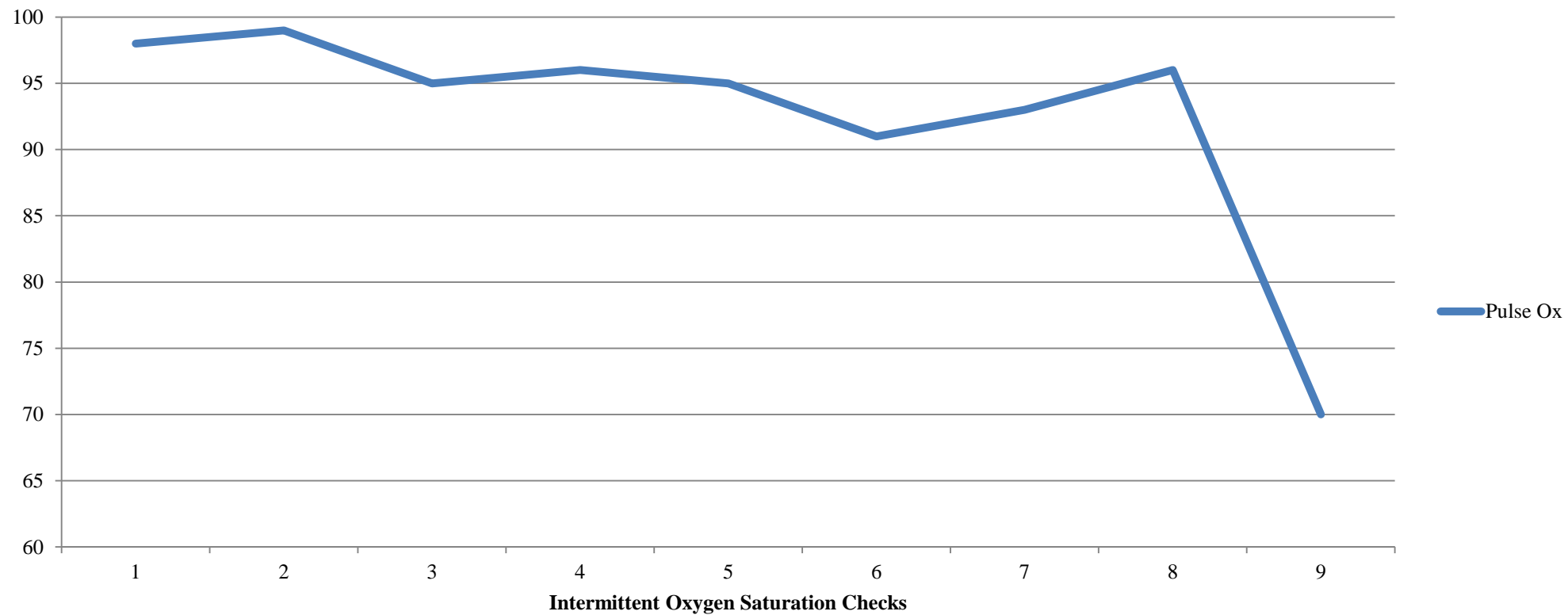
Screening for OHS – STOP BANG plus HCO₃

	Sensitivity %	Specificity %
STOP-Bang ≥ 3 + HCO ₃ ≥ 28	47	79
STOP-Bang ≥ 3 + HCO ₃ ≥ 29	30	88
STOP-Bang ≥ 3 + HCO ₃ ≥ 30	16	96

Chung F et al. Chest 2013

Adverse event ending with Anoxic Brain Injury

Pulse Oximetry Over 36 Hours



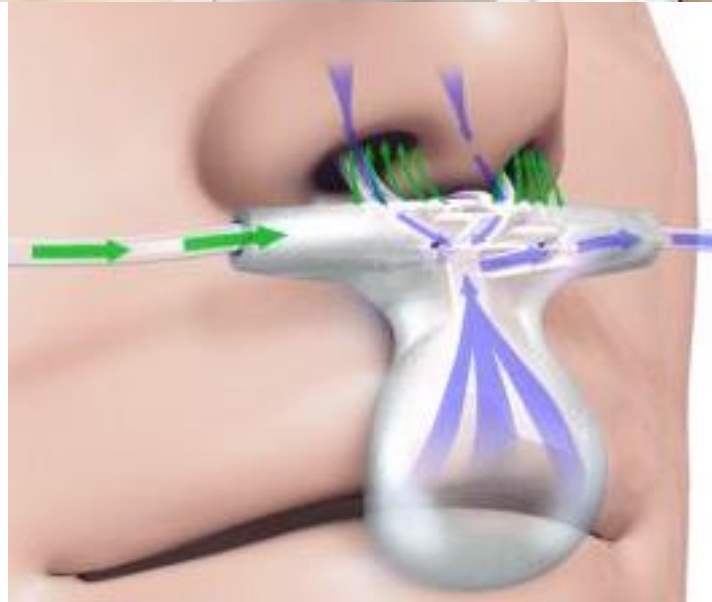
Monitoring Devices

Oxygenation

- Pulse Oximetry

Ventilation

- Capnography
- Minute Ventilation
- Pulse Oximetry AND Respiratory Rate
- Transcutaneous Carbon Dioxide



Recommendation 11

- The panel recommends the judicious use of naloxone based on patient evidence of life-threatening adverse events (strong recommendation, moderate level evidence).
- Naloxone rescue should be initiated at a dose less than or equal to 0.05 mg. intravenous or intramuscular over 1 minute and repeated frequently based on institutional protocol and patient response until sedation and respiratory issues resolve. Institute continuous electronic monitoring and monitoring patient closely.

Recommendation 12 -- Education

The panel recommends clinician education on evidence-based and best practices for:

1. Determining patient risks for opioid-induced unintended advancing sedation and respiratory depression
2. Best practices on assessing level of sedation and respiratory status
3. Use of trend monitoring as opposed to threshold monitoring when evaluating indicators for respiratory status
4. Appropriate use of positive airway pressure therapy
5. Early implementation of appropriate interventions when advancing sedation and respiratory depression are imminent
6. Appropriately educating patients/ family members who want to know how to participate in safety efforts. (strong recommendation, weak level evidence).

Recommendation 13

- The panel recommends that hospital leadership support the development of practice and administrative policies and procedures that outline the implementation of strategies focusing on: 1) clinician, patient, and family awareness of and strategies to avoid the problem; 2) education of clinicians, patient, and family on risk assessment and adaptation of individualized monitoring procedures and policies; 3) proper training on the use of electronic monitoring systems with potential use of risk alerts within electronic health record systems. (strong recommendation, moderate level evidence).
- The panel recommends the development of evidence-based policies and procedures that support clinicians, patients and family members education about the patient's use of positive airway pressure devices to treat obstructive sleep apnea and obesity hypoventilation syndrome during hospitalization. (strong recommendation, weak level evidence).

Summary

- Support staff education and travel to learn about new evidence in pain management
- Support departments of anesthesia and surgery development of ERAS protocols
- Support nursing in education, implementation, and tracking pain related patient outcomes
- Education your PACU nurses on identifying the patient who is sensitive to the respiratory effects of opioids – communicate this at hand-off and to providers
- If you are using pulse oximetry (intermittent or continuous) make sure supplemental oxygen is taken off 10 minutes before assessment. Encourage evidenced based use of supplemental oxygen.
- Provide Evidenced Based care.

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