

Opioid Therapy: Reducing the Risk of Over-Sedation and Respiratory Depression

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Objectives

- ▶ Identify factors that may increase or decrease the risk of opioid-induced respiratory depression
- ▶ Outline considerations for nurse monitoring to reduce the patient's risk
- ▶ Outline considerations for use of technological monitoring to reduce the patient's risk

Incidence of Respiratory Depression

- ▶ Overall mean incidence varies with indicator selected
 - Retrospective literature review of 800 papers on acute pain management

Indicator	Incidence
Naloxone	0.3%
Hypoventilation	1.1%
Hypercarbia	3.3%
Oxygen desaturation	17%

Incidence of Respiratory Depression

- ▶ May be under-reported based on criteria being studied
 - E.g., oxygen saturation changes are disguised when supplemental oxygen is administered
- ▶ May be facility specific
 - Variables such as patient population, available technology, standard pain practices, order sets, and nurse practice environments impact safety

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Risk of Respiratory Depression

- ▶ Increased by
 - Patient factors
 - Iatrogenic factors
- ▶ Potentially decreased by
 - Preemptive care during the perioperative period
 - Multimodal therapy

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Literature Related to Opioids and Pulmonary Risk

- ▶ Scattered; requires sorting out
 - Does not necessarily relate directly to respiratory depression, but includes atelectasis and pneumonia
- ▶ Potential patient risk factors can be found in literature on:
 - Sleep-disordered breathing
 - Neuraxial guidelines
 - Patient-controlled analgesia risk
 - Safety directives: Institute for Safe Medication Practices (ISMP)
 - Risk factors for opioid-induced respiratory depression in acute care setting¹

1. Jurguist C. ASPMN National Conference, Jacksonville, Fla., September 2009.

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National Focus: Opioid Safety

- ▶ Institute for Safe Medication Practices
 - "ISMP High Alert Medication Feature: Reducing patient harm from opiates"
 - February 22, 2007
 - "ISMP Urges Caution with Basal Opioid Infusions"
 - March 19, 2009
- ▶ Anesthesia Patient Safety Foundation (APSF) Newsletters
 - "Opioid-induced postoperative respiratory depression is a preventable cause of morbidity and mortality"
 - Winter 2006-07
 - "Postoperative opioids need system-wide overhaul"
 - Winter 2009-10

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Public Attention on Safety



Safe Patients, Smart Hospitals

"It is not wise to ignore the advice of nurses, family members, or patients, each of whom possesses valuable information that could help doctors better understand their patients and make better decisions."

Pronovost, Vohr, 2010

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Patient Risk Factors for Respiratory Depression

- ▶ Factors well established:
 - Age
 - Pulmonary disease or compromise
 - Diagnosed obstructive sleep apnea (OSA)
 - High risk for OSA
 - Impaired renal or hepatic function
 - Neurologic disorder, e.g., multiple sclerosis
 - Multiple comorbidities
- ▶ Combinations of these create increased risk

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Risk Increases With Age

- ▶ Risk of respiratory depression with opioid therapy (35 tertiary hospitals)
- ▶ Compared with patients aged 16 to 45 years, risk increased:
 - 2.8 X in those aged 61–70
 - 5.4 X in those aged 71–80
 - 8.7 X in those >80

Cepeda, et al, 2003

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Risk in Opioid-Tolerant Patients

- ▶ Retrospective case-controlled review
 - 3058 patients over 4 years
- ▶ Higher use of PCA in opioid-tolerant patients *and* increased sedation
- ▶ Overall greater use of anxiolysis agents
 - No significant positive correlation with these agents and sedation

Rapp et al. (1995)

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Treatment-Related Risks

- ▶ Least risk: continuous epidural infusions
- ▶ Increased risk:
 - Parenteral systemic (IV bolus, IV PCA, IM)
 - Oral doses
 - Single-injection epidural opioid
 - Extended-release epidural opioid
- ▶ More risk occurs during PCA with:
 - Continuous infusions
 - Environmental factors promoting errors
 - Rapid dose escalation
 - Concurrent use of opioids and CNS depressants
 - Unauthorized activation of PCA
- ▶ Timing: Risk is greater in first 24 hours and during night shift

Hagle, 2004; Cohen, 2005; ISMP, 2007; White & Irvine, 1999; Taylor, 2005; Shapiro et al., 2005

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General Principles: Opioids and Respiration

- ▶ Opioid analgesia is primary pharmacologic intervention for acute pain
- ▶ Opioids increase potential for life-threatening respiratory depression for all patients
 - Depress respiratory effort and rate
 - Relax pharyngeal tone
 - Depress respiratory response to hypoxia and hypercarbia
- ▶ Respiratory effort and rate are important clues to impending failure

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General Principles: Opioids and Sedation

- ▶ Sedative effects of opioids generally precede respiratory-depressive effects
- ▶ Patients' responses to opioids are variable



Are we teaching these underlying principles to our younger colleagues????

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Institutional Culture

- ▶ Critical factors
 - Environment of support for early recognition of risk
 - Opportunity for provision of prompt and effective treatment
- ▶ Four major organizational factors impact risk recognition and early intervention
 - Organization of nursing-care activities
 - Development of nursing-assessment skills
 - Critical decision-making processes
 - Equipment-management issues

Hogan, 2006; Aiken et al, 2008

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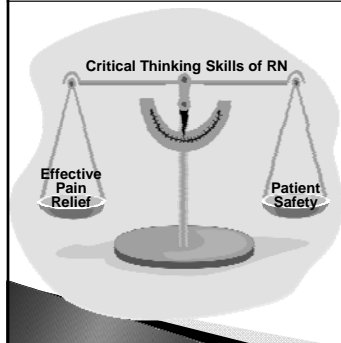
Risk Related to Staffing

- ▶ Higher registered nurse staffing is associated with less hospital-related mortality and with decreased failure to rescue
- ▶ “RN to patient” time should be adequate for assessment of any possible opioid effects on:
 - Patient’s level of consciousness
 - Patient’s respiratory effort

Sengo et al, 2006; Friese et al, 2008; Aiken et al, 2008

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The Role of the RN



- ▶ Identification of patients at risk
- ▶ Sedation scales
- ▶ Respiratory assessment
- ▶ Technology: pulse oximetry and capnography

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Critical Thinking of the Nurse

- ▶ Screen for patients who need increased vigilance
 - Recognize that respiratory monitoring includes both:
 - Nurse monitoring
 - Appropriate use of technology
- ▶ Understand difference between ventilation and oxygenation

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Critical Thinking of the Nurse

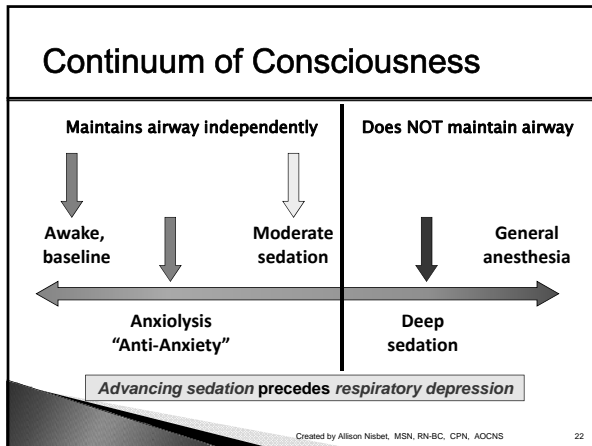
- ▶ Communication and collaboration requires:
 - Reliable and valid tools for assessment
 - Objective communication of data to prescriber
 - Ability to trigger change in therapy
 - Protocols for therapy change when appropriate

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Critical Nursing Knowledge and Monitoring Skills

- ▶ Knowledge of continuum of consciousness
- ▶ Anticipation and recognition of advancing sedation from opioids before respiratory effects are present
 - Reliable use of sedation scales
- ▶ Competent respiratory-assessment skills

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Opioid-Induced Sedation

- ▶ Sedation is common side effect of opioids, at least initially
 - Need to notice unintended advancing sedation
 - Sedation, much like pain, requires serial assessments
 - Need to identify incremental changes in direction of sedation level
 - Recognize discrete changes in level of alertness and arousability

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Tools for Monitoring Sedation with Opioid Analgesia

- ▶ Need quick, reliable tool to assist RN in critical decision making

Provide timely escalation of attention to advancing sedation during opioid administration
- ▶ Requires a systematic approach
 - Ease of documentation
 - Improved communication
 - Corresponding actions to consider

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Sedation Scales

- ▶ Most sedation assessment scales are validated in critical care or procedural sedation settings
 - Goal-directed, intentional sedation
 - RASS, SAS, Ramsey, Aldrete, etc.
- ▶ Should we use sedation scales developed for goal-directed, purposeful sedation for detection of unintended, advancing opioid-induced sedation?

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Sedation Scales

- ▶ Very little research on assessment of opioid-induced sedation in medical-surgical environment
- ▶ Two recent studies evaluated sedation scales outside of goal-directed sedation setting
 - RASS & POSS scales

Dempsey, 2009; Nisbet & Mooney-Catter, 2009

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Pasero Opioid-Induced Sedation Scale (POSS)

- S = Sleep, easy to arouse
Acceptable; no action necessary; may increase opioid dose if needed.
- 1 = Awake and alert
Acceptable; no action necessary; may increase opioid dose if needed.
- 2 = Slightly drowsy, easily aroused
Acceptable; no action necessary; may increase opioid dose if needed.
- 3 = Frequently drowsy, arousable, drifts off to sleep during conversation
Unacceptable; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory; decrease opioid dose 25% to 50% or notify prescriber or anesthesiologist for orders; consider administering a non-sedating, opioid-sparing nonopioid, such as acetaminophen or a NSAID, if not contraindicated.
- 4 = Somnolent, minimal or no response to verbal and physical stimulation
Unacceptable; stop opioid; consider administering naloxone; notify prescriber or anesthesiologist; monitor respiratory status and sedation level closely until sedation level is stable at less than 3 and respiratory status is satisfactory.

Copyright 1994, Chris Pasero. Used with permission.
Source: Pasero C. Acute Pain Service: Policy and Procedure Manual.
Los Angeles, CA Academy Medical Systems, 1994.

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Richmond Agitation-Sedation Scale (RASS)

- ▶ Developed and tested in adult critical care units for use in titrating sedatives
- ▶ Evaluates level of intentional sedation with opioids and sedative agents
 - 0 = patient is alert and calm
 - + = patient is restless → combative
 - - = patient is drowsy → unarousable
- ▶ Correlated with Ramsey, but more specific
- ▶ Strong evidence for reliability

Sessler et al, 2002; Ely et al, 2003

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RASS (Cont'd)

+4	Combative	violent, immediate danger to staff
+3	Very Agitated	Pulls or removes tube(s) or catheter(s); aggressive
+2	Agitated	Frequent non-purposeful movement, fights ventilator
+1	Restless	Anxious, apprehensive but movements not aggressive or vigorous
0	Alert & calm	
-1	Drowsy	Not fully alert, but has sustained awakening to voice (eye opening & contact ≥ 10 sec)
-2	Light sedation	Briefly awakens to voice (eye opening & contact < 10 sec)
-3	Moderate sedation	Movement or eye-opening to voice (but no eye contact)
-4	Deep sedation	No response to voice, but movement or eye opening to physical stimulation
-5	Unarousable	No response to voice or physical stimulation

Sessler, 2002

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RASS (Cont'd)

- ▶ RASS may be modified for use with opioid analgesia by adding nursing actions to each level of arousal
- ▶ Tool itself cannot be altered without altering its reliability and validity
- ▶ Modified version has not been formally studied
- ▶ Primary concern regarding use of RASS for sedation assessment in opioid analgesia is that nurses will equate agitation with need for pain intervention and sedation with over-medication

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Sedation Scales: Survey Findings

- ▶ Both RASS and POSS had strong inter-rater reliability for sedation assessment during opioid analgesia
- ▶ Sampled RNs reported that POSS had highest applicability for measurement of sedation during opioid administration

Dempsey et al, 2009

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Respiratory Assessment

- ▶ Monitoring of status is ongoing with sedation assessment
- ▶ Two components
 - Respiratory rate: count for at least 30 seconds
 - Consider baseline for patient
 - Consider lowest acceptable rate to trigger intervention
 - Quality of respirations

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Assessment of Quality of Respiration

- ▶ Depth and pattern of respirations
 - No use of accessory muscles
- ▶ Level of effort
 - Effortless or labored
- ▶ Adventitious sounds
 - Clear
 - Noisy or snoring
 - Gurgling or stridor

San Diego Patient Safety Taskforce

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Barriers to Respiratory Assessment and Interpretation

- ▶ Lack of understanding by all members of team with regard to assessment
 - Quality of respiration (not just rate) without stimulating the patient
 - Difference between oxygenation and ventilation
- ▶ Patient stimulation during assessment to higher level of consciousness falsely increases respiratory rate

Duff et al, 2007

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Barriers to Respiratory Assessment and Interpretation

- ▶ Documentation may not routinely include:
 - Information pertinent to risk
 - Observations related to respiratory assessment
- ▶ Providers may not always respond with appropriate orders for intervention
- ▶ Technological monitoring may create false sense of security and decrease nursing priority for monitoring

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Barriers to Use of Technology

- ▶ Technology adds complexity to nurse's work
 - Complexity may not be considered in staffing levels
- ▶ Expense may be prohibitive
- ▶ Classroom sessions
 - Lack practice application
 - May not be repeated sufficiently to include all caregivers
 - Nurses report changes in how they learn with age
 - This needs to be addressed during technology education sessions

Zuzzo, Getts, 2008

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Barriers to Use of Technology

- ▶ Resource person may not be available on all shifts
- ▶ Systems may not be user friendly
 - Equipment and peripheral components may be difficult or time consuming to obtain
 - Nurses may attempt to save time by circumventing safety systems

Zuzelo, Getts, 2008

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Use of Technology: Considerations

- ▶ Compliance: Are patients and families educated about purpose of monitors?
- ▶ Does monitoring technology impede patient activity?
- ▶ Are alarms sufficiently audible to alert RNs?
- ▶ Do staff have time to manage alarms?
- ▶ Are devices configured to minimize false alarms?
- ▶ Do RNs receive adequate training to use technology?
- ▶ Is communication between RNs and other healthcare providers adequate to exchange information and facilitate response?

Clark, 2006, ACCE Healthcare Technology Foundation

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Technology: Key Points

- ▶ Alarms are only one tool in the overall assessment of the patient
- ▶ Education regarding technology must be effective with training in the clinical setting
- ▶ Refresher courses should be offered for those missing the education or who have not utilized the technology recently (Competencies)
- ▶ Resource staff for the technology should be available on all shifts

Clark, 2006, ACCE Healthcare Technology Foundation

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Technology: Key Points

Technology will be inadequate if nurses do not understand how to interpret the information gained or have inadequate influence on a change in care based upon information obtained.

ACCE Healthcare Technology Foundation, 2008

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Pulse Oximetry: Strengths

- ▶ Noninvasive
- ▶ Cost effective compared with arterial blood gases
- ▶ Alerts nurse to downward trends in oxygen saturation
- ▶ Can be continuous or used as spot check

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Pulse Oximetry: Limitations

- ▶ Technical Issues
- ▶ Interpretation affected by:
 - Ambient light
 - Motion artifact
 - Abnormal hemoglobin
 - Pulse rate and rhythm
 - Vasoconstriction
 - Cardiac function

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Pulse Oximetry

- ▶ Delay between hypoxic event and detection
- ▶ Provides no indication of patient's ventilatory status (e.g., CO₂ levels)
- ▶ Intermittent use provides limited information (no trends)
- ▶ Continuous monitoring recommended over intermittent use for patients at high risk

Hill, 2000; Ayan, 1998; Fu, 2004

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Pulse Oximetry

- ▶ Misleading in patients receiving supplemental oxygen
- ▶ Detects hypoventilation ONLY when patient is breathing room air
- ▶ Avoid "out of habit" use in patients able to maintain acceptable O₂ saturation without supplemental oxygen

Hill, 2000; Ayan, 1998; Fu, 2004

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Monitoring: Comparison

Pulse Oximetry: SpO ₂	Capnography: EtCO ₂
Oxygen saturation of hemoglobin in arterial blood <ul style="list-style-type: none">• Altered by supplemental O₂	Carbon dioxide <ul style="list-style-type: none">• Not changed by supplemental O₂
Pulse rate	Respiratory rate <ul style="list-style-type: none">• As determined by exhaled CO₂
Reflects oxygenation only	Reflects ventilation or adequacy of breathing <ul style="list-style-type: none">• Does not reflect oxygenation

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Capnography (EtCO₂)

- ▶ EtCO₂ monitoring is ideal to detect changes in postoperative patients:
 - Respiratory rate
 - Exhaled carbon dioxide levels
 - Pauses in breathing
- ▶ Used for trending in patients without pulmonary compromise
 - Gives excellent information and allows comparison of trends to patient's baseline
- ▶ Monitoring for ventilatory insufficiency in high-risk patients requires BOTH pulse oximetry and capnography to evaluate oxygenation and ventilation

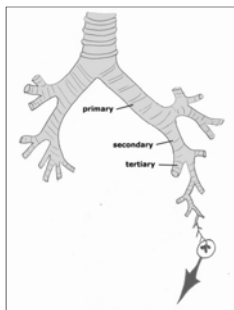
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EtCO₂: Values in Normal Patients

- ▶ Normal level: 30–43 mm Hg
 - Increased respiratory rate decreases EtCO₂
 - Decreased respiratory rate increases EtCO₂
- ▶ Patients with pulmonary disease may have elevated baseline EtCO₂ levels
 - Important to document baseline!
 - May need to adjust alarms

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Anatomic Dead Space Leading to Alveoli



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Exhalation

- ▶ Highest concentration of CO₂ is at end of exhalation
- ▶ Rapid exhalation may not allow CO₂ to clear dead space between bronchioles and nose
- ▶ This may result in lower expired CO₂ report despite patient's retention of CO₂

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Capnography: Strengths

- ▶ Noninvasive
- ▶ Cost effective compared with arterial blood gas measurement
- ▶ Alerts nurse and patient (to take a breath)
- ▶ Includes visual waveform of inspired and exhaled CO₂ concentrations to help evaluate cause of elevation
- ▶ Counts respirations based on minimally expired level of CO₂
 - Not reliant on rise and fall of chest

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Capnography: Limitations

- ▶ Does not measure oxygenation
- ▶ Compliance may be poor
- ▶ Not accurate in patients with rapid respiratory rate (RR)
 - Highest concentration at the end of exhalation
 - Rapid RR may not allow CO₂ to clear dead space between bronchioles and nose
- ▶ Combining capnography with PCA pause may negatively impact pain care

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Monitoring

- ▶ No technological monitoring can replace nursing judgment
- ▶ Nurses need to have:
 - Understanding of patient and iatrogenic risks with opioid therapy
 - Comprehensive patient-assessment skills
 - Incorporate information from both observation and technology
 - Select appropriate technology to understand patient's response to therapy
 - Authority to communicate findings to prescribers who will be accountable for changes in pain-care management based on patient's trends

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Monitoring: Implementing a New Process

- ▶ Select multidisciplinary team of opinion leaders who are invested and engaged in process
 - Involve team in designing clear goals and in selecting outcomes to be achieved
 - Review and evaluate relevant literature
 - Consider facility-specific risk
 - Evaluate priority and resources
- ▶ Evaluate and pilot required equipment for ease of use, safety, and acceptance by patients and staff

Tiber, Moore, 2010

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Implementing a New Process: Pilot the Change (Start Small)

- ▶ Collect baseline data
- ▶ Design protocols and order sets for screening tools, monitoring, and interventions
- ▶ Design documentation process to provide ease of access to patient risks/trending data
- ▶ Disseminate information
- ▶ Education: consider value of CEUs, CME
- ▶ Utilize reminders via Internet
- ▶ Consider refresher education for both knowledge and skill development/equipment
- ▶ Audit selected outcomes and provide timely feedback

Tiber, Moore, 2010

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Questions to Consider

- ▶ Who will be screened?
- ▶ How will screening be documented?
 - User friendly and accessible
- ▶ Where will screening occur?
 - For surgical patients
 - For general admission
- ▶ How will risk be communicated?
- ▶ Will diagnosed OSA patients without their home CPAP have surgeries canceled?
- ▶ Will patients with different levels of risk be monitored differently?

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Nursing Autonomy

- ▶ Nurse should have authority to:
 - Increase intensity of monitoring
 - Add monitoring technology when concerned about patient with increasing sedation or other respiratory parameters
- ▶ Physician should be notified regarding need for increased level of monitoring

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Example of Successful Program to Decrease Naloxone Rescue Dosing

- ▶ “Monitoring High-Risk Patients Post-Operatively: Implementation of a Hospital Screening Process and Capnography to Improve Outcomes”
 - Implementation of STOP-Bang Questionnaire for risk screening with monitoring and intervention protocols and order sets
 - Naloxone incidence: reduced significantly to 5 of 116 patients (4%) in 6 months

Presented September 14th, 2009, at ASPMN National Conference by Brenda Elden, MS, APN, ACNS-BC and Brian Gilley, RN-BC, CPAN

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Conclusion: Nursing Practice

- ▶ As healthcare provider who is with patients 24/7:
 - RN is in best position to incorporate mix of technological and assessment skills
 - Early identification of unintended advancing sedation and changes in respiratory status is essential when providing ANY opioid by ANY route in ANY patient
 - Requires empowerment of RN to act and communicate to other team members
- ▶ That IS professional nursing practice

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Safety = Teamwork

“Each sees problems through a different set of lenses that is shaped by personal experiences and training.

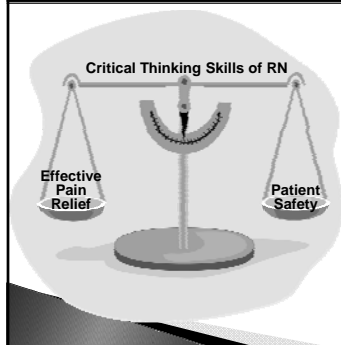
Each of those lenses provides valuable information, information that helps us make wise decisions. . . . No lens is more accurate than the other; they are just different.

The fewer the lenses, the more distorted the view, the worse the decision, and the greater the risk for preventable harm.”

Pronovost, Vohr, 2010

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The Role of the RN



- ▶ Identification of patients at risk
- ▶ Sedation scales
- ▶ Respiratory assessment
- ▶ Technology: pulse oximetry and capnography

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