SLEEP IN THE INTENSIVE CARE UNIT PATIENT

Focus on Critical Care
October, 2017

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Objectives

- Document patients sleep
- Recognize the impact of sleep deprivation on co-morbid conditions
- Recommend sleep enhancing techniques
What is Sleep?

A temporary perceptual disengagement from and unresponsiveness to environmental surroundings

~8 hours/day, 56 hours/week, 240 hours/month and 2,920 hours/year

Carskadon and Dement, Principles and Practices of Sleep Medicine, 2011
Sleep Wake Cycle:
Two Process Model

Homeostatic Sleep Drive

Circadian Alerting Signal (SCN)

Melatonin

9 am
3 pm
9 pm
3 am
9 am

Awake
Asleep

The stages of sleep

- Sleep is comprised of stages
  - Non rapid eye movement
    - Stages 1, 2 and 3 (slow wave sleep)
  - Rapid Eye Movement Sleep
    - Dream Sleep
Physiologic Differences-Sleep States

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>NREM</th>
<th>REM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of sleep cycle</td>
<td>75-80%</td>
<td>20-25%</td>
</tr>
<tr>
<td>Ability to arouse</td>
<td>Easy</td>
<td>Difficult</td>
</tr>
<tr>
<td>Airway resistance</td>
<td>Increases from wakefulness</td>
<td>Increases and varies from wakefulness</td>
</tr>
<tr>
<td>Respiration</td>
<td>Decreases</td>
<td>Increases; coughing suppressed; may show brief stoppages</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Muscular activity</td>
<td>No movement</td>
</tr>
<tr>
<td>Heart rate</td>
<td>Decreases</td>
<td>Increases</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>Decreases</td>
<td>Increases</td>
</tr>
<tr>
<td>Sympathetic nerve activity</td>
<td>Decreases</td>
<td>Increases</td>
</tr>
<tr>
<td>Blood flow to brain</td>
<td>Decreases</td>
<td>Increases (dependent on brain region)</td>
</tr>
<tr>
<td>Brain activity</td>
<td>Decreases</td>
<td>Increases in motor and sensory areas</td>
</tr>
<tr>
<td>Body temperature</td>
<td>Regulated at lower set point</td>
<td>No regulation</td>
</tr>
</tbody>
</table>

All in reference to state of wakefulness. NREM, non-rapid eye movement; REM, rapid eye movement.

Transition from Wake to sleep

Stage W (transition to stage 1: note drop out of alpha rhythm)
Features of stage 2 sleep (N2)
SW Sleep and REM

Stage 4: > 50% delta waves (still Stage N3)

REM (Phasic)
Normal Sleep Histogram-Age Related

http://thoracickey.com/sleep-disorders-laboratory-evaluation/
Good vs Bad Night of Sleep

Figure 1

The sleep architecture demonstrated in the top hypnogram (A) demonstrates a pattern of normal sleep stage progression across the night. The lower hypnogram (B) demonstrates a very disrupted pattern of sleep with frequent brief awakenings throughout the night.

Why is sleep important?

• Animal models, sleep loss leads to
  • Failure of body temperature regulation
  • Increased metabolism
  • Deterioration of hypothalamic neurons
  • Progressive breakdown of host defenses
  • Death

Redeker & McEnany, 2011
Functions

- Conserve energy and metabolism
- Maintain physiologic systems within proper homeostatic mechanisms
- Maintain host defenses
- Reverse/restore physiologic processes that degrade during wakefulness (plasticity)
- Memory Consolidation
- Learning

Redeker & McEnany, 2011
How much sleep do we really need?

- ~8 hours!
- U shaped curve of sleep duration

Cappucchio et al, 2011, Eur Heart Journal
Factors Contributing to Sleep Loss

- Voluntary curtailment (social)
- Environment (i.e. work, technology, etc)
- Role (new parent, school)
- Sleep Disorders
- Medical and psychiatric disorders

Redeker & McEnany, 2011
Effects of Sleep deprivation

- Irritability
- Cognitive impairment
- Memory lapses or loss
- Impaired moral judgement
- Severe yawning
- Hallucinations
- Symptoms similar to ADHD
- Impaired immune system
- Increased heart rate variability
- Risk of heart disease
- Decreased reaction time and accuracy
- Tremors
- Aches

Other:
- Growth suppression
- Risk of obesity
- Decreased temperature
Outcomes of Disturbed Sleep

- Increased stress hormones (catecholamine's)
- Insulin and glucose dysregulation
- Ability to perform activities of daily living
  - Lack of mental processing of self care activities upon discharge
- Decrease in SWS
  - ↓ HGH
  - Alterations in processing and consolidating newly acquired information
Patients are admitted already sleep deprived
Lack of sleep impacts a host of body functions

Illness impacts an individual's ability to have adequate sleep.

Bi-directional impacts
## Co-Morbidity and OSA

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug resistant hypertension</td>
<td>83%</td>
</tr>
<tr>
<td>Obesity</td>
<td>77%</td>
</tr>
<tr>
<td>Congestive Heart Failure</td>
<td>76%</td>
</tr>
<tr>
<td>Diabetes type 2</td>
<td>72%</td>
</tr>
<tr>
<td>Stroke</td>
<td>63%</td>
</tr>
<tr>
<td>Pacemakers</td>
<td>59%</td>
</tr>
<tr>
<td>Arrhythmias</td>
<td>58%</td>
</tr>
<tr>
<td>Coronary heart disease</td>
<td>57%</td>
</tr>
<tr>
<td>Afib (Atrial Fibrillation)</td>
<td>49%</td>
</tr>
<tr>
<td>Depression</td>
<td>45%</td>
</tr>
</tbody>
</table>

*Note: % represent comorbidity*

*Source: Seet & Chung, Anesthesiology Clin 2010*
General Sleep Assessment (1)

• Challenges
  • Sleep problems typically occur gradually; patients may not be aware or concerned
  • May attribute daytime symptoms to other causes

• Assessment
  • BEARS (all ages)
    • B-bedtime problems
    • E-Excessive Sleepiness
    • A-Awakenings
    • R- Regularity of sleep
    • S-Sleep disordered breathing

Redeker & McEnany, 2011
Restless Legs-Bedtime Problems

• Sensorimotor disorder
  • Urge to move legs, worsened by rest or inactivity, symptoms relieved by movement, develop or worsen in the evening or nighttime

• Prevalence 2-3%

• Associated with
  • Comorbidities
  • Immobility
  • Sleep deprivation
  • Circadian disruption
  • Anemia

https://www.youtube.com/watch?v=k2eGoHk9AAc
General Sleep Assessment (2)

• General health

• Specific Conditions
  • Co-morbid/bi-directionality (heart disease, asthma, diabetes, Parkinson's, pain, depression and anxiety)
  • Cardiovascular (BP, EKG, heart sounds)
  • Pulmonary system (scoliosis, muscle tone)
  • Neuromuscular (restless legs syndrome)
  • Glycemic control

Redeker & McEnany, 2011
General Sleep Assessment (3)

- **Anthropometric data**
  - Ht/Wt (BMI >30), neck circumference (17 m, 16 f) correlate with OSA in adults
  - Waist circumference and BMI>95th percentile in children
  - Inspection of the profile, oral and nasal cavities

Retrognathia
Alterations in Sleep Health

- Quantity
- Quality
- Timing and Consistency

Sleep is viewed as a basic biologic process that affects all individuals and has significant impact on the function of all organ systems” (1)

How Do Clinicians Assess, Communicate About, and Manage Patient Sleep in the Hospital?

Ye, Lichuan PhD, RN; Keane, Kathleen MS, BSN, CNL, CCRN; Johnson, Stacy Hutton MS/MBA, RN, NE-BC; Dykes, Patricia C. DNSc, RN

Abstract

OBJECTIVE: The objective of this study was to characterize how clinicians assess, communicate about, and manage patient sleep, with the focus on identifying existing barriers and facilitators to sleep promotion in clinical practice.

BACKGROUND: Sleep is a critical need for improving for hospitalized patients.

METHODS: Content analysis was used to interpret descriptive data from 4 group interviews with a total of 62 clinicians.

RESULTS: Clinicians reported they did not formally assess for patient sleep, which led to largely unmanaged sleep disruption during hospitalization. Major barriers to effective sleep management were limited understanding of the importance of sleep, lack of a standardized tool for assessment, and inadequate communication. Facilitators included collaborative communication with patients and the healthcare team and customized patient-centered interventions.

CONCLUSIONS: It is critical to inform clinicians on the importance of sleep, to standardize sleep assessment, and to facilitate collaboration among caregivers to promote sleep for hospitalized patients.
Multiple environmental barriers to sleep in the ICU were identified when participants were directly asked about factors affecting sleep. Responses highlighted healthcare system-based barriers related to hospital/ICU policy and workflow. Implicit barriers to sleep were found when participants responded to open-ended questions. These included attitudinal barriers such as the uncertainty about the significance of sleep, the tension between providing protocol-driven ICU care and allowing uninterrupted patient sleep, and lack of consensus regarding interventions to promote sleep.

Conclusions

This qualitative study suggests that health care worker attitudes, methods of sleep promotion, hospital institutional policies and workflow may contribute to sleep disruption in the ICU. These barriers provide additional targets for intervention in studies designed to improve sleep in the ICU.
Nurse evaluation and sleep

Sleep questionnaire

<table>
<thead>
<tr>
<th>Measure</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sleep depth</td>
<td>My sleep last night was: light sleep (0) ... deep sleep (100)</td>
</tr>
<tr>
<td>2. Sleep latency</td>
<td>Last night, the first time I got to sleep, I just never could fall asleep (0) ... fell asleep almost immediately (100)</td>
</tr>
<tr>
<td>3. Awakenings</td>
<td>Last night, I was awake all night long (0) ... awake very little (100)</td>
</tr>
<tr>
<td>4. Returning to sleep</td>
<td>Last night, when I woke up or was awakened, I couldn't get back to sleep (0) ... got back to sleep immediately (100)</td>
</tr>
<tr>
<td>5. Sleep quality</td>
<td>I would describe my sleep last night as: a bad night's sleep (0) ... a good night's sleep (100)</td>
</tr>
<tr>
<td>6. Noise</td>
<td>I would describe the noise level last night as: very noisy (0) ... very quiet (100)</td>
</tr>
</tbody>
</table>
# Sleep in the ICU

<table>
<thead>
<tr>
<th>Sleep Parameter</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sleep Time</td>
<td>Unchanged/decreased</td>
</tr>
<tr>
<td>Sleep Latency</td>
<td>Unchanged/increased</td>
</tr>
<tr>
<td>Sleep Efficiency</td>
<td>Decreased</td>
</tr>
<tr>
<td>NREM Stage 1</td>
<td>Increased</td>
</tr>
<tr>
<td>NREM Stage 2</td>
<td>Increased</td>
</tr>
<tr>
<td>NREM Stage 3</td>
<td>Decreased</td>
</tr>
<tr>
<td>REM</td>
<td>Decreased</td>
</tr>
</tbody>
</table>

Environmental and Pathophysiological Factors

- Noise
- Lighting Practices
- Patient Care Activities
- Diagnostic Procedures
- Sedatives Analgesics
- Stress
- Organ Dysfunction
- Inflammatory Response
- Pain
- Psychosis

Noise and Light

• Noise levels typically exceed that recommended by WHO
  • 30 dB Average; 40 dB maximum (Yoder, et al., 2012)
    • As high as 80dB
  • Day/Night Variance
  • Reduced sleep, poor sleep efficiency
  • HCAHPS score
  • Medical devices and conversation

• Lighting is aperiodic
  • Morning light to improve entrainment
  • Open window coverings
  • Circadian influence

• Quality Improvement Programs

"He's resting comfortably."
ICU Delirium

1. American Association of Critical Care Nurses, 2014
2. Cavallazzi, et al., 2012 Annals of Intensive Care
3. Flink, et al. 2012 Anesthesiology
Adverse Outcomes of Delirium

- Inadvertent extubation
- Removal of catheters
- Increased
  - Length of stay
  - Increased costs
  - Increased falls
  - Use of restraints
- Increased morbidity and mortality
  - Worse cognitive status at discharge and 12 months after DC
- Family/caregiver distress
Sleep Deprivation and Delirium

Pharmacology Impacts

- Opioids
  - Decrease total sleep time, SWS, REM
  - Precipitate OSA
  - Worsen hypoxia
  - Ventilator asynchrony
- Benzodiazapines
  - Increase theta; reduce SWS (low doses)
  - Loss of SWS has been shown to increase delirium
- Dexmedetomidine (Precedex)
  - Decrease sleep latency; REM
  - Increases REM
  - Reduces ventilator days
  - Reduces delirium
- Propofol
  - Reduces REM sleep and contributes to poor sleep quality in mechanically ventilated patients (Kondili, 2011)

http://www.medscape.com/viewarticle/723907_2?pa=FKay6DyvdWAoidEOyiMJ7mNUPPP%2BJBMnDcVlg2VcXoz8cq2BFgajZfUoCbbFK5aNJmN08P2fm2zqEsufi7A%3D%3D

Wienhourse, Crit Care Clinics, 2008
Pharmacology Impacts

• Cardiovascular
  • B agonists: increase wake and REM
  • ACE inhibitor: No effect on sleep
  • Dopamine: decrease SWS, REM

• Respiratory
  • Xanthines: Decrease total sleep time, REM, sleep efficiency, SWS
A bit about Melatonin

- Secreted by the pineal gland
- Modulated by the SCN (circadian pacemaker)
- Outside of the blood brain barrier
- Released into the bloodstream
- Secreted at night (darkness), highest levels ~3-4 AM
- Secretion reduced on light exposure

- Critically ill patients have been found to have abnormal (low) levels of melatonin
Melatonin Use in the ICU

• Few RCT
• Data are inconclusive for the prevention or lessening of delirium

• Use of Ramelteon
  • Melatonin agonist
  • Indicated for insomnia
  • Some success reported

http://www.medscape.com/viewarticle/820795?pa=4%2F5zOMn2NBfa97sNtFmW%2FReOlcteyvWIYQwO3c4QJtUyfsH6gLbrmoZz1O3yo%2Bpv43mU9jD%2B1DtnxY47OmyybA%3D%3D
Interventions

• Reduce Effects of Environmental Stimuli
  • Decrease noise
  • Cluster patient care interventions
  • Provide eye masks and ear plugs if appropriate

• Complementary and Alternative Medicine
  • Relaxation, music and biofeedback
    • White noise may improve sleep quality in cardiac post op patients
  • Massage
  • Meditation

• Progressive mobility/up in the chair during the day
• Families bring in familiar objects and pictures.
• Review Drug interactions, understand the consequences
Interventions

"We haven't recognized the importance of prescribing sleep“ Friese, R 2007

About Obstructive Sleep Apnea

Figure 3: Risk factors, pathogenic mechanisms, and treatments for obstructive sleep apnoea
Risk factors for obstructive sleep apnoea have long been recognised, but novel pathogenic mechanisms have now been detected in patients with the disorder. Although CPAP is the current treatment of choice irrespective of underlying cause, treatments based on tackling individual pathogenic mechanisms might prove a successful alternative approach in the future. CPAP = continuous positive airway pressure. MAD = mandibular advancement device. UPPP = uvulopalatopharyngoplasty. HGNS = hypoglossal nerve stimulation. Figure adapted from Jordan and colleagues,16 by permission of Elsevier.
What does OSA look like?
4 Minutes
Sleep Fragments
Section Editors: Bernie Sunwoo, M.D., and Mihaela Teodorescu, M.D.

A Man with Sleep-associated Symptomatic Bradycardia
Abhishek Biswas, Richard B. Berry, Peruvemba S. Siram, and Ashish Prasad

Department of Pulmonary and Critical Care Medicine, University of Florida, Gainesville, Florida

ORCID IDs: 0000-0001-9384-7507 (A.B.); 0000-0002-6579-9883 (R.B.B.); 0000-0003-0586-9197 (A.P.).

Case Vignette
A 61-year-old man presented with increasingly bothersome palpitations that woke him at night but did not occur during the day. His wife reported that he would frequently snore at night and appeared to stop breathing at times. The patient denied daytime sleepiness, chest pain, presyncope, or syncope symptoms. His Epworth scale was 7/24. He had a history of hypertension and benign prostatic hyperplasia but was otherwise well.

Physical examination revealed a healthy-appearing man with a body mass index of 24 kg/m² and a Mallampati II airway. Cardiac examination revealed

Figure 1. A 60-second tracing showing the end of a long obstructive apnea with a blow up of the area of interest (A). During the event, a transition from stage N2 (sleep spindles visible) to rapid eye movement (REM) sleep was noted. At the time of transition to REM sleep, the electrocardiogram (ECG) shows complete heart block, with a ventricular pause of 7 seconds. Arousal from sleep is noted immediately after the period of complete heart block. SpO2 = oxygen saturation as measured by pulse oximetry.
Patterns of Unexpected Hospital Death

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE I</td>
<td>Hyperventilation Compensated Respiratory Distress (e.g. Sepsis, PE, CHF)</td>
</tr>
<tr>
<td></td>
<td>Stable SPO2 with progressively falling PaCO2 eventually yields to slow SPO2</td>
</tr>
<tr>
<td></td>
<td>decline (mitigated by respiratory alkalosis) and followed by precipitous</td>
</tr>
<tr>
<td></td>
<td>SPO2 decline when metabolic acidosis dominates</td>
</tr>
<tr>
<td>TYPE II</td>
<td>Progressive Unidirectional Hypoventilation (CO2 Narcosis)</td>
</tr>
<tr>
<td></td>
<td>Progressive rise in PaCO2 and fall in SPO2 over 15 minutes to many hours.</td>
</tr>
<tr>
<td></td>
<td>(Often due to overdosing of narcotics or sedatives)</td>
</tr>
<tr>
<td>TYPE III</td>
<td>Sentinel Rapid Airflow/SPO2 Reductions Followed by Precipitous SPO2 Fall.</td>
</tr>
<tr>
<td></td>
<td>A state of “arousal dependent survival” that occurs only during sleep.</td>
</tr>
<tr>
<td></td>
<td>Arousal failure allows precipitous hypoxemia during apnea causing terminal</td>
</tr>
<tr>
<td></td>
<td>arousal arrest.</td>
</tr>
</tbody>
</table>
**Figure 3** Type III Pattern of Unexpected Hospital Death (Sleep Apnea with Arousal Failure).
Alarm Fatigue

Figure 6 “Alarm Fatigue” induced by the Type III pattern of figure 5.
OSA in the Hospital

- Estimated 25% of candidates for elective surgery
- OSA undiagnosed in 80% at the time of surgery
- Estimates of OSA in hospitalized patients
  - >50%
- <20% with a diagnosis of OSA received therapy during hospitalization (Premier Inc, database; Memtsoudis et al, 2013, NEJM)
Screening for OSA

- Variety of questionnaires
  - Epworth, Berlin, STOP/STOP BANG, Sleep Apnea Clinical Score, perioperative sleep apnea prediction (P-SAP, 2010)
- Pulse Oximetry
- Home sleep testing for all elective surgical
- Full polysomnography

2004 National Hospital Discharge Survey
- 6.8% reported SA in discharge data
- 5.8% received continued PAP therapy while hospitalized
## STOP-BANG

<table>
<thead>
<tr>
<th>Question</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S</strong> (Snoring)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you snore loudly (louder than talking or loud enough to be heard through closed doors?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T</strong> (Tired)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you often feel tired, fatigued, or sleepy during the daytime?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>O</strong> (Observed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has anyone observed you stop breathing during your sleep?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P</strong> (Blood Pressure)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have or are you being treated for high blood pressure?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B</strong> (BMI)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI more than 35 kg/m²?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A</strong> (Age)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age over 50 years old?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>N</strong> (Neck Circumference)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck circumference greater than 40 cm (16 in)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>G</strong> (Gender)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender male?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
OSA in the Hospitalized Patient

• Why OSA is an important assessment
  • Association with MI, arrhythmias, CHF, stroke, sudden cardiac death
    • Sudden death ~ 50% those with OSA compared to 21% without OSA
    • Die during the sleep hours (12-6 AM)
    • Sudden death related to the AHI, the more severe the higher the risk
  • Depressed arousal mechanisms due to sleep fragmentation and deprivation; acquired arousal failure in obese patients
    • Narcotics further delay arousal

Kaw & Mokhlesi (2012) Sleep and Breathing
Types of patients at high risk for OSA

- CHF
- Obese
  - Patients undergoing bariatric surgery
- Atrial Fibrillation
- Refractory Hypertension
- Type 2 diabetes
- Stroke
- Nocturnal cardiac arrhythmia
- Pulmonary Hypertension

AASM Task Force, 2009 JCSM
2 Relevant Joint Commission Directives

Characteristics of patients who are at higher risk for oversedation and respiratory depression:
- Sleep apnea or sleep disorder diagnosis
- Morbid obesity with high risk of sleep apnea
- Snoring

2014 Hospital National Patient Safety Goals

The purpose of the National Patient Safety Goals is to improve patient safety. The goals focus on problems in health care safety and how to solve them.

Use alarms safely
NPSG.06.01.01
Make improvements to ensure that alarms on medical equipment are heard and responded to on time.
Key Take Away

- OSA patients live in a state of “perpetual arousal dependent survival” (Lynn & Curry, 2011)
- Acquired arousal failure
- Sleep deprivation may have long lasting ramifications
Sleep Apnea in Hospitalized Patients

Regardless of admission diagnosis

↑ vulnerability to adverse outcomes when left untreated
- Cardiorespiratory failure and unanticipated death
- Falls, HCAP, prolonged intubation, longer ALOS

↑ utilization health care resources

↑ risk hospital litigation

Slide used with permission Dr. Lisa Kuhen
## Care Process Changes

<table>
<thead>
<tr>
<th>Do’s</th>
<th>Don’ts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Always assess your patients sleep health</td>
<td>• Underestimate the consequences of poor sleep</td>
</tr>
<tr>
<td>• Document/communicate alterations in sleep</td>
<td>• Dismiss alarms from oximeters</td>
</tr>
<tr>
<td>• If patients use CPAP at home, have them bring it and use it</td>
<td>• Forget to monitor frequently</td>
</tr>
<tr>
<td>• Create an opportunity for sleep; limit interaction</td>
<td>• Assume the patient is sleeping</td>
</tr>
</tbody>
</table>
Summary

- Sleep deprivation can be acute or chronic
  - Both have resulting physiological consequences
- Sleep in hospitalized patients is disturbed resulting in sleep deprivation.
- A large proportion of patients who enter the hospital have not been diagnosed with sleep apnea or have CPAP initiated or continued from home
- Increased awareness of sleep deprivation and sleep apnea can provide for improvement in interventions and early recognition of patients with a potential for adverse consequences
- Program implementation can have important financial considerations
Goals for Sleep in the ICU

- Get enough sleep
- Reset circadian rhythms
- Adjust abnormal sleep structure
- Reduce sleep interruption
- Reduce fatigue/stress

Huang, et al, 2014, Trials
Last Quote

“I fear to become a patient…”

“… that’s what scares me: to be made helpless before my time…. To be awoken when I wish to sleep”

Don Berwick, MD
What ‘Patient-Centered’ Should Mean: Confessions of an Extremist
Health Affairs, 2009
• Please feel free to contact me!

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• 510-728-0828