Quiet in the Hospital: Improving Patient Care

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Objectives

- Describe the University of Michigan Health System’s efforts to improve sleep in hospitalized patients.

- Discuss how the hospital sleep environment impacts patient satisfaction and hospital reimbursement.

- Evaluate potential adverse health impacts of sleep disruption during hospitalization including neurocognitive impacts such as delirium.

- Identify environmental factors for hospital sleep disruption and strategies to minimize patient impact.
Why won’t hospitals let patients sleep?

http://www.pbs.org/newshour/updates/wont-hospitals-let-patients-sleep/
University of Michigan Health System
THE QUIET CAMPAIGN
Quiet Campaign

- Office of Service Excellence
- Launched 2011
- Increase quietness and improve patient care experience and staff work conditions
- Posters, visual displays, noise meters
- Replaced pillow speakers with headphones and ear buds
- Patients given eye masks and ear plugs
- Noisy equipment fixed and replaced (doors, cart wheels)
- Piloting of sound absorbing materials and noise meters
- Partnership with University Health System Consortium (HCAHPS Improvement Collaborative)

http://www.med.umich.edu/u/svcexc/resources/quiet.html
Quiet Hours

9 pm to 5 am  1 pm to 3 pm (Units may vary)
HC A HPS Improvement Collaborative

- Hospital Consumer Assessment of Healthcare Providers and Systems
- Joint project CMS and AHRQ (Agency for Health Care Research and Quality)
- HCAHPS survey since 10/2006- Goal uniformly measure patient perception of inpatient care
- 25% of Medicare’s Value Based Purchasing Score using now 9 weighted measures
- CY15 2 out of 8 HCAHPS domains failed to meet CMS public thresholds (Cleanliness/quietness, Communications about meds)
- During this hospital stay how often was the area around your room quiet at night?
- www.hospitalcompare.hhs.gov

http://www.med.umich.edu/i/quality/reports/patients/hcahps/index.html
HCAHPS survey

- Overall rating of hospital % 9s and 10s
- Doctors always communicate well
- Nurses always communicate well
- Patients always received help as soon as they wanted
- Staff always explained about medications
- Pain was always well controlled
- **Patient’s room always kept quiet at night**
- Patient’s room and bathroom always kept clean
- Patient’s given information about recovery at home
- Patient’s would definitely recommend this hospital to friends and family
## Patient perception of care surveys

<table>
<thead>
<tr>
<th>Press Ganey</th>
<th>HCAHPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Public</td>
</tr>
<tr>
<td>All age inpatients and ER</td>
<td>Adult inpatients</td>
</tr>
<tr>
<td>Larger sampling size</td>
<td>Smaller sampling size</td>
</tr>
<tr>
<td>Larger survey (HCAHPS and more)</td>
<td>Smaller survey</td>
</tr>
<tr>
<td>Roughly 100 questions</td>
<td>18 rated questions, 9 demographic</td>
</tr>
<tr>
<td>Some open ended</td>
<td>No open ended</td>
</tr>
<tr>
<td>Can obtain unit specific data</td>
<td>Hospital data</td>
</tr>
<tr>
<td>Data available immediately</td>
<td>9-12 month data lag</td>
</tr>
<tr>
<td>Rescaled, averaged (0-100 index)</td>
<td>% top box reporting</td>
</tr>
<tr>
<td>Very poor to very good (5 point)</td>
<td>Never to always or yes no (4 point)</td>
</tr>
</tbody>
</table>
“Try to get some rest. I’ll be in every few minutes to make sure you don’t.”
Sleep Quality in the hospital

- Prolonged sleep latency, increased sleep fragmentation, early morning awakenings, decreased total sleep time.
- Association between sleep disturbances and quantity of chronic diseases, pain, tricyclic antidepressants, duration of hospitalization (Frighetto 2004)
- Almost 50% admitted to general hospital medical wards experience insomnia, excessive daytime sleepiness, or both. Few, if any of these sleep problems are ever reported in the medical records (Meissner 1998)
- The use of hypnotic medications both prior to admission and during the hospital stay is common

Sleep Quality in the ICU

- TST 7-9 hours but 50% occurring during daytime hours.
- Increased sleep fragmentation (6.2 awakenings per hour)
- Prolonged sleep onset, decreased sleep efficiency, decreased REM sleep
- Altered sleep wake cycles for up to 3 months after discharge
- Severity of illness and environmental factors likely contribute to poor sleep
  - Normal subjects had less sleep disruption than ICU patients at ICU noise level but normal subjects without intense clinical monitoring
- Mechanical ventilation: Endotracheal tube discomfort, level of inspiratory support, inducing central apnea, patient-ventilator asynchronies.
- Sleep has been deprioritized in hospital setting and perhaps more so in ICU (intubated, sedated patients)
Cyclical interaction: sleep and common medical illnesses.

Young et al. “Sleep in hospitalized medical patients, Part 1: Factors affecting sleep” Journal of Hospital Medicine (3) 6 473-482
Medical conditions: associated sleep problems

- **Asthma**: Nocturnal symptoms, GER
- **CHF**: Orthopnea, PND, OSA, CSA, Diuresis
- **COPD**: Nocturnal hypoxemia, Early morning airway obstruction
- **ESRD**: Pruritus, nausea, RLS, PLMD
- **GERD**: Heartburn, coughing
- **OSA**: Worsened by some hospital meds
- **Stroke**: Dysphagia, focal deficits, insomnia, OSA, CSA

Young et al. “Sleep in hospitalized medical patients, Part 1: Factors affecting sleep” Journal of Hospital Medicine (3) 6 473-482
Adverse effects of sleep deprivation

- **Respiratory**
  - Decreased ventilatory response to hypoxia and hypercarbia
  - Decreased FEV1 and FVC by 5% in COPD
  - MIP decrease from 81.5 to 75.9 cm H2O healthy adults
  - Decreased respiratory muscle endurance

- **Cardiovascular**
  - Increased sympathetic response and BP and HR
  - BP elevated 12 mm Hg after one night sleep deprivation healthy adults
    (Ogawa)

- **Immunologic**
  - Decrease ability for extravasation of T cells, Decreased NK cells 30%
    (Irwin)
Adverse effects of sleep deprivation

- **Metabolic**
  - Dysfunction of HPA axis and disrupted cortisol secretion
  - Suppressed release of insulin from pancreas (Hyperglycemia)

- **Neurocognitive**
  - Adverse effects on cognition (Delirium?) (Poor ability of patients and families to understand instructions?)
  - Adverse effects on balance (falls?)
  - Increased risk for seizures

“When a delirium or raving is appeased by sleep, it is a good sign.”

- Hippocrates

Disruption of Sleep and the delirium relationship:
Possible common pathophysiological pathways between delirium and sleep disruption

Sedation versus sleep

**Sedation**
- Decreased response to external stimuli
- Decreased muscle tone
- Respiratory depression
- Med specific effects
- Dose dependent
- Changes in sleep architecture
- EEG patterns different than sleep

**Sleep**
- Decreased response to external stimuli
- Decreased muscle tone
- Respiratory depression
- Essential biologic function
- Spontaneous
- Reversible
- Circadian rhythm
- Cyclical progression through sleep stages
Objectives: Describe sleep quality and evaluate the association of sleep quality with delirium onset amongst patients enrolled in hospice.

Design: Prospective, observational, longitudinal study.

Setting: Veterans enrolled in hospice Portland Oregon.

Cohort: 105 patients, of whom 73% had at least one sleep measurement.

Sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI).

Delirium was measured with the Confusion Assessment Method.

Of the patients who could be assessed, 44% had poor average sleep quality and 58% reported at least one episode of poor sleep. Overall, sleep quality did not appear to worsen as patients neared death although an increasing number of patients were unable to report on sleep quality.

Poor sleep quality was associated with an increased risk of developing delirium, with a HR of 2.37 (95% CI 1.50 – 3.74), for every one point worsening in the sleep quality score on a four point scale.
1. During the past month, when have you usually gone to bed at night?

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

3. During the past month, when have you usually gotten up in the morning?

4. During the past month, how many hours of actual sleep did you get at night? (This may differ from the number of hours you spend in bed.)

5. During the past month, how often have you had trouble sleeping because you...
   (a) Cannot get to sleep within 30 minutes.
   (b) Wake up in the middle of the night or early morning.
   (c) Have to get up to use the bathroom.
   (d) Cannot breathe comfortably.
   (e) Cough or snore loudly.
   (f) Feel too cold.
   (g) Feel too hot.
   (h) Had bad dreams.
   (i) Have pain.

6. During the past month, how would you rate your sleep quality overall?
   Very good
   Fairly good
   Fairly bad
   Very bad

7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?
The Confusion Assessment Method (CAM) Diagnostic Algorithm

- Feature 1: Acute Onset and Fluctuating Course
- Feature 2: Inattention
- Feature 3: Disorganized thinking
- Feature 4: Altered Level of consciousness

The diagnosis of delirium by CAM requires the presence of features 1 and 2 and either 3 or 4.
“Sleep Quality and its Association with Delirium among Veterans enrolled in Hospice”

Histograms of average sleep quality for patients with no delirium and average pre-delirium sleep quality for patients with delirium during hospice care.

Delirium and hospital sleep disruption

- Hospital Elder Life Program (HELP) tested by Yale Delirium Prevention trial\(^1\) assessed six risk factors (dehydration, sleep deprivation, immobility, visual impairment, cognitive impairment, hearing impairment) at hospital admission.

- When a risk factor was present, it was treated with a targeted intervention.

- Nonpharmacologic sleep protocol included sips of warm milk, back and shoulder rubs and relaxing music when going to sleep.

- Protocol not only reduced sedative and hypnotic drugs, but also reduced incidence of delirium.\(^2\)

Delirium and hospital sleep disruption

- Guidelines for prevention of delirium in hospitalized patients by National Institute for Health and Clinical Excellence (NICE).

- Recommend efforts to improve sleep quality (i.e. avoiding unnecessary nursing or staff procedures during night-time and reducing environmental noise as much as possible) as mainstay measure to attempt to reduce delirium incidence.

Improving the hospital sleep environment
Reducing Hospital Sleep Disturbance

- Establish nocturnal environment
- Enhance staff awareness of conversation noise
- Employ night settings in monitoring equipment with backlighting to reduce light exposure.
- Judicious use of pharmacological agents that may worsen sleep
- Monitor, assess, and treat pain
- Individualized sleep hygiene routines
- Relaxation techniques in preparation for sleep
- Decrease environmental stimuli (eye masks, ear plugs)
- Reduce nocturnal clinical interactions
- Ventilator support to promote rest overnight
- Reduce daytime napping in order to reduce circadian desynchrony
Clinical interactions and impact on sleep

- Walker and Woods reported ICU patients sleep disturbed 1-14 times/hour by staff.
- 50% of ICU patients described being woke up 2-5 times per night (Lee).
- Tamburi and Celik 40-60 patient staff interactions/night.
- Sleep disruption even worse in ventilated patients.
- 14% of ICU clinical interactions could be safely omitted (Le et al.).
- Timing meds or assessments together.
- Future technology may let us collect same data with less sleep disruption.
- Scheduling for patients instead of health care providers.
## Modified Early Warning Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate</td>
<td>&lt;9</td>
<td>9-14</td>
<td>15-20</td>
<td>21-29</td>
<td>&gt;29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart rate</td>
<td>&lt;40</td>
<td>41-50</td>
<td>51-100</td>
<td>101-110</td>
<td>111-129</td>
<td>&gt;129</td>
<td></td>
</tr>
<tr>
<td>Systolic BP</td>
<td>&lt;70</td>
<td>71-80</td>
<td>81-100</td>
<td>101-199</td>
<td>&gt;199</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature</td>
<td>&lt;35</td>
<td>35-38.4</td>
<td>Alert</td>
<td>Voice</td>
<td>Pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neurological</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Unresp</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Adverse Event Rate and Evening Modified Early Warning Score. The bars represent the adverse event rate (per 1000 patient-days). The line represents nighttime vital sign monitoring (per patient median).
Post-hospitalization Syndrome

- Hospital Readmission
- Loss of Strength
- Nutritional Deficit
- Generalized vulnerability to illness
- Adverse drug effects
- Sleep Deprivation

<table>
<thead>
<tr>
<th></th>
<th>Establishement of the 8 hour Quiet Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Quiet Hours 10pm to 6am</td>
</tr>
<tr>
<td>2.</td>
<td>Routine vitals 6am, 2pm, 10pm</td>
</tr>
<tr>
<td>3.</td>
<td>Order medication daily, BID, TID, etc rather than Q 6h, Q 12h, Q 24h, etc</td>
</tr>
<tr>
<td>4.</td>
<td>No standing doses of diuretics after 4pm</td>
</tr>
<tr>
<td>5.</td>
<td>Avoid blood transfusions during “Quiet Hours”</td>
</tr>
<tr>
<td>6.</td>
<td>Install a noise detector</td>
</tr>
<tr>
<td>7.</td>
<td>Play lullaby at 10pm</td>
</tr>
<tr>
<td>8.</td>
<td>Overhead hallway lights on a timer, set to turn off at 10pm</td>
</tr>
<tr>
<td>9.</td>
<td>Nighttime nursing routine: vitals, bedtime meds, toilet, change IV bag, close patient’s door</td>
</tr>
<tr>
<td>10.</td>
<td>When possible avoid IV line in antecubital fossa (alarms if occluded). When possible do not run IV at night</td>
</tr>
</tbody>
</table>

What Keeps Patients Awake?

![Bar Chart]

- Nothing: 20% (Pre-Intervention), 39% (Intervention)
- Discomfort of Illness: 25% (Pre-Intervention), 30% (Intervention)
- Noise: 15% (Pre-Intervention), 20% (Intervention)
- Hospital Staff: 40% (Pre-Intervention), 21% (Intervention)
- Attached Equipment: 10% (Pre-Intervention), 5% (Intervention)
- Worries: 10% (Pre-Intervention), 7% (Intervention)

Decreased Use of As-Needed Sedative by Limiting Sleep Disruption

% Patient Requiring As-Needed Sedatives

Pre-Intervention

Intervention

P=0.0054

P=0.0041

Noise and impact on hospital sleep

- WHO: Noise level should not exceed 30 dB hospital wards
- ICUs worldwide > 50 dB and often > 70 dB (traffic noise)
- ICU Noise increasing over last decades (.42 dB/night/year)
- Noise varies throughout night (Lombard effect)
- Subjectively and objectively: Main source of sleep disruption ICU
- Polysomnographic data regarding noise show some impact but not main impact in ICUs
- Some studies suggest 6-20% subjective reduction in noise after behavior modification
- Studies using noise meters less improvement or results in short term

Familiar sounds (dB)

- Quiet room: ~30
- Soft whisper at 2 m: ~35
- Refrigerator humming: ~45
- Microwave oven: ~55
- Normal conversation at 1 m: ~60
- Daytime acute care hospital floor: ~60
- Alarm clock: ~80
- Hair dryer, blender, lawn mower: ~90
- MP3 player at full volume: ~100

National Institute on Deafness and Other Communication Disorders, American Academy of Audiology, US Department of Labour (Occupational Safety & Health Administration).
Reducing hospital noise with sound acoustic panels and diffusion: a controlled study.

This sound acoustic panel is 36×96 inches and thickness measured 3/8 inch with overall depth of 11 inches. Custom panel is matte colour-studded hollow surfaces with an ordered array of half and full-sized cones, which jut from wall surface.
A-weighted Leq measured (1 s time intervals) in hospitals hallways with (blue triangle) and without (red circle) the use of sonic panels.

Light: Impact on hospital sleep

- Low levels of artificial light less than 500 Lux for as long as 20 min identified as sufficient to suppress nocturnal melatonin secretion
- Light levels within ICUs being highly variable, ranging between a mean of 5 and 1,400 Lux
- Subjective studies have reported that ICU survivors perceived light exposure to be minimally disruptive to their ability to sleep

Melatonin and ICU Sleep

- Mundigler (2002): Melatonin secretion suppressed in septic ICU patients compared to non-septic patients with normalized circadian patterns.
- Double blind placebo controlled study ($n=8$), patients receiving supplemental melatonin demonstrated an improvement in sleep duration and sleep quality (Shilo 2000).
- Egi (2006): 32 tracheostomized ICU patients inconclusive regarding benefit of melatonin in promoting sleep. Although melatonin levels increased in the treatment group, no improvement in nocturnal total sleep time.
- Bourne (2008): Studied effect of supplemental nocturnal 10 mg melatonin in 27 ICU patients who had undergone tracheostomy insertion to promote ventilator weaning. Sleep in treatment group increased by 1 h along with objective sleep quality improvement by bispectral index (BIS).
Assessing patient sleep in the hospital
In lab PSG and home sleep testing

In lab polysomnogram

Home sleep apnea test

1. Respiratory Effort Sensor Belt
   - Measures respiratory effort

2. Nasal Cannula
   - Measures airflow

3. Pulse oximeter
   - Measures oxygen saturation levels

4. Measures heart rate
Actigraphy
Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations? Answer considering how you have felt over the past week or so.

0 = Would never doze  
1 = Slight chance of dozing  
2 = Moderate chance of dozing  
3 = High chance of dozing

1. Sitting and reading
2. Watching TV
3. Sitting inactive in a public place (e.g., theater or meeting)
4. As a passenger in a car for an hour without a break
5. Lying down to rest in the afternoon when able
6. Sitting and talking to someone
7. Sitting quietly after a lunch without alcohol
8. In a car while stopped for a few minutes in traffic

0-9 Normal  
10-14 Mild sleepiness  
15-17 Moderate sleepiness  
>18 Severe sleepiness
**Sleep Diary**

<table>
<thead>
<tr>
<th>a) Today is: Sun M T W Th F Sat</th>
<th>Today’s date is: -</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) Last night I got into bed at _<strong><strong>:</strong></strong> AM PM</td>
<td></td>
</tr>
<tr>
<td>c) I actually tried to go to sleep at _<strong><strong>:</strong></strong> AM PM</td>
<td></td>
</tr>
<tr>
<td>d) I think it took me about _____ minutes to fall asleep.</td>
<td></td>
</tr>
<tr>
<td>e) This morning I planned to wake up at _<strong><strong>:</strong></strong> AM PM (or, check here ____ if you did not plan a specific time)</td>
<td></td>
</tr>
<tr>
<td>f) This morning I actually woke at _<strong><strong>:</strong></strong> AM PM</td>
<td></td>
</tr>
<tr>
<td>g) This morning I actually got out of bed to start my day at _<strong><strong>:</strong></strong> AM PM</td>
<td></td>
</tr>
<tr>
<td>h) Last night after I finally fell asleep, I woke up this many times during the night (circle one):</td>
<td>0 1 2 3 4 5 or more</td>
</tr>
<tr>
<td>i) Each awakening during the night lasted (e.g. 10min, 10min, 20min)? ________________</td>
<td></td>
</tr>
<tr>
<td>j) Altogether these awakenings lasted ____________ minutes.</td>
<td></td>
</tr>
<tr>
<td>k) Last night I think altogether I slept _____ hours, _____ minutes.</td>
<td></td>
</tr>
</tbody>
</table>
Future Directions

- Improvement of accurate and early detection of hospital sleep impairment
- Continued efforts to implement a hospital environment that fosters sleep
- Future study to identify links between hospital sleep impairment and health outcomes
- Future aims to identify improvement in not only patient satisfaction but also clinical outcomes though improved hospital sleep
Public, insurance providers, and health care systems are beginning to focus on improving sleep in the hospital.

Poor sleep quality has been associated with adverse physiological consequences and is common in hospitalized patients and may lead to slowed recovery times from illnesses and predispose to medical comorbidities.

Sleep disturbances and delirium frequently coexist and while a cause and effect relationship has not been established, it is likely that both can cause and/or worsen the other.

Steps can be taken to attempt to foster a hospital environment (such as the Quiet Campaign) that best facilitates sleep in addition to identifying medical factors related to patient’s illnesses that could be improved to aid their sleep.
Questions?