The Silent Hospital, Is It Possible?

Lisa Pahl, MSN, RN
Principal, Acute and Critical Care Consulting
Practice Lead Alarm & Noise Management
Healthcare Transformation Services, Philips
What Is It Noise?

“Unwanted sound judged to be unpleasant, loud or disruptive.”

-Wikipedia
The Goal Is To Effectively Manage Sound

- Reduce Noise
- Confidentiality
- Speech Intelligibility
Sources of Unwanted Sounds For Patients & Families?

One study identified 86 different sources of noise in the hospital environment.
Recommendations, Sound Levels, And Perception

Decibel measurement is logarithmic: a 10-dB increase in noise represents a doubling of the noise level.


*UC San Diego Researchers Try To Quiet Noisy Hospitals, Tuesday, February 25, 2014, By Angela Carone

Image Source: Google Images
Identify Areas of Noise

Consider obtaining decibel levels

(patient rm): IV pump alarms | Bed alarms | chair alarms | Med cabinet alarm, etc.
**Sound Pressure Level | Day vs. Night Recommendations & Actual**

**Day**
- 35
- 70 (85 to 90+ peak)

**Night**
- 30
- 40 (Peak)

**Other Hospitals**
- ED
- ICU
- Tele
- NICU

**How do you compare?**

Values based on $L_{eq}$


Day: 07:00 – 18:59
Night: 19:00 – 06:59
Physiological Risks\(^1,3\) (Patients & Staff)

- **Heart Rate**
- **Blood Pressure**
- **Concentration**
- **Wound Healing**
- **Aggressive Behavior**
- **Impaired Sleep**
- **Psychiatric Symptoms**

Studies have found a correlation between noise and delayed wound healing in patients. As well, studies indicate surgical patients require more pain medication than those patients healing in quieter environments\(^1\)

Sleep is an important part of the healing process. Noise reduces both the quantity and quality of sleep, which weakens the immune system and impedes the body’s ability to generate new cells. It can also lead to problems during the day, such as agitation and delirium.\(^2\)

Noise disruptions impact caregivers’ concentration, causing stress, fatigue, and errors, potentially affecting quality of care.\(^2\)

Using EEG monitoring to observe sleep patterns, a study at a US hospital concluded environmental noise may impact sleep patterns of patients. They found a strong correlation between the number of SPL peaks greater than 80 dB and arousals from sleep.

---

2. [Creating the Quiet Zone: Improving noise control in hospitals, July 12, 2016](https://creatingquietzone.blogspot.com/2016/07/improving-noise-control-in-hospitals.html)
Other Impacts of Noise
Medicare Reimbursement, Patient Safety, & Other Impacts

“A study found that “noise levels interfered with attending and resident interactions in more than a third of shift-change communication.”*”

*Redesigning Hospital Alarms for Reliable and Safe Care by Paul Barach and Juan A. Sanchez in © Springer International Publishing Switzerland 2017 263
J.A. Sanchez et al. (eds.), Surgical Patient Care, DOI 10.1007/978-3-319-44010-1_17

“During this hospital stay, how often was the area around your room quiet at night?”

-Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey question

Per Hospital Compare, the national average response of those who reported it was quiet is 62% - this is one of the lowest rated satisfaction survey response.

“There is an intriguing, yet poorly understood, relationship between sleep and delirium”

Crit Care Med. 2016 Dec; 44(12): 2290–2291
Sleep & Clinical Practice Guidelines

Sleep was just added in 2018 as an area of focus

“Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU.”

John W. Devlin, PharmD, FCCM (Chair)1,2; Yoanna Skrobik, MD, FRCP(c), MSc, FCCM (Vice-Chair)3,4; et al, Critical Care Medicine, 2018, p. 850

-Poor sleep is a common complaint from ICU patients

-Sleep disruption and sleep fragmentation can be significant for critically ill patients
**Recommendation**

**Supplemental Table 42. Evidence Summaries and Evidence-To-Decision-Tables for Sleep Group Actionable Questions**

<table>
<thead>
<tr>
<th>Balance of consequences</th>
<th>Undesirable consequences clearly outweigh desirable consequences in most settings</th>
<th>Undesirable consequences probably outweigh desirable consequences in most settings</th>
<th>The balance between desirable and undesirable consequences is closely balanced or uncertain</th>
<th>Desirable consequences probably outweigh undesirable consequences in most settings</th>
<th>Desirable consequences clearly outweigh undesirable consequences in most settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**Type of recommendation**

<table>
<thead>
<tr>
<th></th>
<th>We recommend against offering this option</th>
<th>We suggest not offering this option</th>
<th>We suggest offering this option</th>
<th>We recommend offering this option</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>○</td>
</tr>
</tbody>
</table>

**Recommendation**

Apparent benefit in self-reported sleep quality, not costly

**Justification**

May be able to be implemented in most crit care settings and many patients.

**Comments during electronic voting by entire panel**

Low evidence, low harm

The questions differ; the evidence profiles report noise OR light reduction strategies. Can we be more specific about the recommendation based on the evidence? Is it a light or noise reduction strategy, or both?
Implement An Alarm Management Strategy

Reduce nuisance alarms

“Of course, medical device alarms at the patient’s bedside present one of the biggest challenges to noise reduction strategies.”

Creating the Quiet Zone: Improving noise control in hospitals
• Published on July 12, 2016

“Numerous deaths have been reported because of alarm fatigue, as beeps are ignored or go unheard, or because monitors are accidentally turned off or purposely disabled by staff who find the noise aggravating.”

Boston Globe Report 2011

5 ICUs had a total of 2.5 million monitoring alarms in a 31-day study period\(^1\) – the equivalent of 30 million alarms in a year

The majority of alarms, between 85%-99% are non-actionable.\(^2\)

https://doi.org/10.1371/journal.pone.0110274
What Makes An Actionable Alarm?

Role of Alarm Informativeness:

ALARM INFORMATIVENESS:
• Alarm accuracy
• Clinical relevance
  • Understanding alarm context – clinical status of the patient
  • May immediately require action
  • May be informative

CONSIDERATIONS:
• Some unit defaults might reduce alarms but could impact patient safety by reducing nurse awareness of patient status
• Nurse driven alarm customization is important
• More research needed

“Measurement Of Physiological Monitor Alarm Accuracy And Clinical Relevance In Intensive Care Units," by Halley Ruppel, RN, MS, Marjorie Funk, RN, PhD, and Robin Whittemore, PhD, APRN AJCC AM JOURNAL CRIT CARE, January 2018, Volume 27, No. 1 pp. 11 – 21
Establish a baseline

On-going assessment and impact of changes

Evaluation of sustainability of changes

- What are the alarm triggers?
- Are alarms related? e.g. High HR and Extreme Tachycardia
- What can the user change and what is password protected?
- What metrics are important – total alarms and number of alarms per bed per day?
### UNIT COMPARISONS - TOP 5 ALARMS

<table>
<thead>
<tr>
<th></th>
<th>UNIT 1</th>
<th>TOTAL</th>
<th>UNIT 2</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR HIGH</td>
<td>48,872</td>
<td>ECG LEADS OFF</td>
<td>18,417</td>
</tr>
<tr>
<td></td>
<td>ECG LEADS OFF</td>
<td>22,720</td>
<td>SPO2 LOW</td>
<td>18,073</td>
</tr>
<tr>
<td></td>
<td>HR LOW</td>
<td>21,208</td>
<td>HR LOW</td>
<td>15,637</td>
</tr>
<tr>
<td></td>
<td>PVCS PER MINUTE</td>
<td>12,871</td>
<td>PACER NOT PACING</td>
<td>10,184</td>
</tr>
<tr>
<td></td>
<td>PACER NOT PACING</td>
<td>4,381</td>
<td>DESAT</td>
<td>8,105</td>
</tr>
</tbody>
</table>

**Identify Areas of Focus**

*Pilot changes and then make a decision of whether to implement*

- Which are common across units/sites versus which are specific to a unit/site?
- Utilize published best practices and key stakeholders to identify changes
- Pilot changes: educate, communicate, support, and ensure Near Miss and Adverse Event reporting
- Evaluate the impact of changes

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Yellow Arrhythmia Alarms</td>
<td>55,477</td>
<td>16,411</td>
<td>-70%</td>
</tr>
<tr>
<td>Total Alarms</td>
<td>108,264</td>
<td>54,920</td>
<td>-49%</td>
</tr>
<tr>
<td>Total Alarms Per Patient Bed Per Day</td>
<td>202</td>
<td>129</td>
<td>-36%</td>
</tr>
</tbody>
</table>
Current State Assessment

*Important to understand all components from a unit, hospital, and system perspective*
### Other Changes & Impact

*Total alarm reduction decreases noise on the units*

<table>
<thead>
<tr>
<th>Unit</th>
<th>Change</th>
<th>Result: Total Alarms</th>
<th>Result: Total Alarms Per Patient Bed Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICU</td>
<td>▪ Adjusted default limit settings for SpO₂ and RR</td>
<td>↓ 39%</td>
<td>↓ 39%</td>
</tr>
<tr>
<td></td>
<td>▪ Defaulted off some medium priority arrhythmia alarms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Adjusted default trigger asystole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tele</td>
<td>▪ Defaulted off some medium priority arrhythmia alarms</td>
<td>↓ 47%</td>
<td>↓ 47%</td>
</tr>
<tr>
<td></td>
<td>▪ Adjusted default trigger asystole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peds</td>
<td>▪ Obtained appropriate size leads sets</td>
<td>↓ 61%</td>
<td>↓ 61%</td>
</tr>
<tr>
<td></td>
<td>▪ Initiated q24h electrode changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Care</td>
<td>▪ Adjusted High &amp; Low HR limit and SpO₂ Low limit</td>
<td>↓ 49%</td>
<td>↓ 36%</td>
</tr>
<tr>
<td></td>
<td>▪ Defaulted off some medium priority arrhythmia alarms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specialty ICU</td>
<td>▪ Only changed the alarm customization process</td>
<td>↓ 23%</td>
<td>↓ 26%</td>
</tr>
<tr>
<td></td>
<td>▪ Provided customization guidelines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Provided change management support</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ No changes to default settings</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluate The Use & Impact Of Secondary Notification Systems

*If not utilized effectively, they can add to noise and alarm/alert fatigue*

Comparison of Number of Asystole and Vfib/Vtach Alarms and Paging Alerts for Critical Care Units

(each over a 30 day period)
Reducing Alarms At The Point Of Care

Understand technology capabilities

Remote Alarm Device

- The Remote Alarm Device:
  - is mounted outside the room e.g. on the wall
  - provides additional visual and audible indications of alarms and tones, e.g. QRS, pulse, or prompt tones remote from the bedside
- When the caregiver goes to the bedside they can switch audio back on again with a single touch selection.

SpO₂ between 89% and 90%, for 10% of the time
Study Using A Bundled Strategy To Reduce Noise

“REDUCTION OF ICU NOISE AND ALARMS WITH A NIGHTTIME NOISE REDUCTION BUNDLE AND MODIFIED ALARM PROFILE.”

Anne Marie Mattingly1, E. Kate Valcin1; 1University of Rochester Medical Center, Rochester, NY Crit Care Med 2013 • Volume 41 • Number 12 (Suppl.)

-Implemented a nighttime noise reduction bundle (NNRB) including the following:
  • Posting quiet hours signs
  • Closing patient room doors
  • Reducing IV pump and monitor volumes
  • Modifying workflow to avoid precipitating alarms
  • Turning off TVs and radios
  • Reducing the volume of staff voices

-Patient monitoring alarm profile targeted at reducing nuisance alarms

Reduction of several metrics, including noise over 24 hours (median 54.3 to 53.0 dB, p<0.0005) and noise at night (median 52.8 to 51.3 dB, p<0.0005). Total alarms, total yellow alarms, and red arrhythmia alarms were all significantly decreased.
Noise Reduction Opportunities

*What can you do now versus longer term?*

- Promote a quiet culture – library voice
- Dim hallway lights during night shift
- Turning off equipment not in use
- Limit overhead paging
- Equipment maintenance
- Adjust phone volumes – at desk and cell
- Implement an Alarm Management Strategy – monitors, IV Pumps, Nurse Call Systems, etc.
- Monitoring for clinical need based on guidelines
- Time non-nursing activities, e.g. restocking supplies, cleaning floors, etc.
- Use of ear plugs, eye pads, and/or soothing sounds
- Engage patients and families

**Long Term:**
- Sound reducing ceiling tiles
- White noise devices
- Private rooms
- Planned location of elevators and ice machines
- Staff and transport hallways separate from patient rooms
- Staff rooms for communication
“The goal is not to silence your organization, but to have the sound of your hospital reflect your mission and values.”

(From: “Runaway Noise in the Hospital” Susan E. Mazer in H&HN Daily, 6/19/2014)