A team approach to improving the acoustical environment

Healthcare Transformation Services, Philips

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Today’s speakers

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Objectives

At the end of the session, the attendee will be able to:

- Differentiate between the acoustical environment, hospital soundscape, and noise
- Identify potential negative impacts of noise on patients and staff
- Explain the goals of an effective sound management strategy
- Utilize a co-create methodology and champion program to help teams collaboratively identify and implement strategies to reduce unnecessary noise, non-actionable alarms, alerts, and notifications, and other sound disruptions
- List metrics/KPIs that can be used to evaluate the impact of noise reduction strategies

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01  Noise, the acoustical environment, and soundscape
02  Sources and impact of noise
03  Establishing a multidisciplinary team
04  Assessing and measuring noise
05  Using a CoCreate methodology to pilot improvements
06  Noise reduction strategies
07  Some results
Noise, the acoustical environment, and soundscape

How are these different?
“Unnecessary noise is the most cruel abuse of care which can be inflicted on either the sick or well.”

Florence Nightingale, “Notes on Nursing,” 1859
What is noise and who decides?

“Any sound that may produce an undesired physiological or psychological effect in an individual or a group.”

– Environmental Protection Agency

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

Wikipedia

https://mynoise.net/Data/CLOCK/fb.jpg
Need to expand focus to the hospital soundscape

Soundscape definition:

“The acoustic environment (physical phenomenon) as perceived or experienced and/or understood by a person or people, in context.”

International Organization for Standardization (ISO) (Work Group 54)

“The sounds heard in a particular location, considered as a whole.”

Oxford Languages
Sources and impact of noise
A study identified 86 different sources of noise in the hospital.

“Since 1960, average daytime hospital sound levels around the world have risen from 57 decibels to 72; nighttime levels have jumped from 42 decibels to 60.”

Science Daily, “Rise In Hospital Noise Poses Problems For Patients And Staff,” November 2005
Sound levels and perception

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

Perceived loudness

<table>
<thead>
<tr>
<th>Reference point</th>
<th>SPL (dB)</th>
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<tbody>
<tr>
<td>Ordinary conversation</td>
<td>60</td>
</tr>
<tr>
<td>ICU alarms</td>
<td>72</td>
</tr>
<tr>
<td>Change of shift report ED*</td>
<td>100</td>
</tr>
</tbody>
</table>

Relatable examples

- Watch ticking
- Quiet rural area
- Dishwasher (in next room)
- Vacuum
- Garbage disposal
- Food blender
- Lawn mower

1/8 1/4 1/2 2x 4x 8x 16x

- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100

EPA & AAP guidelines

- Nighttime change: 42 dB
- Daytime change: 57 dB

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

“Excessive ambient noise in hospitals adversely affects patients’ sleep and recovery, causes stress and fatigue in staff and hampers communication.”

“In critical care areas, disruption of patients’ sleep patterns may contribute to the development of delirium.”

“Noise can have a cumulative effect: when hospitalized for several nights, patients can feel trapped in a stress inducing soundscape, leading to requests for premature discharge and heightened risk of poor recovery and readmission.”

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
Noise and sleep

Hospital Project on Noise, Sound and Sleep (HPNoSS):

- Hospital soundscape can have positive and not just negative effects
- Need holistic understanding of sound in the hospital and the connection between noise, sleep, rest, treatment and recovery
- Multidisciplinary symposium in 2017
- Looking at testing interventions in clinical settings

The 2018 Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in Adult Patients in the ICU

- ICU-acquired risk factors affecting sleep quality (adults): pain, environmental stimuli, healthcare-related interruptions, psychologic factors, respiratory factors and medications
- More research needs to be done
- Suggest using a noise or light reduction strategy

HPNoSS Symposium & Workshop on Positive Hospital Soundscape, a collaborative project between King’s College London’s Florence Nightingale Faculty of Nursing, Midwifery & Palliative Care and the University of the Arts London, facilitated by the Cultural Institute at King’s.

SCCM (Chair)1,2; Yoanna Skrobik, MD, FRCP(c), MSc, FCCM (Vice-Chair)3,4; et al, Critical Care Medicine, 2018, p.85
“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, July 12, 2016
Known problem

85%-99% of alarms are non-actionable*

Patient deaths have occurred due to missed alarms*

5 ICUs had 2.5M monitoring alarm in 31 days ~ 30M alarms in a year**

Goals

Patient safety

Standardization

Noise reduction

Reduce non-actionable alarms, alerts and notifications

*The Joint Commission

Establish a multidisciplinary team: Identify sponsors, experts and key stakeholders needed (permanent or ad-hoc)

<table>
<thead>
<tr>
<th>Resources Needed?</th>
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<tbody>
<tr>
<td><strong>Function</strong></td>
</tr>
<tr>
<td>CEO</td>
</tr>
<tr>
<td>CNO</td>
</tr>
<tr>
<td>CFO</td>
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<td>CMO</td>
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<td>CIO</td>
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<tr>
<td>CTO</td>
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<tr>
<td>Chief Experience Officer</td>
</tr>
<tr>
<td>IT Services</td>
</tr>
<tr>
<td>Clinical Engineering</td>
</tr>
<tr>
<td>Facility Services</td>
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<tr>
<td>Risk Management</td>
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</table>
Team goal: Short term is to reduce noise

Reduce non-actionable alarms, alerts, notifications, and unnecessary noise in order to improve patient safety, patient care, patient and staff satisfaction, and to ensure actionable alarms are responded to and appropriate action taken.
Team alignment on what constitutes non-actionable and unnecessary alarms, alerts, notifications and noise

<table>
<thead>
<tr>
<th>Actionable alarms</th>
<th><strong>REQUIRES</strong> clinical intervention or some type of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Life threatening, immediate response &amp; action required</td>
<td></td>
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<tr>
<td>• Change in patient status, requires action to reverse or prevent further deterioration</td>
<td></td>
</tr>
<tr>
<td>• Requires action to correct a technical problem to assure proper patient monitoring (ex. leads off, SpO₂ sensor disconnected)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Non-actionable alarms</th>
<th><strong>DOES NOT</strong> require clinical intervention or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Short duration, self correcting (ex. SpO₂ alarm signal)</td>
<td></td>
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<tr>
<td>▪ Intentional (ex. Suctioning or positioning/moving a patient)</td>
<td></td>
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<tr>
<td>▪ Triggered due to tight limits rather than actionable ones</td>
<td></td>
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<tr>
<td>▪ False alarm</td>
<td></td>
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<tr>
<td>– System itself incorrectly identifies an alarm condition</td>
<td></td>
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<tr>
<td>– Something interferes with system causing it to detect an alarm (ex. artifact or low voltage triggered asystole)</td>
<td></td>
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</tbody>
</table>
Team goal: Long term is to effectively manage sound

- Hear relevant sounds
- HIPAA compliance
- Speech intelligibility
- Reduce noise
Current state assessment
Standard assessment steps

Data analysis
Alarm & alert data; sound measurements, HCAHPS/survey scores

People
Interviews, surveys and observations

Processes
End-to-end monitoring and alarm, alert and notification workflows and processes

Technology
Understanding, use and integration

Culture
Noise reduction programs, alarm committee, deciders, on-boarding and event reporting
Data analytics pre, post and on-going

Obtain baseline

Evaluate impact of changes

Monitor sustainability

Possible quick wins

Pilot changes

Share results
Other alarm and noise data
Assess as many systems as possible as part of an overall noise reduction strategy

IV alarms loudest in patient rooms so when looking at sound levels, you want overall in the unit for staff impact but also in patient rooms to better understand and try to minimize for the patients.
Alert data and notifications
Need to balance safety with disruptions

Comparison of number of Asystole and Vfib/Vtach alarms and paging alerts for critical care units

Each over a 30-day period

Who is receiving notifications and how many – from all of your systems.
If one unit over a 30-day period has 36,100 monitoring alarms, 54,700 monitoring alarm alerts and 4,801 nurse call alerts of ~ over a million alarms/ alerts per year for that one unit.

Why all this data matters: overall impact to staff and patients

average disruptions per minute

2.2
“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 responses.
We are not allowed to change any limits without a physician order.

I get so many alerts on my phone that I stop looking at them.

I hear alarms in my head when I go home.

It is too noisy in here.

The two things my Mom complained about? The food and the alarms.

If I responded to every alert, I wouldn’t get anything done.

I worry we are going to miss an important alarm or notification and the patient will be harmed.

There are alarms going off constantly in here (CMU).
Onboarding process

Who are the deciders?

Competency assessments

Near miss/event reporting

Staff, patient, & family surveys/input

Simulations for technology/workflow changes and integration

Patient and family education

Safety culture

Our way of working?
Assessment findings and recommendations

- Communication
  - roles & responsibilities
- Telemetry utilization & optimization
- Policies and protocols
  - best practices
- Change management
  - champions
- Other noise reduction opportunities
- Staff workflow
  - standardization
- Rounding
  - patient handoffs
- Patient experience
  - Patient placement
- Staff workflow
CoCreate workshop
Cocreate workshop: team to define the future state
Initial goal of workshop

**Prioritization**
- Review and prioritize identified recommendations

**Plan pilot(s)**
- Identity incremental changes with measurable metrics

**Impact analysis**
- Evaluate pilot(s) results and anticipated versus actual impact; and lessons learned
Team activity: individual input, discussion and final alignment

- **Provide sleep kits**
- **Adjust monitor default settings**
Pilot implementation and impact analysis

Plan

Act

Do

Study

Patient safety
Team outlines pilot strategy

<table>
<thead>
<tr>
<th>Goals:</th>
<th>Activities to be completed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources:</td>
<td>Metrics/KPIs:</td>
</tr>
<tr>
<td>Project owners:</td>
<td>Implementation plan:</td>
</tr>
<tr>
<td>Approvals needed and process for obtaining:</td>
<td>Education, communication and near miss/event reporting</td>
</tr>
</tbody>
</table>

Timeline

Q3 2017

Q4 2017
Obtain feedback from CoCreate team: most valuable aspects

100%

Number of respondents who felt the session was helpful to think about opportunity prioritization with colleagues

“Getting full participation and consensus from colleagues.”

“Everyone’s opinions were heard and inputs counted.”

“The group felt confident that they were able to identify short and long term team opportunities that will be helpful in achieving the future state.”
Champion model

Change management and adoption support
Champions and change

“The ultimate success of the change initiative almost always rests on a multidisciplinary effort and the emergence or designation of a champion or champions.”

Champions

- **Role Model**: Skills and attitude
- **Subject Matter Expert (SME)**: Knowledgeable on best practices, organizational expectations, etc., related to area of focus
- **Peer Mentor**: Provide education and support to peers and enhance competencies
- **Change Agent**: Support adoption of new behaviors, identify and resolve problems, provide feedback, and monitor metrics
Monitoring and alarm champions at a large academic medical center

<table>
<thead>
<tr>
<th>Plan</th>
<th>Education</th>
<th>Outcomes</th>
<th>On-going plan</th>
</tr>
</thead>
</table>
| • Outline expectations  
• Selection criteria  
• Oversight and structure  
• Education plan  
• Selection notification and acceptance  
• Evaluation process | • Lecture and hands on  
• Combined Philips and site instructors  
• Monitor functionality and alarm capabilities  
• Site alarm management expectations | • Total of 4 eight-hour classes  
• Total of 45 staff educated  
• 34 staff from adult units  
• 11 staff from pediatrics  
• Pre to post test results  
• Adult units: 59.1% to 85.8%  
• Pediatric units: 65.5% to 89%  
• Positive evaluations | • Monthly champion meetings: strategy, lessons learned, celebrate successes  
• Representation on alarm and technology committee  
• Metric evaluation support |

Monitoring and alarm champions at a large academic medical center
Case study summaries
Established a multidisciplinary clinical alarm management workgroup to review and assess environmental noise from alarms
• Workgroup composed of nurses, physicians, a respiratory therapist, patient safety and performance improvement members, patient and family advisors, Philips clinical alarm system engineers, subject matter experts, and clinical data analysts
• Used the Association for the Advancement of Medical Instrumentation (AAMI) clinical alarm management inventory tool to identify potential alarms of interest to target
• Obtained baseline alarm data and decided to focus initially on default settings
• The team used published best practices and subject matter experts to identify the settings to modify
• All proposed changes were presented to and approved by the Medical Staff Executive Committee
• The study was performed utilizing the Plan-Do-Study-Act (PDSA) cycle to test the effectiveness of the interventions
Alarm & noise management: Some results
Reducing non-actionable alarms

Challenge:
Help reduce non-actionable alarms, decrease hospital alarm fatigue, and create a comprehensive alarm management system at AU Health.

Solution:
Comprehensive assessment of alarm data with stakeholder input, identification of root causes of the non-actionable alarms, and recommendations for change initiatives and staff training.

Results:

- A 32% reduction in non-actionable alarms in 3 months at AU Health
- Reduced disruption caused by non-actionable alarms
- Several new Alarm Management Strategies implemented

*Results from case studies are not predictive of results in other cases. Results in other cases may vary.

“Our results have seen substantial reductions in the alarms. It’s so quiet. We look forward to continuing to move forward in our quest for a quieter work environment without jeopardizing patient safety and quality.”

Kevin C. Dellsperger, MD, PhD
VP and Chief Medical Officer AU Health
Established a multidisciplinary alarm management taskforce to assess several different alarming devices/systems:
  - Monitoring alarms
  - IV pump alarms
  - Nurse call notifications
Taskforce team consisted of nurses (leadership and staff), physicians, monitor techs, Clinical Engineering, Human Factors specialist, clinical data analysts, IT, and Philips consultants
Assessed multiple sites and units
Vendor collaboration from the systems being assessed
Some key learnings: the Care Techs were the first receivers for multiple alarm/alert notifications and the nurse call system was not standardized across the sites
Nurse call system alert notification process

Patient alert

Pod A
Pod B
Pod C

Phones at every nursing station rang immediately when an alert was triggered

Primary PCT

Primary RN

2 Min delay

2 Min delay

Charge
Pilot changes

- No consoles receive initial alert (for patient, water and go to toilet – after delay, the alert goes initially only to the patient’s console)
- Added secondary PCT
- The alerts above must be silenced in the room
- Disabled medication door and drawer alerts
- Added night tones to consoles

Diagram:

- Patient alert
- Primary PCT
- Secondary PCT
- Primary RN
- Rooms designated pod
- All pods
- Charge
Pilot results

HCAHPS score improvements for response time for call light and toilet*

Call light from 64% to 78.9%
Toilet from 61.9% to 80%
7,990 reduction in audible nurse call system alerts

*HCAHPS data provided by the hospital
“With a centralized monitoring room, the noise level alone is often overwhelming to technicians. The recommended changes made an immediate difference in the noise level that was noticed and felt by all, making for a much healthier and safer work environment. We feel patients are also much safer because the technicians can focus on true and valid alarms and limit the number of notifications to RNs thereby reducing their workload.”

Wendy Cantrell, MSHR
Manager, Telemetry Monitoring
Huntsville Hospital

“Wake Up From Alarm Fatigue: Using Our Monitors Wisely”

S. Jill Ley RN, MS, CNS, FAAN
• Cardiac Surgery Clinical Nurse Specialist, California Pacific Medical Center
• Clinical Professor, University Of California, San Francisco, CA

Partnership with Philips for Alarm Management Assessment: In-depth analysis of 4 units Detailed alarm and clinician response data
Other outcomes and results

- **37% reduction** of total alarms from 765,103 to 498,832
- **155,580 less alarms** heard by patients & families in their rooms
- **61% reduction** in alarms with q24h electrode changes and using appropriate size lead sets
- **61% reduction** in alarms with q24h electrode changes and using appropriate size lead sets
- **Approximately 10,000 hours of non-value added work eliminated** due to process and workflow improvements in a 9 month period
- **23% reduction** in alarms with alarm customization process
- **29% reduction** in select IV pump alarms
- **32% reduction** in non-actionable alarms with default settings changes
- **0.00 adverse patient or near miss events** during pilots

*SICU patient comment when we told her we working on reducing the alarms that went off in her room*

**Sustainable results over time with enhanced patient and staff experience**

Results can vary from site to site
Other noise reduction options beyond alarms and alerts

- Quiet hours
- Patient care kits (e.g., ear plugs, eye masks, etc.)
- Ensure TVs and other devices are off when not in use
- Limit overhead pages
- Dim lights and minimize noise on night shifts, e.g., cleaning during the day
- Adjust phone volumes – at desk and cell
- Routine maintenance on easily fixable items, e.g., squeaky cart or walker wheels
- Time non-nursing activities, e.g., restocking supplies, cleaning floors, etc.
- Sound reducing curtains and/or ceiling tiles
- Engage and educate patients, families, and visitors
- Monitoring for clinical need based on guidelines
- Explore positive sounds, e.g., fountains, music, etc.

When remodeling or building:
- White noise devices
- Private rooms
- Planned location of elevators and ice machines
- Stagger patient room doors on opposite side of hallways
- Staff and transport hallways separate from patient rooms
- Staff rooms for communication
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.
Long term considerations
Team goal: Long term is to effectively manage sound
“The sense of hearing cannot be closed off at will. There are no earlids. When we go to sleep our perception of sound is the last door to be closed and it is also the first to open when we awaken.”

Questions?
Thank you!

For more information about Philips Acute and Critical Care consulting services, contact John Davanzo (john.davanzo@philips.com).