Acoustical Criteria for Hospital Patient Rooms
Resolving Competing Requirements

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Abstract

The acoustical criteria for patient rooms in hospitals, nursing homes and rehabilitation facilities may be based on several needs. One important requirement is that noise levels in the room be conducive to restful sleep. Also, caregivers must have easy auditory and visual access to the patients, and be able to hear vital sign monitor alarms. This often means that patient rooms are located near central nurse stations and that patient room doors are left open. Further, the recently published federal privacy standards developed by the U.S. Department of Health and Human Services (HSS) under the Health Insurance Portability and Accountability Act (HIPAA) require that "appropriate physical safeguards" be put in place to protect the confidentiality of patient health information. The simultaneous and competing requirements for speech privacy, caregiver access and good sleeping conditions present a serious acoustical challenge to health care facility designers. Specific facility design issues and potential solution strategies are presented.
Acoustical Functional Requirements

• Hospital Patient Rooms
  - Inpatient unit, overnight stay
  - Emergency rooms
  - Post-op recovery rooms

• Nursing Homes

• Rehabilitation Facilities
Acoustical Criteria for Hospital Patient Rooms

Acoustical Functional Requirements

Based on several competing needs:

- Quiet rest and *sleep*
- Caregiver *access*
- Patient *privacy*
Acoustical Criteria for Hospital Patient Rooms

Acoustical Functional Requirements

Quiet rest and **sleep**

- Minimize disturbances
  - from outside and inside room
  - central nurse station
  - hallway / semi-private room

- Low mechanical system noise
Acoustical Functional Requirements

Caregiver access

- See and hear patient
- Hear vital sign monitor alarms
Acoustical Functional Requirements

Patient privacy

• HIPAA -- Health Insurance Portability and Accountability Act

• Requires “appropriate physical safeguards” for confidentiality of patient information
Acoustical Criteria for Hospital Patient Rooms

Acoustical Functional Requirements

Patient *privacy* – health information

- Doctor & Nurse discussions
- Visitor discussions

Central Administrative Station
Hallway conversations
Semi-private room / clinic
Acoustical Functional Requirements

Room Criteria – ANSI S12.2-1995

• Quiet rest and *sleep*

Private Hospital Room
NCB 25 to 30

• Patient *privacy* (based on office)

NCB 35 to 40 – masking noise
Private hospital room (sleep) criteria

Private hospital room - upper range
Tangential NCB 30
39 dBA
SIL 30

Private hospital room - lower range
Tangential NCB 25
35 dBA
SIL 25
Sound Masking Systems -- Acoustical Privacy
Acceptable range of introduced noise

Data from Dave Marsh
Sound & Communications
Dec 2001

Upper limit of making noise
Tangential NCB 40
46 dBA
SIL 35

Lower limit of masking noise
Tangential NCB 34
40 dBA
SIL 30

NCB Rating
65
60
55
50
45
40
35
30
25
20
15

Octave Band SPL (re: 20 μPa)
Octave Band Center Frequency (Hz)
Comparison -- Introduced sound masking v. Private hospital room (sleep) criteria

Upper limit of making noise
Tangential NCB 40
46 dBA
SIL 35

Private hospital room
Tangential NCB 25
35 dBA
SIL 25

Octave Band Center Frequency (Hz)

Octave Band SPL (re: 20 µPa)

NCB Rating
Hospital Noise Sources

- Voices – nurse station & visitors
- Nurse call bells
- Instrument / monitor alarms
- Ringing phones
- Rolling hospital carts
- Office noise – printers, file drawers
- Mechanical systems
Case Studies – Hospital Noise

- Inpatient Unit – “Central Administrative Core”
- Patient room – negative pressure exhaust system
- Post Anesthesia Care Unit
  HVAC system
UCONN Health Center - John Dempsey Hospital
4th Floor Inpatient Unit

Central Administrative Core
Hallway - Position C3

Central Core
Tangential NCB 58
63 dBA
SIL 56

Octave Band SPL (re: 20 µPa)
Octave Band Center Frequency (Hz)

NCB Rating
65
60
55
50
45
40
35
30
25
20
15
UCONN Health Center - John Dempsey Hospital
4th Floor Inpatient Unit

Patient Room H4036
door open

Patient Room
Tangential NCB 49 (hiss)
56 dBA
SIL 49

Octave Band Center Frequency (Hz)

Octave Band SPL (re: 20 µPa)

NCB Rating
65
60
55
50
45
40
35
30
25
20
15
New Britain General Hospital -- Negative Pressure Rooms
Measured Mechanical System Noise

Patient Room N 423
4 ft under exhaust vent

Room N 423 - Door closed
Tangential NCB 45 (rumble & hiss)
50 dBA
SIL 42
Johnson Memorial Hospital
Post Anesthesia Care Unit (PACU)

Air handler above hung ceiling
3 ft below - AHU on

PACU
Tangential NCB 62 (rumble)
61dBA
SIL 48

Octave Band SPL (re: 20 µPa)
Octave Band Center Frequency (Hz)
Acoustical Criteria - Hospital Patient Rooms

Solution Strategies

• Build owner & designer (A/E) awareness of issues
• Address early in design
  new / renovation
Solution Strategies

- Reduce mechanical noise
- Reduce room reverberation
- Controlled masking system
  smart -- day / night variation
  targeted -- hallways, stations
- Distributed alarm technology
Future Research Needs

- Develop architectural response to conflicting design requirements
- Quantify / optimize speech interference (masking) for privacy
- Develop hospital privacy design criteria
CONCLUSIONS

• Early awareness builds project success
• Apply good design principles first
• Continue research on architectural design and speech privacy
• Develop design guidelines