Alzheimer Knowledge Exchange

Noise

Part 1 - Physical Design Interventions

This document is geared towards those that are involved in the design of seniors housing, as well as those involved in caring for or working with seniors.

Design affects noise and noise affects behaviour. The evidence is clear and compelling that unwanted and excessive noise increases stress which in turn has health impacts such as higher anxiety and confusion, increased heart rate, blood pressure and fatigue (1-3), delayed wound healing, decreased weight gain (4), impaired immune function (5) and impaired hearing (6). **The affect of noise on medical and behavioural health is magnified for a person with dementia.** While there may be an assumption that good noise hygiene is a common courtesy in any living environment, many environments for persons with dementia (PWDs) can be impacted by the fact that they are also work environments.

Noise by definition is obtrusive or interferes with listening whereas quality of sound is subjective to individuals -- regardless of dementia. The following recommendations will primarily focus on intrusive noise-both from a facility design and organizational processes perspective- that can affect quality of life (7-8). Addressing noise sensitivity does not mean eliminating all noise (this can lead to under-stimulation), rather providing the right kinds of noise at the right level at the right time (9).

> Noise can cause discomfort and can trigger responsive behaviours
>Acceptable noise levels are subjective and can vary daily between individuals and in different contexts

Dementia Unit Layout and Design

RECOMMENDATION:

Locate resident rooms and activity areas such that the impact of noise is minimized (e.g. away from utility rooms, railway tracks)

WHY? Fatigue from over-stimulation is common with PWDs; this can cause undue stress and sleep disturbance (1-3). Lower levels of noise in resident rooms/private areas promotes better rest and gives PWDs a quiet place for comfort.

Note: Seeking the advice of an acoustical engineer is advised.

Strategies:

- Consider the control of sound transmission between certain areas of the building (10)
- Situate bedrooms away from, and not adjacent to, high-noise areas such as dietary, utility, programming and/or administration (10)
- If resident rooms must flank noisy areas, design dividing wall with Sound Transmission Class (see glossary) rating of 45-65 (10) depending on noise source levels (45 for flowing water, 65 for mechanical). Consider soundproofing dividing walls between bedrooms as well (11)
- Ensure quieter lounge areas are available for those who do not want to be immersed in noisy activity

Noise Level Assessments

RECOMMENDATION:

Ensure that knowledgeable staff use a sound level meter (see glossary) to complete Occupational Health and Safety noise level assessments. In addition, conduct informal noise assessments regularly

WHY? Noise and sound are subjective experiences and what may be enjoyable to some is unpleasant to others (7-8). Daytime noise in healthcare settings can range from 65 to 95 dB or higher which can be as loud as the sound of heavy traffic (80dB) within the residents' living space (7). Not understanding the components of sound can contribute to inaction or lack of urgency when action may be required.

Note: Please refer to table at the end of this document for sound level exposures.

Note: Knowledgeable staff includes, but is not limited to, occupational hygienists and occupational health and safety representatives.

Strategies:

- Ensure noise assessments include measurement of volume or sound levels, number of occurrences and duration (1)
- Recognize and address the importance and impact of the duration and type of sound on PWDs (e.g., a vacuum being used for 1.5 hours is very different than for 15 minutes)
- Encourage the supervisor of maintenance/housekeeping to be knowledgeable in the use of a sound level meter

Reduce Noise Echoes

RECOMMENDATION:

Use acoustical ceiling and wall products

WHY? PWDs are more sensitive to noise, specifically intrusive noise (9). Reducing the number of hard surfaces and increasing sound absorbing textiles/ drapes/ carpet helps to absorb noise (conversational and general) helps to minimize the negative effect of "echoes," enhance hearing and lower agitation and frustration (7,12).

NOTE: Whenever textures are being introduced ensure that items are able to be laundered or removed for cleaning (e.g. mould and mildew resistant sound tiles should be used in bathroom (7).

NOTE: Carpet is only 20-30% sound absorptive therefore ceiling or wall treatments are still recommended (13).

NOTE: Most noise is attributed to the type of ceiling treatment used. (13).

Strategies:

- Reduce hard surfaces and increase sound absorbing textiles/drapes/carpet (e.g., sound absorbing ceiling and wall tiles, carpet or cork flooring). Likewise, acoustical wall treatments may be used
- Consider how the architectural features of the space might affect the acoustics, for example domed ceilings might reflect sound (11,13)
- A large room will be louder, therefore consider breaking down rooms into smaller areas
- Apply sound absorbing materials to walls and ensure that surface material is damage resistant below shoulder height (11)

Noise Production Equipment

RECOMMENDATION:

Regularly maintain noise-producing equipment

WHY? Loud noises, as well as persistent intermittent noise (e.g. tap dripping), can trigger worry, unpleasant memories, and cause annoyance and /or agitation (9).

Strategies:

- Lubricate squeaky doors, windows and wheels, leaky toilets or faucets routinely
- Ensure upkeep of mechanical lifts to reduce noise
- Use cleaning equipment (i.e. wax floor machines, vacuums) at appropriate times for the resident such as cleaning halls when residents are in the dining room
- When possible, purchase equipment and machinery that is low noise (7)
- HVAC equipment and ductwork should provide resulting sound levels that do not exceed noise criterion(see glossary) NC 25 in bedrooms, NC 35 in dining areas, NC 40 in toilet/shower rooms, and NC 35 in all other occupied spaces (11,14)
- Soundproof HVAC equipment by utilizing sound attenuation measures (See glossary)

Scheduling of Intrusive Noise

RECOMMENDATION:

Implement sound management schedule in high traffic areas

WHY? High noise levels can lead to stress reactions such as anxiety, confusion, increased heart rate, blood pressure and fatigue from over stimulation (1-3). Noise has also been demonstrated to delay wound healing, decrease weight gain (4), impair immune function (5) and impair hearing (6). Balance quality of life for PWDs with workplace efficiency.

Strategies:

- Schedule vacuuming and floor buffing at times when the fewest number of people will be disturbed (e.g., consider time of day; closing doors). Consider using non-powered carpet sweepers
- Minimize use of pill crushers in dining rooms by crushing pills outside of common areas
- Explore quieter ways of crushing pills (e.g. mortar and pestle) (15)
- Promote downtime and relaxation to minimize effects of cumulative noise
- Limit what is done in the serving area (i.e. dishwashing done in main kitchen)
- Schedule fire alarm testing appropriately. Consult fire code and shorten duration of alarm if possible (see fire alarm section)

Background Noise

RECOMMENDATION:

Regularly assess, monitor and minimize background noise

WHY? PWDs may not be able to "screen out" or ignore unwanted noise (9). This can cause them to become anxious and unable to perform tasks (1-3). This includes: radios, ventilation systems, air conditioners, PA systems, wander-guard systems, grinders for medications, and call bell systems.

Strategies:

- Reduce intrusive noise (e.g., mechanical noise, staff noise, alarming noise)
- Monitor and minimize intermittent (e.g., overhead paging systems) and chronic (e.g., hum of air conditioners or ventilation systems) background noise (1)
- Set staff and visitor pagers, cell phones, as well as Wander-guard system alerts to vibrate
- Eliminate PA system use if possible to reduce perceptual difficulties by PWDs
- Use music to draw people to therapeutic/ recreational programming but provide noise-free areas for residents to avoid music if it is distressing
- Turn televisions off in common or private rooms when not in use
- Keep noise from mechanical equipment to a minimum (2,16)
- Increase vigilance to monitor the effect of noise at high traffic times (e.g., shift change, dinner times etc.)
- Minimize use of pill crushers in dining rooms by crushing pills outside of common areas

Fire Alarms

RECOMMENDATION:

1. Consider choice, distribution and location of audible devices
2. Plan fire alarm testing to be sensitive to the needs of persons with dementia

WHY? Persons with dementia cannot always make the connection to what a fire alarm means. High noise levels can lead to stress reactions such as anxiety, confusion, increased heart rate, blood pressure and fatigue (1-3). When implementing preventative safety measures, consider the impact of fire drills on PWDs (e.g. detrimental impact of continuous alarming noise during fire drills). Fire alarms can measure over 100 decibels (well over comfort level) in order to alert all areas of a building (e.g. people with hearing loss in far bedrooms). Consider who benefits from the current format of routine testing. Despite the need for drills to cover all staff shifts, balance the rationale for multiple drills with the distress it causes for PWDs.

NOTE: Fire alarm levels should not exceed 65dB in resident rooms and hallways, or 92dB in mechanical rooms (17).

NOTE: According to the Fire Code signalling devices need to be tested once a month; nothing states that drills need to be full alarm drills.

Strategies:

- Discuss silent drills with your fire inspector
- It is wise to speak with your local fire department to discuss adaptations that may benefit PWDs during fire alarms
- Consider the client population and try to go to the affected floors prior to drill to address possible issues
- Consider walking through the process on a monthly basis with all factors one would need to address if it were a real fire situation; however understand there is value in full fire alarm drills to prepare staff to respond to a real fire
- Consider design methods that lower maximum alarm sound levels while still meeting the code requirements and the intent of the regulations.
- Choose audible alarm signaling devices that optimize alarm recognition and minimize anxiety

Do you have design considerations to suggest? Please send us your feedback by visiting the AKE website and submitting your questions and / or comments to the Design and Dementia Knowledge to Practice Recommendations Online Feedback Form located in the Design and Dementia Community of Practice web page: **www.akeresourcecentre.org/Design**

Glossary of Terms

Sound Transmission Class (STC): Sound Transmission Class (or STC) is an integer rating of how well a building partition attenuates airborne sound (See Sound Transmission Class Table;17,19).

Sound Level Meter, Decibel Meter: The Sound Level Meter (also called a "decibel meter" or "dB Meter) measures sound pressure levels, in dBA at a distance from the source. Its response is modelled on the human ear, which perceives loudness in logarithmic fashion and is designed to accurately and objectively measure the sound or noise that one can hear. This places a real value on something as subjective as loudness, which is affected by human perception. The meter may also be used to study how sound pressure changes with distance from the sound source (8). A sound level meter is based on the decibel scale which measures sound level based on the sound pressure relative to a reference pressure (threshold of hearing). It cannot measure the subjective loudness experienced by a human, only the objective sound pressure levels in the surroundings (8).

Noise Criterion (NC): Measures noise within a room (See Noise Criterion Table,17).

Sound Attenuation Measures: The three most important methods of noise attenuation are sound barriers, sound absorbers and vibration dampers (20).

Decibel Levels Associated with Selected Sounds (7,21)

Effect	Decibel (dB)	Source
Physical Effect (direct damage)	130-150	Jet engine at takeoff, amplified music
Physiological Effect	120-140	Gunshot, siren at 100 feet *Threshold of pain
	110-120	Chainsaw, jackhammer, snowmobile, rock concert
	90-100	Lawn mower, tractor, farm equipment
	90	USA Occupational Health & Safety workplace limit (Hearing damage may occur)
	75-85	Radio, vacuum cleaner, heavy traffic
Psychological Effect	60	Normal conversation
	40-50	Rustling leaves, soft music, residential area at night
	30	Whisper
	15	Threshold of hearing
	0	Weakest sound

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For additional information about acoustical engineering please visit www.swallowacoustic.ca and www.snyderassociates.com

Acknowledgements

The Alzheimer Knowledge Exchange Design and Dementia Community of Practice is pleased to share the following Dementia-Friendly Design Considerations document focusing on **NOISE**. This is the **third in a series of dementia friendly design consideration documents** that, with permission, have been adapted and build upon both the foundational work and senior friendly hospital audit tool developed by ***Regional Geriatric Program of Eastern Ontario***.

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The Knowledge to Practice Recommendations are living documents which will be continually edited and updated by the AKE Design and Dementia Community of Practice based on emerging quality evidence and the integration of both practice-based and experiential knowledge of those with lived experience.

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