The Effect of White and Pink Noise on Hospitalized Older Adults

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Abstract

The aim of this study was to determine if white and pink noise played at night could decrease delirium rates in hospitalized older adults. This study, using the Theory of Unpleasant Symptoms as a theoretical framework, was conducted on an Acute Care for Elders (ACE) unit in a teaching hospital in the southeastern United States with a convenience sample of 50 participants over the age of 65 admitted to the hospital. Findings include a significantly lower rate of delirium in the intervention group who was played white/pink noise compared to the control who did not ($X^2_{(1)}$= 5.630, p < .05) as well as a significantly lower rate of pharmacological sleep aid use in the intervention group (X^2 = 8.14, p <.005).

Background

What is delirium?

- Attention disturbance
- Acute change from baseline cognition (may fluctuate throughout day)
- Additional cognitive disturbance
- Disturbances cannot be explained by preexisting condition

Why is delirium prevention/treatment important?

- 42% of older adults will develop delirium while in the hospital.
- Delirium is preventable in 30-40% of hospitalized patients.
- Delirium in older adults costs the U.S. over $160 billion annually.
- Delirium is associated with more restraint use, higher rates of hospital-acquired conditions, higher rates of institutionalization upon discharge, and death within 90 days of admission.

Purpose

To determine the effect of white and pink noise on delirium incidence in hospitalized patients over the age of 65.

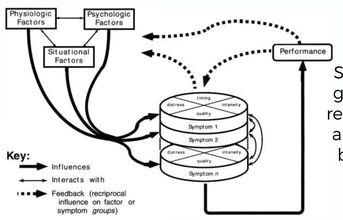
Delirium and Sleep

- Patients with delirium are more likely to have sleep-wake cycle disturbances than those without.
- Patients with both dementia and delirium have higher rates of sleep-wake cycle disturbance than those with dementia alone.
- Non-pharmacological, sleep-enhancing interventions (e.g. eye masks, ear plugs, light therapy, and noise reduction strategies) decrease rates of delirium

Noise and Sleep

- Hospital noise negatively affects sleep.
- Masking ambient sounds with pink or white noise rids the environment of sudden high peaks of sound and helps patients sleep better.
- White noise is superior to ear muffs and earplugs in improving sleep.

Conceptual Framework



The Theory of Unpleasant Symptoms (TOUS) was used to guide the study. It explores the relationship between symptoms and the patient's experience to better manage them through interventions.

Based on the TOUS, both delirium and sleep-wake cycle disturbance are *symptoms* that are influenced/ caused by an *inciting factor.* Both symptoms and factors are influenced by one another. The inciting factor causes symptoms and symptoms may resolve once the factor is removed/changed. Similarly, if you worsen one symptom another may worsen as well.

If sleep-wake cycle disturbance is associated with higher rates of delirium, and white/pink noise has been shown to improve sleep, then white/pink noise should decrease delirium rates.

Methodology

Sample

- 50 adults 65 years of age or older admitted to the geriatric medical-surgical floor (Acute Care for Elders unit)
- 25 participants received the intervention (white/pink noise) and 25 were part of chart review and served as baseline data

Inclusion Criteria	Exclusion Criteria
• 65 years of age or older • English-speaking • Estimated hospital stay of 3+ nights • No hearing deficits/hearing aid use • Free of delirium on admission	• Those failing to meet all the inclusion criteria • Transferred to the floor from another unit or ICU

Setting

26-bed geriatric ACE unit of a 115-bed teaching hospital in the southeastern United States

Intervention

- The principal investigator (PI) determined if newly admitted patients were eligible through chart review and speaking with primary nurse.
- If eligible, informed consent was obtained and PI demonstrated different white and pink noises.
- Participant chooses sound and PI sets sound machine to run automatically between 2200 and 0700.
- Staff nurses chart Nu-DESC scores once per 12-hour shift and as needed for change in patient condition.
- The PI conducts chart review for control group participants to serve as baseline data.

Tools and Data Collection

NUDESC

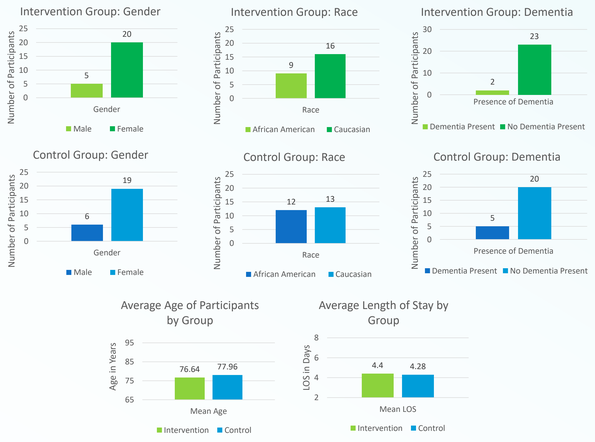
Behavior	0 (no symptoms)	1 (present but mild)	2 (present and pronounced)	Score
Disorientation = Verbal or behavioral manifestation of not being oriented to time or place or misperceiving persons in the environment	Alert and oriented to person, place, and time	Disoriented but easily reoriented	Disoriented x 2 or x 3; not easily reoriented	
Inappropriate behavior = To place and/or person; e.g. pulling at tubes or dressings, attempting to get out of bed when contraindicated	Calm, cooperative	Restless and cooperative (e.g, picking at tubes but follows commands)	Agitated, pulling at devices, climbing out of bed, not redirectable	
Inappropriate communication = communication inappropriate to place and/or for the person; e.g., incoherence, non-communicativeness, nonsensical or unintelligent speech	Appropriate	Unclear thinking or rambling speech	Incoherence, nonsensical or unintelligible speech	
Illusions/Hallucinations = Seeing or hearing things that are not there; distortions of visual objects	None noted	Paranoia, fears	Hallucinations, distortions of visual objects	
Psychomotor retardation = Delayed responsiveness, few or no spontaneous actions/words; e.g., when the patient is prodded, reaction is delayed and/or the patient is unarousable.	None	Delayed or slow responsiveness	Excessive sleeping, somnolent, lethargic	
			Total Score: (Score of ≥ 2 indicates a positive screen for delirium)	

The Nursing Delirium Screening Scale (Nu-DESC) was used to monitor patients for delirium and charted by staff nurses familiar with the tool. It has a sensitivity of 85.7% and a specificity of 86.8%.
A score of 2 or greater indicates the presence of delirium.

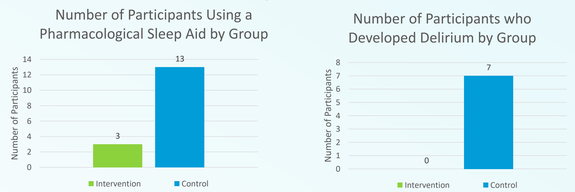
A PI-created data collection form was also used to record age, race, gender, presence of dementia diagnosis, pharmacological sleep aid use, Nu-DESC scores and chosen sound (intervention group only) for all of the participants.

Statistical Results

Descriptions of Intervention vs. Control Groups



Pharmacological Sleep Aid Use and Delirium Development



Using a Pearson's chi square test, it was determined that there was a significant difference in number of participants who developed delirium in the intervention group compared to the control group (X^2 = 8.14, p <.005).

A Pearson's chi square test determined there was a significant difference in number of participants who used pharmacological sleep aids in the intervention group compared to the control group (X^2 = 8.14, p <.005).

A Pearson's chi square demonstrated there was a significant difference in the rate of delirium developed in participants with dementia compared to those without dementia ($X^2_{(1)}$= 5.630, p < .005).

An independent samples t-test of delirium development and length of stay determined there was a significant difference in delirium development and length of hospital stay in days ($t_{(48)}$= *3.205*, p < .003, 95% C. I. = .719 to 3.14).

Discussion of Results

Because no participants in the intervention group developed delirium while seven in the control group did, there was a statistically significant difference in delirium rates. Though causation cannot be determined, white and pink noise could be an effective delirium prevention strategy.

The intervention group used far fewer sleep aids which points to the ability of white and pink noise to improve sleep and to thereby decrease delirium rates. This notion is supported by the TOUS, the guiding theoretical framework, that sleep-wake cycle disruption and/or poor sleep exacerbates or potentiates delirium.

There was a significant difference in rates of delirium and presence of dementia diagnosis. **However, only three of the seven participants that developed delirium had a documented history of dementia, meaning the majority of those that developed delirium did not have a diagnosis of dementia.** This could be due to the lack of documentation of a dementia diagnosis or a result of the small sample size. It does, however, decrease the likelihood that the higher delirium rate in the control group was due to the presence of dementia, a known risk for delirium.

Unsurprisingly, there was also a correlation between length of stay and delirium development. **Those that developed delirium had longer lengths of stay in the hospital on average than those that did not develop delirium.** It is uncertain whether this increase is due to the development of delirium itself, requiring a longer stay to determine and treat the cause, or if the increased length of stay instigated the delirium development.

Conclusion

Limitations

A major limitation of this study was the sample size. The study needs to be repeated with a greater number of participants to truly evaluate the effectiveness of white and pink noise. Another addition could be that of a sleep quality questionnaire to determine if the white/pink noise decreased delirium rates by actually improving sleep. The results of this study are also limited due to the probability that patients at highest risk of delirium arrive to the hospital already delirious. The study could be repeated to determine if white and pink noise lead to decreased duration of delirium in patients already being impacted by delirium.

Implications for Practice

Not only does delirium have extensive financial costs, it has physical and emotional ramifications for patients and families as well. The implementation of sound machines is a cost-effective delirium prevention strategy that aims to reduce costs and harms to patients and the healthcare system.

Bedside nurses can add sound machines to their repertoire of delirium prevention interventions leading to decreased delirium rates, improved patient outcomes, decreased lengths of hospital stays, and decreased healthcare costs for the healthcare system as a whole. Advance practice nurses can also remind bedside nurses to use the sound machines, possibly leading to a decreased need for sleep-inducing medications which could decrease polypharmacy rates in the older adult population.