Staff Perceptions of Noise and Patient Outcomes In the Critical Care Environment

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ABSTRACT

Noise levels in a hospital should not exceed 30 decibels (dB). The noise level in Intensive Care Units (ICUs) can peak at 103 dB. Sleep deprivation in ICU patients contributes to glucose intolerance, insulin resistance, increase in inflammatory cytokines, and delirium. Noise can induce stress, fatigue, and burnout in nurses, and drive errors. In one study, 46% of ICU nurses indicated that a noise-filled workplace was a top performance barrier.

Study questions were "How effective is staff education on the impact of noise on sleep disturbance in reducing noise in two critical care environments? How effective is education on changing staff perceptions of the impact of noise on sleep disturbance? "

A survey of nursing staff assessed perceptions of noise before and after education. Noise measurements were obtained from the ICU and Progressive Care Unit (PCU) environments. The mean dBA for each unit was significantly lower after the educational intervention.

References

Agency for Healthcare Research and Quality (AHRQ), (2015). HCAHPS Fact Sheet. Retrieved from hcahpsonline.org/Files/HCAHPS_Fact_Sheet_June_2 015.pdf

Centers for Medicare and Medicaid Services (CMS), (2015). Summary of HCAHPS Survey Results. Retrieved from www.hcapsonline

Kamdar, B., Needham, D., & Collop, N. (2012). Sleep deprivation in critical illness: Its role in physical and psychological recovery. *Journal of Intensive Care Medicine, 27*(2), 97-11, doi: 10.1177/0885066610394322

Kaur, H., Rohlik, G., Nemergut, M., & Tripathi, S. (2016). Comparison of staff and family perceptions of causes of noise pollution in the pediatric intensive care unit and suggested intervention strategies. *Noise and Health, 18*(81), 78-84

Salandin, A. (2011). Noise in an intensive care unit. *Journal of the Acoustical Society of America, 130*(6), 3754-3760, doi: 10.1121/1.3655884

Waye, K., Elmenhorst, E., Croy, I., & Pedersen, E. (2013). Improvement of intensive care unit sound environment and analyses of consequences on sleep: an experimental study. *Sleep Medicine, 14*, 1334-1340

Xie, H., Kang, J., & Mills, G. (2009). Clinical review: The impact of noise on patients' sleep and the effectiveness of noise reduction strategies in intensive care units. *Critical Care, 13(208)*, doi: 10, 1186/cc7154

INTRODUCTION

ICU survivors have self-reported that sleep deprivation and/or the inability to sleep were among the top three causes of anxiety and stress during their ICU stay, along with pain and intubation (Kamdar, 2012). Previous research suggests that conversations between staff and noise from medical devices seemed to be the most disruptive sources of noise in the ICU (Konkani, 20140).

Sleep deprivation in ICU patients contributes to glucose intolerance, insulin resistance, activation of the hypothalamic-pituitary-adrenal-axis, increase in inflammatory cytokines, and alterations in memory and cognitive function (Waye, 2013). Sleep disturbance also contributes to delirium. "Delirium is independently associated with patient mortality, increased cost and length of stay, and long-term cognitive impairment" (Kamdar, 2012). Sleep deprivation can cause both inattention and hallucinations (Kamdar, 2012). Noise also contributes to patient dissatisfaction.

The aims of this study focused on assessing nurse perceptions of noise as well as the levels of noise in the ICU and PCU. The investigators hypothesized that nurse perceptions of noise in the ICU and PCU would be influenced by awareness of the actual levels of noise in both units across all shifts. Sharing this evidence from the obtained measures along with review of the literature via discussion, education and poster formats could potentially modify nurse perceptions of noise in the ICU and PCU.

This study would provide baseline noise measures across shifts and nurse perceptions of the elements that contribute most to the noise levels in the ICU and PCU.

METHODS AND MATERIALS

The setting for the study was a ten bed medical-surgical intensive care unit and a thirteen bed progressive care unit in a Midwestern community hospital. The equipment used to obtain sound measures was the BAFX Products Industry Decibel Meter. The compact meter can read between 30 dB- 13dBA, providing readings within +/- 1.5 dBs. The meter had a resolution to 0.1 dB, frequency weighting of A, frequency response range of 31.5 Hz ~ 8.5Hz, sampling rate of 2x/second.

Sound measures were obtained over the course of 3 days within one week in 4 locations, on each unit, at 4 different times throughout each 24 hour period. Measures were obtained between 7-8am, 2-4pm, 8-10pm, and 2-4am.

Regular and part time nursing staff working on each unit were recruited to take a survey to evaluate their perception of noise on each unit. Agency and support staff were excluded.

Education regarding the impact of noise on sleep disturbance and reducing noise levels was provided to staff during staff meetings in the form of a powerpoint presentation, as well as face to face communication during shift huddles. Education included the alterations in physiological functioning that can occur as a result of sleep deprivation. A poster and levels of noise flyers were also placed on the units.

A post-intervention survey was given and re-measures of noise occurred on both units according to the same plan as the baseline measures at periods of 2 weeks, 3 months, and 6 months after the intervention. Data analysis consisted of descriptive statistics (mean, standard deviation) to compare noise levels across units by time periods to determine the most noisy and least noisy spaces on the units. T tests and ANOVA were used to compare for any statistical differences.

RESULTS

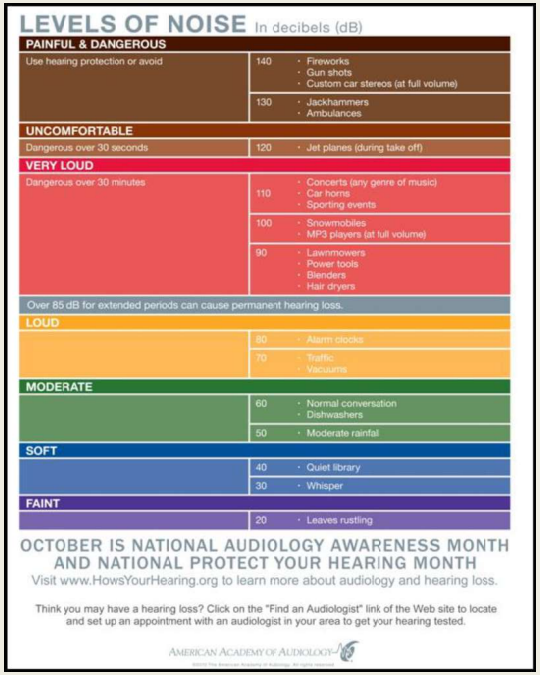
Time	Mean dBA
Baseline	56.71
Post Education	49.5

F 45.56, P=0.00

The mean dBA for the ICU and PCU were significantly lower after the educational intervention.

One-time Readings Measured in dBA

Bipap on highest alert alarm	84.4
Ice machine when running	81.0
Ventilator on highest alert alarm	80.4
IV pump alarm	77.9
Portable x-ray machine crossing threshold into room	71.1
Tube feed pump alarm	61.6

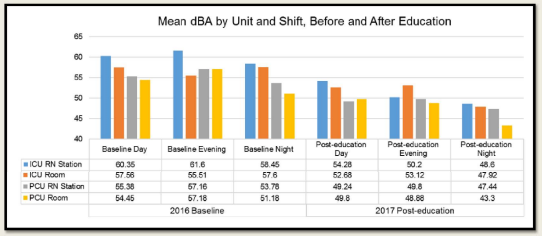


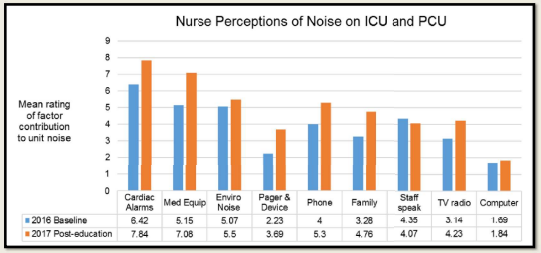
DISCUSSION

Noise levels varied across units and shifts. Hallways and rooms had lower noise than nursing stations.

Noise levels went down following education and presentation of baseline noise data to the nurses. At the same time, nurses' perceptions of factors that contributed to noise in the ICU and PCU appear to have been modified by the education and data presentation.

Nurse perceptions of each factor's contribution to overall noise increased in the second survey which may reflect increased awareness of elements contributing to noise.





CONCLUSIONS

Education of nursing about noise on a unit can reduce noise levels.

Evening and night dBA were not significantly different which may reflect the 24 hour nature of critical care.

Further research is needed to discover how noise levels on a unit can be reduced to enhance quality of sleep.

Limitations: Fluctuating census, did not include ancillary staff, single facility study