School of Medicine

From The "Page" To Practice

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Introduction

Delirium has been defined as acute changes in mental status, which leads to a lack of concentration and disorganised thinking (Pisani et al. 2007). Evidence suggests that 70% of mechanically ventilated patient's (Agarwal et al. 2010) experience delirium whilst in ITU. This leads to prolonged hospital admissions, cognitive deficiency following discharge, with an increased mortality and morbidity rates for these patients (Salluh et al. 2015, Lamond et al. 2018). Sleep deprivation is a contributing factor for the onset of delirium (Darbyshire 2016). ITUs are noisy; often exceeding WHO recommendations of 35 decibels (dBA) by day and 30dBA by night (Berglund et al. 1999). (Darbyshire and Young 2013) recorded peak daytime noise level recorded above 100dBA between 22 -28 times every hour with night time recordings peaking at 85dBA 16 times an hour.

Purpose

The aim of this Quality Improvement Project is to reduce ICU noise by 15% at night to improve patient sleep hygiene and reduce delirium in all critically ill patients on ICU in a Welsh hospital, within one month.

Methods

- **Complete e-Learning module Quality and Safety;** This module taught the principles of human factors, learning from error, measurement for improvement and model for improvement.
- **Literature search:** six electronic databases (Medline, CINHAL, Cochrane Library, Scopus, EMBASE, Web of Science); 2013-2019. **Inclusion criteria:** Full text, English language, adult, humans, non-pharmacological strategies of sleep promotion interventions, critical care/ITU, noise reduction monitors. **Exclusion criteria: Review articles;** paediatrics, neonates, healthy entrants, ventilator modes to promote sleep, complimentary therapies, ITU design or infrastructure. CASP Tools for critical analysis.
- **Quality Improvement Project (QIP)**
  - Model for Improvement Framework (ICHI 2009): PDSA Cycle (table 1)
  - reviewed dBa measurement pre - implementation
  - Implementation of noise warning activation sign (NWAS) (visual).
  - Implementation of educational teaching of MDT.
  - Pre & post implementation review of diagnosed delirium using CAM-ICU.

Results

Data was collected for a 5-week period to obtain baseline noise levels, with a further 5-week period to ascertain if the implementation of noise activated warning signs reduced noise levels. Delirium levels have also been monitored in the post-implementation period, to determine if this QI reduced the incidence of delirium. Results can be seem in tables 2 and 3.

Table 2: Comparison of the noise pre, peri and Post QIP

Overall average Time Period	Baseline dBA	Noise activated warning sign with no education	Noise activated warning sign and staff education
Average night time noise 2200 to 0600	54.1	54.4	50.3
Average highest peak night time noise 2200 to 0600	77.0	75.7	75.7
Average quiet time noise level 1400 to 1600	59.1	56.1	56.3
% time > 60 dBA	19.65%	17.97%	14.74%

Table 3: Comparison of diagnosed delirium in ICU patients pre and Post QIP

	2016	2017	2018	Post-implementation of noise warning activation signs 2019
Number of ITU admissions	732	644	700	63
Recorded Delirium Positive	291	229	301	22
Rate %	40.2%	36.7%	43.0%	34.9%

Discussion

When analysing the quantitative data, it was important to note that averaging the dBA levels did not produce mean noise levels as decibels scales are logarithmic, therefore the average had to be derived from the power. Whilst some noises are perceived to be twice as loud, they are only usually 10 dBA apart, for example, a 60-dBA oximeter alarm will sound twice as loud as a 50-dBA endotracheal unit, yet the 10-dBA difference represents a tenfold increase in intensity. The 70-dBA ventilator alarm will sound four times as loud as the endotracheal aspiration unit, but in relation to acoustic intensity, it is one hundred times more powerful. Therefore, every decrease of 3 dBA denotes a halving of sound intensity. Baseline noise levels identified on the author's unit consistently exceeded the WHO recommendations with day time average 59.6 dBA and night time average 56.5 dBA. These noise levels remain consistent with contemporaneous literature (Darbyshire 2016; Delaney et al. 2017; Litton et al. 2017; Plummer et al. 2018; Simons et al. 2018). But it was noted that WHO's recommended levels were not achievable in a lounge in the researchers' house.

There is an incorrect perception that dedicated "quiet times" and weekends were quieter than "non-quiet times" and week days; although the implementation of noise activated warning signs did reduce noise at "quiet times", This reduction of 3-dBA during quiet time on the author's unit equates to an 18.77% reduction in perceived noise, proving that this type of visual display did promote behavioural change.

The results demonstrate that both visual prompts with teaching are required to highlight noise in the author's ICU. It is important to note there is a high risk of bias in the literature review and this data due to small sample sizes. Following both implementation of NAWS and MDT education, a significant 20% reduction in perceived noise was achieved, highlighting the necessity for both continued education and visual prompts. The impact of this suggest a 8.1% reduction in documented delirium between 2018 and 2019, to date.

Conclusions

The aim of the QI project to achieve a 15% reduction of noise in the ICU at night was achieved. By reducing noise it could be argued that this sleep hygiene strategy improved quality of sleep and aided in reducing diagnosed delirium by 8.1% in a single centre ICU in Wales.

This QI project has not only achieved the aim set, but has demonstrated the value of post graduate education and its role in practice. Our experience demonstrates that critical care nurses can use their academic learning to inform and influence their clinical practices to improve their patient care. Academic learning can empower critical care nurses by equipping them with the knowledge, tools and confidence to gain the support of clinical managers and this can lead to improved patient care and outcomes.

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