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Effect of Noise Reduction Methods in the ICU on Sleep Quality

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Introduction

- Sleep deprivation is a common problem in the critical care unit- in part due to frequent interruptions.
- It causes decreased attentiveness, fatigue, poor cognitive function (Weinhouse et al., 2009), increased risk of delirium (Rompaey, Elseviers, Drom, Fromont, & Jorens, 2012).
- Studies have been conducted that test the effect of various interventions on sleep quality. Some of these interventions are use of earplugs, eye masks, and melatonin.



Methods

- Key words used to search included “earplugs,” “melatonin,” “sleep deprivation,” “delirium prevention,” “intensive care unit,” and “critical care.”
- The databases used for the review were PubMed, CINAHL, The Cochrane Library, and Google scholar.
- Results were limited by “English language only,” adults, and full text. Further limits were based on relevance, and the existence of clinical implications for nursing practice



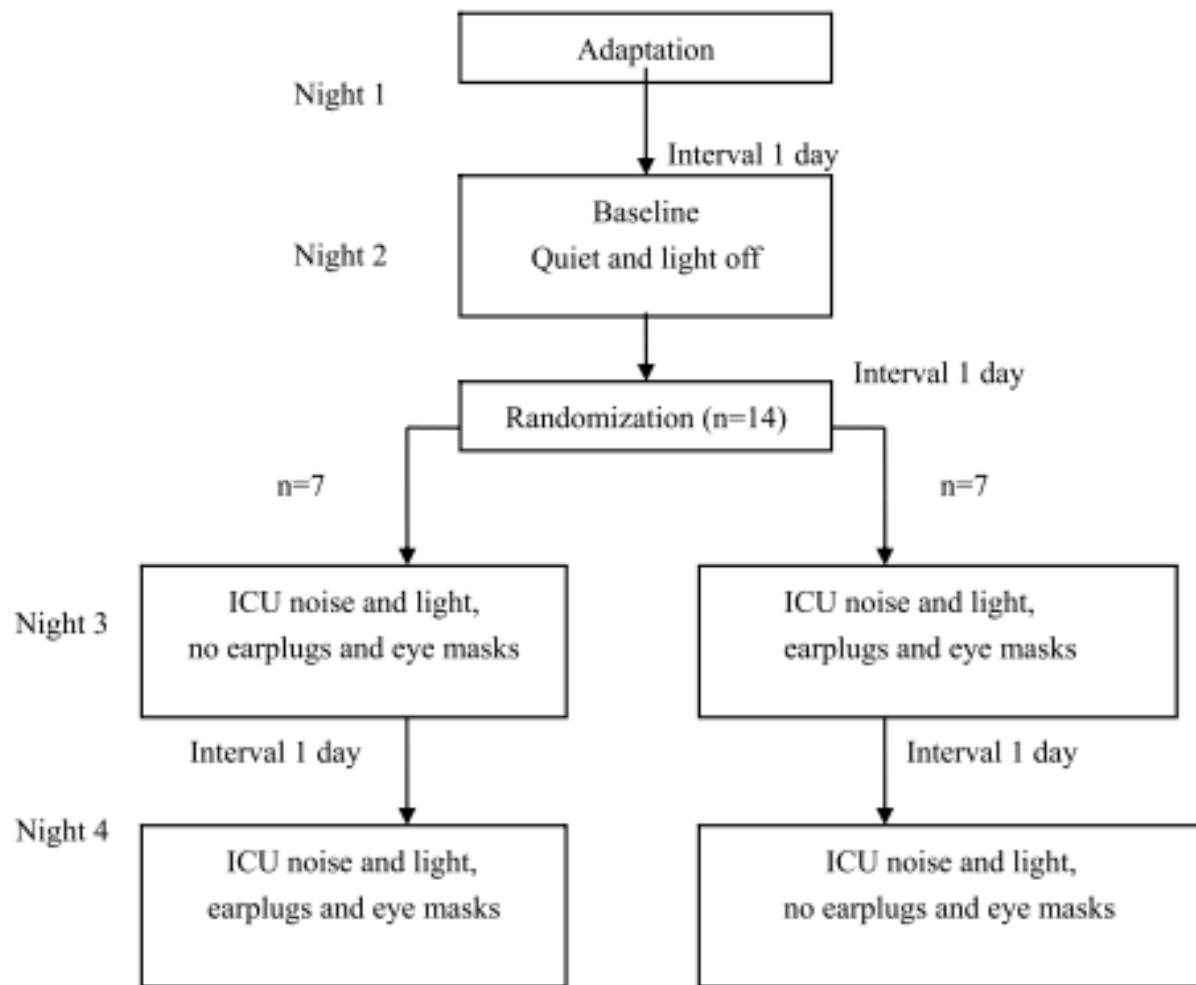


Figure 1 Study design.

Results

- **Improved sleep quality with the use of earplugs and eye-masks**
 - Hu et al., (2010) and Huang et al., (2015) both found that subjects had significantly worsened sleep quality ($p < 0.05$) when exposed to noise and light (NL).
 - Subjects who used earplugs and eye masks (NLEE) had longer REM, less arousal, and elevated melatonin.
- NL had 9.3% REM sleep, compared to NLEE which was 12.9%, $p = 0.005$. Sleep onset latency for NL was 23.4, as opposed to NLEE which was 15.4, with $p = 0.055$. NL subjects had on average 15.1 arousals, in comparison to NLEE's 12.2 arousals, $p = 0.04$ (Hu, Jiang, Chen, & Zhang, 2010).
- Huang et al., (2015) conducted a similar study in which a simulated ICU noise and light environment caused worsened sleep quality. NLEE subjects had a slightly longer total sleep time (385 minutes compared to NL 369 minutes). NLEE had a significantly ($p = 0.01$) higher sleep onset latency of 46.6 minutes in comparison to NL 71.4 minutes. NLEE had significantly ($p = 0.001$) fewer awakenings, averaging 5 times less than those in NL. Those under NL had sleep anxiety level of 46, where as NLEE had sleep anxiety level of 33 ($p = 0.000$). NL had sleep quality 6.1, in comparison to NLEE's sleep quality 3.4 ($p = 0.000$) (Huang et al., 2015).

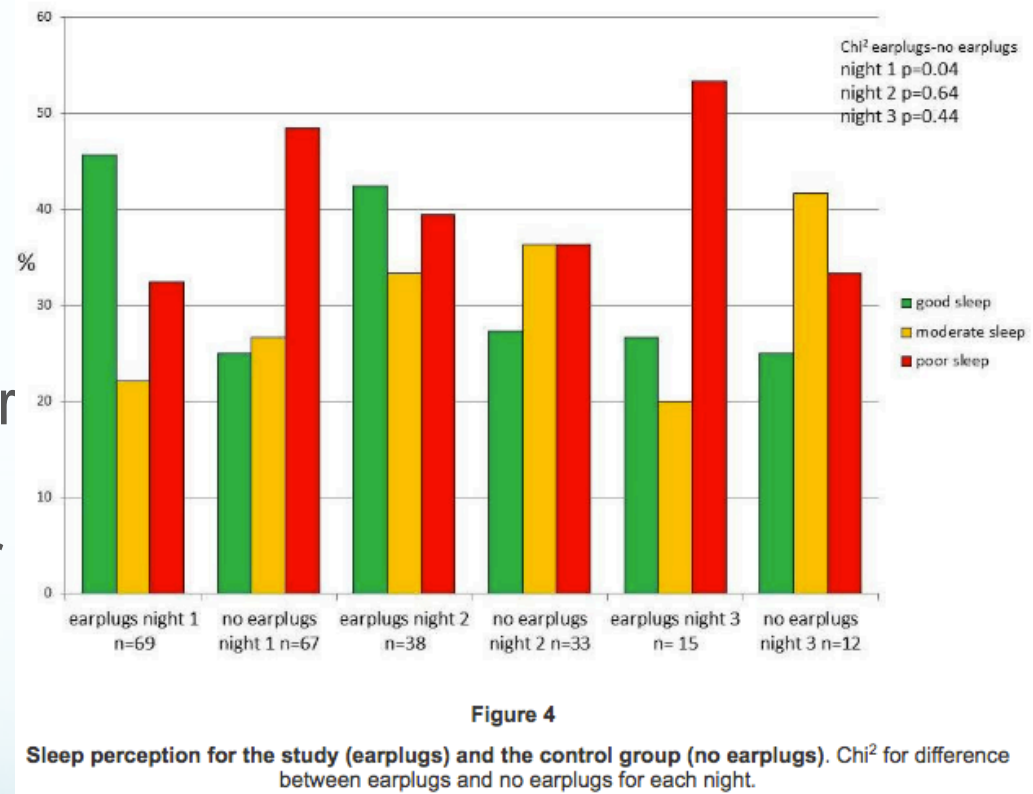
Table 1 Sleep architecture and study condition for subjects (n = 14)

Variable	Baseline	NL	NLEE	ANOVA <i>P</i>	Contrast <i>P</i>
Time in bed (min)	539.7 ± 1.7	536.0 ± 15.9	536.0 ± 13.7	0.48	—
Total sleep time (min)	456.0 ± 39.9	454.7 ± 41.8	475.1 ± 33.4	0.20	0.06
Sleep efficiency Index	0.8 ± 0.1	0.8 ± 0.1	0.9 ± 0.0	0.12	0.09
REM%	10.9 ± 5.9	9.3 ± 4.3	12.9 ± 4.3	0.03	0.005
S1%	21.8 ± 10.4	23.4 ± 11.9	22.5 ± 9.7	0.80	0.67
S2%	43.9 ± 10.2	45.6 ± 10.3	43.5 ± 6.9	0.57	0.20
S3%	14.0 ± 6.8	11.6 ± 6.5	13.9 ± 5.6	0.30	0.11
Sleep onset latency (min)	22.3 ± 13.1	23.4 ± 16.6	15.4 ± 16.4	0.46	0.055
REM latency (min)	121.8 ± 47.0	146.9 ± 56.2	105.7 ± 47.0	0.02	0.013
Arousals index	13.0 ± 4.7	15.1 ± 6.2	12.2 ± 6.5	0.03	0.04

ANOVA, repeated measures analysis of variance; Contrast, paired student's test or wilcoxon's rank sum test of simulated ICU environment with and without earplugs and eye masks; NL, recorded ICU noise and light exposure; NLEE, recorded ICU noise and light, subjects wore earplugs and eye masks; REM, rapid eye movement.

Results

- **Decreased incidence of delirium**
- Those who used earplugs developed delirium at a 43% lesser rate than those who did not, and reported better sleep quality (Rompaey, Elseviers, Drom, Fromont, & Jorens, 2012)



Rompaey, et al., 2012	Hu et al., 2010	Huang et al., 2015
Decreased incidence of delirium with earplugs	Longer REM, less arousal, and elevated melatonin levels with earplugs and eye masks	Longer REM, less arousal, and elevated melatonin levels with earplugs and eye masks
Improved self-ratings on sleep quality	Fewer arousals	Fewer arousals
Decreased sleep anxiety	Longer REM	Longer REM
		Longer total sleep time
		Lower sleep anxiety level

Discussion

- All three studies:
 - Observed sleep quality, but measured it in different ways.
 - Van Rompaey et al., (2012) focused on rates of delirium
 - Hu et al., (2010) and Huang et al., (2015) used the polysomnography and self-perception ratings.
 - Hu et al., (2010) and Huang et al., (2015) used very specific measurements that helped quantify sleep quality, such total sleep time, sleep-onset latency, REM latency, amount of light sleep, amount of REM sleep, and number of arousals or awakenings.
 - They also measured urine excretion, serum melatonin, and serum cortisol.
- The three studies were all randomized controlled trials
- The three studies were all double blinded

Implications

- Evidence suggests that noise remains an obstacle that prevents patients from receiving adequate and restful sleep.
- Healthcare providers should be proactive in promoting a quiet environment in order to foster restful and restorative sleep.
- Earplugs are cost effective and easy to implement. Earplugs and eye masks should be in stock at the hospital and offered to patients

References

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