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THE AFFECT OF THE THESSALONIKI RING ROAD TRAFFIC NOISE EMISSION ON HOSPITALIZED PATIENTS IN PAPAGEORGIOU HOSPITAL

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Abstract

Previous studies have shown the high levels of noise in a hospital environment caused by many factors such as traffic noise, and the ensuing implications on sleep quality of hospitalized patient's especially in ICU's.
This study was undertaken to measure noise levels in a pulmonary ward and an ICU and to detect the influence of the environmental factors on patients' sleep quality as well as lack of rest in the day, during their hospitalization.
Measurements were undertaken using the Cirrus CR:245/R2 Environmental Noise Analyzer, for a period of two weeks, both in a 30-bedded pulmonary ward and in a 16 bedded general ICU. Sleep quality, sleep during the day and the effect of various environmental factors' on them were surveyed on 74 hospitalized patients by means of a questionnaire.
Generally, noise levels in the ward were significantly lower than those in the ICU (52.6dB(A) vs. 59dB(A)). Noise levels in the ward decreased significantly in the course of the day, which was not the case in the ICU.
Patients' perception of sleep quality in the hospital was worse than at home, especially during the first night, with little sleep during the day. Environmental factors did not significantly influence patients' sleep quality.
Noise levels in the ward are high in general, reaching levels close to those of an ICU. Even with the given decrease in the recorded noise, levels remain above the accepted values. Patients' quality of sleep is poorer than home, yet they do not report annoyance by any environmental factor.

1. INTRODUCTION

Sleep quality and quantity of hospitalized patients has been an object of scientific examination, and is suggested to be poor. Sleep recordings performed in hospital settings,

especially Intensive Care Units (ICU), have shown sleep- wake cycle abnormalities such as sleep fragmentation, day- occurring sleep, arousals and awakenings. The causes for this poor sleep quality are multifactorial; environmental stimuli, most often noise, have been implicated for sleep disturbance (1, 2, 3). The significance of noise as an environmental stimulus in hospitals is addressed by both the American Environmental Protection Agency (AEPA) and the World Health Organization (WHO); recommendations by both organizations for noise levels during day and night have been set. AEPA recommendations for noise levels during day and night are at 45dB and 35dB respectively. WHO recommendations are even lower, 40dB during daytime and 35 dB during nighttime.

Most of the previous studies have assessed sleep quality and quantity in the ICU and have correlated noise levels with patients' poor sleep quality (4). Sleep in a medical department can be equally disturbed, since factors producing this disturbance, such as noise, light and human interventions are present, transforming patients' sleep into unrefreshing or unrestorative (5).

The aim of this study was to measure the level of noise in a pulmonary department, to compare it with that of a general ICU, and to estimate the relative role of noise and other environmental factors in patients' perception of sleep quality.

2. METHODS

The study was conducted at a 30 -bed pulmonary department and a 16 -bed general ICU, located in two different tertiary general hospitals, in the same semi-urban area of Thessaloniki, a city in northern Greece with 800.000 habitants.

The organization of the pulmonary department's plan was across a main corridor with patients' rooms enclosed in the one side, and the doctors' offices, auxiliary rooms and nursing station in the other side. Each bed in patients' room was equipped with oxygen and air source and a vacuum. Equipments for measurements of vital signs (blood pressure, pulse, oxygen saturation), or for implementation of non-invasive ventilation were mobile on wheels. Patients' room doors were almost always open.

The ICU included only acute care beds arranged in two semicircular open plans with a nursing station in each semicircular. Each bed was equipped with a ventilator, bedside monitors with EEG, oxymeter and non-invasive arterial blood measurement and equipments for drug administration.

3. NOISE MEASUREMENTS

Noise measurements were conducted by the Cirrus CR:245/R2 Environmental Noise Analyzer, a sound level meter designed for long- and medium-term outdoor and indoor measurements. This instrument measures during a predetermined time period (1 hour) the equivalent sound level in decibels A, dB(A), and the maximum level LAmax.

The specifications of the Sound Level Meter are: Measuring Range 25 to 130 dB(A), Accuracy: IEC 651 & 804 Type1, BS EN 60651 & BS EN 69804 Type 1, Microphone: MK224.

Two noise-monitoring stations were placed for 14 consecutive days in each department. All the measurements were recorded per hour, in order to calculate the noise indications Lday Levening Lnight and Lden according to the 2002/49/EC.

The working personnel of both departments was informed for the study, but received no special order for noise caution.

For analyzing purposes, the recordings were divided into 8-h periods corresponding to

the working schedule for nursing and attending personnel in Greek hospitals–morning, evening and night shifts.

4. SLEEP QUALITY OF HOSPITALIZED PATIENTS

4.1 Patients

Patients hospitalized in the pulmonary department participated in the study. They were hospitalized due to several respiratory conditions, mainly COPD exacerbation. Patients with cognitive impairment of any kind, or inability to communicate were excluded from the study.

The perception of sleep quality and the definition of environmental factors annoyance were evaluated using a questionnaire developed by Freedman et al (5). This was translated into Greek, and modified in the part of the environmental factors to represent the conditions in the pulmonary department.

Questions referred to patients' sleep quality and subjective daily sleepiness during hospitalization. Answers were graded using a scale ranging from 1 to 10 (1 poor- 10 excellent quality/ 1 unable to stay awake- 10 fully alert, respectively).

The questions referred to human interventions, noise and other environmental factors and their disrupting effect on patients' sleep were estimated also by a 1 to 10 scale (1 no disruption-10 significant disruption).

4.2 Data analysis

Descriptive statistics were used. Student's t-test and Analysis of variance (ANOVA) were applied in order to examine differences between groups of variables. A p value lower than 0.05 was considered statistically significant. All results were statistically analyzed using the SPSS 11.5 version for Windows software (SAS, Chicago, IL)

The protocol was approved by the ethics committee of both hospitals.

5. RESULTS

5.1 Noise measurements

Mean value of noise levels in the ward was 52.6±8.2 dB, which was significantly lower than that in the ICU (59.0±2.2 dB, p=0.000). The noise levels over 7 consecutive days in pulmonary ward and ICU are displayed in figure 1.

In the morning shift, noise levels were high both in the pulmonary ward (59.4±6.1dB) and in the ICU (60.6±1.7 dB), without any significant difference between them. The higher noise level in the pulmonary ward, which sometimes exceeded those of the ICU, was recorded during morning shift at 1 pm each workday (63.3±3.1dB).

During the 24h-period, noise levels in the pulmonary ward decreased gradually, with lowest recorded value at 10 pm (49.9±6.5dB), although some higher levels (56.7±3.84 dB) were recorded at 5 pm, which was visiting hour. Noise levels in the other shifts (evening and night) decreased significantly in the pulmonary ward; this was not observed in the ICU, though the same decreasing pattern was recorded (table1). Sound levels in the night shift were high in both departments, with higher values being recorded in the ICU.

There was no significant variation in the noise levels between different days during the recording, with the exception of the weekend (Saturday and Sunday) in the pulmonary

department, where noise levels showed an important decrease, which started from the previous day (Day 5- Friday) , (figure 1).

5.2 Patients

Seventy-four patients (53 men, 21 women), aged 65.0±13.6 years, participated in the study. The duration of their hospitalization was 10.3±9.6 days. Reason for hospitalization was: COPD exacerbation 36.6%, pneumonia/ other infections 17.7% lung cancer 12.7%, acute respiratory failure 9.9%, interstitial lung disease 9.8%, pleural effusion 7%, pulmonary embolism 4.2%

5.3 Sleep quality

In general, patient's perception of home sleep quality was superior to that of hospital (7.6±2.1 vs 6.5±2.1) without any significant difference, though. The first night in the hospital was characterized by poor sleep quality (4.7±2.6), which improved significantly during hospitalization (6.3±2.2, p=0.000), with the last day having the best reported quality (6.8±2.1). Sleep quality at home, overall sleep quality and in the first, median and last night in the hospital are displayed in figure 2. No significant correlation was found between age, gender, duration of stay and perceived sleep disruption. Also there was no difference observed in the reported subjective sleepiness between the first day (5.9±2.6) and the middle and last day (5.9±2.1 and 6.1±2.2 respectively) of hospitalization.

Fourteen different factors were evaluated, representing a source of disturbance (environmental noise and human interventions). No significant difference was observed between each factor in general. Grouping the factors into two subgroups: environmental stimuli (general noise, light, equipment function, staff discussions, telephone ringing, and television) and human interventions (patient care, drug administration, blood pressure measurement, blood draw, pulse oximetry, vacuum and nebulization) no significant difference was observed between them. Patients assessed with almost equal scores nursing interventions (15.9±11.4) and environmental factors (17.9±11.0) as disturbance causes for sleep (p=0.264). Additionally, none of the patient seemed to be significantly annoyed by noise or any other factor, since no correlation was found between the perception of sleep quality and the estimated factors.

6. DISCUSSION

The results of this study highlight some important characteristics of the contemporary hospital environment in Greece. Noise levels are high both in the ICU and the ward. This reflects the common trend of increasing noise in hospitals all over the world (6). As expected, noise levels in ICU, were high during the day and had a trend to lower during the night, but were always above the recommended values for hospital environment. Comparison with the reports of noise level of another ICU in a Greek hospital (11), these recorded noise levels were lower and never exceed 65dB especially during the night. Possible explanations may be the different number of beds in the setting with respect of the room, the use of new technology, and, also, the surrounding area of the hospitals in which the ICUs were. Nevertheless the results confirm that ICU remains a noisy hospital setting.

The recordings of noise levels in the pulmonary ward have different characteristics. Higher values were recorded during the morning shift, and were comparable with that of ICU during the day. Everyday of the recorded period, noise levels followed the same pattern, with a gradual declination at the evening and night, remaining above the recommended values,

though. This declination of noise level in the afternoon and evening may be due to the smaller number of the personnel, working at that time, and the lower work rhythm. In the ICU, however, the noise levels remained always high without any influence from the interchange of staff at the work shifts.

There are several studies from other hospital settings, but to our knowledge this is the first to report noise measurements in a pulmonary ward. The noise levels are higher than reported from a surgical ward in the UK (6) but significant lower from an equivalent hospital location in the USA (4). These differences probably reflected the different working schedule between the countries, as the majority of noise source depends from the number of the personnel, and the degree of their work. The noisy environment has been hypothesized to be an important factor of sleep fragmentation and deprivation especially in ICU for adults and children (10).

There are several studies examining the sleep quality, mainly in ICU patients. To our knowledge this is the first one to examine the sleep quality in patients in a hospital environment, other than the ICU. Patients estimated their sleep quality as poor especially in the first night; sleep quality and sleepiness did not change over the course of hospitalization for them. The influence of environmental factors in sleep quality was low and no strong relationship was found with any of the examined sources of noise and annoyance. Unlike Freedman et all (5) we failed to find any significant correlation with particular environmental factors. This may be due to the fact that in the pulmonary ward the environment is not as busy and the human interventions are not as intense as in ICU.

Possible limitations in our study would be that we did not estimate the sleep quality by a polysomnography and also we had no information about perception of sleep quality in ICU patients, which was difficult to collect due to the patients' status.

However this study confirms that noise pollution is present in Greek hospitals as it is all over the world, independently of the specialty of the department.

It emphasizes also that more work is worth to be done in the field of sleep quality in patients with a respiratory disease, who seem to manifest a poor sleep quality, particularly during the exacerbation of the disease when hospitalization is necessary. Naturally, this is also important for all ICU patients since it can affect their sort- and long- term outcomes.

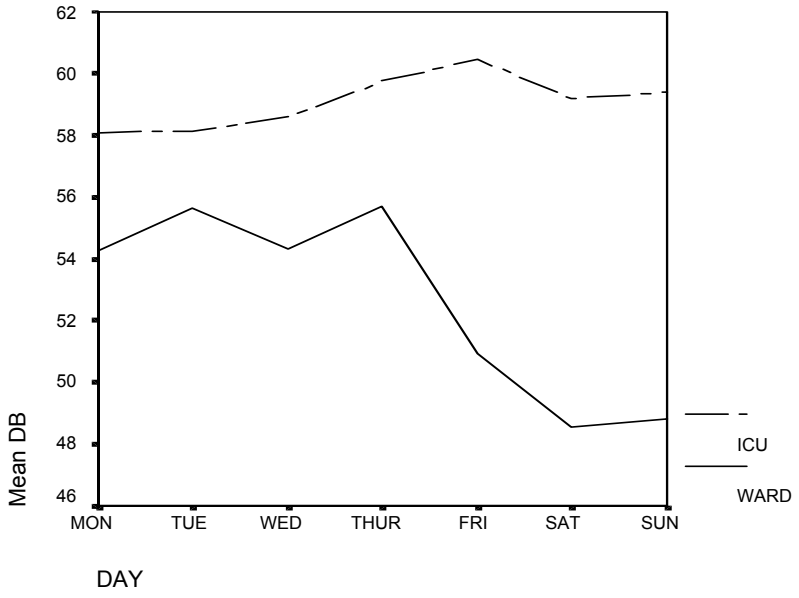

Figure1

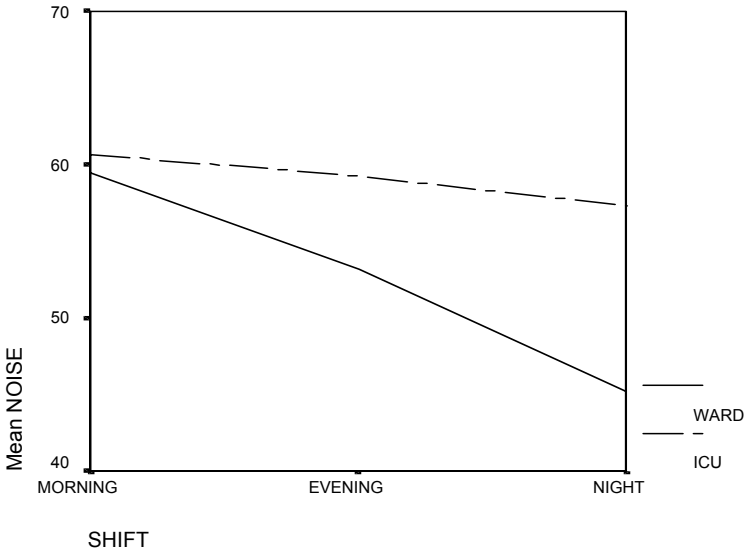

Figure2

Table 1: Noise levels in the clinic and the ICU in the 3 working shifts

	CLINIC			**ICU**			
	mean	min	max	mean	min	max	p
Morning shift	59.4±6.1	45.3	69.7	60.6±1.7	55.8	65.6	ns
Evening shift	53.1±4.7	43	63.7	59.1±2.3	55.2	65.7	0.000
Night shift	45.2±6.8	36.4	63.5	57.3±1.4	54.7	62.2	0.000

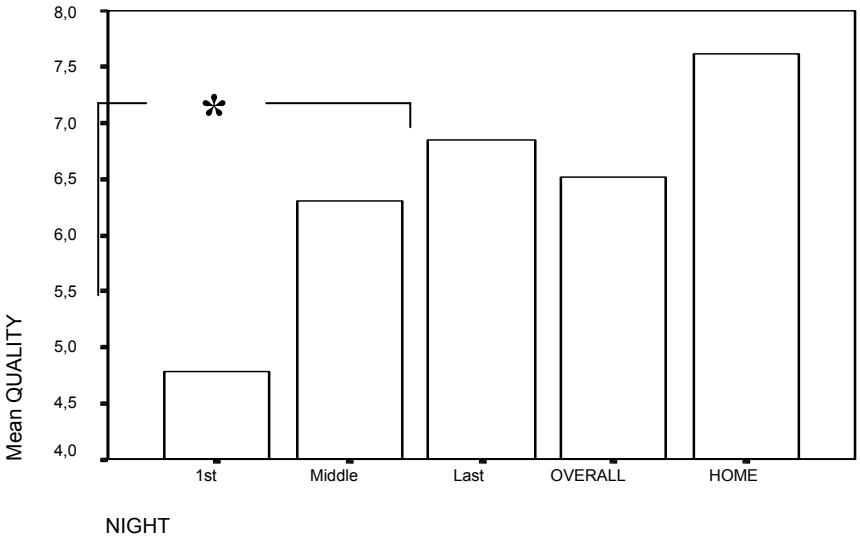

Figure3. Quality

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