



Mapping the noise in a Greek general hospital

G. Loupa*, A. Katikaridis, D. Karali, S. Rapsomanikis

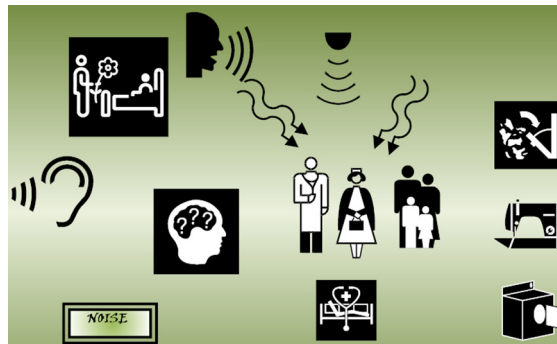
Laboratory of Atmospheric Pollution and of Control Engineering of Atmospheric Pollutants, Faculty of Engineering, Department of Environmental Engineering, Democritus University of Thrace, 67100 Xanthi, Greece



HIGHLIGHTS

- The hospital staff is exposed to noise levels that are annoying and disturbing.
- Noise levels concerning patients were above guideline values.
- Indoor noise levels were above the outdoor levels.
- Noise peaks appeared in frequencies that characterised their emission sources.
- Low frequency noise components are present in all the monitored areas.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 9 May 2018
Received in revised form 18 July 2018
Accepted 22 July 2018
Available online 23 July 2018

Editor: P. Kassomenos

Keywords:

Indoor environmental quality
Occupational safety and health
Patient care
Acoustics

ABSTRACT

Sound pressure levels were monitored in a general hospital, in Greece, at ten indoor locations and at three outdoor locations, in the yard of the building. The selected indoor locations are representative of distinct activities that are common in every hospital, such as the emergency department, patient wards and several supporting services, like washing the clothes or the dishes. Noise levels were highly variable in each monitoring location and depended on the activities in the room, such as conversations, medical equipment in use, analytical devices or other machinery in operation. The highest noise levels that were recorded were in the blood donation unit and in the laundry room (the $L_{10,8h}$ was 73 and 79 dB(A) respectively), mainly due to the opening/closing of the metal lids of garbage bins in the first location and due to the wringing of the clothes in the second. Indoor background noise levels i.e. the $L_{95,8h}$ values, were more than 55 dB(A) and higher than the respective outdoor values (except of the $L_{95,8h}$ in one ward of the paediatric ward). The calculated average $L_{EX, 8h}$ was 69.3 dB(A), below the European Union lower exposure action limit value, i.e. 87 dB(A), that was set to prevent hearing loss of the employees. However, noise levels in the wards, in the emergency and the outpatient department were above the values suggested by international guidelines for a healing environment. Sound spectra revealed peaks in frequencies that were representative of the sources of the noise and also the presence of low frequency noise components.

© 2018 Elsevier B.V. All rights reserved.

1. Introduction

Noise is a perpetual, significant contributor to occupational diseases in numerous working environments (Concha-Barrientos et al., 2004; Moorhouse et al., 2005; Tjunelis et al., 2005). It is an unpleasant and disturbing sound, which is found to be responsible for several auditory

* Corresponding author.
E-mail address: gloupa@env.duth.gr (G. Loupa).

and no-auditory adverse effects on human health and well-being, ranging from simple annoyance to hearing loss (Jones, 2010). Noise health effects depend on the combination of intensity, frequency and duration of exposure to noise (Basner et al., 2014; Jones, 2010).

The hospital environment is housing numerous occupations (nurses, doctors, cleaners, cooks, administrative employees etc.) in its diverse facilities, apart from the patients and the visitors. A general, district hospital like the hospital of the city of Kavala that was examined in the present study, include an emergency department, an intensive care unit, operation theaters, an outpatient department, wards, a laundry and a sewing department, kitchens, a blood donation room, numerous laboratories and administrative offices like an accounting office. It is like a small city in one building. In this complicated environment a mixture of sounds co-exist, usually with a fluctuating intensity and a combination of diverse frequencies, such as conversations, beepers, several machines, HVAC systems, rolling carts. Relevant studies have shown that the noise levels in hospitals have been found to be well above recommended guidelines, such as those suggested by the World Health Organization (Basner et al., 2014; Berglund et al., 1999; Tsara et al., 2008; Zannin and Ferraz, 2016). Elevated noise levels do not support patient well-being and privacy, neither the productivity nor the well-being of the personnel. In the healthcare sector most of the workers are women, which, according to Schneider (Schneider et al., 2005), appear to be more exposed than males to medium levels of noise and also they are exposed to sudden and disturbing noise. Consequently, it was found that noise influences the perceived stress in nurses and finally their intention to change job (Applebaum et al., 2010). Healthcare workers are also exposed to biological and chemical agents, among them substances from medications (Loupa et al., 2016). Combined exposures of noise and ototoxic chemicals may lead to neurotoxic effects, hearing loss or other negative health effects. Apart from the health effects, the noise disturbs speech intelligibility and audibility that is essential to communication between patients and staff and between staff members.

The World Health Organization (WHO) suggested a daytime guideline value of 30 dB L_{Aeq} (averaging time 16 h), together with a 40 dB L_{Amax} during night for the wards in the hospitals (Berglund et al., 1996, 1999). Furthermore, Berglund et al. (1996, 1999) suggested that

“Since patients have less ability to cope with stress, the L_{Aeq} level should not exceed 35 dB in most rooms in which patients are being treated or observed”. According to the U.S. Environmental Protection Agency (US EPA, 1974), noise levels in hospitals should not exceed 45 dB (A) during the day and 35 dB(A) during night (considered a maximum 24-h L_{dn} of 45 dB(A)). L_{dn} is the equivalent A-weighted sound level during a 24-h time period with a 10 dB weighting applied to the equivalent sound level during the night time hours (10 p.m. to 7 a.m.). Also, EPA suggested a L_{dn} of 55 dB(A) for outdoor areas around the hospital.

For the workers, in any workplace, the EU Directive 2003/10/EC have set guidelines that lay down minimum requirements for the protection of workers from damage to hearing. The guideline exposure values are based on the average A-weighted noise level normalized to an 8-h work period ($L_{EX,8h}$) and on the peak sound pressure level: (i) exposure limit values: $L_{EX,8h} = 87$ dB(A) and peak = 200 Pa (i.e. 140 dB (C) in relation to 20 μ Pa) respectively; (ii) upper exposure action values: $L_{EX,8h} = 85$ dB(A) and peak = 140 Pa (i.e. 137 dB (C) in relation to 20 μ Pa) respectively; (iii) lower exposure action values: $L_{EX,8h} = 80$ dB(A) and peak = 112 Pa (i.e. 135 dB (C) in relation to 20 μ Pa) respectively. Other noise effects are not encountered in this directive and the noise spectrum analysis is not obligatory by the legislation. However, the human response to the sound depends on the amount of the received acoustic energy, always in relation to the sound frequency. This response differs from one person to another, especially for sounds with low frequencies. These low frequency sounds are ubiquitous in many indoor environments at moderate sound pressure levels (of about 70 dB), as well as in the healthcare facilities (for example originating from the air-conditioning systems, computers, lifts, medical equipment) (Berglund et al., 1996, 1999; Tamura et al., 2012). The low-frequency noise (LFN) that can provoke annoyance and can disturb rest and sleep, even at low sound pressure levels, has no received much attention in the healthcare environment (Baliatsas et al., 2016; Berglund et al., 1999; Darbyshire and Young, 2013; Mariconte et al., 2015; Ryherd et al., 2008; Waye et al., 1997; Waye, 2011; Zhu et al., 2008).

Questionnaire studies and objective noise measurements in Greek hospitals support that noise is a serious problem for these indoor

Table 1
Information about noise monitoring locations and monitoring schedule.

Location	Monitoring schedule	Area (m ²)	Number of beds	Height of monitor position	Workers/patients
Emergency room	3 days, for 8-h per day (morning or evening)	70	5	1.7 m above ground	5 up to 10 patients, doctors and nurses
Laundry room	1 day for 8-h (morning)	40		1.7 m above ground	4 to 6
Room of sewing	1 day for 8-h (morning)	25		0.9 m above seat	4
Accounting office	1 day for 8-h (morning)	120		0.9 m above seat	8
Dish washing room	1 day for 8-h (morning)	40		1.7 m above ground	6
Bio-pathology lab	1 day for 8-h (morning)	100		1.6 m above ground	6
Blood donation unit	1 day for 8-h (morning)	20		1.6 m above ground	2
Ward (pulmonary dep.)	3 days/once per day for 8-h (morning or evening)	60	6	1.6 m above ground	(a) 3 patients (b) 3 patients and one nurse (c) 3 patients and 2 visitors
Ward (paediatric dep.)	1 day for 8-h (morning)	60	6	1.6 m above ground	2 patients and 2 parents
Waiting room (outpatient dep.)	2 days, for 8-h per day (morning or evening)	120		1.8 m above ground	Variable number of patients and personnel
Outdoors	3 days, for 8-h per day (morning)			1.8 m above ground and 2 m from the walls	(a) Main entrance (b) Emergency dep. Entrance (c) Outpatient dep. entrance

Download English Version:

<https://daneshyari.com/en/article/8858433>

Download Persian Version:

<https://daneshyari.com/article/8858433>

[Daneshyari.com](https://daneshyari.com)