THE ACOUSTIC ENVIRONMENT AND HEALTH RISKS IN HOSPITALS

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INTRODUCTION

The increase of outdoor noise pollution in the environment arises the problem of indoor noise pollution, particularly in health care facilities. Noise exposure represents load for patients in the state of higher psycho-vegetative excitability and for the personnel as well. Hospital represents a specific environment with sources of indoor noise pollution (internal and external) and negative effects on both patients and staff. The main internal sources of noise are health facility functioning, staff activities, elevators, diagnostic and therapeutic instruments, air-conditioning, heating and ventilation (HVAC - noise). The main external sources represent traffic, especially road traffic. Road traffic noise represents a frequent, unavoidable and continuously increasing environmental factor in big cities throughout the world.

OBJECTIVES

The aim of this study was to investigate the status of noise pollution in different hospital environments, to measure and describe hospital noise and to improve noise awareness of the staff.

MATERIAL AND METHODS

- Using an integrated sound level meter and an octave band analyzer, recording were made in various hospital environments (e.g. orthopaedic operating theatre), during various procedures (e.g. total knee replacement).
- Maximal noise levels were measured also in the rooms of hospital wards (patients' room, examination room, etc.).
- The standard five grade noise annoyance scale was used in our study (5 - annoys extremely, always; 4 - substantially, often; 3 - rather, sometimes; 2 - a little, seldom; 1 - not at all, never) in a short questionnaire given to the staff.
- Subjective analysis of noise sources and noise annoyance were assessed in 28 selected university hospital wards in Bratislava, respondents evaluated noise disturbance and the most frequent sources.

RESULTS

Equivalent noise level in operating theatre before surgery was LAmax = 52.9 dB, maximal noise level was LAmax = 68.9 dB. Equivalent noise level during orthopaedic surgery (total knee replacement) went up to LAmax = 71.3 dB, LAmax = 68.3 dB, maximal noise levels reached up to 85 dB(A). Octave band analysis of noise before surgery showed the maximum in lower frequencies (31.5 - 250 Hz); during surgery maximal noise levels were in higher frequencies (1000 - 16 000 Hz). The main sources of high frequency noise in orthopaedic operating theatre were powered instruments (e.g. drill, saw, air hose, air tool) at the main sources of lower frequency noise in an empty operating theatre were heating, ventilation systems and air-conditioning (HVAC noise) (Fig. 1). Results from our noise recordings in orthopaedic operating theatre exceeded noise exposure action levels in occupational environment for particular group of activities according Government regulation No. 115/2006, Ministry of Health, Slovak Republic 2006 (LAeq,A=50 dB) concerning non-specific, especially psychological effects of noise (disturbance, annoyance). Our results do not exceed lower noise exposure action levels concerning specific, aural effects (LAmax, A = 80 dB).

In selected hospital wards in patients' rooms maximal noise levels reached up to 60.0 dB(A) and exceeded in majority of them permissible noise levels for indoor environment in hospital rooms according to Government regulation No. 338/2006, Ministry of Health Slovak Republic 2006 (LAmax = 35 dB) (Tab. 1).

According to questionnaire, 64 % of hospital staff were annoyed by noise at work, 10% highly annoyed (Fig. 3).

Main sources of noise were the traffic, especially road traffic from outdoor sources; operation, machinery and hospital equipment facilities from indoor noise sources (Fig. 4, 5).

CONCLUSIONS

- Noise exposure in health facilities represents load for patients, that are often in the state of higher psycho-vegetative excitability and for the personnel as well.
- This study indicates, that noise surveys should be conducted in hospitals and that measures to decrease noise should be proposed to hospital authorities, administrators and supervisors.
- Awareness of staff, public health, hospital authorities and public is also needed for abatement of hospital noise pollution.
- Proper site location, city planning, traffic engineering, equipment selection, maintenance and system management requires a multidisciplinary approach.