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Noise Pollution in Biochemistry Laboratories of Different Hospitals in Istanbul/Turkey

İstanbul/Türkiye'deki Çeşitli Hastanelerin Biyokimya Laboratuarlarındaki Gürültü Kirliliği

Original Investigation
Özgün Araştırmalar

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Abstract

Objective: To measure and analyse noise levels generated by different biochemistry analysers in public hospitals.

Methods: Noise levels generated from different analysers were measured in biochemistry laboratories by using a sound level meter. Each device was operated separately and noise levels were measured for 15 minutes; the lowest and highest sound pressure levels were recorded and compared with the World Health Organisation (WHO) guidelines for community noise. Also, 20 laboratory workers were chosen randomly and their hearing levels were screened.

Results: The highest noise level recorded from biochemical analysers was 81 dB with an average of 77.7±2.11 dB; the lowest noise level was 64 dB with an average of 66.9±1.66 dB. The average highest noise level of total blood count devices was 78.5±5.94 dB and the average lowest noise level was 66.3±7.05 dB. The average highest measurement of hormone analysers was 78.5±1.95 dB and the average lowest measurement was 66.1±4.53 dB. The average highest measurement of urine analysers was 75.3±5.39 dB and the average lowest measurement was 64.3±4.62 dB. The average highest noise level of centrifuge devices was 80.6±5.68 dB and the average lowest noise level was 69.2±5.75 dB. In the audiometric screening, the hearing thresholds were within normal levels.

Conclusion: The WHO guidelines state that noise levels in hospital areas should be 35-40 dB in the daytime and 30-40 dB in the evening. Our results exceed these guidelines at all times.

Key Words: Noise pollution, hospital, biochemistry laboratory, health effects

Özet

Amaç: Değişik devlet hastanelerindeki gürültü düzeylerinin araştırılması.

Yöntemler: Biyokimya laboratuarlarındaki çeşitli analiz cihazlarından çıkan ses seviyeleri, ses düzey ölçer ile ölçüldü. Her bir cihaz ayrı ayrı çalıştırılarak çıkan gürültü düzeyleri 15 dakika boyunca ölçüldü ve minimal ve maksimal düzeyler tespit edildi. Elde edilen veriler, Dünya Sağlık Örgütü (DSÖ) kılavuzlarında belirtilen düzeylerle karşılaştırıldı. Ayrıca 20 çalışan işitme seviyeleri açısından tarandı.

Bulgular: Biyokimya analizörlerinden elde edilen en yüksek ses 81 dB ve ortalama 77,7±2,11 dB en düşük seviye 64 dB ve ortalama 66,9±1,66 dB idi. Tam kan sayımından elde edilen en yüksek ses ortalaması 78,5±5,94 dB ve en düşük ses ortalaması 6,3±7,05 dB idi. Hormon cihazlarından çıkan en yüksek ses ortalaması 78,5±1,95 dB ve en düşük ses ortalaması 66,1±4,53 dB idi. İdrar tahlil cihazlarından çıkan en yüksek ses ortalaması 75,3±5,39 dB ve en düşük ses ortalaması 64,3±4,62 dB, sentrifüj cihazından çıkan en yüksek ses ortalaması 80,6±5,68 dB ve en düşük ses ise 69,2±5,75 dB idi. Odyolojik incelemede çalışanların işitme eşikleri normal sınırlar içindeydi.

Sonuç: Elde edilen veriler DSÖ'nün önerdiği seviyelerin üzerinde bulunmuştur.

Anahtar Kelimeler: Gürültü kirliliği, hastane, biyokimya laboratuarı, sağlık etkileri

Introduction

Noise pollution is a common health hazard worldwide. The invention of technological devices led to potentially harmful noise levels, especially in hospitals (1). Noise is an annoying environmental stressor generated from external sources like transport, industry and neighbours as well as internal sources (2). The noise in hospitals seems to come from inside, with intensive care units and surgical wards being important sources. Biochemistry labs that are furnished with many types of technological equipment can be another source of hospital noise, which may affect the health of the care provider.

The effects of noise on human health can be classified as auditory and non-auditory. Systematic occupational exposure to high sound pressure levels can cause noise-induced hearing loss. Apart from hearing impairment, noise disturbs activities and communication, causing annoyance that leads to stress (2, 3).

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The investigators studied noise levels in intensive care units, surgical wards, emergency departments and haemodialysis units of hospitals (4-6). Biochemistry labs are among the busiest departments of hospitals, where the staff work day and night shifts. The goals of this investigation were to assess the noise generated by different analysers in the biochemistry laboratories of 10 different hospitals in Istanbul-Turkey and discuss the health effects of noise pollution.

Methods

Noise levels generated from different analysers were measured in the biochemistry laboratories of 10 different public hospitals by using a RadioShack digital sound level meter, range 60-120 dB (Fort Worth, TX, USA). The study protocol was presented to the institutional review board and the local ethics committee approved the study. Each participant also signed an informed consent. The devices that were analysed were biochemical analysers, total blood count analysers, hormone analysers, urine analysers and centrifuge devices. The sound level meter was held exactly one metre away from the analysers. Each device was operated separately and noise levels were measured for 15 minutes; the lowest and highest sound pressure levels were recorded and compared to the World Health Organisation (WHO) guidelines for community noise. Also, 20 laboratory workers (12 females, 8 males; ages ranging between 27 and 45 with an average of 35.3±6.1 years) were chosen randomly and screened for their hearing levels.

Statistical analysis

SPSS 16 software program was used for the statistical analysis; comparisons were made with Student's t test.

Results

The results of the recorded measurements are summarised in Table 1. The highest noise level recorded from biochemical analysers was 81 dB with an average of 77.7±2.11 dB, and the lowest noise level was 64 dB with an average of 66.9±1.66 dB. Total blood count device noise levels were between 60 and 90 dB with the average highest noise level being 78.5±5.94 dB and the average lowest noise level of 66.3±7.05 dB. Hormone analysers exhibited noise levels between 62 and 81 dB; the average highest measurement was 78.5±1.95 dB and the average lowest measurement was 66.1±4.53 dB. The recordings of urine analysers ranged from 55 to 84 dB; the average highest measurement was 75.3±5.39 dB and the average lowest measurement was 64.3±4.62 dB. The highest noise level recorded from centrifuge device was 92 dB with an average of 80.6±5.68 dB and the lowest noise level was 60 dB with an average of 69.2±5.75 dB. The highest noise levels were recorded from centrifuge devices but the difference was not statistically significant ($p>0.05$). The WHO has recommended that noise levels in hospital areas should be 35-40 dB in the daytime and 30-40 dB in the evening. In our recordings, the noise generated from different biochemistry analysers highly exceeded the recommended levels. In the audiometric screening, the hearing thresholds were all within normal levels.

Discussion

Occupational noise exposure is an important health hazard today and may cause both physical and psychological effects. Noise in hospitals is an important issue for both health providers and patients. There are studies that have analysed the noise levels in different parts of hospitals. Tijunelis et al. (6) recorded and analysed noise in a large emergency department (ED) and compared their results to the EPA guidelines; they found that emergency departments had excessive noise levels on a regular basis. They concluded that there were easily identifiable sources of noise pollution that could be modified in order to decrease stress in EDs. Intensive care units were also well-studied parts of the hospitals and the noise levels in intensive care units were also much higher than the recommended levels; this can affect the psychological state, and cause sleep disturbances and disorientation in patients, as well as anxiety in nurses (4, 7).

The effects of noise pollution on health can be classified as auditory and non-auditory effects. The auditory effect is the consequence of sound energy on inner ear hair cells, causing hearing loss. Noise-induced hearing loss is caused by the systematic

Table 1. Lowest and highest noise levels generated from different analysers

Hospitals	Biochemistry analysers noise levels in dB		Total blood count device noise levels in dB		Hormone analyser noise levels in dB		Urine analyser noise levels in dB		Centrifuge device noise levels in dB	
1	66	77	62	90	62	77	55	84	60	89
2	66	78	60	80	65	80	60	75	72	80
3	67	80	65	75	63	78	61	65	75	77
4	70	75	85	88	77	82	64	70	78	82
5	67	76	65	78	63	81	65	77	65	75
6	66	77	68	76	65	78	67	77	66	78
7	67	78	61	75	70	77	69	76	76	92
8	64	75	66	73	64	79	64	71	66	79
9	67	80	64	73	64	77	70	79	67	79
10	69	81	67	77	68	76	68	79	67	75
Average/std. dev.	66.9±1.66	77.7±2.11	66.3±7.05	78.5±5.94	66.1±4.53	78.5±1.95	64.3±4.62	75.3±5.39	69.2±5.75	80.6±5.68

occupational exposure to high sound pressure levels. This loss is irreversible and gradually progresses with time; this kind of loss is the second most common form of sensorineural hearing problem following presbycusis (8). Chronic exposure to loud noise initially damages hair cells, which are responsible for high-frequency sounds. Over time, continued contact with excessive noise may lead to impaired transmission of both low- and high-frequency sounds to the brain (9). A 40-year exposure to 85 dBA per 8h working day carries a 35% risk of NIHL amongst exposed workers, whilst 90 dBA exposure increases the incidence to 51% (10, 11). Exposure to continuous noise of 85-90 dBA, particularly over a lifetime in industrial settings, can lead to a progressive loss of hearing, with an increase in the threshold of hearing sensitivity (12). In our study, the hearing levels of the participants screened were within normal levels. Although the noise generated from the devices was exceedingly higher than the recommended levels (66 to 80 dB), it was less than the level of 85-90 dB that may cause hearing impairment. Also, the participants were young, thereby decreasing the probability of noise-induced hearing problems.

The non-auditory effects of noise on human health may be due to stress responses causing symptoms of illness. One of the most well-studied non-auditory effects of noise is sleep disturbance. Exposure to noise disturbs sleep in a manner that is proportional to the amount of noise experienced in terms of an increased rate of changes in sleep stages and in the number of awakenings (2). Noise also impairs performance, causes some physiological responses mediated by the autonomic nervous system (increased heart rate and blood pressure), nausea, headaches, argumentativeness and changes in mood and anxiety, all of which may influence the patient-physician relationship (2).

Conclusion

The annoyance of noise for health providers may affect the relationship between caregivers and patients, as well as patient care and education. It is necessary to control noise levels in hospitals and laboratories and take precautions to decrease noise pollution within health centres.

Conflict of Interest
No conflict of interest was declared by the authors.

Peer-review: Externally peer-reviewed.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Author Contributions
Concept - E.G., H.K., M.K.; Design - E.G., O.N.D., M.Y., H.K.; Supervision - M.K.; Materials - H.K., M.K.; Data Collection and/or Processing - E.D., M.Y., H.K., O.N.D.; Analysis and/or Interpretation - M.Y.; Literature Review - N.Ş., M.Y.; Writer - H.K., M.Y.; Critical Review - E.D., M.K.

Çıkar Çatışması
Yazarlar herhangi bir çıkar çatışması bildirmemişlerdir.

Hakem değerlendirmesi: Dış bağımsız.

Hasta Onamı: Yazılı hasta onamı bu çalışmaya katılan hastalardan alınmıştır.

Yazar Katkıları
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