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Noise Pollution in Different Hospital Policlinics of İstanbul/Turkey

İstanbul/Türkiye'deki Değişik Hastane Polikliniklerinde Gürültü Kirliliği

Original Investigation
Özgün Araştırmalar

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Abstract

Objective: This study was performed to measure and analyse noise levels measured in different public hospital policlinics.

Methods: Noise levels in general policlinics of five different public hospitals were measured by using a RadioShack digital sound level meter. The measurements were made from 8:15 to 16:00 hours. They were recorded and were compared with World Health Organisation (WHO) guidelines for community noise.

Results: The average LminA level in Centre 1 was 61±1.73 dB and LmaxA level was 80.14±1.34 dB. The measurements in Centre 2 noted an average LminA level of 62.7±1.7 dB, LmaxA level of 82.42±1.39. The average LminA level in Centre 3 was 63.14±2.41 dB, LmaxA level was 83.57±2.93 dB. The measurements in Centre 4 noted an average LminA level of 59.85±1.06 dB, LmaxA level of 74.85±1.34. The average measurements in Centre 5 were 59.57±3.5 dB for LminA, 75.28±2.92 dB for LmaxA. The highest noise levels were recorded in Centre 3, but the difference was not statistically significant (p>0.05).

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. Turkish Noise Control Regulations also restrict the noise levels to maximum 40 dB. Our results exceed these guidelines at all times.

Key Words: Noise pollution, hospitals, policlinics

Özet

Giriş: Bu çalışma değişik devlet hastanelerinin polikliniklerindeki gürültü düzeylerini ölçmek için yapılmıştır.

Yöntemler: Beş değişik devlet hastanesinin polikliniklerindeki gürültü düzeyi RadioShack digital ses ölçer ile ölçülmüştür. Ölçümler saat 8:15 ile 16:00 arasında yapılmış ve elde edilen veriler Dünya Sağlık Örgütü (DSÖ) kılavuzlarındaki değerlerle karşılaştırılmıştır.

Bulgular: Birinci merkezdeki LminA 61±1,73 dB ve LmaxA 80,14±1,34 dB idi. İkinci merkezdeki değerler LminA ortalaması 62,7±1,7 dB ve LmaxA ortalaması 82,42±1,39 dB idi. Üçüncü merkezdeki LminA seviyesi 63,14±2,41 dB ve LmaxA ise 83,57±2,93 dB idi. Dördüncü merkezdeki LminA ortalaması 59,85±1,06 dB, LmaxA ortalaması 74,85±1,34 dB idi. Beşinci merkezde ise LminA seviyesi 59,57±3,5 dB ve LmaxA seviyesi 75,28±2,92 dB idi. En yüksek seviye 3. merkezde ölçülmüştür ancak diğer merkezlerle anlamlı fark bulunmamıştır (p>0,05).

Sonuç: DSÖ'nün hastane bölgesinde gürültü düzeylerinin gündüz 35-40 dB, gece ise 30-40 dB'i aşmaması gerektiğini bildirmektedir. Türk Gürültü Kontrol Düzenlemesi de gürültü düzeylerinin maksimum 40dB olması gerektiğini bildirmektedir. Çalışmamızda tüm değerler önerilen seviyelerin üzerinde bulunmuştur.

Anahtar Kelimeler: Gürültü kirliliği, hastane, poliklinik

Introduction

Noise pollution is an important and common health problem, especially in industrialised and developing countries. The use of technological devices creates potentially harmful noise levels, especially in hospitals (1). Noise is a well-documented environmental stressor, which is generally created by external sources like transport, industry and neighbours, as well as internal sources (2). Noise in the hospitals seems to come from inside, with intensive care units and surgical wards being important sources. Crowded places like hospital policlinics are also important sources of noise within the hospital environment and any noise exceeding the recommended levels may affect the health of both patients and hospital staff.

Noise is an unwanted sound that is commonly interpreted as a meaningless sound of greater than usual volume. Indoors, noise travels through the air and, according to the structure of the building and room, may be insulated by walls or windows. Noise may cause different health effects on humans, which can be broadly classified as auditory and non-auditory. Systematic occupational exposure to high sound pres-

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sure causes adverse effects, including elevated blood pressure, reduced performance, sleeping difficulties, annoyance and stress, tinnitus, noise-induced hearing loss (NIHL) and temporary threshold shift (2-4).

Hospital noise is an important hazard to community. Mechanical devices, ventilation systems, and patients and staff are general sources within hospitals. The adverse effects of noise in the hospital not only affects people seeking medical help, but also health care givers. There are studies that have measured noise levels in intensive care units, surgical wards, emergency departments and haemodialysis units of hospitals (5-8).

General policlinics of hospitals are among the most crowded and busiest departments of hospitals, where staff work from 8:00 to 16:00 hours. Our goals with this investigation were to assess the noise generated in general policlinic departments of 5 different public hospitals in İstanbul, Turkey, and to discuss the possible effects of noise pollution on human health.

Methods

Noise levels in general policlinic departments of 5 different public and research hospitals were measured by using a RadioShack digital sound level meter, range 60-120 dB (Fort Worth, TX, USA). The study protocol was presented to an institutional review board, and the local ethics committee approved the study. The sound level meter was placed on a tripod about 150 cm high, away from intersection of walls in waiting rooms of the hospitals, where most of the examination rooms merge into. The area of each room was about 400 metres square. The measurements were made from 8:15 to 16:00 hours and evaluated in one hour periods for 8 hours. Centre 1 is one of the busiest hospitals in Istanbul; about 2500 patients are admitted to policlinics daily. Centre 2 is a training and research hospital with 1016 beds and about 3800 admissions day. About 2500 patients apply to Centre 3 daily and the patient count in Centre 4 was about 1250/day. Centre 5 is also a general policlinic of a university hospital, where about 950 patients are admitted. At the end of each day, recordings were collected and compared to World Health Organisation (WHO) guidelines for community noise and to the permitted maximum noise levels of Turkish Noise Control Regulations. The maximum noise level recorded was specified as LmaxA, the minimum noise level as LminA and equivalent noise level as LeqA; all levels were recorded in dB. The recorded data were analysed and average noise levels were calculated and compared to WHO guidelines for community noise and to the permitted maximum noise levels of Turkish Noise Control Regulations.

Statistical analysis

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

Results

The results of the recorded measurements are summarised in Table 1. The average lowest noise level recorded in Centre 1 was 61±1.73 dB, ranging from 59 to 63 dB, and the average highest noise level was 80.14±1.34 dB (range 78-82 dB). The LeqA value for Centre 1 was 70.28±1.38 dB. The minimum noise levels in Centre 2 ranged from 61 to 65 dB, with an average LminA value of 62.71±1.70 dB. The maximum noise levels were between 80 and 84 dB, with an average of 82.42±1.39 dB, and LeqA was 71.57±1.13 dB. The measurements in Centre 3 yielded an average LminA of 63.14±2.41 dB (between 59 and 66 dB), an average LmaxA value of 83.57 dB±2.93 dB (between 78-87 dB) and an average LeqA value of 74.42±2.29 dB (between 70 and 76 dB). The average LminA value of Centre 4 was 59.85±1.06 dB (ranging from 59 to 62 dB), the average LmaxA value was 74.85±1.34 dB (ranging from 73 to 76 dB) and the average LeqA value was 70.42±1.27 dB (ranging from 69 to 72 dB). The measurements in Centre 5 yielded an average LminA level of 59.57±3.50 dB (between 54 and 63 dB), an average LmaxA level of 75.28±2.92 dB (ranging from 70 to 78 dB) and an average LeqA level of 67.14±1.77 dB (ranging from 64 to 69 dB). The highest noise levels were recorded in Centre 3 (83.57 dB), but the difference was not statistically significant ($p>0.05$). In Figure 1, the comparison of LminA levels of the 5 centres to the Lnorm value of 40 dB can be seen. The noise levels were about 20 dB higher than the recommended level. Figure 2 denotes the comparison of LmaxA levels of the centres to normal values, which report levels that are about 40 dB higher. Figure 3 demonstrates about 25 dB over the recommended levels of 40 dB in LeqA values. In our recordings, the noise within the hospital policlinic environment highly exceeded the recommended levels.

Discussion

Long-term exposure to noise pollution may lead to many physical and psychological health problems. The effects of noise pollution on health can be studied as auditory and non-auditory effects. The auditory effect is the consequence of sound energy on the inner ear hair cells, causing NIHL. NIHL typically involves the frequency range (pitch) of human voices, and thus interferes with spoken communications (3). This kind of loss is the second most common form of sensorineural hearing problem following presbycusis (9). A 40-year exposure to 85 dBA per 8h

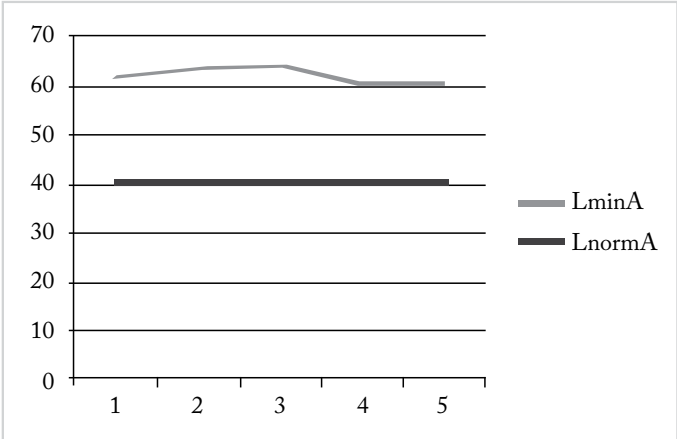

Figure 1. The graphics of LminA values and LnormA in dB

Table 1. LminA, LmaxA and LeqA measurements of different centres (1, 2, 3, 4, 5 denotes the centres)

Hours	Lmin dBA1	Lmin dBA2	Lmin dBA3	Lmin dBA4	Lmin dBA5	Lnorm dBA
8:15-9:15	61	65	63	60	60	40
9:15-10:15	63	61	64	59	63	40
10:15-11:15	63	62	64	62	62	40
11:15-12:15	62	65	65	60	63	40
13:15-14:15	60	63	66	59	59	40
14:15-15:15	59	62	61	60	56	40
15:15-16:00	59	61	59	59	54	40
Average	61	62.7142857	63.14285714	59.8571429	59.5714286	
Std. dev.	1.73205080	1.70433621	2.410295378	1.06904497	3.50509833	
Hours	**Lmax dBA1**	**Lmax dBA2**	**Lmax dBA3**	**Lmax dBA4**	**Lmax dBA5**	**Lnorm dBA**
8:15-9:15	82	83	84	75	76	40
9:15-10:15	80	82	84	73	78	40
10:15-11:15	79	82	84	76	77	40
11:15-12:15	81	84	86	77	78	40
13:15-14:15	80	84	87	75	75	40
14:15-15:15	81	82	82	74	73	40
15:15-16:00	78	80	78	74	70	40
Average	80.1428571	82.4285714	83.57142857	74.8571429	75.2857143	
Std. dev.	1.34518541	1.39727626	2.935821456	1.34518542	2.92770022	
Hours	**Leq dBA1**	**Leq dBA2**	**Leq dBA3**	**Leq dBA4**	**Leq dBA5**	**Lnorm dBA**
8:15-9:15	70	72	75	70	67	40
9:15-10:15	73	71	76	69	69	40
10:15-11:15	71	71	75	71	68	40
11:15-12:15	70	73	75	72	67	40
13:15-14:15	69	73	77	69	69	40
14:15-15:15	70	71	73	72	66	40
15:15-16:00	69	70	70	70	64	40
Average	70.2857142	71.5714286	74.42857143	70.4285714	67.1428571	
Std. dev.	1.38013111	1.13389342	2.299068134	1.27241802	1.77281052	

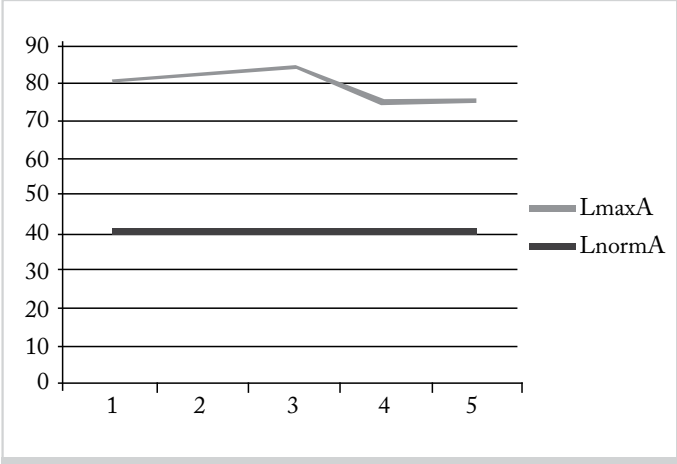

Figure 2. The graphics of LmaxA values and LnormA in dB

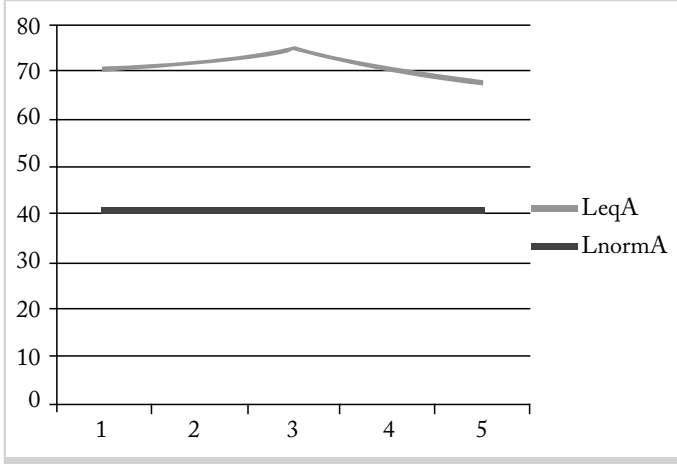

Figure 3. The graphics of LeqA values and LnormA in dB

working day carries a 35% risk of NIHL among exposed workers (10). Exposure of 90 dBA increases the incidence to 51% and exposure to continuous noise with a level 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 (11, 12). The non-auditory effects of noise on human health may be due to stress responses causing symptoms of illness. Noise may cause sleep disturbance proportional to the amount of noise experienced in terms of an increased rate of changes in sleep stages and in number of awakenings (2). Noise also impairs performance, causes some physiological responses mediated by autonomic nervous system (increased heart rate and blood pressure), nausea, headaches, argumentativeness and changes in mood and anxiety that may influence the patient-physician relationship (2). The noise in hospitals is an important issue for both health providers and also for patients. The noise in the hospital facilities is a result of the normal work or human activities and equipment, and this can be prevented by the staff (5, 13, 14). In our study, we noted that most of the noise within the policlinic departments is from human activity and conversation between patients. Also, environmental noise increases the noise in these departments, together with high-pitched and irregular announcements.

There are studies that have analysed the noise levels in different parts of the hospitals. Tijunelis et al. (7) recorded and analysed noise in a large emergency department and found that emergency departments experienced excessive noise levels on a regular basis that can be modified by identifying the sources. Akansel and Kaymakci (15) studied the effects of noise on patients with coronary artery bypass surgery in intensive care units and detected higher noise levels than the recommended levels. They found that noises created by other patients, those who were admitted from emergency room and operating room into the intensive care unit, monitor alarms, and conversations among staff were the most disturbing noise sources for patients. The excess noise in intensive care units affects the psychological state, and causes sleep disturbance and disorientation in patients, as well as anxiety in nurses (16). Also, operating rooms in the hospitals are quite noisy places. The high sound pressure level of noise in the operating theatre has a negative impact on communication between operating room personnel (17). Noise pollution makes errors more probable and is one of the risk factors for provider burnout and negative outcomes for patients (18).

In our study, the noise in hospital policlinics was between 60 and 83 dB, which is less than the level of 85-90 dB that may cause hearing impairment but higher than the Turkish Regulations and WHO guidelines. The annoying noise within the hospitals may affect the physiological state and performance of the working staff as well as that of the patients. Noise in hospitals may be prevented or at least decreased during the construction of hospital buildings by isolating and insulating the rooms from external noise sources. Also, the working staff and patients may be educated and instructed about precautions to eliminate the noise pollution by prompt notes. Noise control groups in the hospitals may be organised and preventable sources may be eliminated. We believe that noise pollution in hospitals can be reduced by simple precautions.

Conclusion

The effect of noise on hospital staff and patients may impair communication between caregivers and patients causing undesirable attitudes. A multidisciplinary approach must be applied to decrease excess noise in the hospital policlinics from the constructing team to the management and administrative teams. Some simple precautions like the quick replacement of broken and noisy machinery and noisy lamps or decreasing conversational noise will surprisingly eliminate noise pollution within the 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., N.Ş., M.K.; Design - E.G., O.N.D., M.Y., N.Ş.; Supervision - M.K.; Materials - N.Ş., M.K.; Data Collection and/or Processing - E.D., M.Y., O.N.D., N.Ş.; Analysis and/or Interpretation - M.Y.; Literature Review - N.Ş., M.Y.; Writer - N.Ş., 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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References

1. Pereira RP, Toledo RN, Amaral JLG, Guilherme A. Qualificação e quantificação da exposição sonora ambiental em uma unidade de terapia intensiva geral. Rev Bras Otorrinolaringol 2003; 69: 766-71. [CrossRef]
2. Stansfeld SA, Matheson MP. Noise pollution: non-auditory effects on health. Br Med Bull 2003; 68: 243-57. [CrossRef]
3. Nelson DI, Nelson RY, Concha-Barrientos M, Fingerhut M. The global burden of occupational noise-induced hearing loss. Am J Ind Med 2005; 48: 446-58. [CrossRef]

4. van Dijk FJ, Verbeek JH, de Fries FF. Non-auditory effects of noise in industry. VI. A final field study in industry. Int Arch Occup Environ Health 1987; 59: 55-62. [CrossRef]
5. Tsiou C, Eftymiatos D, Theodossopoulou E, Notis P, Kiriakou K. Noise sources and levels in the Evgenidion Hospital intensive care unit. Intensive Care Med 1998; 24: 845-7. [CrossRef]
6. McLaren E, Maxwell-Armstrong C. Noise pollution on an acute surgical ward. Ann R Coll Surg Engl 2008; 90: 136-9. [CrossRef]
7. Tijunelis MA, Fitzsullivan E, Henderson SO. Noise in the ED. Am J Emerg Med 2005; 23: 332-5. [CrossRef]
8. Ronco C. Noise pollution in hemodialysis centers. Nat Clin Pract Nephrol 2008; 4: 289. [CrossRef]
9. Rabinowitz PM. Noise-induced hearing loss. Am Fam Physician 2000; 61: 2749-60.
10. Goodlee F. Noise, breaking the silence. BMJ 1992; 304: 110-3. [CrossRef]
11. Love H. Noise exposure in the orthopaedic operating theatre: a significant health hazard. ANZ J Surg 2003; 73: 836-8. [CrossRef]
12. Kryter KD. The Effects of Noise on Man, 2nd edn. Orlando, FL: Academic Press, 1985.
13. Snyder-Halpern R. The effect of critical care unit noise on patient sleep cycles. CCQ 1985; 7: 41-51.
14. Kam PC, Kam AC, Thompson JF. Noise pollution in the anaesthetic and intensive care environment. Anaesthesia 1994; 49: 982-6. [CrossRef]
15. Akansel N, Kaymakçi S. Effects of intensive care unit noise on patients: a study on coronary artery bypass graft surgery patients. J Clin Nurs 2008; 17: 1581-90. [CrossRef]
16. Topf M, Dillon E. Noise-induced stress as a predictor of burnout in critical care nurses. Heart Lung 1988; 17: 567-73.
17. Tsiou C, Efthymiatos G, Katostaras T. Noise in the operating rooms of Greek hospitals. J Acoust Soc Am 2008; 123: 757-65. [CrossRef]
18. Donchin Y, Seagull FJ. The hostile environment of the intensive care unit. Curr Opin Crit Care 2002; 8: 316-20. [CrossRef]