ORIGINAL ARTICLE

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Determination of Noise Levels in the Outpatient Clinics of Medical Faculty Hospital at Duzce University

ABSTRACT

Objective: The aim of the study was to assess noise levels in the waiting areas of the outpatient clinics at DUZCE University Medical Faculty Hospital

Methods: The noise level was measured continuously for five days and eight hours a day at 11 measurement points in the waiting areas of the outpatient clinics. The device was set to give an hourly average. This was a descriptive study and there was no sample selection. SPSS statistical package was used and Kruskal Wallis, Mann-Whitney U, Friedman and Wilcoxon tests were performed for data analysis. A value of $p < 0.05$ was considered significant.

Results: The average noise level was 62.1 dBA (min 48.5dBA and max 70.8dBA). This value and even the minimum measured value were above the threshold values specified in the EPA, WHO and Environmental Noise Assessment and Management Regulations. Although their noise levels were also above the thresholds, only the radiology outpatient clinics have significantly lower values than the others ($p < 0.05$). The noise levels had no significant differences among days or hours.

Conclusions: The measured noise levels were above the threshold values in the waiting areas of the outpatient clinics. Noise prevention measures should be considered.

Keywords: Hospital, Outpatient Clinic, Noise, Measurement, Noise Pollution

Düzce Üniversitesi Tıp Fakültesi Hastanesi Polikliniklerinin Gürültü Düzeylerinin Belirlenmesi

ÖZET

Amaç: Çalışmanın amacı DUZCE Üniversitesi Tıp Fakültesi Hastanesi'nde poliklinik bekleme alanlarının gürültü düzeylerini değerlendirmektir.

Gereç ve Yöntem: Polikliniklerin bekleme alanlarında, 11 ölçüm noktasında, gürültü düzeyi sürekli beş gün ve günde sekiz saat ölçülmüştür. Cihaz saatlik ortalama verecek şekilde ayarlanmıştır. Araştırma tanımlayıcı tiptedir. Örneklem alınmamıştır. Veri Analizleri için SPSS paket programı kullanılmış ve Kruskal Wallis, Mann-Whitney U, Friedman ve Wilcoxon testleri yapılmıştır. $p<0.05$ değeri anlamlı olarak kabul edilmiştir.

Bulgular: Polikliniklerin bekleme alanlarında ortalama gürültü seviyesi 62.1 dBA (min 48.5 ve max 70.8) dir. Bu değer ve hatta minimum ölçülen değer bile EPA, DSÖ ve Çevresel Gürültünün Değerlendirilmesi Ve Yönetimi Yönetmeliği'nde belirtilen eşik değerlerin üzerindedir. Gürültü düzeyleri eşik değerlerin üzerinde olmasına rağmen, sadece radyoloji poliklinikleri diğerlerinden anlamlı derecede daha düşük değerlere sahiptir ($p<0.05$). Gürültü düzeylerinde günler, saatler arasındaki fark anlamlı bulunmamıştır.

Sonuç: Polikliniklerin bekleme alanlarında gürültü seviyesi eşik değerlerin üzerinde ölçülmüştür. Gürültü önleyici tedbirler düşünülmelidir.

Anahtar Kelimeler: Hastane, Poliklinik, Gürültü, Ölçüm, Gürültü Kirliliği

INTRODUCTION

Exposure to noise is increasing not only in the industrialized countries but also in developing countries, particularly in the normal daily life. This means, that exposure to noise is still a public health problem in the 21st century (1).

Hospitals were also affected by this continuously growing noise pollution. It is believed that this current problem might be avoided with the preventive measures taken during the building design, creating working groups for the prepared noise maps of the hospital, education of the hospital staff and patients (2). Environmental Protection Agency (EPA) determined the maximum noise level for hospitals as 45dB in the inside of the hospital and 55dB in the outside (3). World Health Organization (WHO) recommends that the Leq value should not exceed 30dBA in the hospitals (4). The Turkish Legislation for the Evaluation and Management of the Environmental Noise determined the noise levels as 35dB if windows are closed and 45dB if windows are open for health centers like hospitals, dispensaries, outpatient clinics and residential services (5).

In this study, the aim was to evaluate the noise levels in the waiting areas of the outpatient clinics in the Medical Faculty Hospital at DUZCE University.

MATERIAL AND METHODS

The study was conducted in the waiting areas of the outpatient clinics of the Medical Faculty at DUZCE University. No sampling was done. This study was designed as a descriptive research. Svantek SV 30 calibrator and SVAN 957 sound and vibration analyzer device were used for the calibration and measurements. The accreditation of these devices was carried out in the ECONORM Environmental Technologies Inc. The cost of the accreditation was compensated from the fund provided by the DUZCE University Scientific Research Projects. On March 30th, 2016 a test measurement was performed in the first measurement point for one hour. So, the installation and setup of the devices, recording and analyzing features were controlled. Between March 31st, 2016 and June 17th, 2016, the noise levels (dBA) were measured in the waiting areas of the outpatient clinics, five days a week (Monday, Tuesday, Wednesday, Thursday and Friday) during the working hours (between 08:00-12:00 and 13:00-17:00) in every measurement point. Measurements were performed at 11 points. These points were the common waiting areas of the outpatient clinics. Outpatient clinics are located on four floors. The first measurement point is located on the first floor and is the common waiting area for the Thoracic Surgery, Neurosurgery, Ophthalmology and Urology departments. The second measurement point is located on the first floor and is the common waiting area for the Pulmology, Hematology, Otorhinolaryngology and Gynecology-Obstetrics departments. The third measurement point is located on the first floor and is the common waiting area for Orthopedics, Family Medicine, Obesity and Smoking Cessation departments. The fourth measuring point is located on the first floor and is the point of entry to all outpatient clinics where Information desk, Cashier's office, Social Service Specialist, Electrocardiography and Breastfeeding Rooms are located. The fifth measurement point is located on the second floor and is the common waiting area for Psychiatry, Physical Medicine and Rehabilitation, Gastroenterology, Endoscopy and Oncology departments. The sixth measurement point is located on the second floor and is the common waiting area for Nephrology, Internal Medicine, Cardiology, Infectious Diseases and Dermatology departments. The seventh measurement point is located on the second floor and is the common waiting area for Forensic Medicine, Endocrinology departments. The eighth measurement point is located on the second floor and is the common waiting areas for Anesthesia-Pain, Cardiovascular Surgery, Plastic Surgery and Neurology departments. The ninth measurement point is located on the second floor and is the common waiting area for Pediatric-Adolescent Psychiatry, General Surgery, Pediatry and Pediatric Surgery departments. The tenth measurement point is located on the minus first floor and is the common waiting area for X-ray, Ultrasonography and Mammography departments. The eleventh measurement point is located on the minus second floor and is the common waiting area for Fluoroscopy, Computerized Tomography and Magnetic Resonance Imaging departments. A total of eleven measurement points were determined, including one on the minus first floor, one on the minus second floor, four on the first floor and five on the second floor. The measurement points were planned to be the mid-point of the corridors. The measurements were carried out by placing the tripod at a distance of at least 1 meter from the walls and 1.5 meters from the windows and doors and 1.5 meters from the ground.

The noise measurement results were records in dBA units. The formula for the calculation of the mean noise level values is the following (6):

$$\mathrm{SPL_{avg}} = 10 \log \left(\frac{1}{N} \right) \sum_{j=1}^{N} 10^{(\mathrm{SPL}_j/10)}$$

SPL_{avg}: mean noise level, dB
N= number of measurements
SPL_j= the "j"th noise level, dB
j=1, 2, 3…., N

Daily mean values, mean values in the forenoon and after noon, mean values of each measurement point were calculated with the help of this formula in MS Excel software. All data were evaluated with the package software SPSS.

Nonparametric tests were used regardless of whether the variables followed normal distribution or not. The reason for that choice was the inability to calculate the arithmetic mean of the measurements in the decibels and the parametrical tests comparing the arithmetic means.

Kruskal-Wallis test was used for the comparison of the multiple (more than two) group mean values belonging to one feature in the independent groups, in other words the comparison of the mean noise level values at the measurement hours and measurement points. Double comparisons, which were done to find out the groups responsible for the differences, were performed with Mann-Whitney U test and were evaluated with the Bonferroni correction method. The comparison of the forenoon and afternoon noise measurements in the independent groups was carried out with Mann-Whitney U test.

Friedman test was used for the comparison of the variable obtained with multiple (more than two) measurements in the dependent groups, in other words for the comparison of the noise levels of each day and hour for each measurement point. Double comparisons, which were done to find out the groups responsible for the differences, were performed with Mann-Whitney U test and were evaluated with the Bonferroni correction method. Wilcoxon test was used for the comparison of the variable obtained with two measurements in the dependent groups, in other words for the comparison of the noise measurements in the forenoon and afternoon of each day and hour for each measurement point $p<0.05$ was considered as statistically significant (7).

The approval of the Ethics Committee for the Non-invasive Clinical Research in the Medical Faculty at DUZCE University was obtained (date: 28.12.2015; No: 2015/80).

RESULTS

Equivalent Noise Level (Leq) (Decibel A (dBA)) distributions of each measurement point according to the days of week and hours were shown in Table 1. The mean values of noise levels according to the hours showed that the minimum was 48.5 dBA and the maximum was 70.8 dBA and the median was 60.8 dBA.

Table 1. Leq (dBA) distribution of 11 measurement points according to the days of week and hours

Days	Hours	Measurement Points										
		1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**
Monday	08:00-09:00	59.6	64.1	66.4	67.9	54.8	55.6	60.1	55.7	60.5	51.1	53.0
	09:00-10:00	62.8	59.3	60.2	61.7	56.5	61.3	61.1	64.2	65.6	54.4	54.6
	10:00-11:00	63.3	60.8	60.9	62.5	60.3	60.8	60.7	63.2	66.9	55.0	57.2
	11:00-12:00	61.6	63.3	61.3	61.2	57.7	58.5	59.9	64.8	64.4	54.3	57.6
	13:00-14:00	62.9	63.7	60.6	61.4	56.1	58.2	60.8	59.8	65.0	53.1	56.7
	14:00-15:00	65.6	65.1	61.8	62.3	59.1	61.2	60.7	60.6	62.3	54.3	57.6
	15:00-16:00	64.0	62.3	67.3	61.9	57.0	57.3	62.1	61.7	68.5	53.2	58.8
	16:00-17:00	68.6	61.6	59.1	64.2	58.5	65.6	57.0	59.9	62.5	52.2	58.7
Tuesday	08:00-09:00	67.1	63.7	67.0	68.9	55.2	56.5	56.9	56.9	60.8	51.1	53.7
	09:00-10:00	62.3	61.0	60.8	60.9	58.3	56.8	58.9	62.6	66.6	55.0	55.6
	10:00-11:00	64.0	61.2	63.9	63.4	63.0	57.7	62.4	63.7	66.0	57.9	54.5
	11:00-12:00	62.1	62.7	64.6	62.4	64.5	57.9	61.7	63.8	65.8	56.5	55.2
	13:00-14:00	62.3	65.3	62.9	69.9	62.7	57.7	62.7	64.0	62.0	53.1	55.0
	14:00-15:00	65.1	61.5	62.8	63.4	57.5	57.4	60.3	61.9	64.4	56.9	57.5
	15:00-16:00	64.7	63.3	62.5	64.2	59.0	65.9	59.6	64.4	62.0	54.3	55.2
	16:00-17:00	66.0	62.1	61.1	64.8	60.6	59.8	60.2	59.4	61.9	52.4	52.8
Wednesday	08:00-09:00	66.8	64.9	65.8	68.7	55.7	55.8	55.8	56.6	58.1	48.5	53.6
	09:00-10:00	61.5	59.8	61.6	63.5	58.8	59.0	58.1	63.5	65.2	56.7	54.8
	10:00-11:00	63.7	62.9	60.3	63.0	60.0	57.5	60.2	63.3	68.1	56.0	55.0
	11:00-12:00	62.3	63.1	62.4	65.7	58.8	56.9	60.9	63.5	64.6	56.2	57.6
	13:00-14:00	62.0	62.7	62.9	64.5	57.6	57.8	58.4	60.1	64.4	56.1	53.7
	14:00-15:00	61.7	62.9	62.9	65.2	60.1	63.1	61.0	59.3	65.3	59.4	55.5
	15:00-16:00	63.4	61.8	61.5	65.0	60.0	61.3	69.5	64.0	64.2	58.2	56.5
	16:00-17:00	64.2	62.4	61.6	67.5	60.4	56.7	61.5	59.7	60.8	53.8	57.4
Thursday	08:00-09:00	59.7	66.8	66.5	62.0	57.2	58.3	56.8	57.1	61.4	51.8	51.7
	09:00-10:00	63.2	61.2	61.1	61.9	58.3	57.2	59.6	63.9	62.6	58.2	54.3
	10:00-11:00	63.8	63.0	59.7	64.6	59.4	57.0	61.1	67.4	64.4	56.2	56.0
	11:00-12:00	66.3	63.5	59.4	63.7	59.1	59.9	62.0	64.6	63.3	56.8	54.9
	13:00-14:00	64.3	61.4	66.0	63.1	60.5	57.2	59.5	64.0	63.9	56.1	55.5
	14:00-15:00	63.9	62.8	61.6	62.9	59.8	62.4	60.9	61.2	62.5	54.3	54.8
	15:00-16:00	60.6	61.3	59.6	63.6	56.6	59.6	60.3	59.5	61.8	55.1	54.7
	16:00-17:00	65.3	60.7	61.2	63.3	57.0	58.5	58.6	58.8	62.8	53.2	53.7
Friday	08:00-09:00	60.0	63.6	65.5	66.2	56.6	59.2	56.3	55.8	63.1	49.1	52.5
	09:00-10:00	60.8	59.5	59.7	62.6	57.9	61.4	66.1	61.1	65.1	58.1	54.9
	10:00-11:00	61.5	61.0	62.2	63.6	57.9	63.9	67.3	63.8	66.1	56.7	58.4
	11:00-12:00	63.6	60.5	65.0	63.3	59.0	58.9	61.6	63.0	64.6	56.1	56.7
	13:00-14:00	59.8	58.6	60.4	61.1	55.1	59.3	56.8	57.0	63.2	53.9	53.5
	14:00-15:00	62.8	61.6	65.1	68.5	60.6	59.5	60.0	58.5	62.7	55.9	53.6
	15:00-16:00	60.8	61.7	60.8	61.9	57.8	59.1	59.7	58.5	61.5	57.8	54.7
	16:00-17:00	65.3	60.3	61.3	65.1	60.3	58.1	59.7	58.5	70.8	55.2	55.8

Mean values of the noise levels calculated for forenoon and afternoon according to the days of week at the measurement points were listed in Table 2. The general noise mean value in all waiting areas of the outpatient clinics at DUZCE University was 62.1 dBA. Separate calculation of the mean values of each measurement point showed that the lowest noise level (55.5 dBA) was at the tenth measurement point and the highest noise level (64.7 dBA) was at the fourth measurement point. Separate evaluation of each day revealed that the lowest noise level (61.6 dBA) was on Thursday and the highest noise level (62.5 dBA) was on Tuesday. The noise level was 62.1 dBA in the forenoon and 62.0 dBA in the afternoon.

Table 2. Mean values of the noise level (dBA) in the forenoon and afternoon according to the days of week for each measurement point.

		Measurement Points											General mean value
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	
Monday	In the forenoon	62.0	62.3	63.0	64.3	57.8	59.6	60.5	63.1	64.9	53.9	56.0	
	In the afternoon	65.8	63.4	63.4	62.6	57.8	61.9	60.5	60.6	65.4	53.3	58.0	62.0
	Total	64.3	62.9	63.2	63.5	57.8	60.9	60.5	62.0	65.1	53.6	57.1	
Tuesday	In the forenoon	64.4	62.3	64.6	65.1	61.6	57.3	60.5	62.5	65.3	55.8	54.8	
	In the afternoon	64.7	63.3	62.4	66.4	60.4	61.7	60.9	62.8	62.7	54.5	55.4	62.5
	Total	64.6	62.8	63.6	65.8	61.0	60.1	60.7	62.7	64.2	55.2	55.1	
Wednesday	In the forenoon	64.1	63.0	63.0	65.8	58.6	57.5	59.2	62.5	65.2	55.3	55.5	
	In the afternoon	62.9	62.5	62.3	65.7	59.7	60.5	64.9	61.2	64.0	57.4	56.0	62.3
	Total	63.6	62.8	62.7	65.8	59.2	59.2	62.9	61.9	64.6	56.4	55.8	
Thursday	In the forenoon	63.8	64.1	62.8	63.2	58.6	58.3	60.3	64.5	63.1	56.3	54.5	
	In the afternoon	63.8	61.6	62.8	63.2	58.8	59.9	59.9	61.4	62.8	54.8	54.7	61.6
	Total	63.8	63.1	62.8	63.2	58.7	59.1	60.1	63.2	62.9	55.6	54.6	
Friday	In the forenoon	61.7	61.4	63.7	64.2	57.9	61.3	64.5	61.8	64.9	56.0	56.1	
	In the afternoon	62.7	60.7	62.4	65.2	59.0	59.0	59.2	58.2	66.4	55.9	54.5	61.9
	Total	62.2	61.1	63.1	64.7	58.5	60.3	62.6	60.4	65.7	56.0	55.4	
Total	In the forenoon	63.3	62.7	63.5	64.6	59.2	59.1	61.4	63.0	64.7	55.5	55.4	62.1
	In the afternoon	64.2	62.4	62.7	64.9	59.2	60.7	61.6	61.1	64.5	55.4	55.9	62.0
	Total	63.8	62.6	63.1	64.7	59.2	60.0	61.5	62.1	64.6	55.5	55.7	62.1

The distribution of the noise levels according to the measurement points was shown in Table 3. There was a significant difference between the noise levels among the measurement points (Kruskal Wallis=278.409; p<0.001).

In order to determine the responsible groups for this difference, double comparison was performed between the groups. These comparisons were evaluated with Bonferroni correction method.

Table 3. The distribution of the noise levels according to the measurement points (dBA)

	Number	Logarithmic mean value	Quarter values			Kruskal Wallis	p
			25.	50. (median)	75.		
First point	40	63.8	61.63	63.25	64.60		
Second point	40	62.6	61.05	62.20	63.30		
Third point	40	63.1	60.80	61.60	64.43		
Fourth point	40	64.7	62.33	63.45	65.08		
Fifth point	40	59.2	57.05	58.65	60.08		
Sixth point	40	60.0	57.33	58.50	60.58	278.409	p<0.001
Seventh point	40	61.5	59.05	60.25	61.40		
Eighth point	40	62.1	58.93	61.45	63.80		
Ninth point	40	64.6	62.08	64.05	65.28		
Tenth point	40	55.5	53.20	55.05	56.65		
Eleventh point	40	55.7	53.85	55.00	56.70		

Post hoc test results showed that 10th and 11th groups had significant difference compared to all other groups, except between themselves. 10th and 11th point were responsible for the significant difference between the noise measurements at the measurement points. In respect of the logarithmic mean and median values, the noise levels at the 10th and 11th measurement points were significantly lower compared to other groups.

There was no significant difference between the days of week considering the noise levels (Kruskal Wallis=2.55; p=0.636). There was no significant difference between the working hours considering the noise levels (Kruskal Wallis=11.065; p=0.136). There was no significant different between the noise measurements in the forenoon and afternoon (Mann-Whitney U=24129; Z= -0.053; p=0.958).

There was no significant difference between the noise levels in the forenoon and afternoon at each measurement point (The first measurement point: Wilcoxon Z= -1.346; p=0.178. The second measurement point: Wilcoxon Z= -0.205 p=0.837. The third measurement point: Wilcoxon Z= -0.877 p=0.380. The fourth measurement point: Wilcoxon Z= -1.158 p=0.247. The fifth measurement point: Wilcoxon Z= -0.342 p=0.732. The sixth measurement point: Wilcoxon Z= -1.531 p=0.126. The seventh measurement point: Wilcoxon Z= -0.019 p=0.985. The eighth measurement point: Wilcoxon Z= -1.531 p=0.126. The ninth measurement point: Wilcoxon Z= -0.896 p=0.370. The tenth measurement point: Wilcoxon Z=0 p=1. The eleventh measurement point: Wilcoxon Z= -1.177 p=0.239).

DISCUSSION

In this study, the mean general noise level was 62.1 dBA (min.: 48.5 dBA and max.: 70.8 dBA) in the waiting areas of the outpatient clinics of the Medical Faculty Hospital in DUZCE University. According to the limits of the Turkish Legislation for the Evaluation and Management of the Environmental Noise, the indoor noise level should be Leq 35 (dBA) with closed windows and Leq 45 (dBA) with open windows in the health centers (5). So, that the mean values of noise levels in the waiting areas in general and at every measurement point were exceeded these limits. The mean noise level values in the waiting areas of the outpatient clinics at DUZCE University (62.1 dBA) were exceeded the maximum noise level determined by the Environmental Protection Agency (EPA) for the inside of hospitals (45 dB) (3). It also exceeded the minimum value determined by WHO (48.5 dBA) (4). Even the minimum measured value (48.5 dBA) in the study is over the limit values of EPA, WHO and Turkish Legislations.

The mean values of noise levels at the 10th and 11th measurement points were significantly lower compared to other measurement points. Both of these measurement points were in the waiting areas of the outpatient clinic for Radiology. During the measurements were made, it was observed that the number of patients was relatively lower in these points. The reason of the lower noise levels might be the small number of the patients in these outpatient clinics.

In another study conducted in Istanbul, the noise levels of six hospitals were measured and the calculated mean values were 66.3 dBA, 67.1 dBA, 70.2 dBA, 70.4 dBA, 71.5 dBA and 74.4 dBA (2). The noise levels in the outpatient clinics of DUZCE University were lower than these 6 hospitals in Istanbul, although they were above the recommended limits. This may be due to the fact that Istanbul's population is higher than DUZCE (8).

In an Indian study, in different places of a tertiary health care center, mean noise level was 70.38 dBA at daytime and 64.46 dBA in the evening. This study was conducted in both outpatient clinics and inpatient wards. Leq level was 74.40 dBA in the outpatient clinic of dermatology , 74.87 dBA in the outpatient clinic of pediatry and 73.88 dBA in the outpatient clinic of surgery at between 09:00-10:00(9). These values exceeded the values of the outpatient clinics in DUZCE University.

Studies conducted in several countries showed that the noise levels were above the limits of EPA and WHO in the clinics and intensive care units of the evaluated hospitals. In a Turkish study conducted in the intensive care unit of the department of pediatrics at Akdeniz University, a noise level was 72.6 dBA measured before the improvements were implemented. Then the four-bed rooms were divided into one-bed sections, the intensive care units were re-designed and the observation room for nurses was separated from the other parts of the units. The noise level measurements after these changes showed that the mean noise level dropped to 56 dBA. The difference between the pre- and post-measurements was statistically significant (10). In another study conducted in Turkey, the investigators investigated five hospitals and found out that the mean noise levels were between 55 and 75 dBA, which were above the recommended limits (11). A study was conducted in Greece and they found out that the mean noise level was 52.6 dBA in the intensive care unit, 59 dBA in the pulmonary department (12). A study was conducted in three hospitals in Mosul (Iraq) and the measured mean noise level was 93.44 dBA (13). In a study conducted in a burn unit in London, the measurements done in central points showed that the mean noise level value was 65.9 dBA. The noise level was also Leq 65.0 dBA in the patient rooms (14). In a review, which evaluated 29 studies conducted in the intensive care units in the USA, it was demonstrated that there was no study showing noise level values in the

intensive care units within the recommended limits of EPA and/or WHO. They also stated in the same analysis that the noise increased parallel to the increase in numbers of staff and patients (15). In a study conducted in John Hopkins University, studies focused on noise levels in different hospitals, in different years were compared and it was found out that the noise levels were above the recommended limit of WHO in all hospitals, in all years and the noise level increased with time (16). The noise level measurements done in the renal unit of a London hospital revealed mean Leq levels of 58.2 - 67.6 dBA (17). In a study conducted in the emergency hospital of Johns Hopkins University, measurements were done for 24 hours and noise levels of 61-69 dBA were determined, which were above the recommended limits. The highest noise level was observed in the triage unit. Considering the comparison of this study with other studies conducted in the same hospital, the investigators concluded that the emergency unit has higher noise levels compared to other departments (18). In Brazil, the measurements done in different departments of a hospital showed that the mean noise level was 63.7dBA, which was above the recommended level of WHO (19). In Tanzania, the noise levels were measured in the inpatient wards of a hospital and the determined mean noise level was 57dBA, which was also above the internationally recommended noise level limits (20).

CONCLUSION

The general mean noise level value of the outpatient clinics in the DUZCE University Hospital was 62.1 dBA. The lowest noise level (55.5 dBA) was measured at the tenth measurement point, which was in the waiting area of radiology, ultrasonography and mammography. The highest noise level (64.7 dBA) was in the fourth measurement point, which was in the waiting area around the information desk, cashier's office, social service specialist, electrocardiography and the breastfeeding room. The fourth measurement point was also close to the main entrance of the hospital. The lowest noise level (61.6 dBA) was on Thursday and the highest level (62.5 dBA) was on Tuesday. The mean noise level was calculated as 62.1 dBA in the forenoon and 62.0 dBA in the afternoon. There was no significant difference between the days of week and between the forenoon and afternoon regarding the mean values of the noise levels. There was also no significant difference between days, hours, forenoon and afternoon considering the mean values of noise levels at each mesurement point.

The mean values of noise levels were significantly lower in the waiting areas of the outpatient clinic of the radiology department. The reason might be the relatively small number of patients in this outpatient clinic compared to others.

In this study, the noise levels in the waiting areas of the outpatient clinics of the Medical Faculty Hospital in DUZCE University were above the nationally and internationally recommended limits. Taking appropriate measures is important and necessary for the health of the workers, patients and visitors. Noise level measurements in other places of the hospital and implementation of appropriate measures should be also considered.

Author Statements

The authors declare that they have no conflict of interest.

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