Archives of Occupational Health | Volume 2 | Issue 3 | July 2018 | 164-9.

Original

Noise Pollution in Hospitals

Morteza Esmaeilzadeh Kavaki[1], Faezeh Sepahi[2]*, Zainab Dashab[3], Mahboubeh Sheikh Amirlou[3], Malihe Hashemi[4], Meysam Faramarzi[4]

[1] Master of Occupational Health Engineering, College Member of School of Public Health, North Khorasan University of Medical Sciences, Bojnourd•[2] MSc student of Occupational Health Engineering, Faculty of Health, Yazd University of Medical Sciences, Iran•[3] Environmental Health Engineering, School of Public Health, North Khorasan University of Medical Sciences, Bojnourd, Iran•[4] Professional Health Engineering, North Khorasan Health School, Bojnourd, Iran• Corresponding Author: Faezeh Sepahi, Email: fs.day@yahoo.com, Tel: +98-915-7681873

Abstract

Background: Sound complications, from health and comfort aspects, are important in different environments, patients, and hospitals staff; furthermore, health care services are affected by the sources of noise pollution. A quiet environment is needed for the suitable activity and service of the health team, the comfort and the improving process of the patients. This study was conducted to determine the degree of sound pollution in hospitals in Bojnourd in 2013. **Methods:** This was a descriptive-analytic study. The measurements were carried out in different departments (7 sections in Imam Reza Hospital, 8 sections in Imam Ali Hospital and 4 large sections in Bent-Alhoda Hospital). Educational programs in Bojnourd were performed in two shifts in the morning and afternoon by a sound meter device of the CEL 62x model. The device was calibrated by the piston-phones and they were compared with the recommended standard values by the World Health Organization (45 dB per Sunset and 30 dB per night). Data were analyzed by SPSS software version 16 using paired t-test and ANOVA. **Results:** The results of the study showed that the mean volume of sound at Imam Reza Hospital in morning and evening were 56.6 and 59.2 dB respectively and the average volume of sound at Bent-Alhoda Hospital in the morning and afternoon were 54.3 and 61.3 dB respectively. In the Imam Ali Hospital, the average volume in morning and evening shifts were 57.4 and 62.6 dB respectively, and in all parts the sound was higher than the standard values**. Conclusion:** The rate of sound in the hospitals of Imam Ali, Imam Reza and Bent-Alhoda in all sections and in most of the working hours was higher than the standard. With regard to the severity of sound and the sources of sound production in different parts of hospitals, it is possible to establish a degree of sound intensity closer to the permissible limits. Therefore, the adoption of engineering and management measures to reduce the sound pollution are the recommendation of this study.

Keywords: Hospital; Sound pollution; Sound pressure level

Introduction

Looking at the population of countries, the population of urban is increasing, especially in immigrant cities; an unprecedented increase in population has an increasing and negative effect on sound pollution.[1] Sound is any change that can be detected by the human ear, sound is an inseparable part of human life and different sounds have different degrees of intensity and frequencies.[2] The presence of sound pollution causes conditions in which the welfare, comfort,

Citation: Esmaeilzadeh Kavaki M, Sepahi F, Dashab Z, Sheikh Amirlou M, Hashemi M, Faramarzi M. **Noise Pollution in Hospitals.** Archives of Occupational Health. 2018; 2(3): 164-9.

Article History: Received: 15 May 2018; Revised: 16 May 2018; Accepted: 1 July 2018

comfort of human life or the environment, and even people's health are affected; moreover, usually complications of sound pollution are unacceptable [3]Hospitals are considered as one of the sensitive areas associated with sound pollution.[4] The sources of sound pollution also affect the hospital which provides health services. This can affect the health and comfort aspects of patients and staff. The staffs need to be in a relaxed environment for giving services. Furthermore, patients' comfort during their hospitalization is very important in the process of their disease improvement.[5]

Relaxation and comfort of the patients at the time of hospitalization are of interest to the health authorities, and the presence of some contaminants can exacerbate the illness of the person. In addition, it will affect the health of the staff, resulting in a negative effect on the provision of appropriate services for patients. Therefore, correct location of the hospital at the time of building and adopting appropriate measures to reduce the sound pollution are the most important points to be considered by the authorities.[6,7] The sound pollution can affect the visual system, the system equilibrium, sleep and social, nervous, psychological and general physiological relationships such as increased heart rate, blood pressure, respiratory rate, which affects the function of the body organs. These complications are harmful to those who have cardiovascular disease and pregnant women.[8-10] Studies have shown that the sound is one of the important factors in causing discomfort and sleep disturbance in specialized care units.[11] The World Health Organization has stated that the level of sound in hospitals should not be more than 45 dB per day and 40 dB in the evening and 30 dB per night. Also, the EPA recommends that sound levels in the hospital should not be exceeded from 35 dB per day (8.12). These centers are state-owned and due to the fact that 35% of the population of this city is marginalized and the most frequent visits and hospitalization are in them. Therefore, the level of sound in these hospitals is likely to be higher. Implementing the plan of sound pollution at different hours and different sections show that according to the results of the project, an appropriate analysis of the reasons and pattern of sound production in these hospitals can be made and effective interventions are designed to control the sound in hospitals and create a safe environment with the least stress for patients.

Methods

This study is a descriptive study aimed to determine the degree of sound pollution in all parts of Imam Reza hospitals, Imam Ali Hospital and Bent al-Hoda Hospital, in which sounds were evaluated according to the existing parts of the hospital. Measurement sound in different sections (7 sections in Imam Reza Hospital, 9 sections in Imam Ali Hospital and 4 sections in Bentolhoda Hospital) were performed in two shifts in a peripheral (station) method. To determine the environmental measurement sound plan after preparing the initial map of each section and plotting the section with regard to the area of the rooms, networks were divided to 2 × 2 m .The minimum sound pressure level (LPmin), maximum sound pressure level (LPmax) and average sound pressure level were measured and calculated and all the measurements were performed by the CEL-62x sound meter device and the sound meter before the measuring were calibrated by piston-phone. Measurements in two shifts in morning and afternoon and visits during weekdays in three educational hospitals were done. After measuring the sound at the station in the studied population, in order to perform statistical operations, the data from the sound report form were derived and analyzed by SPSS software

version 16 and analyzed by paired t-test, Wilcoxon and ANOVA tests.

Results

In this study, a total of 1974 measurements were performed at two shifts in the morning and evening in 20 parts of hospitals in Bojnourd. The results of measurement in different parts of Imam Reza Hospital Table 1 showed that out of 458 measurement stations in the morning and evening, the maximum degree of sound (72.1 dB) at nursing station in the morning, and the minimum sound level in the pediatric department (44 dB), and in the evening, the emergency room with a maximum sound level of 75.2 and a minimum level of sound in the brain (48.6 dB) were measured. The highest and lowest degrees of sound were measured at the shift of the morning in Imam Ali Hospital 66.1 and 45.3 dB respectively for emergency and MRI. In the shift of the evening, for male surgical department and women's surgery, the highest and lowest degrees were measured 77.1 and 48.9 dB. At Bent alhoda Hospital, the highest sound was recorded in the women's ward with 65.4 dB and the lowest in the neonatal department with 43.2 dB. In the shift of the evening, the highest and lowest rates in the women's ward were measured 69.3 and 47.9 dB. The average sound in morning and evening shifts in all hospitals was different from the standard and was significant and was exceeded from the standard. The mean sound pressure level in morning and afternoon in three hospitals was analyzed by ANOVA and there was no significant difference (p-value> 0.05) Figure 1.

The mean values of sound pressure levels in morning and afternoon shifts in Bojnourd educational hospitals have been classified according to the relevant sections in table 1 and, with consideration of the nonparametric data type, and the Kolmogorov-Smirnov test showed that the data was not normal. Therefore the Wilcoxon test was used to compare the values of morning and evening.

Table 1. Sound Volume Measured in Different Parts of Bojnourd Educational Hospitals in Db

Hospital	Ward	No. of Stations	Morning			Evening			*P*-Value
			Max	Min	$\overline{Lp}$	Max	Min	$\overline{Lp}$	
Imam Ali	MRI	15	55.2	45.3	50.8	68.8	55.3	62.2	p <0.001
	Dialysis	24	56.6	48.2	52.7	60.4	51.9	56.7	p < 0.05
	Women's surgery	45	58.2	49.2	53.2	66.7	48.9	60.9	p <0.001
	Men's surgery	66	61.3	46.2	54.8	76.2	54	63.9	p <0.001
	Radiology	12	60	48	54.8	62.4	63.1	57.5	p >0.05
	Laboratory	12	60.2	49.1	58.7	65.1	53.1	60.7	p >0.05
	Professional clinic	10	56.1	49.1	53.3	77.1	54.8	68	p < 0.05
	Intensive care	8	63.1	59	61.9	63.9	54.8	60.9	p >0.05
	Emergency	27	66.1	56.2	61.3	65.8	56.2	61.2	p >0.05
Imam Reza	Average				57.4			62.6	p < 0.05
	Internal section	94	72.1	48.2	61.1	62.9	48.9	57.1	p >0.05
	Neurology	59	59.5	47.2	53.9	67.4	48.6	58.9	p >0.05
	Department of pediatrics	123	62.3	44	53.3	64	53.6	56.7	p >0.05
	Infection	62	57.6	48.7	53.4	59.4	50	55.4	p > 0.05
	Ccu	38	57.2	49.1	53.4	66.2	57.4	62.2	p <0.05
	Heart section	84	59	45.2	52.7	67.8	52.1	59.6	p >0.05
	Emergency	82	62.3	48.9	59.3	75.2	52.1	60.7	p >0.005
	Average				56.6			59.2	p >0.005
Bent Alhoda	Women	94	65.4	52.1	53.3	69.3	47.9	61.3	p <0.001
	Neonatal ward	92	64.1	43.2	55.4	69.2	49.7	60.6	p <0.001
	Women's surgery	81	62	48.4	55.2	3.66	49.9	61.4	p <0.001
	Isolated section	43	57.6	45.5	52.6	68.1	49.8	61.7	p < 0.01
	Average		54.3					61.3	p < 0.01

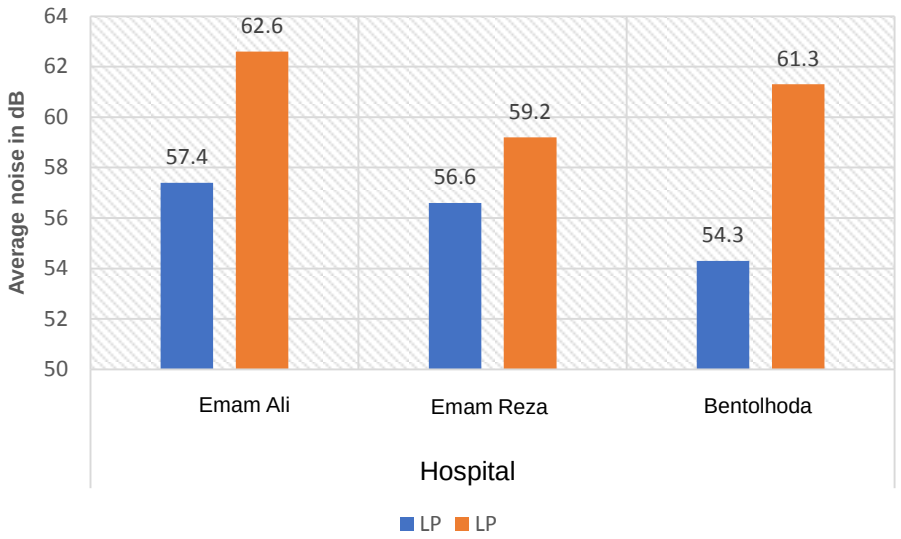

Figure 1. Average Sound in dB in Hospitals in Bojnourd

Discussion

Hospitals are important centers of health care, so the nature of the activities and types of provided services require a quiet environment. Many studies have shown that sound has been a detrimental factor.[13,14] The results of this study showed that the average degree of sound in the internal part of Imam Reza hospital with 67.7 dB is higher than other parts. Also, the results of the study showed that the average volume of sound in the neonatal department of Bent Alhoda hospital is 58 dB. The rate of sound in Imam Ali Hospital, Imam Reza and Bent Alhoda has been higher than the standard in all sections and in most of working hours. According to the study of noise pollution in the NICU of the Children's Hospital in 2006 by Zenuzi et al., The mean SPL of the sound in the study center was higher than the recommended values and this could endanger the health of infants and the staff. That study is in line with our study.[2] the study of sound pollution in Ahwaz Oil Hospital and its comparison with the environmental standard carried out by Beit Saeed et al. showed that all indicators studied in all parts of the oil hospital were exceeded the standard limit, which is similar to this study.[6] A study by Jonneidi et al., entitled "determining the mean sound pressure level in the operating room of a referral hospital in Tehran", showed that the mean of sound pollution in the operating rooms was twice as high as the standard, which is in line with this study.[15] The evaluation of exposure to sound in nurses of Qom hospitals in 1391conducted by Heidari et al., Showed that in all hospitals, the sound level was higher than standard, and on the other hand, the received sound was significantly more than other parts in emergency wards, gynecology and obstetrics, infectious wards,[16] which is consistent with this study. The results of a study by Karami et al., noise pollution in different parts of hospitals of Golestan and Ahvaz hospitals of Fatemeh Alzahra in 2012, showed that the sound level was higher in all sections during most of working hours which is similar to this study.[17] The result of a study by Asgharnia et al., entitled "sound pollution" in public hospitals in Babol in 2012, showed that the level of sound intensity on weekdays and holidays and in the morning, evening and visiting hours was higher than the standard and this is consistent with this study.[18] A study by Hakamabadi et al., entitled "determining the rate of sound pollution in intensive care units and emergency departments of educational hospitals of North Khorasan University of Medical Sciences",

indicated that the volume of sound in emergency and intensive care units was higher than standard which is in line with this study.[19] The study by Abbasi et al., entitled "determining the amount of sound pollution in the intensive care units of the educational hospitals of Isfahan University of Medical Sciences", showed that the most important causative factors in the ICU included the staffs in ICU, nurses, doctors and used equipment in the ICU environment, including refrigerating thermal equipment, alarms, and oxygen tubes, which is similar to the present study.[11] It is noteworthy that in comparison with the permissible level of sound pressure equivalent in hospitals at daytime (45 dB), this rate is higher than the permissible level in all parts, which is in parallel to the studies conducted by Soutar and Wilson [20] and Balogh et al.[21], as well as the studies in India, Spain and Greece.[22-24] Sobotova also confirms the sound pollution in hospitals in the capital of Slovakia.[25] In a study by Otenio et al. in 10 different hospitals and in a 24-hour period, an average of 63.7 dB was measured. This amount is higher than the recommended 45 dB by the Brazilian Technical Standards Association (1987).[26]

Conclusion

The results of this study indicate that the main sources of sound in the hospital interior environment include the commuting of personnel and health care staff, visits of physicians, attendants and patients' companions and the sound of devices in the hospital rooms in different parts of hospitals. According to this study, the sound level in hospitals was higher in all sections and during most of working hours. If the rules are implemented, appropriate measures can reduce the degree of sound pollution in the investigated hospitals and also providing training and education to the staff can restrict the conversation to provide a relaxed environment for patients, as well as engineering and management controls can reduce the amount of noise. The limitations of this plan include the lack of cooperation of departmental officials. Finally it is suggested that control discussions and noise reduction can be taken into consideration in the hospital.

Conflict of interest

The authors declare no conflict of interests.

Acknowledgment

The Authors appreciate all of the workers who took apart in this study.

References

1. Moharam Nejad N, Safari Pour M. The Impact of Urban Development on Voice Pollution in Tehran Region and Providing Management Tools for Improving Condition. Environmental Science and Technology. 2009;10(4):43-57. [Persian]
2. Zonouzi F, Ranjbarian M, Afjee A. Evaluation of noise pollution in Mofid Children's Hospital. Medical Journal of Islamic Azad University. 2005;16(3):129-34. [Persian]
3. Dehghany MH, Asgari AR, Khalili F. General Environmental Engineering. Ghashyeh;1386. [Persian]
4. Sazgarnia A, Bahreyni Toossi MH, Moradi H. Noise pollution and traffic noise index on mashhad main streets during the busiest hours of summer. Iranian journal of medical physics. 2005;2(3):21-30. [Persian]
5. Golmohammadi R, Aliabadi M. Assessment of noise pollution and its annoyance effects in Hamedan hospitals. Health Services Research. 2011;7(6):. [Persian]
6. Bit Saeed N, Monazzam Ismailpour R, Sehkavatjo MS, Moatar RF. Evaluation of noise pollution in Ahwaz Oil Hospital and its omparison with environmental standard. [Poster] at: Proceedings of 5th Specialized Conference on Environmental Engineering; 2011 nov 21-22; Iran, Tehran. Tehran: Tehran university; 2011. [Persian]
7. Movafagh A, Jalilzadeh R, Delbari A, Doosti M, editors. Evaluation and measurement of noise pollution in Tehran, one of the hospitals (Hospital Alghadir Case Study). [Poster] at: Proceedings of the 3rd Symposium on Environmental Engineering; 2009 Oct 7-8; Iran, Tehran. Faculty of Environment, University of Tehran; 2009. [Persian]
8. Rabiyan M, Gharib M. Noise pollution in the oprating rooms and intensive care units. Teb va tazkieh. 2004;(51);50-6. [Persian]
9. Tirgar A, Koohpaee A, Alhayyari T, Ali Mohammadi A. Occupational health based on new resources. 3ed. Tehran: Andisheh Rafi; 2008. [Persian]
10. Goines L, Hagler L. Noise pollution: a modern plague. Southern medical journal –birmingham alabama. 2007;100(3):287.
11. Abbasi S, Talakoob R, Soltani F, Yousefi H. Evaluating the noise level and sources in isfahan university hospital's intensive care units. Isfahan medical school. 2011;28(118):1-8. [Persian]

12. WHO. Environmental health criteria 12: noise. Geneva: WHO; 1980.
13. Lewis P, Staniland J, Cuppage A, Davies JM. Operating room noise. Canadian journal of anaesthesia= Journal canadien d'anesthesie. 1990;37(4 Pt 2):S79.
14. Shapiro RA, Berland T. Noise in the operating room. New England Medicine. 1972;287(24):1236-8.
15. Joneidi Jafari A, Sahebdel E, Hajipour A, Jafari Javid M, Mohammad Mireskandari S, Karvandian K, et al. Mean sound level in operation rooms in a referral hospital: a brief report. Tehran university medical journal. 2014;71(11):739-44. [Persian]
16. Heydari HR, Mohebi S, Paidari N, Ramouz P, Nayebi T, Omrani D, et al. Noise exposure assessment among nurses in Qom Educational Hospitals in 2012, Iran. Qom university of medical sciences journal. 2014;7(6):46-53. [Persian]
17. Karami K, Torabipour A, Jamali N, Jamshidi Z. Evaluation of noise pollution in different parts of Ahvaz and Fatemeh Zahra hospitals in Bushehr. Jundishapur journal of health sciences. 2012;4(4):77-84. [Persian]
18. Asgharnia H, Tirgar A, Amouei A, Fallah S, Khafri S, Mohammadi A, et al. Noise pollution in the teaching hospitals of Babol (Iran) in 2012. Babol university of medical sciences. 2014;16(4):64-9. [Persian]
19. Hokmabadi R, Fallah H, Takhsha N. Evaluation of noise pollution in intensive care units and emergency in hospitals of north khorasan university of medical sciences. North khorasan university of medical sciences. 2013;5(2):331-337. [Persian]
20. Soutar RL, Wilson JA. Does hospital noise disturb patients? British medical journal (Clinical research ed). 1986;292(6516):305.
21. Balogh D, Kittinger E, Benzer A, Hackl J. Noise in the ICU. Intensive care medicine. 1993;19(6):343-6.
22. Babisch W. Cardiovascular effects of noise. Noise and health.2011;13(52):201.
23. Poursadegh M, Rezaei M, Hashemi E. A study of noise pollution in emam reza and ghaem hospitals. Medical journal of mashhad university of medical sciences. 2001;44(71):8-18. [Persian]
24. Morris BH, Philbin MK, Bose C. Physiological effects of sound on the newborn. Perinatology. 2000;20(S1):S55-S60.
25. Sobotova L, Jurkovicova J, Stefanikova Z, Sevcikova L, Aghova L. The acoustic environment and health risks in hospitals. Central european journal of public health. 2007;15:S20.
26.Otenio MH, Cremer E, Claro EMT. Noise level in a 222 bed hospital in the 18th health region-PR. Revista brasileira de otorrinolaringologia. 2007;73(2):245-50.