



Investigation of Noise Pollution in One of the Hospitals Covered in Kurdistan University of Medical Sciences

Ebrahim Norouzi ¹, Somayeh Farhang Dehghan ², Majid Baiyatian ³, Amir Zarei ⁴, Esmaeil Ghahramani ⁵, Ayub Mahmodi⁶, Sirvan Zarei ^{7*}

¹ BSc, Department of Occupational Health Engineering, Health Network of Qorveh, Kurdistan University of Medical Sciences, Sanandaj, Iran

² Ph.D., Assistant Professor, Department of Occupational Health and Safety at Work Engineering, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³ Ph.D., Assistant Professor, Department of Occupational Health and Safety at Work Engineering, Tehran Medical Sciences Branch, Islamic Azad University, Tehran, Iran

⁴ Ph.D. Student, Department of GIS & RS, Faculty of Earth Sciences, Shahid Beheshti University, Tehran, Iran

⁵ Ph.D. Stu, Lecturer, Department of Environmental Health Engineering, Faculty of Health, Environmental Health Research Center, Kurdistan University of Medical Sciences, Sanandaj, Iran

⁶ BSc, Vice Chancellor for Resource Management Affairs, Kurdistan University of Medical Sciences, Sanandaj, Iran

⁷ MSc, Department of Health, Safety and Environment (HSE), Workplace Health Promotion Research Center, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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Abstract

Noise pollution in different hospitals parts, as the most common source of environmental stress, has destructive psychological and physiological effects on patients. Therefore, this study was conducted to investigate the extent of noise pollution in one of the hospitals under the auspices of the Kurdistan University of Medical Sciences. this study was descriptive-analytical and cross-sectional with a sound the equivalent of 15 min with minimum and maximum sound levels in 2019 in different wards of the Hospital and its surroundings in three shifts in the morning, afternoon, a night using The TES-1351B sound meter was performed. Data were also analyzed using SPSS22 using statistical tests. The maximum mean sound level interval in the morning of the average and closed days reported was 67.85 in the emergency department and 62.48 dB in the hospital grounds, respectively. This amount measured in the afternoon of the average days related to the specialized clinic section of the hospital, 69.34 decibels, and on holidays, it was estimated at 72.46 decibels in the hospital compound, and the Leq rate in the night shift measured for average and closed days, respectively. The emergency room was 59.95 decibels, and the hospital grounds were 78.64 decibels. The results showed that there was a significant difference between the values of sound level measurement on average days and holidays and measurement times (morning, evening, and night) and diagnostic, administrative, and therapeutic sections ($P < 0.05$). In conclusion, it was found that hospitals had a high level of noise pollution and in most cases, the values were higher than the standards of the WHO.

Keywords: Noise Pollution, Sound Pressure Level, Hospital, Kurdistan

1 Introduction

Sound pollution is increasingly sought after by the industrialization of cities and countries and is seen as a pervasive problem in most states (1). Noise pollution, as one of the most important and at the same time, the most hidden and undetectable pollutants has been classified (2) and can lead to hearing loss, interference with speech, sleep disturbances, voice harassment, decreased performance, and chronic physiological effects (including chronic physiological effects)(3). Hygienic hazards caused by noise pollution are not rapidly achievable and have a lower priority than other pollutants (4). Excessive noise pollution at the hospital site directly endangers patients and hospital staff and has adverse health effects (5). The more annoying sounds there are over

time, the more intense and long-lasting they are, and the more intense their psychological consequences, primarily if they are heard at rest; Because the defense mechanisms are more severely impaired and lead to anxiety, headaches, dizziness, and psychological complications such as extreme anger, rage, irritability, and decreased tolerance thresholds (6). Hospital is one of the most important institutions for providing health care services, its facilities, and facilities, play an essential role in restoring the physical and mental health of patients, medical research, and training forces required by health and medical groups. It is one of the essential issues when patients are hospitalized. Unwanted noises can affect people psychologically and physiologically. Patients' comfort and recovery are affected by the quality of their sleep (7). Lack of

*Corresponding author: Zarei Sirvan, MSc, Department of Health, Safety and Environment (HSE), Workplace Health Promotion Research Center, School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran, Email: sirvanzareei1370@yahoo.com

sleep in the intensive care unit is common due to environmental conditions. Rest and sleep are not enough. There has been a lot of noise in all hospital wards for a long time and it is always increasing. (8). Internal sources of noise pollution include air conditioners, elevators, medical equipment, and staff activity (9). The most important external source is the noise caused by urban traffic, which is unavoidable, continuous, and unfortunately increasing (10). The World Health Organization recommends less than 35 decibels of noise during the day and less than 30 decibels during the night. It is a decibel. Permissible sound limits in and around hospitals during the day are 55 and 45 decibels, respectively, from 7 to 22, and 45 and 35 decibels, respectively, from 10 to 7 p.m., during the night (11). Noise pollution in hospitals and its consequences for the sick community has encouraged many researchers to research this area. A study on identifying the primary sources of sound and providing sound control methods in hospitals in Behbahan has shown that the primary causes of sound are personnel and clients, door noise, air conditioning, medical equipment, and furniture and beds. It includes spatial planning, selection of appropriate materials, control of outdoor noise pollution, control of indoor noise pollution, and proposed training (12). Also, the results of a similar study conducted in hospitals in Sanandaj in 2012, showed that the sound level in the intensive care unit of Sanandaj hospitals at all hours and days of the week exceeds the standard (13). In another study in three educational hospitals in Tehran's District One in 2017, the level of noise pollution in some sections of educational hospitals is higher than national and international standards (14).

In New York, the sound has been studied in three areas of the hospital (emergency room, intensive care unit, and surgery department), nursing stations, and patient rooms, and in all regions, the sound hospital is more than allowed and the human factor has been identified as the primary source of noise pollution (15). The health effects of noise pollution, which have been reported in studies, include hearing loss, cardiovascular disorders, sleep disorders, and wound healing disorders. The psychosocial effects of excessive noise pollution include misunderstanding, lack of proper and effective communication, and increased annoyance. (16). Also, the results of measuring the annoying noise level in the clinical wards of Bushehr Educational and Medical Hospital by Mohammadi et al. Showed that the sound level in all departments was higher than the Iranian standard and stressed the need for more hospital managers to pay attention to noise pollution and appropriate corrective measures (17). The hospital under the auspices of the Kurdistan University of Medical Sciences is the only medical center in the city, and patients from different strata and villages of the town refer to this center. Thus, it is essential to assess the situation of noise pollution due to its proximity to City Park. According to previous studies in other medical centers in the country and even in developed countries, it is necessary. However, no studies have been conducted in this hospital so far; Therefore, because noise pollution can exacerbate people's illness, slow their recovery and also negatively affect employees and provide appropriate services, the present study aims to determine the level of noise pollution in Hospital under the auspices of Kurdistan University of Medical Sciences in 1398, to Comparison of World Health Organization standards was designed and implemented to control environmental noise pollution.

2 Materials and Methods

This study was descriptive-analytical and cross-sectional. It was conducted in 2009 to investigate the level of noise pollution in the clinical and administrative part of the Hospital under the auspices of the Kurdistan University of Medical

Sciences and the surrounding area. In this study, to measure the level of sound pressure in different parts of the hospital and its surroundings, using the TES-1351B sound meter, the regular station-stationing method was measured in Slow mode, and A network-level was measured. Was used to calibrate the sound meter. The research community, the Hospital under the auspices of Kurdistan University of Medical Sciences, and the research sample included patients' rooms, nursing and corridor stations, diagnostic, clinical, and administrative departments, and the inner area around the hospital. The clinical wards were selected by targeted sampling. They were among the essential wards of the hospital, including surgery, internal medicine, intensive care, emergency, operating room, a specialized clinic, laboratory, ultrasound and radiology, and dialysis. To determine the sound measurement points in each section, a professional health protocol was used. Based on this, the distance between the measuring points from the walls was considered two meters from the next measurement point to one meter. The sound measurement was performed in the morning from 8 to 12 in the morning, from 14 to 18 in the afternoon, and from 20 to 24 in the evening on average and closed days of the week. To eliminate the effect of air and wind flow, sponge protection on the microphone surface was similar to other articles. The total number of measuring stations, including 12 sections and 60 stations, was determined. Data analysis was also performed using the mean Leq index, compared with the SPSS₂₂ standards and software, and descriptive statistical methods (frequency, mean, and standard deviation).

3 Results and Discussion

In Table 1, the results of measuring noise pollution parameters in different wards of the Hospital under the auspices of Kurdistan University of Medical Sciences in the morning, evening, and night shifts on average and closed days are presented. The sound equivalent in the emergency department of the Hospital in the City on average days in the morning, evening, and night are equal to 55.67, 67.95, and 59.58, respectively. On the holidays, it is 61.50, 52.74, and 44.63 dB was measured. Also, the sound equivalent in the internal ward of the Hospital in the City on average days in the morning, evening, and night times is 58.04, 58.21, and 53.04 decibels, and 42.38 and 43.04 on holidays, respectively. And 41/24 decibels were reported. Also, the amount of sound equivalent in the surgery department at the Hospital under the auspices of Kurdistan University of Medical Sciences on average days in the morning, evening, and night times are equal to 54.61, 54.42, and 52.77 decibels, respectively, and 48.64 and 27 on holidays, respectively. / 41 and 43/43 37 decibels were reported. On the other hand, the sound equivalent in the operating room ward at the Hospital under the auspices of Kurdistan University of Medical sciences on average days in the morning, evening, and night times were 61.85, 59.22, and 55.85 decibels, respectively, and 49.11 on holidays, respectively. 46.85 and 43.56 decibels were measured. Also, the level of sound equivalent in the intensive care unit of the Hospital under the auspices of Kurdistan University of Medical science on average days in the morning, evening, and night times are 54.57, 49.46, and 51.22 decibels, respectively, and on the holidays, 48.71 and 43.22, apiece. And 48/28 decibels were calculated. Also, the level of sound equivalent in the laboratory department in a Hospital under the auspices of Kurdistan University of Medical sciences on average days in the morning, evening, and night are 58.74, 59.31, and 52.22 decibels, and on holidays, 51.77 and 44.22, respectively. And 40/26 decibels were measured. On the other hand, the level of sound equivalent in the specialized clinic ward at the Hospital under the auspices of Kurdistan University of Medical sciences on an average day in the morning, evening,

and night were 58.34, 69.34, and 52.64, respectively. Also, the sound equivalent in the radiology and ultrasound department in the Hospital under the auspices of Kurdistan University of Medical sciences on average days in the morning, evening, and night times are 55.49, 48.26, and 50.49 decibels, respectively, and 43.49 / 90 on holidays, respectively. / 46 and 42/59 were measured in decibels. The equivalent sound level in the compound section of the Hospital under the auspices of Kurdistan University of Medical sciences on average days in the morning, evening, and evening is 62.10, 57.88, and 58.44 decibels, respectively 62.48, 72.46 on the day off. And 78.64 decibels were measured. On the other hand, the level of sound equivalent in the administrative and support department in the Hospital under the auspices of Kurdistan University of Medical sciences on average days in the morning, evening and night, respectively, is 17.51, 48.37, and 54.17 decibels, respectively. On holidays, 42.18, apiece, 54.17, and 44.47 decibels were measured. Also, the level of sound equivalent in the dialysis ward at the Hospital under the auspices of Kurdistan University of Medical Sciences on an average day in the morning, evening, and night were 61.41, 53.59, and 52.41, respectively.

The congestion of the emergency department as the only medical center in the city at night and the high noise of citizens on the street leading to the hospital is due to its proximity to City Park. There was a statistically significant difference between the morning, evening, and night measured values using the one-way analysis of variance test ($P < 0.05$). The average Leq equivalent in the morning shift of standard days was in the range of 51.17 to 67.85 decibels related to the support and emergency departments. The average sound level (Leq) in the evening of standard days was 48.26 to 69.34 decibels related to radiology and ultrasound departments and specialized clinics, respectively. The average sound level (Leq) in the night shift of average days was 50.12 to 59.58 decibels related to the administrative and emergency departments, respectively. The average sound level (Leq) in the morning shift was 41.9 to 42.49 decibels associated with the administrative sections and the area. The average sound level (Leq) in the evening shift was between 41.27 and 72.76 decibels on the surgical wards and the hospital grounds. The mean Leq equivalent at night shifts was 40.26 to 78.64 dB, associated with the laboratory and hospital wards, and compare these values with. The standard is 30 decibels higher. Leq averages higher than usual in the morning, evening, and night shifts of the hospital compared to the rule of 55 decibels. The average values of these indicators in the night shift above the evening and the evening shift are more than the morning shift due to a large number.

According to Table 1, the maximum mean sound level (Leq) measured over 15 minutes in the morning of the average day, related to the emergency department, was 67.85 dB, due to overcrowding of patients and patients, as well as on the day off in the ward. The hospital grounds are 62.48 decibels due to congestion on the streets around the hospital and close to the city park. This amount was reported in the afternoon of average days related to the hospital's specialized clinic section on 69.34 decibels. This was due to the presence of the majority of dedicated physicians and in the holidays on the amount of 72.46 decibels and was reported on the hospital grounds. The maximum average sound level (Leq) at night on standard days and holidays was related to the emergency department with 59.59 decibels and the hospital area with 78.64 decibels, respectively, which was successful with the results studies by Pour Sadegh (18), (19) Was consistent but not consistent with the results of the Nababit survey (20). of visitors, clients, and patients in different wards and the high noise caused by citizens' incomes. On the other hand, based on the average level

of sound (Leq) in the morning shift, the holidays were in the range of 42.18 to 62.48 decibels related to the administrative and support sections and the area, which is 30 decibels higher than the standard. On the other hand, the average sound level (Leq) in the evening of the holidays was in the range of 41.37 to 72.46 decibels, which is related to the surgical department and the hospital ward, which is used to compare the mean of the standard values with the statistical test. It is 30 decibels higher. Also, the average sound level (Leq) in the night shift on holidays was 40.36 to 78.64 decibels related to the laboratory and hospital wards, respectively, which is higher than the World Health Organization standard. Overall, the results of the present study show that the level of sound intensity in different wards of the Hospital under the auspices of Kurdistan University of Medical Sciences City is higher than the standard set by the World Health Organization, which was studied by Beit Saeed and colleagues in Ahvaz Oil Hospital in 1390, which showed all the indicators considered in different wards. The hospital is above standard (21).

The results of a study by Hekmatbadi et al. In North Khorasan Educational Hospital in 2011 showed no significant difference between the measured values of sound pressure levels on different days and periods during it (day and night) and various sections (emergency and specialized care)(22), which is not consistent with the present study. In a survey by Jafari et al. In Feyz Hospital and its surroundings in Isfahan in 2011, it was found that the maximum average sound level in the morning was related to the clinic and in the afternoon to the administrative department, and in general, high noise pollution in the hospital. Reported and consistent with the present study (23). A survey by Asghar Nia et al. In Babul Public Hospitals in 2012 showed that the level of sound intensity on average days and holidays in all three time periods in the morning and evening and the time of visit was higher than the standard set by the World Health Organization and are consistent with this study. (24). Finally, according to the obtained results, it was determined that the sources of noise pollution inside the Hospital under the auspices of Kurdistan University of Medical Sciences were the arrival and departure of clients, patients, and staff, ventilation system, transportation in the area inside the hospital, the sound of loudspeakers and the sound system of the hospital outside the hospital and resources. Cars on the streets around the hospital, especially on holidays, cause noise from patients entering and leaving, ambulances, and car horns. Therefore, the Hospital under the auspices of the Kurdistan University of Medical Sciences has a high level of noise pollution and, in most cases, is higher than the standards of the World Health Organization. Therefore, noise pollution in this hospital is considered a severe problem. Factors such as the number of personnel, the number of clients on that day and time, the physical space of the wards, the traffic, and the selection and maintenance of the ward supplies can be useful in increasing the noise pollution of the environment.

4 Conclusions

The results of the present study show that the sources of noise pollution inside the Hospital under the auspices of the Kurdistan University of Medical Sciences are the movement of patients, patients and staff, ventilation system, transportation inside the hospital, speaker sound, and hospital audio system and sources outside the hospital are traffic on the streets. Around the hospital, especially on holidays, there is noise from the entry and exit of patients, ambulances, and car horns. Therefore, the hospital has high noise pollution and in most cases is higher than the standards of the World Health Organization. Therefore, noise pollution in this hospital is a serious problem.

Table 1: Results of measuring noise pollution parameters in different wards of the Hospital under the auspices of the Kurdistan University of Medical Sciences

Parameter	Shift	Day	Emergency	Internal	Surgery	Surgery room	CCU	Laboratory	Specialized clinic	Radiology and ultrasound	Area	Office and support	Dialysis
L _{eq15}	Morning	Normal	67.85	58.04	61.38	61.85	54.57	58.74	58.34	55.49	62.10	51.17	61.41
		Closed	64.50	42.38	48.64	49.11	48.71	51.07	-	43.90	62.48	42.18	-
	Evening	Normal	55.49	58.21	54.42	59.22	49.46	59.31	69.34	48.26	57.88	48.37	53.59
		Closed	52.74	43.04	41.27	46.84	43.22	44.22	-	46.49	72.46	54.17	-
	nighting	Normal	59.58	53.04	52.07	55.85	51.23	52.22	52.64	50.49	58.44	54.42	52.41
		Closed	44.63	41.24	43.37	43.56	44.28	40.26	-	42.59	78.64	44.47	-
L _{max}	Morning	Normal	69.25	63.24	67.46	65.14	59.52	61.47	64.22	59.18	65.56	58.45	64.24
		Closed	66.78	48.58	51.16	53.24	54.26	55.14	-	48.84	66.25	45.10	-
	Evening	Normal	59.36	62.32	59.41	63.74	53.48	62.51	71.69	52.25	59.40	51.24	57.69
		Closed	55.23	47.44	45.78	48.35	46.49	48.20	-	49.98	75.29	58.34	-
	nighting	Normal	61.56	58.27	56.24	58.70	55.46	56.20	55.87	53.74	61.24	59.26	58.12
		Closed	48.68	45.66	48.76	47.18	47.25	44.34	-	45.80	80.26	46.54	-
L _{min}	Morning	Normal	62.45	53.27	56.65	55.18	51.69	54.14	52.68	52.18	58.95	46.22	56.51
		Closed	56.38	40.24	44.12	44.87	45.32	47.60	-	39.24	58.67	39.84	-
	Evening	Normal	52.30	53.98	51.17	53.80	45.74	54.26	63.54	44.59	54.28	43.15	49.38
		Closed	48.29	39.18	38.22	42.73	39.44	38.56	-	41.58	64.78	50.38	-
	nighting	Normal	54.24	49.22	48.64	51.10	47.97	46.18	48.20	44.96	52.76	50.28	49.10
		Closed	40.44	38.12	38.64	39.24	37.12	36.69	-	39.42	70.14	40.62	-

To cause this pollution, factors such as the number of personnel, number of visitors in that day and hour, physical space of departments, traffic, selection and maintenance of equipment can be effective in increasing ambient noise pollution and therefore technical, engineering, and managerial measures such as staff awareness are suggested. And hospital officials and citizens in terms of keeping the noise level low, educating staff on how to properly use the equipment and not to make noise, timely repairs of facilities and sound equipment, preventing congestion of patients, improving the movement of citizens in the hospital Through coordination with responsible organizations such as the municipality and the police, as well as the transfer of special wards of the hospital to quieter neighborhoods. In this study, only one of the hospitals covered by the Kurdistan University of Medical Sciences was studied. Due to this limitation, it is suggested that in future studies, the research environment be broader, and a comparison be made between several hospitals in the province. In addition to the above restrictions, sampling was performed only in one of the rooms of each ward and only on two average and closed days. Audiometry should be performed. In general, according to the results of the study and interviews with nurses and patients during the data collection period, the noise in hospital wards was mainly due to the lack of double-glazed windows, the sound of traffic on the streets of the hospital grounds, speeches by visitors and hospital staff—mobile phones. Considering the study results, the need to pay more attention to the significant comfort and convenience of patients and staff working in the hospital and protect them against noise pollution is well felt. Also, planning and adopting appropriate and effective corrective measures to reduce noise pollution to a permissible and standard level seems necessary.

Conflict of interest

The authors point out that there is no conflict of interest in the present study.

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Ethical issue

Authors are aware of and comply with, best practices in publication ethics specifically about authorship (avoidance of guest authorship), dual submission, manipulation of figures, competing interests, and compliance with policies on research ethics. Authors adhere to publication requirements that the submitted work is original and has not been published elsewhere in any language. Also, all procedures performed in studies involving human participants were following the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All procedures performed in this study involving animals were following the ethical standards of the institution or practice at which the studies were conducted

Competing interests

The authors declare that no conflict of interest would prejudice the impartiality of this scientific work.

Authors' contribution

All authors of this study have a complete contribution to data collection, data analyses, and manuscript writing.

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