



Evaluation of Noise Pollution in the Public Hospitals in Khorramabad, Iran in Winter 2017

Bahram Kamarei¹, Nahid Khoshmanvand^{2}, Ahmad Reza Daraei³, Omid Delfan³*

1-Assistant Professor of Environmental Health Engineering, Lorestan University of Medical Sciences, Khorramabad, Iran

2-Instructor, Department of Environmental Health Engineering, Lorestan University of Medical Sciences, Khorramabad, Iran

3-Student, School of Health and Nutrition, Lorestan University of Medical Sciences, Khorramabad, Iran.

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***Corresponding author**

Nahid Khoshmanvand

Email:

nahidkhoshnam92@gmail.com

Tel:

tel:+989387677501,

ORCID iD:

000-0002-0135-6629

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ABSTRACT

Background & Objective: Sound is a physical factor in the hospital environment, which could disrupt the comfort and normal activities of patients. Disturbing sounds may hinder proper staffing in hospitals in the direction of patient activities. The present study aimed to evaluate the noise pollution level in various wards of the public hospitals in Khorramabad city, Iran.

Materials and Methods: In this cross-sectional study, the noise pollution in the hospitals was measured at two intervals in the morning and evening using a digital sound level meter (model: CEL440). Data analysis was performed in the Microsoft Excel software and SPSS version 22 using (ANOVA and t-test).

Results: Mean sound equivalent level was denoted in different settings, including the dialysis, cardiac ward, men's admission, men's internal ward, children's ward, intensive care unit (ICU), cardiac care unit (CCU), and neonatal intensive care unit (NICU) in Shahid Rahimi Hospital, as well as the ICU and CCU in Shahid Madani Hospital. Moreover, the highest and lowest noise pollution level were observed in the NICU and CCU, respectively.

Conclusion: According to the results, the measured level of noise pollution had a significant correlation with time and place in most of the hospital wards. Noise pollution was higher in the morning compared to the evening, and the measured sound was significantly associated in two hospitals. In addition, pollution level was higher than the standard level (35 dB), which requires effective measures in this regard.

Introduction

Noise pollution is the disruption of human comfort due to unpleasant sounds. Based on this definition, any sound that is unwittingly heard by the human ear and forces the individual to tolerate the discomfort causes noise pollution (1). The effects of noise pollution on human health and wellbeing vary depending on the length of contact and frequency of the sound. Some of the main adverse effects of noise pollution are physiological effects (e.g., hypertension, cardiovascular and digestive disorders), physical effects (e.g., hearing loss and hearing impairment), psychological effects (e.g., chest and sleep disturbance, irritability) and behavioral changes (e.g., pruritus and spasticity). Furthermore, noise pollution deteriorates the performance of individuals through reducing their efficiency (2).

Sound is an inseparable part of the everyday life of humans. Noise pollution involves the conditions in which public health, wellbeing, and comfort are threatened (1). The World Health Organization (WHO) has introduced noise pollution as the third most hazardous contamination after air and water pollution (3). According to the WHO, the recommended noise levels for humans are 35 dB per day, 30 dB in patients' rooms, and 40 dB per night in the hospital

sections that do not exceed this rate (4). Since 1990s, the mean noise level in hospitals has been reported to be 38 dB per day and 42 dB per night (5).

Hospitals are one of the most important healthcare institutions, which play a pivotal role in restoring the physical and mental health of patients. Therefore, it is essential to create a peaceful environment in hospitals (6). Due to the time-consuming nature of hospital admissions, the lowest level of noise pollution can interfere with conversations, disturbing concentration and reducing the accuracy of procedures, thereby causing neuropsychiatric disorders and sleep disturbances in hospitalized patients (7).

Recently, the importance and sensitivity of noise pollution in hospitals has become a major concern among researchers, and the findings in this regard have indicated a high level of noise pollution in different hospital wards; this issue highlights the need for the proper location of hospitals in order to minimize noise pollution (8).

In a study, Pour Sadeghi et al. reported that the level of noise pollution in Imam Reza Hospital and Ghaem Hospital in Mashhad (Iran) is above the permissible limits (9). In the research by Otenio et al, mean sound level was estimated at 63.7

dB, which was higher than the recommended limits (10). Moreover, Cabreea and Lee have claimed that increased level of disturbing sounds in the hospital environment may heighten discomfort and pain in hospitalized patients (6). Given the importance of the issue, it is essential to measure the level of noise pollution in hospitals so as to identify the sources and control and reduce noise pollution.

The present study aimed to compare the mean equivalence of sound with global standards in the wards of two public hospitals in Khorramabad, Iran in 2017.

Materials and Methods

This descriptive, cross-sectional study was conducted in the winter of 2017 in the dialysis, cardiac ward, men's admissions, men's internal ward, intensive care unit (ICU), cardiac care unit (CCU), and neonatal intensive care unit (NICU) of Shahid Rahimi Hospital and the CCU and hospital admissions in Shahid Madani Hospital.

Level of noise pollution was measured at two intervals in the morning (8-12 a.m.) and evening (15-18 p.m.). Samples were collected from each ward. Sampling was performed within 12 weeks in the selected hospitals. The sound pressure level was measured using a 440-CEL sound meter

(made in the U.K). To do so, the calibrated device was placed at a standard height of 1.5 meters from the ground.

Data analysis was performed in the Microsoft Excel software using descriptive statistics and SPSS version 22 using analytical statistics. In addition, t-test and ANOVA were used to determine the correlations between the studied variables.

Results

Mean sound level was measured in various hospital wards in the morning and evening. According to the findings, the mean sound level in the ICU of Shahid Rahimi Hospital in the morning and evening was 64.88 and 63.95 dB, respectively. As for the CCU, the level was estimated at 61.91 and 60.64 dB, while it was 70.31 and 71.46 dB in the NICU, respectively. With regard to the surgery wards in the morning and evening, the level of noise pollution was calculated to be 65.26 and 63.78 dB, respectively. In the internal ward of male patients in Shahid Rahimi Hospital, the level of sound pollution in the morning and evening was 67.19 and 67.06 dB, respectively. As for the cardiac wards, children's ward, and the dialysis ward of Shahid Rahimi Hospital in the morning and evening, the mean sound pollution level was estimated at 65.09 and 65.5 dB,

70.45 and 70.5 dB, and 67.94 and 67.12 dB, respectively.

In Shahid Madani Hospital, mean sound level was measured in the morning and evening, and the mean sound pollution in the CCU and cardiac ward was calculated to be 67.12 and 66.85 dB and 68.1 and

68.75 dB, respectively. According to the obtained results, mean sound level was higher than the standard limit (35 dB) in the studied wards. The highest and lowest mean measured sound levels were denoted in the NICU of Shahid Rahimi Hospital and CCU of Shahid Rahimi Hospital, respectively

Table 1. Mean Measured Sound Levels in Shahid Rahimi Hospital in Khorramabad, Iran in 2017

Wards	Mean	Standard Deviation	Minimum	Maximum
ICU	64.4	1.28	66.33	66.7
CCU	61.28	1.62	57.33	64.03
NICU	70.89	1.56	65.7	74.65
Dialysis	67.53	1.05	65.45	70.4
Cardiac	65.3	1.54	62.06	67.96
Children	70.48	1.39	63.13	74.48
Men's Internal	67.13	0.65	65.97	67.98
Men's Surgery	64.67	1.57	61.25	74.65

Table 2. Mean Measured Sound Level in Public Hospitals in Khorramabad, Iran in 2017

Ward	Mean	Standard Deviation	Minimum	Maximum
ICU	66.99	1.16	63.5	68.97
Cardiac	68.43	1.05	67.17	70.82

Discussion and Conclusion

Although the effects of noise pollution in hospitals remain unclear, evidence suggests variable effects on patients and even hospital staff. Constant exposure to noise pollution in the hospital environment could increase the blood pressure and risk of cardiovascular diseases in patients, while diminishing noise pollution has been shown to alleviate the aggressive behaviors in patients (11).

Some of the significant influential factors in noise pollution in hospitals include the presence of patients and healthcare staff in the setting, urban traffic, traveling companions, and electronic equipment in the wards (television and cell phones). In addition to these issues in the public hospitals in Khorramabad city, the level of noise pollution was observed to be relatively higher in Shahid Madani Hospital and Shahid Rahimi Hospital due to their location in downtown districts and use of educational facilities in these hospitals, as well as failure to comply with proper standards in the construction of these hospitals.

The results of the present study were consistent with the findings of Pour Sadeghi et al. and Golmohammadi et al., which confirmed the high level of sound balance in the hospitals in Mashhad and

Hamedan (Iran) (9, 12). In general, data analysis in the current research indicated a significant difference between the measured levels of sound balance between the two hospitals. Furthermore, a significant difference was observed in the noise pollution between the ICU and other sections, with the exception of the cardiac ward and men's surgery ward in Shahid Rahimi Hospital. A significant difference was also denoted between the CCU and other wards in this regard, as well as the NICU, with the exception of the pediatric ward. The dialysis ward, with the exception of men's internal ward, was significantly different in terms of noise pollution compared to the other wards. The cardiac ward, with the exception of the ICU and men's surgery ward, showed a significant difference with the other wards in this regard. The children's ward, with the exception of the NICU, also had a significant difference with the other wards in terms of noise pollution.

In the present study, the highest sound level was observed in the NICU and children wards, while the lowest sound level was denoted in the CCU. Comparison of noise pollution in the morning and evening indicated a significant difference in the level of the measured sound between morning and evening shifts. On the other hand, the

highest sound level was measured in the morning (8-12 a.m.) and during the therapeutic and educational practices of students.

In a study by the American National Association (NIOSH) in the operating rooms of a teaching hospital, it was reported that specific activities increased the sound level to more than 90 dB, which is higher than the standard limit (13). Similarly, the results obtained by Sabotova et al. in the hospital environment showed that the mean sound level in most hospitals was higher than the standard limit (14). In this regard, Golmohammadi et al. evaluated noise pollution and its disturbing effects in the hospitals in Hamedan (Iran), stating that the mean sound pressure level inside and outside the hospital was higher than the standard limit (12).

Another study in this regard was performed by Hokm Abadi et al. to estimate the rate of noise pollution in the emergency care sections of the teaching hospitals in North Khorasan University of Medical Sciences, reporting the mean level to be higher than the standard limit (1). Findings of the present study are in congruence with the results of the previous studies in this regard. Considering that the recommended sound level in hospitals is 35-40 dB during the day and 40-30 dB at night, findings of the current research

indicated that the sound level in various wards of Shahid Madani Hospital and Shahid Rahimi Hospital in Khorramabad city was above the standard limit. Furthermore, the results of the present study showed the highest measured sound level in neonatal sections.

Noise pollution is associated with various adverse effects and decreases the concentration of the hospital staff directly or indirectly, which ultimately have a negative impact on the provision of care services. Therefore, it is essential to take effective measures to locate hospitals appropriately, while raising the awareness of hospital managers regarding this issue, so that they would adopt technical strategies to control and reduce the sources of noise pollution.

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