

A Study of Public and Local Noise Level in Wards of A State Hospital in Kermanshah

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Abstract: Noise is considered as one of the most common environmental sources of stress which has malicious effects on humans psychologically and physiologically. It is important to provide peace and comfort for the patients during their hospitalizing and admission in hospital due to their unpleasant conditions. Also, high amount of noise influences hospital staff resulting in providing inappropriate services to patients. The aim of this study is to investigate the amount of public and local noise in wards of a hospital in Kermanshah. The present research was done as a descriptive-cross-sectional study in different parts of a state hospital in Kermanshah in 1394. A TES-1358 sound meter device used to measure the noise. In the end, the results were analyzed by SPSS-16 Software and were compared to Iranian standards, the EPA and NIOSH organization. the mean and standard deviation of local noise in different wards, public noise in the dialysis and disposition parts were 66.9 ± 9.5 , 87.8 ± 2.3 , 70.9 ± 1.3 and 83.8 ± 2.3 , respectively. The results showed that all measured points inside and outside the hospital were above the standards of Iran, the EPA and the NIOSH organization. the results showed that the amounts of noise in different parts of the studied hospital, were higher than the allowed limit presented by the standards. Therefore, considering the defined sources of noise and the level of produced noise in all sectors of hospital, it is recommended to reduce noise in hospitals by applying technical, engineering and management principles, the use of suitable materials in the construction of hospitals, providing nursing management regulations to reduce the undesirable noise in the sectors, prevention of visitors rush during meeting hours and periodic hospital equipment inspection.

Key words: Noise, hospital, state, Kermanshah, EPA

INTRODUCTION

From psychology point of view, sound pollution is defined as an undesirable, unpleasant and or unwilling sound. Noise, quantitatively is a mixture of different sounds with different wavelength and intensity which has no certain compounding and is unpleasant for ears (Heydari *et al.*, 2013) nowadays, sound pollution is proposed as a pervasive and global problem in the most countries (Sazegarnia *et al.*, 2005) since being exposed to ultrasound devastates health and in general it has negative effect on all creatures, thus, it is considered as one of environmental contaminations (Heydari *et al.*, 2013) a majority of researches have shown that noise can cause persecution and harassment, sleeping disorder, high blood pressure and hearing problems (Abolhasannejad *et al.*, 2014) physiological and mental effects of noise on man often appear gradually and in a long-term, they have influence on nerve system and the negative outcomes outbreak (Karamkhani, 1994) noise is considered as one of the most common environmental

sources of stress which has malicious effects psychologically and physiologically including: increased stomach secretion and stimulation of adrenal and pituitary glands; in addition, exposure to this harmful physical factor, brings about disorder in performance and staff and personnel's job burnout (Moshi *et al.*, 2010) mental effects of noise are different in terms of the person, type and location of work and time, however, generally, it can be said that noisy environment causes disorder in conversation and understanding, decreasing brain activity and inconsistency of physical actions; on the other hand, it diminishes the power of learning and increases the number of mistakes one of important institutions providing hygienic-therapeutic services are hospitals which play important role by providing facilities in bringing back physical and mental health of the sick, medical researches and education of hygienic and medical forces. Calm environment is one of the important issues should be considered during patients' admission to the hospital (Jafari *et al.*, 2011). Providing educational and therapeutic services, hospitals are under the impact of

sound pollution sources which may have negative effects on patients and staff from health and comfort points of view. In addition to the staff's need to calm environment to provide desirable services, considering the patients hospitalization has a great importance in the process of recovery. Some of the internal sources of sound pollution are air ventilation devices, elevators, the therapeutic equipment and staff's activity. The most external source of sound causes from urban traffic which unfortunately is unavoidable, ongoing and increasing. According to Iran's standard, the amount of noise outside and inside the hospitals from 7 am to 22 pm is 55 db (A) and 45 db (A) and during the night from 22 to 7 is 45 db (A) and 35 db (A), respectively (Zamanian *et al.*, 2015) the factor in a higher level than allowed limit can cause cardiovascular and vascular disorders, increase admission time in the hospital, increase the need to more doses of medicine and cause different mental effects (Abolhasannejad *et al.*, 2014) sound pollution of hospitals and its influence on the sick, made a large number of researchers from several countries including Iran study on this issue (Jafari *et al.*, 2011) in a study by Zonouzi and colleagues in NICU of Mofid hospital, it was shown that the average level of public noise pressure was approximately the same in all parts of the section, about 8-13 db higher than allowed level determined by American Academy of Pediatrics (Zonouzi *et al.*, 2006) in a research by Poursadegh and colleagues in Imam Reza and Qaem hospitals in Mashhad, it was demonstrated that sound contamination is higher than the limit in most parts of the hospitals (8 Jafari) the results of Rabieyan and Qareeb's study showed that noise has various physiological and mental effects. Furthermore, it can cause disruption in work, activity, connections, dream and rest (Poursadegh *et al.*, 2001) Otenio and colleagues in their study at 10 different hospital departments, during a 24-h period, showed that the mean level of sound was measured 63.7 db, >45 db recommended by the Brazilian Association of Technical Standards (Otenio *et al.*, 2007) in a research by Sobotova and colleagues in different hospitals, it was specified that the mean level of noise was higher than permitted limit in most hospitals (Sobotova *et al.*, 2007). Lee and Cabrera's study in the United States showed that increasing sound pollution in hospital rooms causes to increase the patients' pain and discomfort (Cabrera and Lee, 2000). Thus, evaluating of noise in such places and sound controlling in order to reach the standard limit has a great importance. The purpose of this study was to investigate the amount of public and local noise in wards of a hospital in Kermanshah.

MATERIALS AND METHODS

The study, a descriptive, cross-sectional one was carried out in different parts of an educational-therapeutic

center in Kermanshah in 1394. After explaining the purpose of the research for administrators to study and identify the sources of sound contamination and localization, level of sound equivalent index quantity (leq) during the middle hours of each shift was evaluated using a TES-1358 sound meter. Sound measurement method towards staff and hospitalized patients in different parts of hospital and determination of metering station were in accordance with the recommendations of the standard ISO-9612 (Leventhall, 2004) in order to measure at certain points, sound meter device was set 1.5 m and in patients' room one m above the ground; then, the data was measured by specific angle (Abolhasannejad *et al.*, 2014) to make sure of mentioned amounts, device calibration using model SC-941 calibrator was also performed before measuring at each station. Eventually, the obtained data was analyzed using SPSS-16 and were compared with the standards of Iran and the world (Zamanian *et al.*, 2015; Ehteshmzadeh *et al.*, 1997).

RESULTS AND DISCUSSION

Table 1-3 show the results of the mean and standard deviation of local and public noise in all given wards. Table 2 represents the mean of local sound and its comparison to the standards of Iran OEL-the EPA and (NIOSH, 1998).

Table 1: The mean and standard deviation of local sound equivalent level in the hospital wards

| Variable | Mean | SD | Minimum | Maximum |
|-------------|------|-----|---------|---------|
| Local sound | 66.9 | 9.5 | 52 | 88.6 |

Table 2: The mean of measured local sound in hospital wards in comparison to the standards

| Wards | Mean of measured leq | Iranian standard OEL-the EPA and NIOSH |
|---------------------------|----------------------|---|
| Internal-patient room | 59.0 | 45 db during the day |
| CCU-nursing station | 65.3 | |
| Corridor | 71.1 | |
| Women-patient room | 68.8 | 35 db during the night According to Iran's standard, the amount of noise outside and inside the hospitals from 7a.m to 22 pm is 55 db (A) and 45 db (A) and during the night from 22-7 is 45 db (A) and 35 db (A), respectively (Zamanian <i>et al.</i> , 2015; Ehteshmzadeh <i>et al.</i> , 1997) |
| Women-nursing station | 70.1 | |
| Dialysis | 72.4 | |
| RO room | 88.6 | |
| Radiotherapy | 68.7 | |
| ICU respiratory | 57.0 | |
| ICU emergency | 55.8 | |
| Pediatric nursing station | 54.2 | |
| NICU-nursing station | 55.2 | |
| ICU thorax | 64.5 | |
| Phone room | 63.4 | |
| CSR-autoclave device | 75.7 | 75.2 |
| CSR-supervisor's room | 52.0 | |
| CSR-packaging room | 62.2 | |
| CSR-sterile room | 70.0 | |
| CSR-sewing room | 85.2 | |
| Laboratory | 66.1 | |
| Utilities-control room | 72.1 | |
| Laundry room-drying room | 75.2 | |

Table 3: The mean and standard deviation of public sound in high- noise units of hospital

| Variable | Mean | SD | Minimum | Maximum |
|-------------------|------|-----|---------|---------|
| Utilities | 87.8 | 2.3 | 84.4 | 92.5 |
| Dialysis | 70.9 | 1.3 | 68.2 | 73.7 |
| Waste disposition | 83.8 | 2.2 | 80.3 | 88.3 |

(According to Iran's standard, the amount of noise outside and inside the hospitals from 7 am to 22 pm is 55 db (A) and 45 db (A) and during the night from 22-7 is 45 db (A) and 35 db (A) , respectively

Table 4: The mean of measured Leq of sound productive sources in hospital wards

| Sound sources | Mean of measured leq |
|--|----------------------|
| Utilities-chiller | 89.70 |
| Utilities-boiler | 88.3000 |
| Utilities-pump | 88.2000 |
| Utilities-milling unit | 1060.0000 |
| Waste disposition-boiler | 87.3000 |
| Waste disposition-autoclave | 85.8000 |
| Waste disposition-compressor | 84.6000 |
| CSR unit-(sewing room-working sewing machines) | 85.2000 |
| Laboratory-washer device | 72.5000 |
| Laboratory-ELEcsys2010 device | 71.5000 |
| Laundry room-dryer machine | 75.6000 |
| Corridor-clients passing and talking | 77.1000 |
| Nursing station- nurses talking | 7400.0000 |
| Phone room | 64.0000 |

Table 4 presents the mean of sound pressure level of sound sources in the studied parts of the hospital. Hospitals are among important centers providing public services which require calm environment due to the nature and type of provided services. This considers the need of patients and working staff. A lot of studies have shown that noise is a harmful factor in such centers among which are hospitals (Shapiro and Berland, 1972; Lewis *et al.*, 1990) the obtained results showed that the level of public and local noise in all designated stations inside and outside the observed hospital were more than OEL standards of Iran, EPA and NIOSH (Tables 1-3). Based on Jafari and colleagues' research, studying acoustic pollution in wards of Feyze hospital in Esfahan and around the hospital, results of different shifts were more than standard limit (Jafari *et al.*, 2014) the study of Sobotova and colleagues in different hospitals showed that the mean of sound equivalent level was more than permitted limit in most hospitals (Sobotova *et al.*, 2007) in our study, the mean of leq in internal and women wards were 59 and 68.8, respectively (Table 2). Lee and Cabrera's study in the united states showed that increasing acoustic pollution in hospital rooms causes to increase the patients' pain and discomfort (Cabrera *et al.*, 2000) in the present study, the mean of sound pressure level in the respiratory ICU, emergency ICU and thorax ICU were 57, 55.8 and 64.5 db, respectively (Table 2). Standard level of sound in ICU based on Iran's standard during the day and during the night is 35 and 30 db, respectively (Abbasi *et al.*, 2011). According to Iranian standard, all

obtained values in the three ICUs are higher than presented standard. Soutar and Wilson reported the mean of sound level in ICU 66 db A and Balogh reported it between 60 and 65 db A (Hodge and Thompson, 1990) in their survey, Poursadegh and colleagues also reported the level mean in the ICU of Imam Reza and Qaem hospitals in Mashhad 58 and 59.7 db, respectively, being more than standard limit (Poursadegh *et al.*, 2001) and it is also in accordance with our results. Furthermore, according to the results of Abbasi and colleagues' study, the mean of sound equivalent level at ICU ward in training hospitals of Esfahan medical university including Al Zahra, Kashani and Chamran hospitals were 64.4, 64.2 64.08 db, respectively more than standard limit (Abbasi *et al.*, 2011) based on another research by Krueger, done in 9 stations of NICU, the mean level of sound pressure was measured 60.4 db (Krueger *et al.*, 2005). In the present study, the main sources of generating sound in a hospital included movement of patients, nurses talking, sound of devices in the facilities, laundry, waste disposition and CSR unit, phone ring and laboratory (Table 4) Abbasi and colleagues' study also showed that the most important factors of generating sound in the ICU includes staff talking and people and personnel's voice during work as a result, the maximum level of noise causes from this factor (Abbasi *et al.*, 2011) according to Meshkati and colleagues study, the sources of sound in hospital are external noise, system of ventilation, phone, radio, TV, nurses conversations, patients, visitors and so on in addition, based on a study in Lyon hospital in France, major sources of noise refers to staff conversation, phone ring, medical equipment alarms and sounds of nursing care (Allaouchiche *et al.*, 2002) in our study, the amount of noise in the hallways of the wards was 71.1 (Table 4) which is much more than the standard. In a study conducted by Joneidi Jafari and colleagues, it was demonstrated that the most sound contamination not only was overall related to surgery room but also related to their connecting corridors. This proves that human voice of conversations plays the key role in sound pollution of surgery rooms. The reason is that there are not many devices and tools in corridors. In general, based on Jafari Joneidi' study, the most important and major factor of sound pollution in surgery rooms was human noise in the present study, clients and personnel's talking noise were 77.1 and 74, respectively (Table 4) based on Allaouchiche *et al.* (2002) study in receivey wards of the hospital, it was also demonstrated that clients and personnel's talking noise was more than other sound sources and the maximum was sometimes over 65 decibels (Allaouchiche *et al.*, 2002) the results showed that the values of noise in the observed wards of the hospital were

higher than allowed limit presented by Iranian standards, EPA (1974) and NIOSH (1998); therefore, regarding the known sources of sound and the level of produced sound in different wards of the hospital, it is recommended to apply and observe the following tips to reduce the noise in hospitals as much as possible.

Apply technical, engineering and management principles which can considerably decrease the noise sources. Not to use materials such as stone in making walls and floor that cause sound reflection in rooms or corridors. Kinetic covers excel in controlling infection and absorbing sound comparing to stone. Additionally, construct roofs of high-sound absorbable materials.

Nursing management provisions can considerably decrease undesirable buzz and sound in admission wards. Prevent visitors rush during meeting hours applying regulations that do not permit each patient to have more than two visitors at the moment. Use warning signs for silence in admission wards and oral notification to patients, patient entourage and staff and to wear special noiseless shoes. Specify a medical tool engineer to inspect hospital equipment periodically. Noisy equipment and beds should be repaired and rubber pads and shields should be used in order to decrease vibrating sound. It is vital to modify alarm and warning systems of anesthesia tools and available monitors in ICU of surgery or recovery room. Sound levels can be significantly reduced using a variety of methods such as the use of plastic trays and bowls in addition to the use of softer paper or cloth used to wrap surgical instruments (Heydari *et al.*, 2013; Zamanian *et al.*, 2015) some of the risk assessment methods must be used in hospital for assessing the exposure of health risk factor (Pirsaheb *et al.*, 2016; Yarmohammadi *et al.*, 2016). We recommended Effects of Administrative Interventions on Improvement of Safety and Health in Workplace must be done to reduced exposure of staff (Ebrahimi *et al.*, 2016). The effect of Noise Pollution in High-Traffic Streets in nearby hospital must be tested.

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