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Evaluation of Noise Pollution Levels in Hospitals and its Effects on Staff Health in AL - Najaf City in Iraq

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Abstract

The aim of the study was to determine levels and sources of noise pollution in the hospitals and its effects on staff health in AL - Najaf city in Iraq. The study included measure sound levels in all wards in three hospitals (Al-sadr teaching hospital, Al-hakeem general hospital and Al-zahraa' teaching hospital) using a digital sound level meter. The present work also examined distribution of symptoms caused by noise in employees of three hospitals and main sources of noise in hospitals by using prepared questionnaire through direct interview in the workplace. The results showed that the average measured A-weighted equivalent continuous level (L_{Aeq}) in all hospitals and in different shifts was more than recommended level (20 – 35 dB) of World Health Organization (WHO).The study revealed that the main sources of noise in inside the wards rooms of hospitals Al-Sadr Teaching Hospital, Al-Hakeem General Hospital and Al-Zahraa' Teaching hospital were "staff conversation" (91%); "maneuver-patient treatment" (83%); "doors opening or closing" (77.5%); "mobile phone ringing and conversation" (76.5%).Moreover, it was observed that (32%) of respondents were headache by noise in hospitals . Moreover, the type of noise health effects that most complained among employees were vocal fatigue (31%), dizziness (30.5%), and feeling sick at the end of the workday (28.5%). This study concluded that the noise level in three hospitals was higher than the WHO rating; therefore, this problem causes raising the noise annoyance on of hospital staff.

Key words: *Noise pollution , Hospitals and Staff health.*

Introduction

Noise in hospitals has become a subject of growing concern in recent years, since it is often cited as a major complaint by patients in hospitals [(1)]. [(2)] reported that noise levels in hospitals averaging 72 dBA during the day and 60 dBA at night. Environmental noise present in hospitals all over the worlds is a common exertion and is recognized as a serious health hazard and not just as a nuisance [(3)].

Noise pollution has many health effects, e.g., increased blood pressure, noise-induced hearing loss, sleep disorders, annoyance and irritability [(4)] .In addition; high noise can also leave adverse effects on work activity and events. It can also cause impaired sleep and behavior, increased gastric intestinal activity, heart rate, blood pressure, respiratory rate, and oxygen consumption [(5)].

Noise may elevate blood pressure, increase heart rate, stimulate the release of epinephrine (adrenaline), increase pain, and alter quality of sleep [(6)] [(7)] .

Noise has been increasing over the years, specifically in large metropolitan areas. This increase is also perceived inside hospitals. Different noises originated from distinct sources, such as the operation of different devices and conversation among professional cause noise pollution in the hospital environment and this may affect the individual's physical and emotional health [(8)].

In general, the problem of hospitals' noise pollution is a global issue and because of its negative health impacts, it requires and deserves further attention [(9)] endeavors to prevent medical errors and risks stemming from the presence of patients and employees only in the hospital environment are very important in terms of patient and employee safety [(10)] . In addition, working

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performance is also affected by noise pollution. The aim of this study was to assess noise levels and sources and its effects on staff health of three hospitals in AL - Najaf city in Iraq.

Materials and Method

This study was carried out in three large hospitals: Al-Sadr Teaching Hospital, Al-Hakeem General Hospital and Al-Zahraa' Teaching hospital in Al-Najaf AL-Ashraf city in Iraq from November 10, 2018, to January 12, 2019.

Workplace noise assessment:

The noise levels measurements were conducted using Noise measurements were recorded by using digital sound level meter model: UNI-T; UT352, China in three major hospitals Al-Sadr Teaching Hospital, Al-Hakeem General Hospital and Al-Zahraa' Teaching hospital. In each hospital, several locations were chosen to measure various noise parameters at different time intervals.

Noise level assessments were performed at four time periods include morning time (09:00 am–12:00 am), afternoon time (12:00 am–04:00 pm), evening time (04:00 pm–06:00 pm), and night time (06:00 pm–09:00 pm).

In this study, noise level was recorded in every measurement in Decibel (dB): A-weighted equivalent continuous level (L_{Aeq}). In order to obtain a realistic recording of noise levels, neither the staff nor patients in the four institutions were aware of the recordings. The time for each measurement was 5 minutes, recording was repeated for two times in each location, and then the average reading was recorded.

Questionnaire surveys:

The questionnaire has been applied to 200 employees selected from three hospitals. Structured questionnaires were used to assess the staff response on noise pollution in all locations of the hospitals. All participants completed a researcher-made questionnaire. It included two parts:

First part: noise sources inside and outside the wards rooms in hospital: The second part: sources of noise pollution inside and outside the ward rooms such as (television and radio sets, mobile phone ringing and conversation, doors opening or closing, medical equipment, heating, ventilation, air-conditioning or cooling system, bed creak, maneuver-patient treatment, patients moaning or crying, staff conversation, conversation of patients visitors, wheelbarrows).

Second part: symptoms caused by noise on hospital employees: symptoms caused by exposure to noise pollution such as (headache, anxiety/jitters, dizziness/ dizzy, annoyance, tension or irritability, discomfort, uncomfortable around loud noise, sleep alterations, experience difficulty sleeping, inability to sleep, inattention, low concentration, unable to concentrate in work, gastric changes, problem in speech, difficulty hearing what people say, tinnitus, ear ache, hearing deficiency, blocked ear, vocal fatigue, and feeling sick at the end of the workday).

Statistical analysis:

The data were statistically analyzed by using SPSS (statistical package for social sciences). The independent sample t-test, ANOVA (analysis of variance) . All values were expressed as mean ± Standard Error of Mean. P-value less than 0.05 and 0.01 were considered statistically significant.

Results

Sound levels in three hospitals:

The results recorded that the average A-weighted equivalent continuous sound levels (L_{Aeq}) in different locations of Al-sadr teaching hospital was (62.80 ± 2.14 dB).In addition , it can be observed that the average A-weighted equivalent continuous sound levels (L_{Aeq}) in different locations for Al-hakeem general hospital was (61.50 ± 2.12 dB). Also, The study found that the the average A-weighted equivalent continuous sound levels (L_{Aeq}) in all locations of hospital Al-zahraa' teaching hospital was (61.64 ± 2.11 dB) (Table 1).

Table (1) Average A-weighted equivalent continuous sound levels (L_{Aeq}) in Al-sadr teaching hospital, Al-hakeem general hospital and Al-zahraa' teaching hospital.

Hospitals	Sound levels (dB) (L_{Aeq})	F test	P value
	Mean ± SD		
Al-sadr teaching hospital	62.80 ± 2.14	0.45	0.64 (NS)
Al-hakeem general hospital	61.50 ± 2.12		
Al-zahraa' teaching hospital	61.64 ± 2.11		

Note: (NS) = Not significant.

In addition, statistical comparison of mean A-weighted equivalent continuous sound levels (L_{Aeq}) among different hospitals on the basis of time periods, the result observed that no significant elevation in mean (L_{Aeq}) of Al-sadr teaching hospital during morning, afternoon, evening comparison with Al-zahraa' teaching hospital and Al-hakeem general hospital in same period time (Table 2).

Table (2) Comparison of mean A-weighted equivalent continuous sound levels (L_{Aeq}) in (dB) among various hospitals on the basis of time periods.

Time	Sound levels (dB) (LAeq)			F test	P-value
	Al-sadr teaching hospital	Al-hakeem general hospital	Al-zahraa' teaching hospital		
	Mean + SD	Mean + SD	Mean + SD		
Morning	64.7±1.24	63.34±1.1	63.29±0.99	0.58	0.62 (NS)
Afternoon	64.31±2.45	63.09±2.42	63.39±2.6	0.29	0.82 (NS)
Evening	62.07±4.01	60.68±3.72	60.86±3.48	0.57	0.57 (NS)
Night	60.1±1.29	58.88±1.01	59±0.92	0.35	0.75 (NS)

NS= Not significant.

Sources of Sound levels in hospitals

The present study revealed that the main sources of noise in inside the wards rooms of hospitals Al-Sadr Teaching Hospital, Al-Hakeem General Hospital and Al-Zahraa' Teaching hospital were "staff conversation" (91%); "maneuver-patient treatment" (83%); "doors opening or closing" (77.5%); "mobile phone ringing and conversation" (76.5%) (Figure 1). Moreover, it was observed that the "talking of visitors or patient's family members in corridors" (94.5%) and "Staff conversation" (92%) were the major noise sources outside the wards rooms in hospitals Al-Sadr teaching hospital, Al-Hakeem general hospital and Al-Zahraa' teaching hospital (Figure 2).

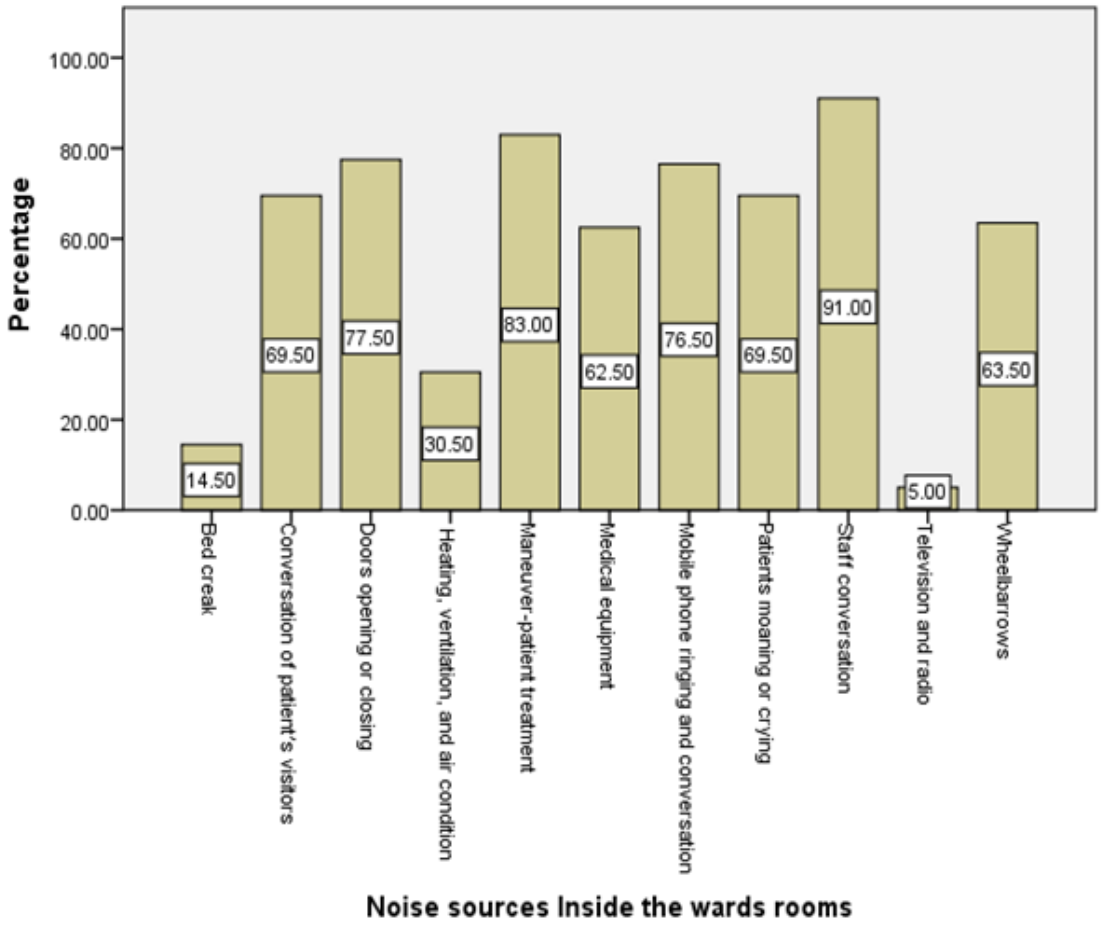

Figure (1) Sources of noise inside wards rooms in in three hospitals according to hospitals employees.

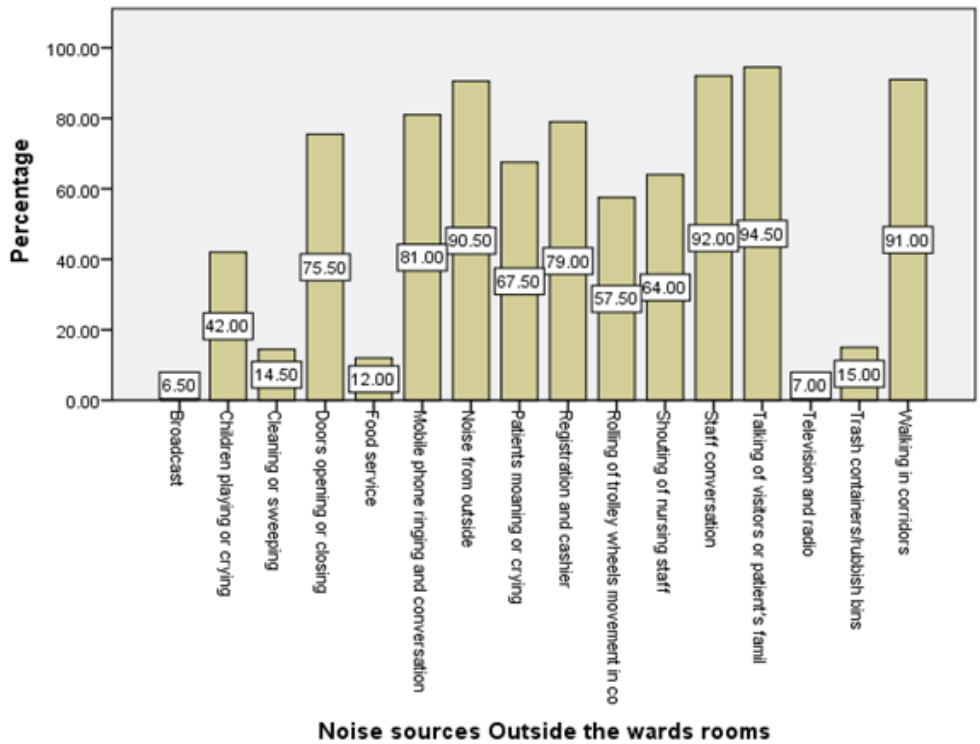

Figure (2) Sources of noise outside wards rooms in in three hospitals reported by hospitals employees.

Distribution of symptoms caused by noise in employees of three hospitals:

The study indicated that (32%) of respondents were headache by noise in hospitals (Figure 3). Moreover, the result also showed increment in percentages of vocal fatigue (31%), dizziness (30.5%), and feeling sick at the end of the workday (28.5%) in employees of three hospitals (Figure 3).

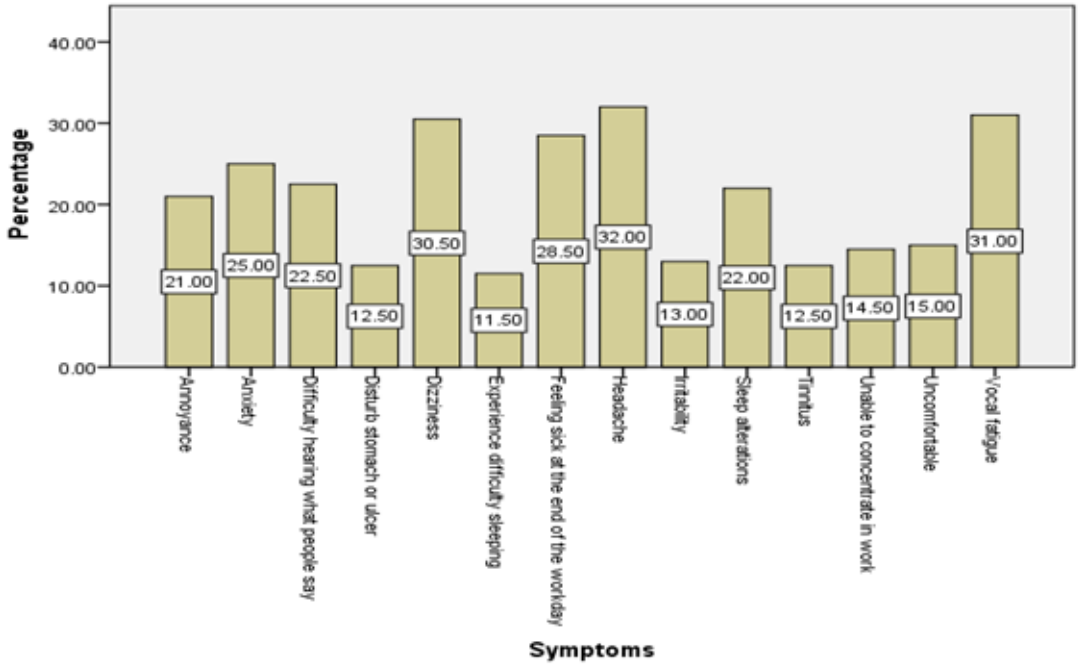

Figure (3) Frequency distribution of symptoms caused by noise in employees of three hospitals according to hospitals employees.

Discussion

Sound levels in hospitals:

The results recorded that the average A-weighted equivalent continuous sound levels (L_{Aeq}) in different locations of Al-sadr teaching hospital, Al-hakeem general hospital and Al-zahraa' teaching hospital were (62.80 $\pm$ 2.14, 61.50 $\pm$ 2.12 and 61.64 $\pm$ 2.11 dB respectively). In the present study, the mean equivalent noise levels observed on all wards exceeded the recommended WHO guidelines for hospitals [11].

Eivazzadeh, M. et.al. (2017) found the higher levels of noise in a emergency ward (69.65 ± 1.68) were linked to a higher the working procedure of this ward compared to other wards; Moreover, the data recorded that the highest mean L_{max} and L_{min} (94.43 and 50.43, respectively) in the emergency ward. This might be due to the emergency care unit does not have a fixe time for treatment activities and clinical operations take place on demand all day[12].

In addition, the result observed that no significant elevation in mean (L_{Aeq}) of Al-sadr teaching hospital during morning, afternoon, evening comparison with Al-zahraa' teaching hospital and Al-hakeem general hospital in the same period in the same period time. The findings agreed with results of previous study by [13] conducted a measurement of noise levels in Mosul medical city center teaching hospitals and concluded that the mean equivalent noise level (94.35 dBA) during morning time was higher than level (90.14 dBA) during afternoon. Furthermore, the study also recorded mean equivalent noise levels were higher on the weekdays (94.05 dBA) than on the weekend (88.57 dBA).

Pai, et.al. (2007) observed increase of noise level in the wards and locations was between 50.3 and 68.1 dB in Taiwan hospital which exceeded the suggested hospital ward sound level. The study also found The quietest units were the Surgical Intensive Care Unit and recovery rooms with a noise level lower than 50 dB during the night. Moreover, The higher noise levels were in the hall and pharmacy which were highly populated areas[14].

Sources of Sound levels in hospitals:

This study recorded that that the main sources of

noise in inside the wards rooms of hospitals Al-Sadr Teaching Hospital, Al-Hakeem General Hospital and Al-Zahraa' Teaching hospital were "staff conversation" (91%); "maneuver-patient treatment" (83%); "doors opening or closing" (77.5%); "mobile phone ringing and conversation" (76.5%) . Similar results obtained by [15] who found that the daily average sound levels measured inside these hospitals during daytime were between 52.6 and 64.6 decibels. They also reported that most nursing staff members expressed that "talking of visitors or patient's family members" is the major source of noise inside the wards, whereas "talking of visitors or patient's family members" and "children playing" are the two major noise sources outside the wards.

Furthermore, the study showed that the "talking of visitors or patient's family members in corridors" (94.5%) and "Staff conversation" (92%) were the major noise sources outside the wards rooms in hospitals Al-Sadr teaching hospital, Al-Hakeem general hospital and Al-Zahraa' teaching hospital. Similar findings were recorded by Similar results obtained [16] indicated that many studies have shown that noise levels in most hospitals in USA are much higher. They pointed out two general sources of noise in hospitals. The first one includes paging systems, alarms, bedrails, telephones, staff voices, ice machines, pneumatic tubes, carts, and noises generated by roommates. The second source includes the surfaces of the floors, walls, and ceilings which usually are hard and reflect sound rather than absorb it.

Distribution of symptoms caused by noise in employees of three hospitals:

The results indicated that (32%) of respondents were headache by noise in hospitals (Tables 1, and 2). Moreover, the type of noise health effects that most complained among employees were vocal fatigue (31%), dizziness (30.5%), and feeling sick at the end of the workday (28.5%). This finding agreed with [17] who measured noise level in different environments of a public hospital and to analyze its effects on staff from reporting complaints. The study results showed that the minimum sound level 52.5 decibels in the intensive care unit (NICU) and a maximum sound level 85 decibels in the emergency room. They also observed staff feel discomfort to loud sounds (74.4%) and (35.5%) feel sick after hours due to stress caused by noise that is produced by multiple devices combined with the sounds of alarms, works, visits and schedules conversation between the hospital employees.

Montes-González, et.al (2019) reported that one of the main hospitals in the Extremadura region (Spain) is presented here to allow a global assessment of the acoustic impact of outdoor sound sources. Taking into account the results obtained, the noise impact on this hospital is primarily influenced by three sound sources: road traffic, cooling towers of the hospital and the emergency helicopter[18].

Fillary, et.al. (2015) exposure to excessive noise is associated with sleep disturbance, and symptoms such as dizziness, confusion, fatigue, high blood pressure, digestive problems, heart arrhythmias and neuropsychological disturbances. Moreover, noise is considered as the most common cause of discomfort, imposes stress and disrupts communication[19].

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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