

# Noise at Egyptian Hospitals

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Environmental problems in hospitals are a serious issue. Here we will focus on one of these problems: Noise, There many noise sources inside and outside hospitals, for example all electromechanical equipment (HVAC system, Laundry...) inside the hospital. Outside the hospital is important also in this respect because the present of many sources as airplane fly over and traffic that cause a lot of high noise level inside the hospital, It can cause nuisance for doctor and hospital staff and more important to the patients.

People at hospitals need rest more than anyone else. The presence of noise can be very harmful to the patients.

Hospitals are intended to be places for the rest of ill or injured people. But Hospitals need a huge mechanical infrastructure, which contributes directly to the noise level inside the premises. Even day to day activity results in an extraordinary amount of noise such as from the impact of trays, hospital furniture, metal bed fixtures, conversation and TV. This noise is exacerbated because of the hard surfaces normally used in hospitals to limit bacterial growth. Sources of noise are not only from inside the hospital, but they also come from outside the hospital. Traffic around the hospital is important in this respect.

A series of noise level measurements at some of Cairo streets was done near or next some hospitals, and inside others and a comparison with the world health organization regulation shows the urgent need for a better working noise environments

A solution to this problem is discussed using a prediction code for traffic and a recommendation to minimize the noise sources inside and out said hospitals at the design stage is reviewed.

## 2-Introduction

Noise can roughly be defined as any unwanted and disturbing sound. The disturbance could be caused by the pitch or the loudness of the sound.

In the past few years pollution through noise has been raising rapidly, which threatens all the people subjected to high levels of noise.

Noise affects the human being physically, and psychologically.

Noise causes ear damage, hearing loss, speech interference annoyance and stress.

Noises also affect children, new born and even the embryo.

Our main concern now is noise in hospitals specially the crowded hospitals of Cairo.

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surfaces normally used in hospitals to limit bacterial growth. Sources of noise are not only from inside the hospital, but they also come from outside the hospital. Traffic around the hospital contributes generously to the sound level inside the hospital.

### **3-Literature survey**

Sound is of great value to humankind. Sound gives us the advantage of speech and language, which can calm, excite, or elicit joy or sorrow. But not all sound is desirable. Sounds that are valuable in one location may travel to places where they may not only serve no desirable purpose, but may interfere with and disrupt useful activities

#### **3-1-THE ECONOMIC IMPACT OF NOISE**

A 1971 study regarding the economic impact of noise could only definitively assess the economic costs of aircraft noise. Costs were found to occur in the of property easements, litigation, loss of industrial and residential property value, and insulation of the receiver (home or business) or the source (aircraft). Benefits from the abatement of aircraft noise are received by residential and industrial property owners as well as by airport operators and airlines. However, the article is careful to point out that since air travel is a major transportation mode necessary for a region's economic health, costly noise restrictions might retard economic development of that region.

The study found it difficult to assess the cost of noise within the home or from nearby freeways and streets because of a lack of verifiable data. [1-2]

In hospitals it is difficult to estimate the cost due to lake of statistical elements for patient and confidentiality in Egyptian hospitals.

#### **3-2-Sleep benefits**

Medical literature has verified what we all generally believe to be true-that sleep is beneficial and lack of sleep can produce negative health effects. As we age, sleep problems and disorders generally increase. Specifically, researchers have concluded that age-associated changes include increased difficulties in initiating or maintaining sleep at night, For residents in nursing homes, the problem is exacerbated because this population generally experiences more limitations on functionality, more depression, and higher rates of cognitive impairment-all factors that have been shown to disturb normal sleep patterns. In fact, one study found that sleep disturbance causes health deterioration and the likelihood of increased mortality for geriatric residents. Long term care providers are continually striving to improve sleep through best-practice models including methods to calm residents through tranquil environments, massage, and other methods of relaxation.

#### **3-3-Negative impact of noise at Hospitals**

According to U.S. Environmental Protection Agency [1], one of the main causes of sleep disturbance in hospitals and nursing homes is noise. The literature repeatedly shows that, for the general population, exposure to noise constitutes a health risk that includes the inducement of hearing impairments, hypertension and ischemic heart disease, annoyance, sleep disturbance, and decreased school performance. Related to interventions to improve sleep, long term care providers continually seek to improve the nursing home environment and have participated in efforts to abate controllable noise that is bothersome to residents-for example, turning off unused television sets and radios. Thus, the literature shows that persons receiving care in

health care facilities would not only benefit from the environmental health benefits of noise control, but also eliminate the primary cause of sleep disturbance[1-2]

### **3-4-Protection from Unreasonable Noise for Nursing Homes:**

GNHYHA (Greater New York Hospitals association) strongly recommends that the local law be amended to include nursing homes in the class of protected entities because nursing homes serve many individuals who are exceptionally frail and who experience the nursing home as an extended or permanent residence. Although the intensity of services is often not as high as in hospitals, nursing homes often serve frail individuals at a fairly high level of care for a much lengthier period of time. Aside from the level of frailty of persons in nursing homes, we remind the Committee that these individuals are residents, people who actually live at the facility and who require protection from unreasonable noise. Additionally, due to medical advances, many procedures formerly provided in hospitals can now be provided in sub acute care units located in the nursing home setting. Sub acute care includes services such as intense rehabilitation, severe wound care, and minor surgical procedures. [2] That similar to small private hospitals in Greater Cairo.

Children have been chosen as the focal point because children may be more vulnerable to noise than adults, because children have less control over their environments and daily situations than adults have and because legislation and policy have not traditionally focuses on the special needs of children.

Children's daily lives are full of noise and children make noise themselves. It is as if children are being brought up in noise and learn to regard noise as a normal situation. But noise can adversely affect children. The most well-known and most serious consequences of noise are hearing damage and tinnitus. Noise can also provoke a stress response in children that includes increased heart rate and increased hormone response. Noise can disrupt sleep and thus hinder needed restoration of the body and brain. Noise can negatively affect children's learning and language development, can disturb children's motivation and concentration and can result in reduced memory and in reduced ability to carry out more or less complex tasks.

Even before birth, a foetus can be harmed by the pregnant woman's occupational noise. A premature infant may spend time in an incubator in a room with noise machinery and can be surrounded by noise in hospitals. Children need to be able to find peace and quiet. The adults are responsible for establishing settings that can support children's needs and protection of children's health by legislation, standards and behavior modifications should be based on knowledge on the harmful effects of noise on children

The other hospital staffs are subject to high noise level specially people work at the noisy machine area. [3-4]

Patients of two hospitals in Belo Horizonte (BH) Brazil were questioned on the eve of discharge to evaluate the sleep conditions related to noise. Patients had a worse perception of sleep at University Hospital, whose subject to sound pressure level of  $Leq=53.7$  dB(A) and it was greater than the one at Baleia Hospital of  $Leq=45.5$  dB(A). Noise was the only sleep-disturbing factor to be statistically significant. [4]

The quality of sleep is frequently impaired by the excess of noise of the modern society, and in overpopulated cities it needs to be better characterized, especially for patients in hospitals, because it is assumed to be important for patient's recovery.

The main objective of the Technical Initiative of FINCE, is to develop recommendations For schoolroom acoustical criteria, including practical knowledge

of the costs and benefits of noise and reverberation control, in order to optimize acoustic environment, the aim of these recommendations is to provide acoustical and noise control guidance to educational space designers and builders, and to those who influence national Codes for schoolroom design [5]. A similar code is in need for the Egyptian hospitals especially for greater Cairo

New infrastructure influences the surroundings. It is important to study the possible side effects on the Environment. These effect studies support the decision making process. Based on these studies, the design with minimal effects on the environment can be selected and measures can be schemed by which the influence on the Environment noise is reduced.

Noise contours can be generated based on the interpolated spatial noise model. Noise contours are isolines connecting locations with equal noise levels. The Dutch acoustic software and others packages also offer the possibility to calculate noise contours for a specified area [6]

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#### **4-Measuring techniques**

A standard sound level meter B&K 2260 used for the measurements

For outside hospital measurements was taken at two position one to represent the main Road noise and the second for background noise and the hospital lies between the two positions, Measurements was taken for 24 hour in both positions for six locations around different area at Greater Cairo.

For inside position one reading for each location represents the noise level at this position

#### **5-Results and finding**

The measurement results is divided into two main categories

##### **5-1-Outside hospitals**

Table 1 : NOISE LEVELS AT SURVEY LOCATIONS [A] FOR DAY, NIGHT AND EVENING

Max. Permissible noise level limits by Egyptian	Day	Evening	Night
Residential Areas including some workshops or commercial businesses or on public roads	7 am - 6 pm	6 pm - 10 pm	10 pm - 7 am
	50 - 60 dB(A)	45 - 55 dB(A)	40- 50 dB(A)
Shoubra St. South of El Khalafawi Sq. next to Shobra Hospital	74.0	73.8	68.1
El Orooba St. Near Military Academy Near military hospitals (officers)	73.1	72.6	70.3
Bab El Shairiyya Sq. of El-Rahma Hospital and Saeed Galal Hospitals	73.1	75.2	67.3
El Nasr St. East of El Nozha St. near Hassabo Hospital and Petroleum Hospital	76.6	74.2	72.8
Fum El-Khalig next to el Qasr Al Ayni Hospital	67.7	66.5	61.4
Cornish Road North of El Moneeb Bridge near El-Salam Hospital	74.4	73.9	73.0

Note 1 : Noise Levels in dB(A);  $L_{AFeq}$  : average over time periods "day", "evening" and "night"

Table 2 : NOISE LEVELS AT SURVEY LOCATIONS [B] FOR DAY, NIGHT AND EVENING

	Day	Evening	Night
Residential Areas in the City	7 am - 6 pm	6 pm - 10 pm	10 pm - 7 am
	45 - 55 dB(A)	40 - 50 dB(A)	35 - 45 dB(A)
Shoubra St. South of El Khalafawi Sq. next to Shobra Hospital	67.8	63.7	56.3
El Orooba St. Near Military Academy Near military hospitals (officers)	61.5	61.3	52.9
Bab El Shairiyya Sq. of El-Rahma Hospital and Saeed Galal Hospitals	69.2	67.7	67.9
El Nasr St. East of El Nozha St. near Hassabo Hospital and Petroleum Hospital	64.9	65.3	57.2
Fum El-Khalig next to el Qasr Al Ayni Hospital	68.0	65.4	57.1
Cornish Road North of El Moneeb Bridge near El-Salam Hospital	67.1	64.9	57.7

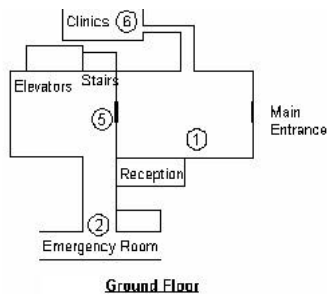
Note 1 : Noise Levels in dB(A);  $L_{A_{F_{eq}}}$  : average over time periods "day", "evening" and "night"

Table 3: Max Noise level at the specified location and the Traffic Noise Index (TNI)

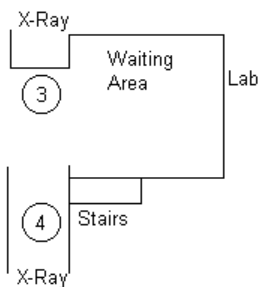
Location		Maximum $L_{A_{F_{eq}}}$	Time	TNI
Shoubra St. South of El Khalafawi Sq. next to Shobra Hospital	A	<b>76.8</b>	14:00:00	75.1
	B	<b>74.2</b>	7:06:50	64.6
El Orooba St. Near Military Academy Near military hospitals (officers)	A	<b>73.9</b>	8:00& 15:00	70.2
	B	<b>65.3</b>	20:08:00	64.0
Bab El Shairiyya Sq." of El-Rahma Hospital and Saeed Galal Hospitals	A	<b>78.0</b>	19:53:52	70.5
	B	<b>76.7</b>	12:27:50	77.2
El Nasr St. East of El Nozha St. near Hassabo Hospital and Petroleum Hospital	A	<b>79.8</b>	15:00:00	76.4
	B	<b>76.8</b>	19:12:04	64.8
Fum El Khaleeg Sq. next to el Qasr Al Ayni Hospital	A	<b>81.8</b>	17:00:00	57.4
	B	<b>73.1</b>	13:13:38	73.9
Cornish Road North of El Moneeb Bridge near El-Salam Hospital	A	<b>79.3</b>	18:23:12	69.4
	B	<b>73.3</b>	8:08:02	65.8

### **5-2-Inside hospitals**

The Sound pressure level of the following three hospitals was measured, at different locations inside the building:



? El Nozha Hospital



Base Floor

**Figure (1) shows the Measured Locations inside El-Nozha Hospital**



Figure (2) shows Surrounding neighborhood of El-Nozha Hospital

Point	$L_{Aeq}$	$L_{max}$	Location
1	59.1	67.9	Entrance (Reception)
2	57.8	66.8	Emergency Section
3	63.2	71.2	X-Ray –area (A)
4	66.4	68.3	X-Ray –area (B)
5	62.8	65.4	Ward
6	63.7	70.4	External clinic

?. **Heliopolis Hospital**

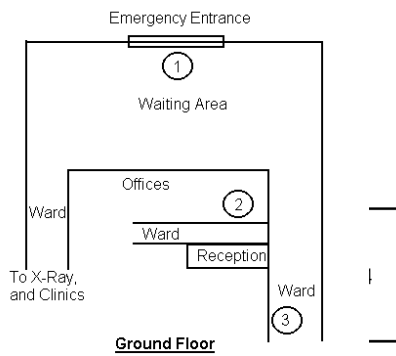


Figure (3) shows Measured Locations inside Heliopolis Hospital



Figure (4) shows Surrounding Neighborhood of Heliopolis Hospital

Point	$L_{Aeq}$	$L_{max}$	Location
1	64.3	74.7	Emergency Entrance inside

2	71	82.3	Emergency area
3	59.8	73.9	Entrance for award
4	60.2	68.4	Main hall of ward
5	63.2	70.8	Inside 1 <sup>th</sup> floor ward
6	60.9	70.4	Inside 2 <sup>rd</sup> floor ward
7	60.7	61.6	Inside 1 <sup>rd</sup> floor ward
8	56.3	70.1	Main hall ward

iii. Manshyet El-Bakry Hospital Results



Figure (5) shows Surrounding Neighborhood of Mansheyet El-Bakry Hospital

Point	L <sub>Aeq</sub>	L <sub>max</sub>	Location
1	70.2	80.7	Emergency Entrance
2	80.8	86	Kitchen area outside
3	63.8	71.5	Inceptor area Entrance
4	52.6	57.1	Children Ward 1, no patients
5	68.4	77.8	Inside children room, no patients
6	52.1	58.7	Children ward 2, no patients
7	50.7	57.6	Children ward 3, no patients
8	59.5	69.8	Main children ward empty

The above results both inside and out said hospitals show clearly that the noise level in all mention hospitals above the Egyptian and world health organization limits.

## **6-Solution**

For inside

- 1-Building code for Egyptian hospitals should include a target specification of about Nc25 or similar to satisfy the required noise by the world health organization of about 30-35 dB (A) inside the building
- 2- All electromechanical equipments such as (HVAC system- Laundry) should checked for noise performance and good maintenance system applied.

For outside

- 1-Recheck at the design stage that the building designs away from the direct impact of the traffic noise and city noise and well away distance from the road (green area) a computer prediction code can be useful in this respect
- 2- It may required Design The suitable acoustic barrier
- 3-Review of the current legislation for the noise pollution in Egypt

But for exciting hospitals some measure could b e taken to improve the patinas environment as follows

1. Reduce the amount of sound energy released by the noise source using noise control technology.
2. Divert the flow of sound energy away from the worker by well known technology.
3. Protect the receiver from the sound energy reaching him/her.
4. Proper maintenance of electromechanical equipment, equipment replacements.
5. Revised operating procedures, equipment redesign, enclosures and Barriers
6. Acoustical shields and barriers.

## **7-Conclusion and Recommendation**

- 1- Noise level at the Egyptian hospitals very high to the national and international standard something should be done about it
- 2- The Current legislation for traffic noise not completed
- 3- Awareness program is needed for that
- 4- The problem can be solved using a known noise control technology

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## 9- Appendixes

### Appendix (1) Egyptian Law of Environment and World health organization limits for noise

TABLE 1 Maximum permissible limits for noise level in different zones

TYPE OF Z ONE	PERMISSIBLE LIMITS FOR NOISE LEVEL DECIBEL (A)					
	DAY		EVENING		NIGHT	
	from	to	from	to	from	to
Commercial, administrative and downtown area.	55	65	50	60	45	55
Residential areas including some workshops or commercial businesses or on public roads.	50	60	45	55	40	50
Residential areas in the city.	45	55	40	50	35	45
Residential suburbs having low traffic flow.	40	50	35	45	30	40
<b>Rural residential areas (Hospitals and gardens).</b>	<b>35</b>	<b>45</b>	<b>30</b>	<b>40</b>	<b>25</b>	<b>35</b>
Industrial areas (Heavy Industries).	60	70	55	65	50	60

**Guideline values for community noise in specific environments. by World health organization [7].**

Specific environment	Critical health effects	$L_{Aeq}$ [dB(A)]	Time base [hours]	$L_{Amax}$ fast [dB]
Hospital, ward rooms, indoors	Sleep disturbance, night-time	30	8	40
	Sleep disturbance, daytime and evenings	30	16	-
Hospitals, treatment rooms, indoors	Interference with rest and recovery	As low as possible		

In hospitals during nighttime, the recommended guideline values for wardrooms should be 30dB LAeq together with 40 dB LAmax. Since patients have less ability to cope with stress, the equivalent sound pressure level should not exceed 35 dB LAeq in most rooms in which patients are being treated, observed or resting.