

Noise Pollution in Sensitive Zone and its Effects: A Review

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Abstract: Noise pollution in the present decade has been a noteworthy supporter to an undesirable living environment inside an urbanized city. In recent times, inhabitants from sensitive zone units such as hospitals and schools etc. are much influenced by noise pollution. Over the period activities such as migration to and from urban areas, infrastructural developments etc. have essentially increased inside the sensitive zones. Various research studies have checked sound levels altogether over as far as possible in sensitive zones have shown noise as a critical pollutant in numerous urban communities around the globe. Noise pollution in sensitive zones has increased too as being a part of urban area and needs to be controlled being more vulnerable to its pollution impacts. In this review study, impacts of noise levels in healing facilities and education centers are distinguished, its effect on inmates in these zones is concentrated on and expressed. The review paper implies the need to control noise levels in the sensitive zones for a superior domain.

Keywords: Noise pollution, Sensitive Zones, WHO, Noise standards.

I. INTRODUCTION

Advancement from recent decades has made individuals to be aware of sounds as could be permitted wellsprings of danger. Noise, defined as unwanted sound, is a pollutant whose effects on health have been neglected, despite the ability to precisely measure or calculate exposure from peak level or energy averaged over time [1].

High noise levels are sound levels which are undesirable sound usually and above the prescribed standard limits of various agencies. Exposure to high noise levels are very well known to have harmful effects on health and well-being of human beings. Noise is a well-known source of pollution in urban and work environments. Sound pressure levels in urban environments have produced harmful effects on people's health [48].

The World Health Organization [14] considers noise to be a danger variable for poor health and a noteworthy issue of the present decade. It is collectively acknowledged that the medical facility encompassing environment influences patient's perspective when they are conceded and treated in these spots [25].

To create a healing environment in the hospitals is crucial and more prominent than any time in recent memory consideration now being paid towards the encompassing physical medicinal services environment, including the effect of sound. Noise is again and again an extremely regular protest by patients and staffs, yet very little has been carried out to decrease healing center noise.

The noise levels in the hospitals are caused both by the use of hospital equipment's, and the environmental noise around hospitals. In urban areas, the main noise sources are transportation and industry [2].

In developing nations with the increment in the development movement and vehicular populace raising step by step, the residents of urban communities are encountering extreme natural issues that outcome from development exercises among the day time and street activity in the peak hours, which is mainly from Automobiles.

Noise during road traffic hours has become a significant source of environmental pollution in sensitive zones and it has harmful effects on human beings.

Although it is very important for the hospitals and vicinity to be silent for patients in order to have a peaceful treatment. Similarly, noise around the learning environments affects the learning abilities.

II. LITERATURE REVIEW

Unfortunately, various contextual investigations let us know that noise levels inside hospitals and schools are much higher than the norms. Since the 1960s the noise levels inside healing facilities have expanded by a normal of 0.38 dB[A] [day] and 0.42 dB[A] [night] every year [17].

Additionally literature look on related journals showed that the issue of high noise levels in hospitals and schools is around the world, with reports from different nations, for example, United Kingdom, India, Brazil, Greece, Taiwan and Turkey [26-30].

A. *Developing Countries*

In economically developing countries such as Brazil, India and China, rising levels of noise pollution are associated with the accelerated growth of cities and the increasing circulation of automotive vehicles [48].

Here are few instances of noise in sensitive zones of developing nations around the globe.

1) Hospitals:

A study was conducted in a 222 bed hospital of Parana a state of Brazil and found a mean value of 63.7 dB [A], which exceeds the maximum allowed values agreement with the World Health Organization [1993] that recommends a noise level up to 40 dB [A] for the day shift and 35 dB [A] for the night shift in hospitals [28]. A noise map of Konya [Turkey] city hospitals was prepared and found a similar type of problem [42]. Researchers [19-23] subscribe to the comparative conclusion expressing that in Indian urban communities vehicular activity is the major source of noise. Patients in these sensitive areas are affected by the vehicular noise.

Here, it is very important to understand the fundamentals that the decibel is a unit for measuring sound pressure intensities or loudness levels based on a logarithmic scale. Then again, concerning human listening to, a 10 dB[A] build would be seen sound as a rough multiplying of uproar. Hence, a 60 dB[A] sound is seen as roughly four times as noisy as a 40 dB[A] sound, although having a pressure level 100 times higher.

With the above some examples of the studies the danger with respect to noise in the hospitals on patients and staff can be imagined, since the noise levels on an average are 30 to 40 dB[A] higher than the World Health Organization [WHO] guidelines.

2) Schools:

The outside noise level in schoolyards should not surpass LAeq 55 dB, while empty classroom noise levels should not surpass LAeq 35 dB[15]. Researchers obtained background noise levels in classrooms as far and wide as possible generally surpass 35 dB[A] [37, 38, 41]. The measured school noise level was ranging between 61.3 dB and 73.2 dB [47].

Noise levels in schools of Cairo [Egypt] were due to high traffic noise levels, from adjacent main roads, which made a significant contribution to the noise levels of classrooms [38].

Noise monitoring in sensitive zones of an industrial town i.e Asansol, India which consisted of educational institutions, court, religious places and health establishments. The daytime Leq value which they reported ranged from 60.8 to 85.6 dB[A] whereas night time Leq value ranged from 54.0 to 73.8 dB[A] [11]. Now, again all these values exceed the maximum limits in sensitive areas.

They observed traffic congestion was higher in all the locations. They also mentioned that locations of the entire educational and health establishment in the area were adjacent to the arterial transport route of the city.

This may be one of the major reason of such high noise levels in these areas [11].

Noise monitoring was carried out in residential, industrial, sensitive and commercial areas of central Mumbai, India and found the problem of high noise levels, as the levels were above 79 dB, which is 29 dB more than Indian noise regulation standards in sensitive areas. The sensitive areas were affected by noise pollution mainly due traffic movement and also continuous movement of school buses on nearby roads [4].

A study carried out in Guangzhou Higher Education Mega Center, located on Xiaogwei Island in Panyu District, Guangzhou, China evaluated that most of the traffic noise values were above 60 dB in the study area.

Noise value of all the roads were on an average 61.16 dB, which suggests that the traffic noise pollution is serious [3].

B. Developed Countries

Here are few cases of noise in sensitive areas of developed countries around the globe.

1) Hospitals:

Traffic noise was ranked second among the selected environmental stressors in terms of public health impact in six European countries in a European commission Report 2011, where preliminary results from Environmental Burden of Disease [EBD] in Europe project, which was presented at WHO ministerial conference held in Parma in March 2010. Further, the trend is that noise exposure is increasing in Europe compared to other stressors [e.g. exposures to second hand smoke, dioxins and benzene], which are declining [49].

Sound levels inside hospitals were found ranging from 60 to 70 dB[A] with peaks of around 90 dB[A], the same to a busy motorway. Now, such a high noise in hospitals can have errors by hospital staff and have serious implications for patient well-being [12].

2) Schools:

A noise study was carried out in two public schools in Valencia, Spain. Schools were exposed to excessively high road traffic noise levels while the other was located in a relatively quiet area. The socio economic level of those attending the schools was very similar.

A set of external and internal noise measurements were carried out, along with two different attention tests among the children. Test results were consistently better in the quiet school. Exposure to high traffic noise levels in the noisy school over the whole school year was likely determinant of the results [33].

London's primary schools external noise influenced the internal environment when children were engaged in quiet activities [37].

III. HARMFUL EFFECTS OF NOISE

People living in heavily trafficked inner city are also experience more of the other adverse health effects of car use such as noise pollution, congestion, stress and severance of communities by roads. Less affluent districts tend to be concentrated in areas with a higher density of roads and traffic and this can lead to impaired air quality, higher noise levels and higher injury rates [6].

In many cities poorer people are most likely to live in neighbourhoods affected by traffic or noise, and those close to major transport infrastructure causing community severance [7].

A. Hospitals

1) *Sleep Disturbance:*

Mental well-being is of worldwide concern, and it is evaluated that one in every four worldwide will be influenced by a mental issue at some phase of life [13]. The World Health Organization [15], Geneva, Guidelines for Community Noise, recommended that noise in hospitals everywhere throughout the world is a typical stressor and is perceived as a genuine wellbeing risk and not generally as an annoyance. The World Health Organization [WHO] has drawn up guidelines to promote a community noise management plan and to decrease the impacts of noise on wellbeing. As per these rules, the noise levels inside hospitals should not surpass 30 dBA.

Continuous sleep is the most vital necessity for good physiological and mental working of a sound life, and sleep disturbance influence is thought to be a noteworthy impact of noise [25]. From the above articulation it can be presumed that if a patient doesn't sleep for the obliged time then the patient is physiologically and rationally aggravated likewise with the sickness the patient is enduring. This physiological and mental aggravation may exasperate the real illness for which he is accepting the treatment in the clinic.

2) *Psychological Problems:*

Noise pollution is a major environmental problem, and some estimated 10 millions of people in Europe are exposed to the excessive traffic noise, which may cause stress, illness and even fatal impact [10]. Different scientists subscribes to the comparable supposition that disturbance and sleep disturbance influences are the most across the board and decently recorded subjectively reported impacts of noise[34-36], yet morning tiredness, cerebral pains and milder mental conditions have likewise been accounted for to be connected with noise in adult population[13].

Public transport at daytime and night is significant and independent predictor of high noise annoyance [9]. Uncertainty and delays, constant traffic noise outside the home, and inability to access social services and support can all contribute to stress.

In addition to causing stress, noise pollution can also directly affect health by causing sleep deprivation and annoyance [7]. The association between the noise level and self-reported treatment of hypertension was stronger in subjects that reported a higher annoyance due to road traffic noise [8].

3) *Physiological Problems:*

Noise, characterized as undesirable sounds, could influence individuals both mentally and physiologically [16]. The essential listening to system of the ear cochlea is the correspondence of sounds to mind by the little hair cells.

Extreme sounds harm these cells, some of the time past recuperation because of prolonged exposure to sounds [31]. European commission, [49] mentions in their report that the evidence from epidemiological studies on the association between exposure to road traffic and aircraft noise and hypertension and ischaemic heart disease has increased during recent years.

Road traffic noise has been shown to increase the risk of ischaemic heart disease, including myocardial infarction. Both road traffic noise and aircraft noise increase the risk of high blood pressure. Exposure to residential road traffic noise was associated with a higher risk for stroke among people older than 64.5 years of age [5].

Exposure to excessive noise amid pregnancy may bring about high-recurrence listening to misfortune in new-borns, rashness, intrauterine development impediment, cochleae harm, interruption to the ordinary development and advancement of untimely babies [32]. Negative impacts of noise are connected with a patients expanded levels of anxiety [18].

B. Schools

High noise levels can negatively affect the performance of both teachers and pupils. Children are particularly vulnerable to the effects of noise because of its potential to interfere with learning at a critical development stage.

Furthermore, children's abilities to anticipate, understand, and cope with stressors are less developed than those of adults [33].

High background noise levels in occupied classrooms was long identified as factors negatively affecting the academic performance of students [39,33]. Children in the noisier areas had elevated resting systolic blood pressure and overnight urinary cortisol.

Children from noisier neighbourhoods also evidenced elevated heart rate reactivity to a discrete stressor reading test in the laboratory and rated themselves higher in perceived stress symptoms on a standardized index. Girls, but not boys, evidenced diminished motivation in a standardized behavioural protocol[40].

IV. STANDARD LIMITS OF NOISE FOR SENSITIVE AREAS IN DEVELOPED & DEVELOPING PART OF GLOBE

Table 1. Comparison of Standard Limits of Noise for Sensitive Areas [43, 44, 45, 48]

| Countries | Category of Area | Day time | | Evening time | | Night time | |
|-----------|------------------|---------------|---------------|--------------|--------|---------------|---------------|
| | | Hospital | School | Hospital | School | Hospital | School |
| India | D - Silence Zone | 50 | 50 | - | - | 40 | 40 |
| USA | - | - | 45* | - | - | - | 45* |
| Brazil | -# | 55 | 55 | 50 | 50 | 45 | 45 |
| Japan | AA | 50 dB or less | 50 dB or less | - | - | 40 dB or less | 40 dB or less |

*- LAeq [24] - It is a 24 hour equivalent A- weighted sound level.

#-Noise immission limits Leq in dB[A] Strictly Residential Area, Parks, Hospitals.

AA-Area category AA shall be applied to areas where quietness is specially required, such as those where convalescent facilities and welfare institutions are concentrated.

Table 2. Comparison of Timings [43, 44, 45, 48]

| Countries | Day time | Evening time | Night time |
|-----------|----------------------|----------------------|-----------------------|
| India | 6:00 A.M.-10:00 P.M. | - | 10:00 P.M.- 6:00 A.M. |
| USA | - | - | - |
| Brazil | 7:01 A.M.-7:00 P.M. | 7:01 P.M.-10:00 P.M. | 10:01 P.M.-7:00 A.M. |
| Japan | 6:00 A.M.-10:00 P.M. | - | 10:00 P.M.- 6:00 A.M. |

Table 3. Recommended Noise Standard Limits by World Health Organization [WHO, 1999] [46]

| Specific environment | Critical health effect[s] | LAeq [dB] | Time base [hours] | LAm _{ax} , fast [dB] |
|--|---|-----------|-------------------|-------------------------------|
| School class rooms and pre-schools indoors | Speech intelligibility, disturbance of information extraction, message communication. | 35 | During class | - |
| Pre-schools bedrooms, indoor | Sleep disturbance | 30 | Sleeping-time | 45 |
| School, playground outdoor | Annoyance [external source] | 55 | During play | - |
| Hospital, ward rooms, indoors | Sleep disturbance, night-time | 30 | 8 | 40 |
| | Sleep disturbance, daytime and evenings | 30 | 16 | - |
| Hospitals, treatment rooms, indoors | Inference with rest and recovery | #1 | - | - |

#1: as low as possible

V. MITIGATION MEASURES

Table 4. Recommended Noise Management Measures by World Health Organization [WHO, 1999] [15]

| Legal measures | Examples |
|---|---|
| Control of noise emissions | Emission standards for road and off-road vehicles, emission standards for construction equipment, emission standards for plants, national regulations |
| Control of noise transmission | Regulations on sound-obstructive measures |
| Noise mapping and zoning around roads, airports, industries | Initiation of monitoring and modeling programmes |
| Speed limits | Residential areas, hospitals |
| Enforcement of regulations | Low Noise Implementation Plan |
| Minimum Requirements for acoustical properties of buildings | Construction codes for sound insulation of building parts |
| Engineering Measures | |
| Emission reduction by source modification | Tyre profiles, low-noise road surfaces, changes in engine properties |
| New engine technology | Road vehicles, aircraft, construction machines |

| | |
|---|---|
| Transmission reduction | Enclosures around machinery, noise screens |
| Orientation of buildings | Design and structuring of tranquille, using buildings for screening purposes |
| Traffic management | Speed limits, guidance of traffic flow by electronic means |
| Passive protection | Ear plugs, ear muffs, insulation of dwellings, façade design |
| Implementation of land-use planning | Minimum distance between industrial, busy road and residential areas, location of tranquility areas , separating out incompatible functions |
| Education and information | |
| Raising public awareness | Informing the public on the health impacts of noise, enforcement action taken, noise levels, complaints |
| Monitoring and modeling of sound spaces | Publication of results |
| Sufficient number of noise experts | University or high school curricula |
| Initiation of research and development | Funding of information generation according to scientific research needs |
| Initiation of behavior changes | Speed reduction when driving, use of horns, use of loudspeakers for advertisements |

VI. CONCLUSION

The studies related to the noise in the sensitive area are reported to be more among the developing countries as compared to the developed countries. There is an urgent need of noise related studies particularly in the sensitive areas in the developing countries. Upon understanding the gravity of the severity of the noise levels, the effects on the inhabitants and surrounding can be better predicted. These studies will definitely help in controlling the noise levels and in turn the effects of the same on the surrounding population.

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