

“Noise Pollution & Human Health: A Review”

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Abstract: Noise pollution is a major problem in cities around the world. Noise is defined as unwanted sound. Environmental noise consists of all the unwanted sounds in our communities except that which originates in the workplace. Environmental noise pollution, a form of air pollution, is a threat to health and well-being. It is more severe and widespread than ever before, and it will continue to increase in magnitude and severity because of population growth, urbanization, and the associated growth in the use of increasingly powerful, varied, and highly mobile sources of noise. It will also continue to grow because of sustained growth in highway, rail, and air traffic, which remain major sources of environmental noise. In factory workplace workers are exposed to high noise due to machinery in routine. The potential health effects of noise pollution are numerous, pervasive, persistent, medically and socially significant. Noise produces direct and cumulative adverse effects that impair health and that degrade residential, social and working environment with corresponding real (economic) and intangible (well-being) losses. Noise represents an important public health problem that can lead to hearing loss, sleep disruption, cardiovascular disease, social handicaps, reduced productivity, negative social behaviour, annoyance reactions, absenteeism and accidents. It can impair the ability to enjoy one's property and leisure time and increases the frequency of antisocial behaviour. Noise adversely affects general health and well-being in the same way as does chronic stress. It adversely affects future generations by degrading residential, social, and learning environments with corresponding economic losses. The aim of enlightened governmental controls should be to protect citizens from the adverse effects of airborne pollution, including those produced by noise. People have the right to choose the nature of their acoustical environment; it should not be imposed by others.

Keywords: Annoyance; Cardiovascular disease; Hearing loss; Noise; Public Health; Urbanization

1. Introduction

Florence Nightingale recognized noise as a health hazard in 1859 when she wrote “Unnecessary noise is the most cruel abuse of care which can be inflicted on either the sick or the well” [5]. Noise pollution; an urban territorial phenomenon is assuming serious proportions in every city. The frequency and intensity of pollution has been increasing day by day [6]. Noise pollution is an annoyance to human beings. The noise is usually machine-created sound that disrupts activity or balance of human’s way of life. It is a growing environmental problem that is increasingly becoming an omnipresent, yet unnoticed form of pollution not only in developed countries but also in the developing countries. The word noise is derived from Latin word “Nausea” implying “unwanted sound” or sound that is loud, unpleasant or unexpected. It can be defined as wrong sound, in the wrong place and at the wrong time [3].

The noise problems of the past pale in significance when compared with those experienced by modern city dwellers; noise pollution continues to grow in

extent, frequency, and severity as a result of population growth, urbanization, and technological developments [5]. Due to exposure of noise people are suffering from different kinds of diseases like Hearing Impairment, Interference with spoken communication, Sleep disturbances, cardiovascular disturbances, Annoyance etc [1].

2. Adverse Health Effects of Noise

The WHO has documented seven categories of adverse health effects of noise pollution on humans. Much of the following comes from the WHO Guideline on Community Noise and follows its format. The guideline provides an excellent, reasonably up-to-date, and comprehensive overview of noise-related issues, as do the other recent reviews on this subject [2].

2.1 Hearing Impairment

Hearing is essential for well-being and safety. Hearing impairment is typically defined as an increase in the threshold of hearing as clinically assessed by audiometry. Impaired hearing may come from the workplace, from the community,

and from a variety of other causes (eg, trauma, ototoxic drugs, infection, and heredity) [5]. There is general agreement that exposure to sound levels less than 70 dB does not produce hearing damage, regardless of the duration of exposure. There is also general agreement that exposure for more than 8 hours to sound levels in excess of 85 dB is potentially hazardous; to place this in context, 85 dB is roughly equivalent to the noise of heavy truck traffic on a busy road. With sound levels above 85 dB, damage is related to sound pressure (measured in dB) and to time of exposure. The major cause of hearing loss is occupational exposure, although other sources of noise, particularly recreational noise, may produce significant deficits. Studies suggest that children seem to be more vulnerable than adults to noise induced hearing impairment [2].

Noise induced hearing impairment may be accompanied by abnormal loudness perception (loudness recruitment), distortion (paracusis), and tinnitus. Tinnitus may be temporary or may become permanent after prolonged exposure.^[1] The eventual results of hearing losses are loneliness, depression, impaired speech discrimination, impaired school and job performance, limited job opportunities, and a sense of isolation [6].

2.2 Negative Social Behaviour and Annoyance

Annoyance is defined as a feeling of displeasure associated with any agent or condition believed by an individual to adversely affect him or her. Perhaps a better description of this response would be aversion or distress. Noise has been used as a noxious stimulus in a variety of studies because it produces the same kinds of effects as other stressors. Annoyance increases significantly when noise is accompanied by vibration or by low frequency components [1]. The term annoyance does not begin to cover the wide range of negative reactions associated with noise pollution; these include anger, disappointment, dissatisfaction, withdrawal, helplessness, depression, anxiety, distraction, agitation, or exhaustion. Lack of perceived control over the noise intensifies these effects [4].

Social and behavioural effects of noise exposure are complex, subtle, and indirect. These effects include changes in everyday behaviour (eg, closing windows and doors to eliminate outside noises; avoiding the use of balconies, patios and yards; and turning up the volume of radios and television sets); changes in social behaviour (eg,

aggressiveness, unfriendliness, nonparticipation, or disengagement); and changes in social indicators (eg, residential mobility, hospital admissions, drug consumption, and accident rates); and changes in mood (increased reports of depression) [7].

Noise exposure per se is not believed to produce aggressive behaviour. However, in combination with provocation, pre-existing anger or hostility, alcohol or other psychoactive agents, noise may trigger aggressive behaviour [6].

The results of annoyance are privately felt dissatisfaction, publicly expressed complaints to authorities (although underreporting is probably significant), and the adverse health effects already noted. Given that annoyance can connote more than slight irritation, it describes a significant degradation in the quality of life, which corresponds to degradation in health and well-being. In this regard, it is important to note that annoyance does not abate over time despite continuing exposure to noise [2].

2.3 Interference with Spoken Communication

Noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, handicaps, and behavioural changes [1]. These include problems with concentration, fatigue, uncertainty, lack of self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships, and stress reactions. Some of these effects may lead to increased accidents, disruption of communication in the classroom, and impaired academic performance. Particularly vulnerable groups include children, the elderly, and those not familiar with the spoken language [6].

2.4 Sleep Disturbances

Uninterrupted sleep is known to be a prerequisite for good physiologic and mental functioning in healthy individuals. Environmental noise is one of the major causes of disturbed sleep. When sleep disruption becomes chronic, the results are mood changes, decrements in performance, and other long-term effects on health and well-being. Much recent research has focused on noise from aircraft, roadways, and trains. It is known, for example, that continuous noise in excess of 30 dB disturbs sleep. For intermittent noise, the probability of being awakened increases with the number of noise events per night [2].

The primary sleep disturbances are difficulty falling asleep, frequent awakenings, waking too early, and alterations in sleep stages and depth, especially a reduction in REM sleep [1]. Apart from various effects on sleep itself, noise during sleep causes increased blood pressure, increased heart rate, increased pulse amplitude, vasoconstriction, changes in respiration, cardiac arrhythmias, and increased body movement. For each of these, the threshold and response relationships may be different. Some of these effects (waking, for example) diminish with repeated exposure; others, particularly cardiovascular responses, do not. Secondary effects (so-called after effects) measured the following day include fatigue, depressed mood and well-being, and decreased performance. Decreased alertness leading to accidents, injuries, and death has also been attributed to lack of sleep and disrupted circadian rhythms [3].

Long-term psychosocial effects have been related to nocturnal noise. Noise annoyance during the night increases total noise annoyance for the following 24 hours. Particularly sensitive groups include the elderly, shift workers, persons vulnerable to physical or mental disorders, and those with sleep disorders [6].

2.5 Cardiovascular Disturbances

A growing body of evidence confirms that noise pollution has both temporary and permanent effects on humans (and other mammals) by way of the endocrine and autonomic nervous systems [7]. It has been postulated that noise acts as a nonspecific biologic stressor eliciting reactions that prepare the body for a fight or flight response. For this reason, noise can trigger both endocrine and autonomic nervous system responses that affect the cardiovascular system and thus may be a risk factor for cardiovascular disease. These effects begin to be seen with long-term daily exposure to noise levels above 65 dB or with acute exposure to noise levels above 80 to 85 dB. Acute exposure to noise activates nervous and hormonal responses, leading to temporary increases in blood pressure, heart rate, and vasoconstriction. Studies of individuals exposed to occupational or environmental noise show that exposure of sufficient intensity and duration increases heart rate and peripheral resistance, increases blood pressure, increases blood viscosity and levels of blood lipids, causes shifts in electrolytes, and increases levels of epinephrine, norepinephrine,

and cortisol. Sudden unexpected noise evokes reflex responses as well [4].

Cardiovascular disturbances are independent of sleep disturbances; noise that does not interfere with the sleep of subjects may still provoke autonomic responses and secretion of epinephrine, norepinephrine, and cortisol. These responses suggest that one can never completely get used to night-time noise [6].

Temporary noise exposure produces readily reversible physiologic changes. However, noise exposure of sufficient intensity, duration, and unpredictability provokes changes that may not be so readily reversible. The studies that have been done on the effects of environmental noise have shown an association between noise exposure and subsequent cardiovascular disease. Even though the increased risk for noise-induced cardiovascular disease may be small, it assumes public health importance because both the number of people at risk and the noise to which they are exposed continue to increase [2].

Children are at risk as well. Children who live in noisy environments have been shown to have elevated blood pressures and elevated levels of stress-induced hormones [1].

2.6 Disturbances in Mental Health

Noise pollution is not believed to be a cause of mental illness, but it is assumed to accelerate and intensify the development of latent mental disorders. Noise pollution may cause or contribute to the following adverse effects: anxiety, stress, nervousness, nausea, headache, emotional instability, argumentativeness, sexual impotence, changes in mood, increase in social conflicts, neurosis, hysteria, and psychosis [2]. Population studies have suggested associations between noise and mental-health indicators, such as rating of well-being, symptom profiles, the use of psychoactive drugs and sleeping pills, and mental-hospital admission rates. Children, the elderly, and those with underlying depression may be particularly vulnerable to these effects because they may lack adequate coping mechanisms. Children in noisy environments find the noise annoying and report a diminished quality of life [1].

Noise levels above 80 dB are associated with both an increase in aggressive behaviour and a decrease in behaviour helpful to others. The news media regularly report violent behaviour arising out of disputes over noise; in many cases these disputes

ended in injury or death. The aforementioned effects of noise may help explain some of the dehumanization seen in the modern, congested, and noisy urban environment [4].

3. Conclusions

The ultimate goal should be to identify ways to improve the acoustic environment, but generally only rudimentary measures (dBA) have been reported. These acoustic metrics may be overly simplistic for hospital environments [5]. Additionally, a number of “mechanism” studies evaluating changes in the acoustic environment are needed in order to optimize the effectiveness of acoustic or behavioural alterations [7]. We should prevent exposure of noise in working environment to save our precious life.

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References

- [1]. Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., THE LANCET, Volume 383, issue 9925(April, 2014), page 1325-1332.
- [2]. Berglund B, Lindvall T. (eds.) Community Noise. Archives of the Center for Sensory Research. 1995;2:1-195. This document is an updated version of the document published by the World Health Organization in 1995, (January 6, 2007).
- [3]. Firdaus, G., Ahmad, A., Noise Pollution and Human Health: A Case Study of Municipal Corporation of Delhi, Indoor and Built Environment, Sage Publications(2010).
- [4]. Goines, L., Hagler, L., Noise Pollution: A Modern Plague: Southern Medical Journal 2007, 100(3): 287-294
- [5]. Hsu, T., Ryherd, E., Wage, K., Ackerman, J., Noise Pollution in Hospitals: Impact to patients, Clinical Review-vol.19, No.7 (July, 2012), JCOM Journal
- [6]. Passchier, W., Passchier, W., Noise Exposure and Public Health, Environmental

Health perspective, Vol. 108, Supplemental (March, 2000).

- [7]. Singh, N., Davar, S., Noise Pollution-Sources, effects & Control, Journal of Human ecology, 16(3):181-187(2004).