

Noise Pollution is one of The Main Health Impacts in Big Cities Today

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Abstract

Noise pollution today is one of the biggest health risks in big cities along with air pollution. It must be admitted that noise pollution was overlooked by scientists and city authorities lately. Noise pollution has adverse effect on all living organisms. Scientists confirm that noise incentives central nervous system that stimulus to release some hormones which increases risk of hypertension. Hypertension is related with many other cardiovascular and cerebrovascular diseases like infarction and strokes. Nowadays this tendency is being changed at last and noise pollution is often considered not only as harmful as air pollution but sometimes even more. European and North American countries have taken a number of measures to reduce noise level in big cities. Examples of popular measures include replacement of older paved roads with smoother asphalt, better management of traffic flows and reducing speed limits to 30 km. per hour, using less-noisy models of transport, like electric vehicles, cycling and walking.

Key words: noise; pollution; health; traffic; aviation; vehicle; electric car; cycling; walking

Introduction

Noise pollution is a constantly growing problem in all big cities of the world. Many people may not be aware of its adverse impacts on their health. Noise pollution is a major problem both for human health and the environment [1, 2]. Long-term exposure to noise pollution can induce variety of adverse health effects like increasing annoyance, sleep disturbance, negative effects on cardiovascular and metabolic system, as well as cognitive impairment in children. Millions of people in big cities suffer from chronic high annoyance and sleep disturbance. It is estimated that school children suffer reading impairment as a result of aircraft noise. Despite the fact that noise pollution is one of the major public health problem in most big cities of the world there was a tendency of underestimating it making accent mostly on air pollution [3].

World Health Organization (WHO) guidelines for community noise recommends less than 30 A-weighted decibels dB(A) in bedroom during night for good quality sleep and less than 35 dB dB(A) in classrooms to allow good teaching and learning conditions. The WHO guidelines for night noise recommend less than 40 dB (A) Of annual average (L_{night}) outside of bedrooms to prevent adverse health effects from night noise.

According to European Union (EU) publication:

- about 40% of the population in EU countries is exposed to road traffic noise at levels exceeding 55 dB (A)

- 20% is exposed to levels exceeding 65 dB (A) during daytime and
- more than 30 % is exposed to levels exceeding 55 dB (A) at night

Some groups of people are more vulnerable to noise. For example, children spending more time in bed than adults are more exposed to night noise. Chronically ill and elderly people are more sensitive to disturbance. Shift workers are at increased risk because their sleep structure is under stress. Nuisance at night can lead to increased visits in medical clinics and extra spending on sleeping pills that effects families budgets and countries' health expenditure [4, 5].

Facts and Analysis

Adverse effect of noise is defined as a change in the morphology and physiology of an organism that results in impairment of functional capacity. This definition includes any temporary or long-term lowering of the physical, psychological or social functioning of humans or human organs. The health significance of noise pollution is given according to the specific effects: Noise-induced hearing impairment, Cardiovascular and physiological effects, mental health effects, Sleep disturbance and Vulnerable groups.

Noise-induced hearing impairment

The International Organization for Standardization (ISO 1999) standard 1999 gives a method for calculation noise-induced hearing impairment in populations exposed to all types of noise (continuous, intermittent, impulsive) during working hours. Noise exposure is characterized by L_{Aeq} over 8 hours (L_{Aeq} , 8h). In the standard, the relationships between L_{Aeq} , 8h and noise-induced hearing impairment are given for frequencies of 500-6000Hz and for exposure time of up to 40 years. These relations show that noise-induced hearing impairment occurs predominantly in the high-frequency range of 3000-6000Hz, the effect being largest at 4000Hz [6, 7].

Hearing impairment in young adults and children were assessed by L_{Aeq} on 24h time basis [7-9]. It includes pop music in discotheques and rock-music concerts [8]. Pop music through headphones [10, 11], music played by brass bands and symphony orchestras [11, 12]. There is literature showing hearing impairment in people exposed to specific types of non-occupational noise. These noises originate from shooting, motorcycling, using noisy toys by children, fireworks' noise [13, 14].

In Europe environmental noise causes burden that is second in magnitude to that from air pollution. At least 113million people are suffered from traffic-related noise above 55dB L_{den} that costs the EU about E57.1 billion an year. Additionally 22 million Europeans are exposed to railway noise, 4 million to aircraft and about 1 million to industrial noise. All these exposures to noise pollution causes about 1.6 million of life lost annually, about 12000 premature deaths and 48000 cases of ischemic heart diseases. About 22 million people suffer from chronic high annoyance and 6.5 million from sleep disturbance [15-17].

Cardiovascular and physiological effects

Laboratory studies of workers exposed to occupational noise and noisy streets, indicate that noise can have temporary as well as, permanent impacts on physiological functions in people. Acute noise exposures activate autonomic and hormonal systems, leading to temporary changes such as hyper-tension and ischemic heart diseases associated with long-term exposure to high sound pressure levels [7, 11, 18]. The magnitude and duration of the effects are determined in part by individual characteristics, lifestyle behaviors and environmental conditions. Sounds also evoke reflex responses, particularly when they are unfamiliar and have a sudden onset. The most occupational and community noise studies have been focused on the possibility that noise may be a risk factor for cardiovascular disease. Studies in occupational settings showed that workers exposed to high levels of industrial noise for many years at their working places have increased blood pressure and risk for hypertension, compared to workers of control areas [19, 20]. Cardiovascular adverse effects are associated to long-term exposure of L_{Aeq} , 24h. Values in the range of 65-70 dB or more, for both air and road-traffic noise.

Mental health effects

Environment noise accelerates and intensifies development of adverse effects on mental health by variety of symptoms, including anxiety, emotional stress, nervous complaints, nausea, headaches, changes in mood, increase in social conflicts, psychiatric disorders as neurosis, psychosis and hysteria [21- 32]. Noise adversely effects cognitive performance. In children environmental noise impairs a number of cognitive and motivational parameters [20, 22]. Two types of memory deficits were identified under experimental noise exposure: incidental memory and memory for materials that observer was not explicitly instructed to focus on during learning period. Schoolchildren in vicinity of Los Angeles airport were found to be deficient in proofreading and persistence with challenging puzzles [20]. It has been documented following exposure to aircraft noise that in workers exposed to occupational noise it adversely effects cognitive task performance. In children too environmental noise impairs a number of cognitive and motivational parameters in children too [21-24].

Sleep disturbance

Annoyance in populations exposed to environmental noise varies not only with the acoustical characteristics of the noise, but also with many non-acoustical factors of social, psychological, or economic nature [17, 7]. These factors include fear associated with the noise source, conviction that the noise could be reduced by third parties, individual noise sensitivity, the degree to which an individual feels able to control the noise.

At nights environmental noise starting at L_{night} levels below 40 dB, can cause negative effects on sleep such as body movements, awakenings, sleep disturbance, as well as effects on the cardiovascular system that becomes apparent above 55dB [24-27]. It especially concern vulnerable groups such as children, chronically ill and elderly people. All these impacts contribute to a range of health effects, including mortality. During the COVID-19 pandemic European cities experienced sufficient reduction in noise pollution due to reduced road traffic movement.

The WHO recommends reduction of road traffic noise levels to 53dB during daytime (L_{den}) and 45dB during the night (L_{night}). Though, the Environment Noise Directive (END) sets mandatory reporting for noise exposure at 55dB L_{den} and 50 dB L_{night} [26-28]. It means that we don't yet have accurate understanding of exact number of people exposed to harmful noise levels as defined by the WHO [5, 6].

Vulnerable groups

Vulnerable groups of people include people with decreased abilities like: people with particular diseases and medical problems; blind people or having hearing impairment; babies and small children; elderly and old-aged people. These people are less able to cope with impairments of noise pollution and are at greater risk to harmful effects. People with impaired hearing are most effected to speech intelligibility. From 40 years aged people demonstrate difficulties to understand spoken messages. Therefore, majority of this population can be belonged to vulnerable group of people. Children are also included in vulnerable group of noise exposure [29]. So, monitoring is necessary to organize at schools and kindergartens to protect children from noise effects. Specific regulations and recommendations should be taken into account according to types of effects for children like, communication, recreation, listening to loud music through headphones, music festivals, motorcycling, etc.

Conclusions

Our cities have already witnessed welcome period of unusual quiet during confinement periods due to Covid-19 pandemic, but noise pollution is rising again and in some cases even more than precrisis levels. It is clear that we cannot live without sound or noise and reducing noise pollution to zero level is unrealistic. However, we must work to make sure that noise be reduced to less harmful levels to environment and human health. Examples of measures include: installing road and rail noise barriers; optimizing aircraft movements around airports and urban planning measures. But the most effective actions to reduce exposure can be reduction of noise at source, namely by reducing number of vehicles, introducing quieter tires for road vehicles and laying quieter road surfaces. Anyway, it is unlikely that noise pollution will decrease significantly in near future and that transport demand is expected to increase. Air traffic noise is also predicted to increase along with city inhabitants. Effective measures against this situation can be raising awareness and changing people's behavior by using less-noise models of transport, such as electric vehicles, cycling and walking. Zero emission buses must be welcomed in big cities as well, as refuse collection trucks and municipal vans. Required infrastructure of safe cycling must be constructed in cities for safe cycling and available public bike fleet. Such types of transport as motorcycles and scooters must be banned in big cities because they produce the most terrible and loud noise that adversely

impacts on citizens. Municipalities and mayors of big cities must organized so-called quiet city areas, like commodity parks and other green spaces, where people can go to escape city noise.

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