

Editorial

# Noise: What is to be Done?

Mathias Basner

Editorial to accompany the articles:  
 „Aircraft Noise and the Risk of Stroke—a Systematic Review and Meta-Analysis“  
 and  
 „The Cardiovascular Effects of Noise“  
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Hearing loss is one of the most severe health effects of noise with 1.3 billion affected people worldwide (1). However, health effects of noise go far beyond hearing. The so-called non-auditory effects of noise include annoyance reactions of the exposed population, sleep disturbance, school children's learning impairment, and cardiovascular disease like an increased risk for hypertension and myocardial infarction. (2). According to the World Health Organization (WHO), circa 1.6 Million healthy life years are lost annually due to non-auditory effects of environmental noise in the Western European member states alone (3).

Noise is defined as „unwanted sound“. While the auditory effects are predominantly determined by noise level and exposure time, the circumstances of the noise exposure play a crucial role for the non-auditory noise effects. For example, patrons of a rock concert do not perceive the music as noise despite high sound pressure levels. In contrast, a person living three blocks away from the concert hall who cannot fall asleep because of the music perceives the music as noise despite much lower sound pressure levels. Sound is often perceived as noise if one has little control over it and feels at somebody else's mercy (4).

## Little doubt: Noise is an important risk factor for cardiovascular disease

The number of studies on the health effects of noise has increased considerably over the past few years. Even if high-quality studies are still missing for many noise sources and disease endpoints, there is little doubt among noise effects researchers that noise is an important risk factor for cardiovascular disease. One may thus ask why the prevention of noise-induced health effects does not play a more important role in politics. Several reasons may be responsible.

- We habituate to many things—including noise. However, the habituation is rarely complete, i.e., pathophysiological processes are still at work even if we no longer perceive noise as such. (5). Similar to the genesis of many other diseases, noise effects are also the result of cumulative processes, i.e., health impairment is the result of relevant exposure over long periods of time. Humans are markedly bad at connecting our present behavior with future outcomes. All these are possible reasons for why the strain imposed by suffering from noise does not exceed a critical level in the population, and why only some affected people actively fight those responsible for the noise. Even if

scientific studies constitute an important foundation for political decision processes: considerable pressure from the affected population is often a prerequisite for political change (6).

- The risk increases found in epidemiological studies are often comparatively moderate. Accordingly, in the meta-analysis of Weihofen et al. (7) the point estimate for an increased risk for stroke was 1.013 per 10 dB L<sub>DEN</sub> increase in aircraft noise exposure. Due to the large number of relevantly exposed persons even this small risk increase has public health relevance. However, the strength of an association is one of the classical epidemiological criteria for causality. The weaker the association, the greater the concern that unobserved confounders or other systematic biases could account for the observed effect. Accordingly, it is easy for those responsible for the noise emission to dismiss the epidemiologic evidence as insufficient.

- We also have a noise equity problem. Noisy areas are less attractive, less expensive, and therefore attract low-income residents with equally low political influence. This assures that noisy areas stay noisy and quiet areas stay quiet.

- Last and probably most important—noise not only produces victims: Patrons of a rock concert enjoy the music and do not want to miss out. Bikers love their loud exhaust systems. An airport is an important economic factor for a region and generates many jobs. It also brings many amenities for those who live close to it but not under the flight tracks. Thus, for each resident affected by noise another resident in favor of the noise source is quickly identified. This is why noise regulations always have to strike a fair balance (8).

## At what point is loud too loud? Critical role of noise effects research

The critical question is: When is loud too loud, i.e., at what noise exposure level are the basic rights for physical and psychological well-being violated? Noise-effects research plays an important role here. Reviews like the ones on the following pages can help evaluate the results of multiple studies. The review of Hahad et al. (9) shows that, despite some limitations, our knowledge on the cardiovascular health effects of noise has increased substantially since 2007. However, the quality of the studies could often be better. Accordingly, Weihofen et al. (7) assessed the quality of the studies contributing to their state-of-the-art meta-analysis as average to low.

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## Comparability of studies urgently needs to be improved

Missing standardization of both exposure and outcome variables complicates systematic reviews and constitutes a general problem in noise-effects research. As Weihofen et al. (7) remark correctly, more high-quality studies are urgently needed that include exposure metrics that go beyond average noise levels. Hopefully, this research need will be reflected in future funding for noise-effects research in Germany.

However, the fact that more studies are needed should not lead us to postpone the urgently needed protection of the population from noise. The knowledge we have acquired so far is sufficient to take preventive actions and substantiate them with the respective legal noise regulations (10).

### Conflict of interest statement

Dr. Basner received a honorarium from the World Health Organization (WHO) for preparing a literature review on the effects of noise on sleep. He received grants from the Federal Aviation Administration (FAA) to perform studies on the effects of aircraft noise on sleep. Dr. Basner is president of the International Commission on Biological Effects of Noise (ICBEN).

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