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Cardiovascular and Metabolic Effects of Long-term Traffic Noise Exposure

AKADEMISK AVHANDLING

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ABSTRACT

Traffic noise is an increasingly common environmental exposure affecting large parts of the European population. Since the auditory system is directly linked to the sympathetic nervous and the endocrine systems, noise may induce a stress response, influencing several physiological, metabolic and immunological processes. Previous epidemiological studies suggest harmful effects of traffic noise on the cardiovascular system; however, the overall picture is inconclusive. The primary aim of this thesis was to investigate the long-term effects of traffic noise on cardiovascular and metabolic outcomes. A secondary aim was to apply and evaluate digital noise maps produced in Sweden in accordance with the European Environmental Noise Directive (END) for assessments of residential traffic noise exposure.

The long-term effects of aircraft noise on hypertension, obesity and Type 2 diabetes were investigated using questionnaire and clinical data from a cohort within the Stockholm Diabetes Prevention Program. Aircraft noise exposure was assessed by Geographic Information Systems and based on the participants' residential history. After exclusion of subjects who used tobacco prior to the clinical examinations, the risk of hypertension related to aircraft noise exposure was increased in males (RR per 5 dB(A) L_{den} 1.21; 95% CI 1.05-1.39) but not in females (RR 0.97; 0.83-1.13). Stronger associations were seen among noise annoyed (RR 1.42; 1.11-1.82). Regardless of sex, long-term exposure to aircraft noise also showed statistically significant associations with waist circumference: 0.62 cm (0.54-0.70) per 1 dB(A) L_{den} . Also, females exposed at ≥ 50 dB(A) L_{den} had a twofold increased risk of Type 2 diabetes, although adjustments for contextual confounding reduced the estimates.

A sub-population of the National Environmental Health Survey 2007 (NEHS07) was used to evaluate the Swedish END maps of road traffic and railway noise. The observed proportion of annoyed subjects was plotted as a function of noise exposure and compared to already established exposure-response functions. Generally, there was a good agreement between observed and predicted proportions of annoyed, suggesting that the noise maps are useful for assessments of residential traffic noise exposure. The best agreement was found when the noise estimates derived from the maps were adjusted for how the dwellings were located within the buildings.

Cross-sectional analyses were performed based on the NEHS07 of associations between neighborhood traffic load, L_{den} levels of road traffic and railway noise, respectively, and prevalence of self-reported hypertension and cardiovascular disease. Neither traffic load nor road traffic noise was associated with the cardiovascular outcomes; however, there was a borderline significant association between railway noise and cardiovascular disease. Methodological limitations make these results difficult to interpret.

In conclusion, our findings suggest adverse effects of long-term traffic noise exposure on cardiovascular as well as metabolic outcomes. Thus, traffic noise may have detrimental public health effects and research in this area should be prioritized.