

Transportation noise and incidence of hypertension

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Summary

In this study, we examine the response to noise from road, railway and aircraft traffic in terms of incident hypertension. In the acute setting, noise may evoke increases of blood pressure and heart rate as well as increase the release of stress hormones such as adrenalin, noradrenalin and cortisol. With long-term exposure, this may elevate the risk of cardiovascular diseases, including hypertension. However, there is a lack of high-quality longitudinal data. In this cohort study, we followed 4,854 men and women from five municipalities in the Stockholm area for an average of nine years. Exposure to noise was assessed based on the residential history of our participants and data on hypertension were obtained from measurements, registers and questionnaires. We found a statistically significant increased risk of hypertension in relation to aircraft noise exposure (HR 1.16, 95% CI 1.08-1.24 per 10 dB L_{den}) but no associations for road traffic or railway noise. There appeared to be a particularly high risk among persons exposed to both aircraft and road traffic noise.

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1. Introduction and methods

A recent systematic review, performed within the framework of the development of new WHO Environmental Noise Guidelines for the European Region, examined the evidence of traffic noise and cardiovascular diseases, including hypertension [1]. Although there were tendencies of associations for all three traffic noise sources in cross-sectional settings, very few longitudinal analyses have been performed to confirm the associations. Here, we examine the association between long-term exposure to noise from road, railway and aircraft traffic and incidence of hypertension among 4,854 men and women taking part in the Stockholm Diabetes Preventive Program (1992-2006).

All participants were assessed with regard to noise exposure based on their residential history. The time-weighted average noise level at the most exposed façade of the buildings five years preceding the event was used as indicator of exposure. Information on diagnosis of hypertension was obtained from clinical examinations and questionnaires performed both at a baseline and a follow-up survey, approximately nine years apart. Furthermore, information from the National Patient Register was used to confirm the diagnosis. Information on potential individual and contextual confounders was also obtained through the questionnaires and registers. Cox regression models were used to compute Hazard Ratios (HR) and 95% confidence intervals (CI) of hypertension related to noise exposure.

2. Results

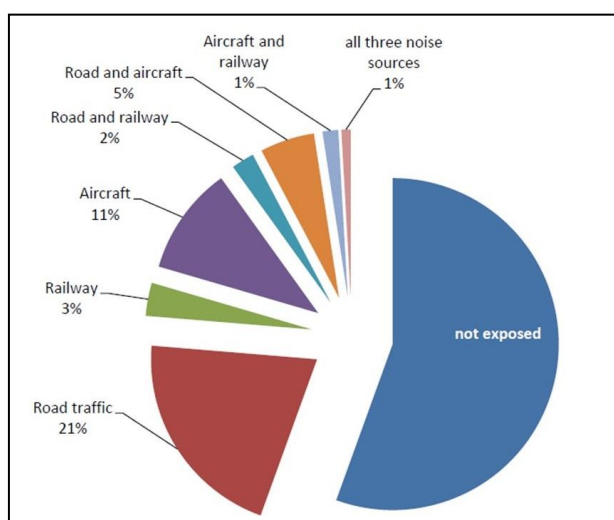


Figure 1. Percentage of persons exposed.

In total, 21 % of our participants were exposed to road traffic noise equal to or above 45 dB L_{den} , 11 % were exposed to aircraft noise and 3 % to railway noise (Figure 1). Some participants were exposed to more than one source of noise, for instance 5 % were exposed to both road traffic and aircraft noise.

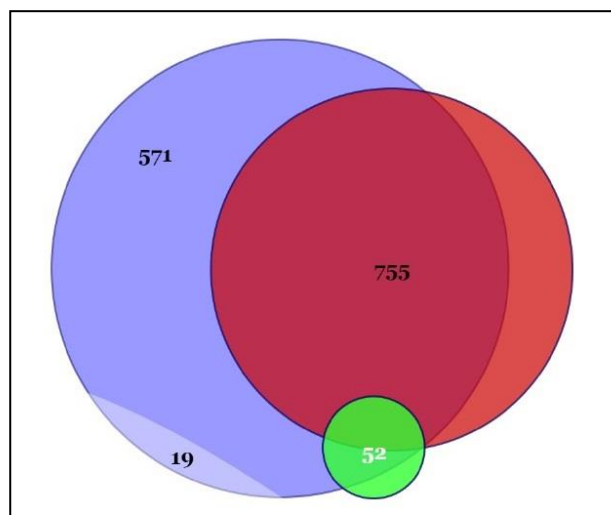


Figure 2. Identification of cases. Dark blue indicating measured blood pressure $\geq 140/90$ mmHg, light blue indicate self-reported treatment of hypertension, red indicate a physician diagnosis of hypertension and green indicate identification via the patient register.

In this study, we identified a total of 1,397 cases of hypertension, equal to 25 % of the study population (Figure 2). A majority, 755 cases were identified by self-reported doctors diagnosis of hypertension, also stating the year of diagnosis. The blood pressure measurements identified an additional 571 cases, 52 were identified from registers and 19 via self-reporting of treatment for hypertension.

The average 5-year aircraft noise exposure prior to an event was associated with an increased risk of hypertension (HR 1.16; 95 % CI 1.08-1.24), but there were no associations for road traffic or railway noise (Table 1). However, the risk appeared particularly high among those exposed to both aircraft and road traffic noise (HR 1.39; 95 % CI 1.14-1.70).

All estimates have been adjusted for sex, education, physical activity, psychological distress and family history of diabetes. Additional adjustments for diet, alcohol, jobstrain, smoking, shift work, area level socioeconomic status, baseline municipality and NO_x did not result in any significant changes in the risk estimates.

Furthermore, the results remained unchanged when restricting the population to those living at the same address for the complete follow-up period.

Table I. Hazard ratio of hypertension per 10 dB L_{den} in relation to noise exposure 5-year preceding the event.

<i>Source</i>	<i>HR</i>	<i>95 % CI</i>
Road	0.93	0.86-1.01
Railway	0.91	0.82-1.02
Aircraft	1.16	1.08-1.24

3. Discussion

In experimental settings and in field studies, exposure to loud noise has been shown to increase blood pressure and heart rate as well as to increase the release of stress hormones [2-4]. This has caused researcher to study if long-term exposure to traffic noise may act as a risk factor for cardiovascular diseases, such as hypertension. Despite an increasing number of studies on transportation noise and hypertension, the evidence is till limited and inconclusive. The recent WHO review [1] states that much of the uncertainty is due to a lack of high quality longitudinal data.

In this cohort study, we aimed to assess if exposure to noise from road, railway and aircraft noise is associated with an increased incidence of hypertension. The results indicated a clear association for aircraft noise, but not for road traffic or railway noise. Possibly, the lack of an association for railway and road traffic noise may be due to a low exposure contrast in our data. We did, however, find a particularly high risk estimate for those exposed to both aircraft and road traffic noise, indicating that exposure to multiple sources of traffic noise may be especially harmful. Since a large part of the European population is exposed to traffic noise [5], even small increases in risk may be detrimental from a public health point of view. Actions among policy makers and urban planners are therefor needed in order to protect the public from exposure to excessive noise.

4. Conclusions

Overall, this longitudinal study provides evidence of an association between aircraft noise exposure and incidence of hypertension.

Acknowledgement

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