



Transportation noise (in particular railway noise) and blood pressure in REGICOR compared to SAPALDIA

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1 INTRODUCTION

Studies on the long-term effects of transportation noise on blood pressure are inconsistent. Besides, the noise features of each transportation mode may affect cardiovascular health differently. However, few studies have analyzed their specific contribution (1). In particular, a limited number of studies have investigated the impact of railway noise (2, 3).

Traffic-related air pollution has also been associated with cardiovascular endpoints and it may have short- and long-term effects on blood pressure (4). Therefore, it has been proposed to consider traffic-related air pollution when analyzing cardiovascular health effects of traffic noise.

Dratva et al. (2), investigated the impact of road and railway noise on blood pressure, adjusting for the potential confounding by traffic-related air pollution, in a Swiss population-based cohort (SAPALDIA). Our objective was to replicate this study in the city of Girona, north-eastern Spain, in the framework of a Spanish adult population-based cohort (REGICOR).

2 METHODS

SAPALDIA evaluated 6450 participants aged 28-72 from different study areas of Switzerland whereas REGICOR analyzed 3635 citizens aged 35-83 of the city of Girona. In both cases, detailed socio-demographic, life-style and health information was available from surveys. At least two blood pressure measurements were obtained by trained fieldworkers following general standard procedures.

Equivalent A-weighted noise levels (LAeq, dB(A)) at the façades of the participants' dwellings were estimated in both cohorts. For SAPALDIA, noise data was obtained from the Swiss Federal Office of Environment noise databank (SONBASE). Traffic and railway day- (6am-8pm) and night time (8pm-6am) noise levels were modeled with the STL86+ and SEMIBEL models, respectively. In REGICOR, road traffic noise levels for the day- (7am-9pm) and nighttimes (9pm-7am) were derived with a validated city-specific road traffic noise model based on the NMPB routes-96 model and complying with the European Environmental Noise Directive 2002/49/EC. Railway noise levels were obtained from a propagation noise model based on ISO 96/13 and accepted by the same 2002/49/EC Directive. Residential outdoor long-term nitrogen dioxide concentrations (NO₂, µg/m³) were estimated with a hybrid (i.e., dispersion and land-use regression) model for SAPALDIA and from a land-use regression model for REGICOR.

Cross-sectional analyses were performed in both cohorts, using multiple linear regression models for systolic (SBP) and diastolic (DBP) blood pressures with noise exposure as the independent variable of interest and several additional covariates, including residential NO₂-exposure. The effect estimates are reported for a change in 10dB(A) in noise levels.

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3 RESULTS

SAPALDIA (2): The mean and standard deviation of traffic noise exposure was 51(\pm 7.2) dB(A) during day and 39(\pm 6.9) dB(A) at night, the respective measures for railway noise being 19(\pm 10.6) dB(A) and 17(\pm 10.9) dB(A). Adjusted regression models yielded significant effect estimates for an increase by 10dB(A) in railway noise at night (SBP β =0.84, 95%CI: 0.22; 1.46; DBP β =0.44, 95%CI: 0.06; 0.81) and during the day (SBP β =0.60, 95%CI: 0.07; 1.13), independently of the effects of NO₂. Very similar results were obtained without adjustment for NO₂. Larger effect estimates were found in sub-samples with chronic disease. Effects of traffic noise were only observed in the sub-group of diabetics.

REGICOR: The mean and standard deviation of traffic noise exposure was 64.8(\pm 5.0) dB(A) during the day and 56(\pm 5.2) dB(A) at night, the respective measures for railway being 31.3(\pm 16.0) dB(A) and 35.8(\pm 17.7) dB(A). We observed positive effects on systolic blood pressure for an increase by 10dB(A) in traffic noise at night (SBP β =1.17, 95%CI: -0.10; 2.44) and during the day (SBP β =1.38, 95%CI: 0.06; 2.70), that were reduced and became insignificant after adjustment for NO₂. Associations between railway noise and SBP were negative both for exposure at night (SBP β = -0.35, 95%CI: -0.75; 0.04) and during the day (SBP β =-0.43, 95%CI:-0.86; 0.01). No effects were observed for DBP.

4 DISCUSSION AND CONCLUSION

We found evidence for an adverse effect on blood pressure from railway noise in SAPALDIA and from traffic noise in REGICOR. The larger effect estimates in the population with chronic disease and the adverse railway noise effects could not be confirmed in REGICOR.

To our knowledge, only one more study (3) evaluated these combined effects and found an indication of a positive association of traffic noise with systolic blood pressure and of railway noise with self-reported risk of hypertension.

Further analyses are needed to address the various open questions and inconsistencies. Differences in urbanization and mean rail- and traffic noise levels, as well as imperfect control of confounding effects of air pollution, are potential explanations of the inconsistent results. Moreover, passive protection measures against noise at dwellings and coping behaviours of participants may differ between the studied populations, but have not yet been taken into account. Coping behaviour has been poorly investigated in this field of research but may be of high importance in the proper evaluation of the effects of noise. Adaptive strategies (e.g. double and triple glazing windows) and coping behaviour likely depend on the level of noise. Thus, there is a potential for serious underestimation of the effects of noise if such factors are not taken into account. These issues and the differences between the studies will be further investigated in the populations of SAPALDIA and REGICOR.

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