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Association of Heart Rate Variability with average exposure to NO₂ and Noise in a Population-based sample of adults

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Abstract

Background: Low Heart Rate Variability (HRV) is known to be associated with cardiovascular morbidity and mortality. In the SAPALDIA cohort study, long term exposure to NO₂ was found to be inversely associated with HRV in women but not in men.

Furthermore, although other studies have shown cardiovascular effects of noise, little is known about its association with HRV.

Objective: To disentangle effects of traffic noise and NO₂ on HRV.

Methods: 24-hour electrocardiograms were recorded in randomly selected SAPALDIA participants aged ≥ 50 years. Noise annoyance and general health were investigated by interviews. Annual exposure to NO₂ at the address of residence was predicted by hybrid land use/dispersion models. Estimates of street and railway noise levels at residential addresses during day and night were obtained from a model developed by the Federal Office of the Environment (FOEN). Associations of HRV parameters with NO₂ and noise were estimated using multivariable mixed linear regression models adjusting for further potential confounders.

Results: Street and railway noise showed a significant positive association with 24-h and night-time HRV (SDNN, total power, high and low frequency power), in men (n=683) but not in women (n=724). In men, 10 dB increments in street noise and railway noise, during the night, were each associated with an increase in SDNN by 4% (CI_{95%} = [1; 7]).

The previously observed gender difference in the NO₂ effect disappeared after controlling for noise exposure. A 10 µg/m³ increment in 1-year average NO₂ level was associated with a decrement in SDNN by 2% (CI_{95%} = [-4; 0]). Replacing objective noise data by noise annoyance perception provided qualitatively similar results.

Conclusion: The gender difference in the effect of NO₂ on HRV could be largely explained after controlling for noise exposure due to traffic. The unexpected positive association between noise exposure and HRV in men needs further investigation.