

## Consider the Source: Noise–Stroke Association Varies by Transportation Type

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Noise pollution is an important environmental cause of ill health,<sup>1,2</sup> yet many people are not aware of the impacts of noise can have on them. Environmental noise can cause stress and sleep disruption<sup>3,4</sup> and has been associated with adverse mental health outcomes<sup>5</sup> and cardiometabolic risk factors.<sup>6,7,8</sup> In a recently published study in *Environmental Health Perspectives*, researchers assessed how exposure to transportation noise may affect stroke incidence.<sup>9</sup>

The Nordic Studies on Occupational and Traffic Noise in Relation to Disease (NordSOUND) project, led by senior author Mette Sørensen, pooled data from nine large Scandinavian cohorts to investigate the association between road, rail, and air traffic noise exposures and risk of stroke. The researchers found incidence of stroke to be associated with road traffic noise but not railway noise. The results for air traffic noise were mixed.<sup>9</sup>

The authors investigated individual exposure to transportation noise over a 5-year period as a risk factor for stroke, adjusting for confounders such as smoking, alcohol consumption, socioeconomic, and air pollution. Of nearly 136,000 participants, just over 11,000 persons had a stroke by the end of followup.<sup>9</sup>

Nina Roswall, NordSOUND project manager and first author of the paper, explains that the researchers estimated a 10-dB increase in road traffic noise exposure to be associated with a 6% increase in risk of stroke. The association between road traffic noise and stroke remained after adjusting for air pollution exposures.

The relationship with air traffic noise was more nuanced. “For aircraft noise, there was an association among those with low exposure [40–50 dB] vs. no exposure [<40 dB], but no association among those with high exposure [>50 dB],” Roswall says. “This lack of association with high exposure may be due to individual soundproofing among people living close to airports.”

Regarding railway noise, Roswall suggests that the lack of association with stroke could be explained by differences in how people react to noise from trains compared with cars, trucks, and aircraft.<sup>10,11</sup> In addition, railway noise may be reduced at night, especially in residential areas.

According to the authors, this study is thought to be the first to include both detailed modeling of noise exposure from road, rail, and aircraft over time and near-complete registration of



Noise is thought to act on the cardiovascular system through an indirect pathway, involving cognitive perception of noise—that is, how annoying it is—along with stress hormone release and sleep disturbance. Noise from road traffic is often perceived as an especially annoying form of transportation noise. Image: © Andrey/adobe.stock.com

stroke cases through the uniquely comprehensive national disease registries in Scandinavia. “Also, our study was able to include detailed information on a large number of factors that could confound the association between traffic noise and stroke, including both lifestyle factors and individual and area-level socioeconomic conditions, as well as air pollution,” says Roswall. “This was not possible in some of the previous large studies, meaning that their results may be affected by these unassessed conditions.”

Roswall points out a unique aspect of the study. “We were able to synthesize multiple large cohorts from different countries to yield a robust study design. Our study [is] the first pooled study with detailed data on transportation noise exposure over time.”

According to Bo Norrving, a professor of neurology at Lund University’s Department of Clinical Sciences and head of the Swedish Stroke Register, this unique study dealt with an issue for which there is insufficient scientific evidence. “These findings add to the increasing support of environmental factors as contributing to stroke, which links to possibilities of prevention,” says Norrving, who was not involved in the study.

University of Dusseldorf professor Barbara Hoffmann, also not involved in the new study, says this is the most comprehensive analysis to date on transportation noise and incident of stroke. She notes the substantial effort made to harmonize the pooled data set for this thorough analysis and points to several strengths of the study: the high-quality exposure assessment for noise, the assessment of air pollution, the availability of residential history (which allowed time-varying exposure assessment throughout the observation period), and the comprehensive information on covariables such as personal characteristics and health behaviors.

Hoffmann notes that the duration of some of the study cohorts, which go back almost 50 years, is a potential limitation. “During this period, the criteria and access to diagnostic methods for the diagnosis of stroke have changed considerably, specifically for stroke subtypes, potentially leading to an under- or overestimation of the true effect,” she explains. She adds that new insights might result from using novel indicators that may reflect the pathogenic characteristics of noise exposure better than the currently used average exposure.

In Western Europe, up to 1.6 million healthy life-years are estimated to be lost annually due to noise-associated conditions, including ischemic heart disease, cognitive impairment of children, sleep disturbance, tinnitus, and annoyance.<sup>1</sup> About 40% of the European population is exposed to nighttime road traffic noise at levels >55 dB,<sup>12</sup> the threshold at which the World Health Organization says “cardiovascular effects become the major public health concern.”<sup>13</sup>

“It is therefore essential to assess the magnitude of effect of environmental noise exposure on the risk of stroke, as well as other diseases, in order to estimate the impact of transportation noise on public health and raise the awareness of noise exposure

in modern-day urban societies,” Roswall concludes. “This information will be crucial for planning and legislation.”

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