

Science for Environment Policy

Both traffic noise and air pollution linked to stroke

Road traffic noise and air pollution both increase the risk of having a stroke, recent research from Denmark suggests. The results suggest that traffic noise is more strongly associated with ischaemic stroke, whereas only air pollution appears to be linked with more serious, fatal strokes.

Environmental noise and air pollution are believed to have similar biological effects on our blood vessels that increase the risk of stroke. For instance, they may lead to hardened arteries and high blood pressure. [Air pollution](#) is thought to cause damage when it is inhaled and enters the bloodstream. [Noise](#) may have more indirect effects: it disturbs sleep and increases stress, which can raise blood pressure.

The study, conducted under the EU [QUIET](#) project¹, is one of few to investigate the combined effects of traffic noise and air pollution. It analysed data, from a population study of [health](#) and lifestyle of 51 569 residents in Copenhagen and Aarhus over 11 years. The participants were aged 50-64 years at the point of enrolling onto the study.

The researchers modelled air pollution and traffic noise levels for every participant's home. National medical records showed that 1999 of the participants had been diagnosed with stroke. For air pollution, the study focused on nitrogen oxides (NO_x) and nitrogen dioxide (NO₂), which are good markers of traffic air pollution and correlate closely with both ultrafine particles and PM₁₀ (10 micrometres or less in diameter). Noise was calculated as L_{den}: measured over a 24 hour period, with a 10 dB penalty at night (22:00-07:00) and a 5 dB penalty in the evening (19:00-22:00) to reflect people's extra sensitivity to noise during these times.

Statistical models analysed the independent effects of noise and air pollution, as well as their combined effects. They also accounted for the influence of other factors that affect stroke risk, such as diet, physical activity and smoking, as identified from earlier research.

Participants were more likely to have had a stroke if they lived in noisy and polluted areas. Traffic noise and NO₂ levels had significant associations with ischaemic strokes in particular, a form of stroke that occurs when clots block blood flow to the brain. Similar patterns were seen between NO_x exposure and stroke risk, but they were not as statistically significant, so the study did not make a confident association between the two.

Every increase of 10 dB L_{den} of noise above 42 dB L_{den}, averaged over a year, increased the [risk](#) of ischaemic stroke for an individual by 16%, the data suggest. Every 10 micrograms of NO₂ per cubic metre of air (10 µg/m³), also averaged over a year, increased the risk by 11%.

In combination, the greatest stroke risk of +28% was found for a NO₂-noise combination of over 15.7 µg/m³ and above 62.1 dB L_{den}. This is compared to less than 11.3 µg/m³ and under 55.3 dB L_{den}.

The data suggest that the body is only sensitive to air pollution, in relation to ischaemic stroke, when noise levels are high. Stroke risk increased significantly when noise levels were over 62.1 dB L_{den} even if NO₂ levels were relatively low (i.e. below 15.7 µg/m³), but it did not increase when noise was low and pollution was high. However, the researchers say that more work is needed to investigate this pattern.

Of the 1999 stroke diagnoses, 171 were fatal. NO₂, but not noise, was associated with these serious strokes. The study's results also suggest that noise, but not air pollution, is more strongly associated with ischaemic stroke.



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