



**Transport Research Institute. Technical Paper 103**

**Noise harms health – and 20mph speed limits can reduce that harm**

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**March 2023**

## Headlines

Noise is overlooked in terms of its negative impacts of health. Decision-makers, among others, are not aware as to the severity of health harms from noise.

Older adults and young people are particularly vulnerable to the health effects of noise

In many urban areas most people are exposed to high noise levels at home, and for many of these road traffic is the principal source.

Evidence suggests that reduction of speed limits to 20mph or 30kmph can significantly reduce noise and therefore also noise related health harms.

## Context

Noise is often called the Cinderella of environmental health harms. Where other harms like air pollution, soil contamination and climate change get, and got, a lot of public and/or political attention, noise is often overlooked. Many politicians and policy makers are not aware of the extent to which noise damages health, and it is often believed that noise only causes annoyance that ends when it stops. However, the harms of noise go far beyond annoyance and includes that it is a barrier to sleep. Adequate, restful sleep (about 7–9 hours for adults) and mental well-being are as essential to good health as adequate nutrition and physical activity.

In general, the latest research evidence suggests that the health effects of noise are second only to those of air pollution.<sup>1</sup> Long lasting noise leads to stress and anxiety (significant health problems in themselves), but also contribute to physical effects including high blood pressure which can lead to cardiovascular problems such as heart attacks and strokes that can cause death and disability<sup>2 3</sup> This is, in part, due to the fact that older adults, along with young people, are more vulnerable to the health effects of noise.

The principal source of noise in urban areas is road traffic noise. Research has indicated that long term exposure to road traffic noise may be negatively associated with executive function (the mental processes and skills used to perform tasks, concentrate on new information and negotiate decisions) among older adults i.e. over 50.<sup>4</sup> Even at moderate levels of road noise exposure, elderly adults i.e. aged 75 plus are at increased risks of death from all causes and cardiovascular illness and death, particularly of stroke.<sup>5</sup> There is also evidence of the impact of noise on the health of youths.<sup>6</sup> More noise annoyance was associated with less social cohesion, and in turn with worse mental health; noise annoyance was also associated with lower neighbourhood restorative quality, which links to social cohesion and physical activity, again leading to poorer mental health for young people.

The World Health Organization published updated Environmental Noise Guidelines in 2018<sup>7</sup>. Included are recommended limit values for environmental noise exposure based on systematic reviews for a range of health outcomes, including cognitive impairment. However, these are very broad and can't account for individual sensitivities or changes that come with age. Some people are likely to still experience health effects of noise well below these values. More important than recommended limits is, arguably, to reduce noise levels as much as possible. In many urban areas most people are exposed to high noise levels at home, and for many of these road traffic is the principal source. There are many ways to reduce noise, but evidence suggests that driving behaviour, tyre and pavement properties, vehicle design and speed are the most important.<sup>8</sup>

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<sup>1</sup> ünzel, T.,; Krölller-Schön, S.,; Oelze, M., et al 2020 "[Adverse Cardiovascular Effects of Traffic Noise with a Focus on Nighttime Noise and the New WHO Noise Guidelines](#)". *Annual Review of Public Health*. 41: 309–328. doi:[10.1146/annurev-publhealth-081519-062400](#). PMID [31922930](#).

<sup>2</sup> Selander J, Nilsson ME, Bluhm G, Rosenlund M, Lindqvist, Nise G, Pershagen G. 2009 Long-term exposure to traffic noise and myocardial infarction. *Epidemiology*, 20:272-279.

<sup>3</sup> Wolfert, H. 2009 Eurocities meeting Florence, 19<sup>th</sup> March.

<sup>4</sup> Mac Domhnaill, Douglas, O., Lyons, S. et al, 2021 Road traffic noise and cognitive function in older adults: a cross-sectional investigation of The Irish Longitudinal Study on Ageing, *BMC Public Health*, 21: 1814

<sup>5</sup> Halonen, J., Hansell, A., Gulliver, J., Morley, D., Blangiardo, M., Fecht, D., Toledano, M., Beevers, S., Anderson, H., Kelly, F., et al. 2015 Road Traffic Noise Is Associated with Increased Cardiovascular Morbidity and Mortality and All-Cause Mortality in London. *European Heart Journal*, 36, 2653–2661.

<sup>6</sup> Dzhambov, A., Tilov, B., Markevych, I., Dimitrova, I. 2017. Residential road traffic noise and general mental health in youth: The role of noise annoyance, neighbourhood restorative quality, physical activity, and social cohesion as potential mediators, *Environment International*, 109: 1-9.

<sup>7</sup> WHO (2018). Environmental Noise Guidelines for the European Region. [noise-guidelines-eng.pdf \(who.int\)](#)

<sup>8</sup> Ögren, M., Molnár, P., Barregard, L.J.E.R., 2018. Road traffic noise abatement scenarios in Gothenburg 2015–2035. *Environmental Research*, 164, 516-521.

### Case study – noise and road traffic crash effects on health in Houston, Texas

In this US study, it was estimated that 302 premature deaths (adults 30–75 years old) were attributable to transportation-related noise compared to 330 fatalities from motor vehicle crashes (adults younger than 75 years old).<sup>9</sup> Transport-related noise and motor vehicle crashes were responsible for similar proportions of deaths at 1.7% and 1.9% of all-cause premature deaths, respectively. Households with lower median income had a higher risk of adverse exposure and premature deaths potentially attributable to transport-related noise. A larger number of premature deaths were associated with living in the central business district and near to highways and airports. Overall, 632 premature deaths per year were attributed to transportation noise and crashes; this was 3.6% of premature deaths in the city, a comparable death rate to Alzheimer’s disease and higher than that for diabetes. Overall, in the US, evidence also suggests that the rate of premature death associated with transport noise is greater than that of influenza, suicide or pneumonia.

### The impacts of 20mph speed limits

Logic and reason suggest that reducing vehicle speeds will reduce vehicle related noise and reductions in urban speed limits to 20mph or 30kmph have become increasingly popular because of potential benefits to health beyond road traffic crash reduction. However, until recently there has been little evidence to support the logic that a reduction in noise is one of these. There are a number of reasons for this failure to consider noise, including the chronic nature of the health effects of noise, but also that noise travels well beyond the “boundaries” of the relatively small areas that were seeing speed limit changes.

Evidence already exists that shows that road traffic crashes occur disproportionately in the most deprived areas. Further, this has been suggested to be because most deprived areas have more types of vehicle travelling at a greater range of speeds and a 20 mph limit default could greater benefit those previously at highest injury risk.<sup>10</sup> Effects on noise, as well as emissions, community severance and other, wider, health effects, could therefore also be greatest in the most deprived areas.

A 2020 study from Lausanne, Switzerland, estimated health impacts if the city authority changed the speed limit from 50kmph to 30kmph on some of the road network.<sup>11</sup> They concluded that the reduction in the posted speed limit would have brought about substantial health improvements spread across the population. Noise reduction due to the 30kmph speed limit (assumed to be 2 decibels (dB)<sup>12</sup>; decibels measure intensity of sound) was estimated to annually prevent 1 cardiovascular death, 72 hospital admissions from cardiovascular disease, 17 incident diabetes cases, 1,127 individuals being highly annoyed and 918 individuals reporting sleep disturbances from noise. Health benefits from a reduction in road traffic crashes were less pronounced (1 severe injury and 4 minor injuries). If the whole city speed had had a speed reduction to 30kmph this would have more than doubled the annual benefits from the partial city speed reduction. This scenario (speed limit reduction) was the only scenario that contributed to a reduction in mortality from road traffic crashes (one death per two years).

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<sup>9</sup> Sohrabi, S., Khreis, H., 2020. Burden of disease from transportation noise and motor vehicle crashes: Analysis of data from Houston, Texas. *Environ International* 136, 105520.

<sup>10</sup> Jones, S.J., Brunt, H., 2017. Twenty miles per hour speed limits: a sustainable solution to public health problems in Wales, *Journal of Epidemiology and Community Health*, 71, 699–706.

<sup>11</sup> Rossi, L., Vienneau, D., Ragettli, M., Fluckiger, B., Roosli, M 2020 Estimating the health benefits associated with a speed limit reduction to thirty kilometres per hour: A health impact assessment of noise and road traffic crashes for the Swiss city of Lausanne, *Environment International* 145: 106126.

<sup>12</sup> [Comparative Examples of Noise Levels - IAC Acoustics](#)

Empirical data from Zurich, where more of the road network was changed from 50kmph to 30kmph, allowed for evaluation of the effects of the reduced speed limit on a range of health outcomes.<sup>13</sup> This was on noise levels (Lday and Lnight),<sup>14</sup> noise annoyance, self-reported sleep disturbance, as well as perceived road safety, and in particular, to elucidate if the reduced speed limit leads to a shift of exposure-response relationships towards lower effects. A statistically significant decrease in noise annoyance and of self-reported sleep disturbances was observed, as well as a moderate but significant increase of perceived road safety.

Further analysis showed that residents who could benefit most from the introduction of the 30 km/h speed limit were those whose bedrooms were oriented towards the street, while people with apartments or bedrooms facing away from the street towards e.g. a backyard, had no additional benefit. Poorer income households are more likely than higher income groups to be in close proximity to road and suffer more from road traffic noise as well as other negative health impacts arising from motorised traffic. It is likely, therefore, that the greater benefits once the speed limits were reduced were to those in lower income households.

### Discussion and conclusions

Noise is an under-recognised cause of significant mental and physical health harms. Road noise is one of the largest contributors to background noise in our communities. Efforts are needed to reduce the contribution of road traffic to noise as well as wider harms such as air pollution, physical inactivity, road traffic injuries and community severance. Lowering of speed limits to 20mph or 30kmph, in areas where people live, work and play is being advocated for and introduced widely. There is evidence for a wide range of health benefits from reducing speed limits, but until recently, reductions in noise were hypothesised, rather than proven. Recent evidence suggests that reduction of speed limits to 20mph or 30kmph can significantly reduce noise and therefore also noise related health harms.

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<sup>13</sup> Brink, M. Mathieu, S., Rüttener, S. 2022 Lowering urban speed limits to 30 km/h reduces noise annoyance and shifts exposure-response relationships: Evidence from a field study in Zurich, *Environment International*, doi: <https://doi.org/10.1016/j.envint.2022.107651>

<sup>14</sup> Noise can be measured using Leq, which is the equivalent continuous sound level, and represents the total sound exposure for the period of interest or an energy average noise level for the period of interest. [noise-measurement-terminology-guide.pdf \(cirrusresearch.co.uk\)](https://www.cirrusresearch.co.uk/noise-measurement-terminology-guide.pdf)  
Lday is the weighting of Leq during the day time, Lnight the weighting of Leq during the night time

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**Authors:** Dr Adrian Davis  
Dr Sarah Jones

Email: a.davis@napier.ac.uk  
Sarah.Jones27@wales.nhs.uk

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Quality Assessor	Kristian James Public Health Wales
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