



Health cost of land transport noise exposure in New Zealand

Road and rail noise can affect people's health, costing the New Zealand economy.

Living close to a buzzing highway or humming railway line isn't the most desirable choice. For good reason – existing research confirms that transport noise is linked to negative effects on our health, increasing the chance of being annoyed, sleep disturbed, and at risk of ischaemic heart disease.

How big is this problem in New Zealand? Between 2020 and 2022, researchers of this study set out to uncover the health cost from people being exposed to noise from New Zealand's road and rail networks. Noise from airports and seaports was excluded from the study because data wasn't widely available.

Researchers focused on three health effects

Researchers determined that the existing research linking transport noise with annoyance, sleep disturbance, and ischaemic heart disease was credible. They chose to investigate the cost of these three health effects because they could confidently identify a relationship between them and people's exposure to road and rail noise.

The costs associated with people's exposure to transport noise were estimated using 'exposure-response functions' for each health effect. This study only investigated these three health effects because the quality of evidence for other health effects wasn't good enough for researchers to establish exposure-response functions.

Road and rail noise costs New Zealand approximately \$654 million a year

After carrying out a complex investigation, researchers were able to reveal the significant cost resulting from the impact of transport noise on people's health. Road noise makes up most of the cost, at approximately \$502 million a year, while rail noise accounts for the remaining \$152 million a year.

A study of this scale and complexity is unique for New Zealand. It involved:

- reviewing the literature of existing studies about the health effects from noise, noise modelling, and modelling of costs
- identifying the three health effects to consider – annoyance, sleep disturbance, and ischaemic heart disease – and their exposure-response functions
- estimating the number of dwellings and people in them using 2018 Census data to calculate the size of the population exposed to transport noise
- modelling transport noise from New Zealand's road and rail networks using noise prediction software
- developing and using a model to estimate the health cost of transport noise related to each of the three health effects
- producing an online dashboard to visualise the results of the cost modelling – displaying costs for road and rail noise by region, health district, and territorial authority.

Location-specific data for transport noise was the foundation of the study

Researchers calculated noise levels from road and rail networks across New Zealand to understand the current population's noise exposure. This meant that they could identify and visualise the health and cost impacts across the country using a web map application.

While strategic mapping of transport noise across New Zealand has been carried out before, this is the first time it has been linked to costs associated with health effects. This is also the first study on the strategic mapping of noise from New Zealand's rail network.

The cost model used the outcomes of the noise modelling

Information from the literature review allowed researchers to estimate the health costs of transport noise using the outcomes of the noise modelling.

The cost model was informed by the:

- population exposed to transport noise
- proportion of the population affected by transport noise
- disability weighting – a measure of the severity of the health effect, and used to calculate Quality-Adjusted Life Year (QALY – the value of a year of life in perfect health)
- health value – the value of one year lived in full health (the value of one QALY).

Researchers tested the uncertainty of the cost modelling

The cost of \$654 million a year is based on a central scenario where researchers examined disability weights, relative risk, and QALY values that were central values recommended in the relevant literature. Researchers tested lower and higher value estimates that were also provided in the literature to account for the inherent uncertainty in the cost modelling. This allowed researchers to determine the potential range of the estimated costs.

Findings show the areas most affected

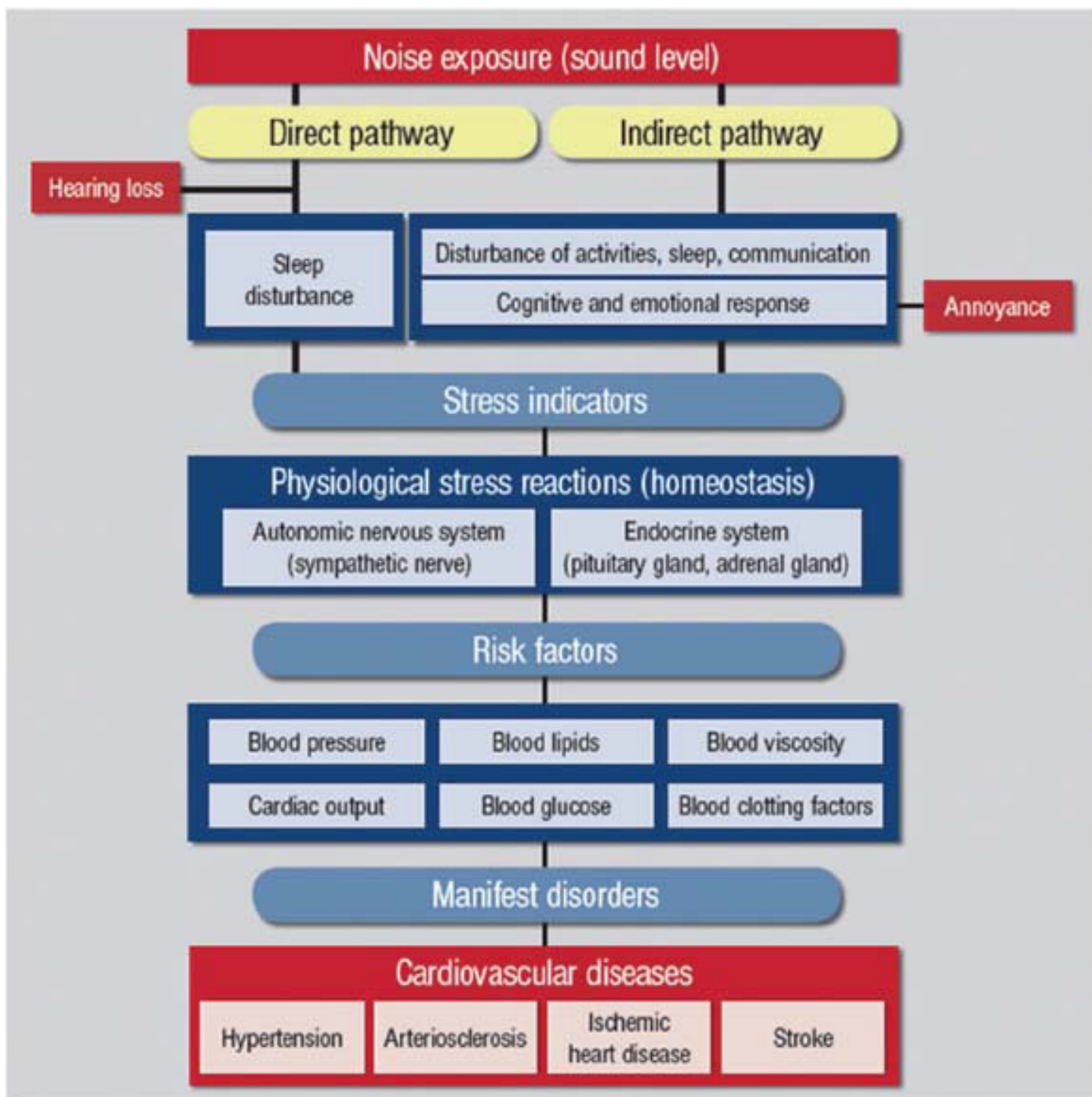
The cost model separates the costs associated with road and rail noise by key geographical statutory boundaries so that the areas most affected by road and rail noise can be easily identified.

The findings will also help stakeholders understand how people might be affected by a projected increase or decrease in exposure to transport noise.

How does noise exposure affect people?

Babisch's model below shows how noise exposure can lead to health effects, both directly and indirectly.

Noise reaction model/hypothesis (Babisch, 2014) - Figure 3.2
 in *Health cost of land transport noise exposure in New Zealand*



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 Available at www.nzta.govt.nz/resources/research/reports/715