Exposure-response functions for traffic noise and cardiovascular diseases

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19-02-2025

Funded by the European Union

BEST-COST is funded by the European Union's Horizon Europe programme under Grant Agreement No.101095408.

Statement of the problem & Aim

- 2018 Environmental Noise Guidelines for the European Region
  - Quality of evidence supporting the association between **transportation noise** and **cardiovascular disease outcomes varied considerably**
  - Recent evidence?

Aim and objectives

- To conduct a systematic review incorporating a **qualitative synthesis** and **quantitative meta-analysis** of existing evidence regarding the association between **long-term exposure** to **transportation noise sources** (i.e. road traffic, railway, and aircraft) and **non-fatal** and **fatal** major cardiovascular disease outcomes
- To derive exposure-response functions for transportation noise sources and major cardiovascular disease outcomes.

Methods

- **Qualitative evidence synthesis**
  - Six bibliographic databases and one search engine
  - Cohort & case-control studies
  - Studies reported on the noise exposure levels (e.g. L_{den}) and defined how and when the exposure was measured
  - Data screening and extraction
  - Risk of bias assessment

- **Quantitative evidence synthesis**
  - Risk measures: categorical *versus* continue values
  - **Conventional meta-analysis**
    - Mixed (and fixed) effects models
    - Between-study heterogeneity
    - Meta-regression to derive exposure-response curves
  - **Meta-Regression-Bayesian, Regularized, Trimmed (MR-BRT)**
    - GRADE guidelines
    - Between-study heterogeneity
    - Burden of Proof Risk Function / Risk outcome scores
    - MR-BRT to derive exposure-response curves

Exposure-Response Functions

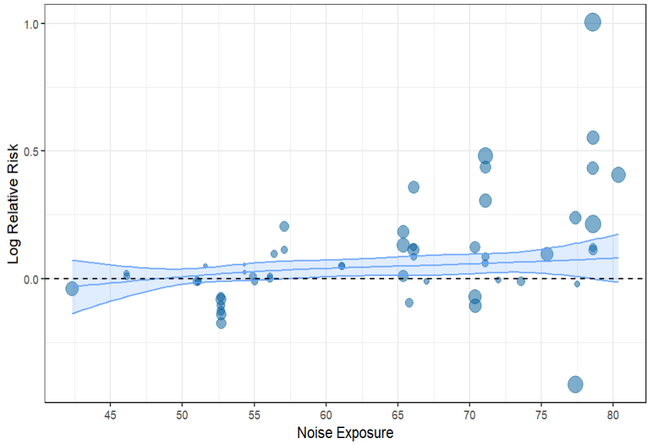
Myocardial infraction

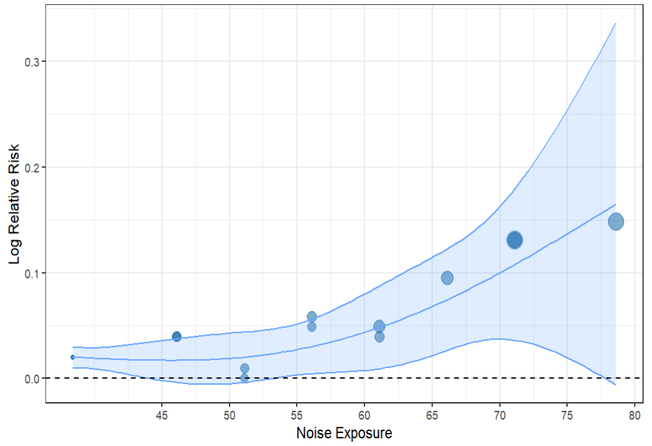
Road traffic noise

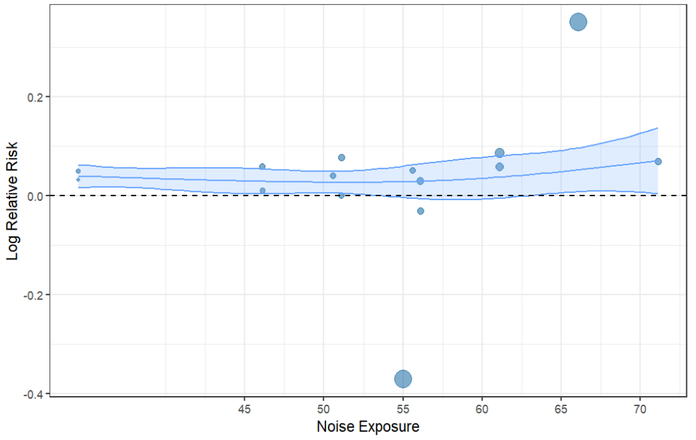
Railway noise

Aircraft noise

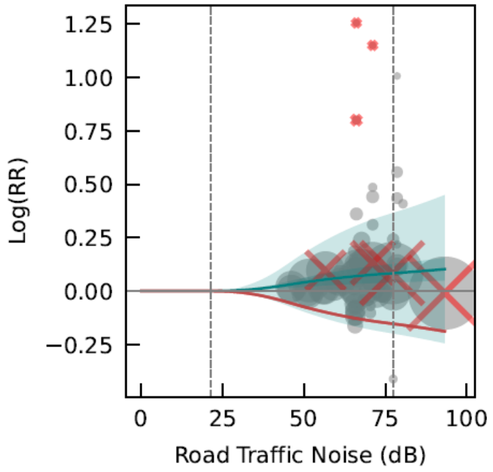
Conventional meta-analysis

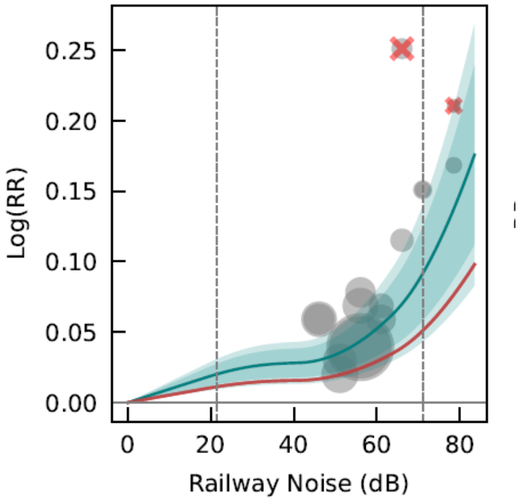


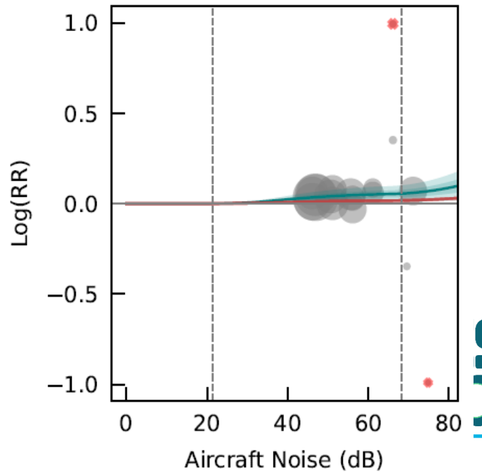




MR-BRT







Exposure-Response Functions

Myocardial infraction

	Road traffic	Railway noise	Aircraft noise
Conventional meta-analysis	RR = 1.02 (0.99-1.05) p=0.08	**RR=1.01 (1.01-1.01)** **p value=<0.0001**	RR=1.02 (0.99-1.05) p value=0.14
MR-BRT	BPRF = 1.03 (0.93-1.15) ★	BPRF = 1.03 (1.01-1.05) ★ ★	BPRF = 1.03 (1.00-1.05) ★ ★

Exposure-Response Functions

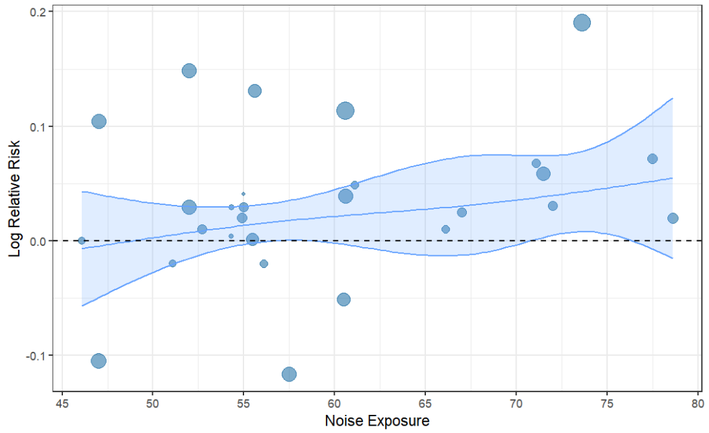
Stroke

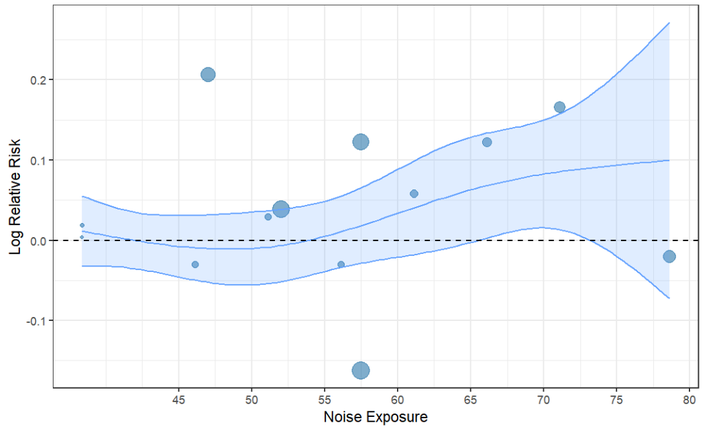
Road traffic noise

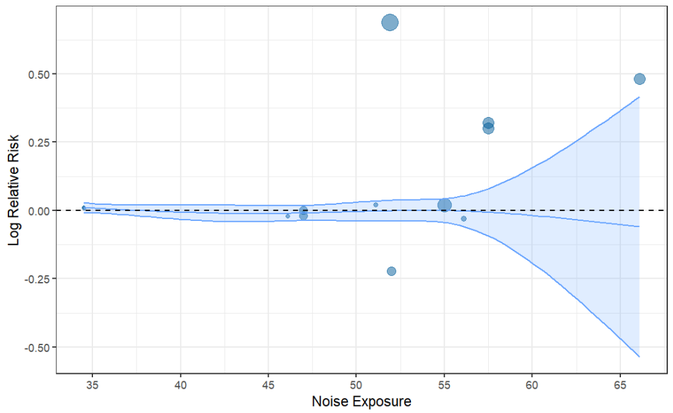
Railway noise

Aircraft noise

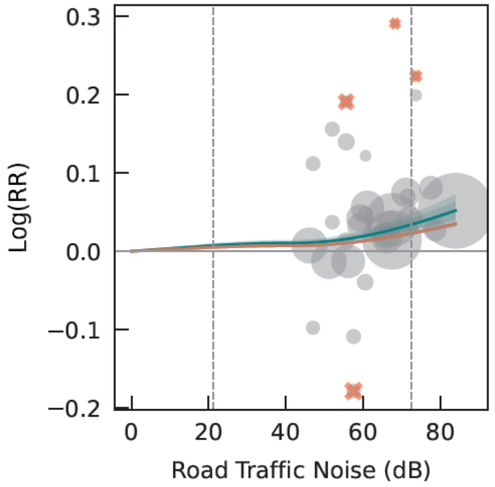
Conventional meta-analysis

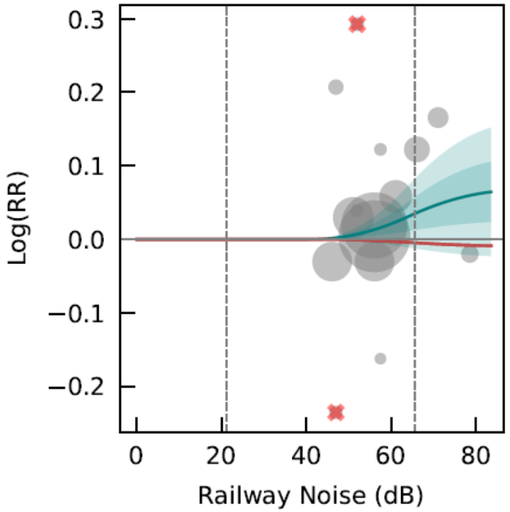


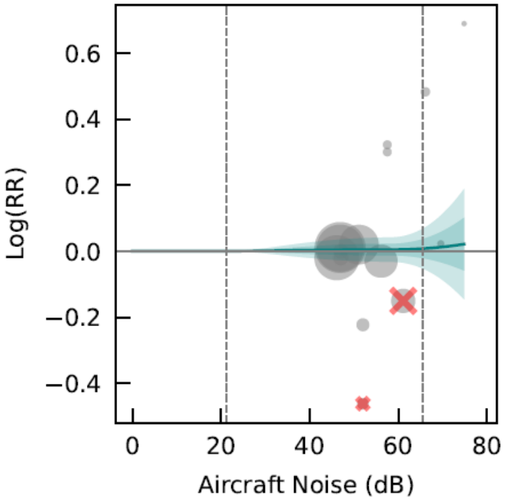




MR-BRT







Exposure-Response Functions

Myocardial infraction

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MR-BRT	BPRF = 1.03 (0.93-1.15) ★	BPRF = 1.03 (1.01-1.05) ★ ★	BPRF = 1.03 (1.00-1.05) ★ ★

Stroke

	Road traffic	Railway noise	Aircraft noise
Conventional meta-analysis	RR = 1.01 (1.01-1.02) p=0.04	RR = 1.00 (1.00-1.01) p=0.53	RR = 1.00 (0.99-1.01) p=0.84
MR-BRT	BPRF = 1.01 (1.01-1.02) ★★	BPRF = 1.00 (1.00-1.00) ★	BPRF = 1.01 (0.98-1.02) ★

Discussion & Conclusions

- Conventional meta-analysis results indicate a small increased **myocardial infraction** risk per 10dB for road traffic (2%), railway (1%), and aircraft noise (2%), with **railway noise showing the strongest evidence** ($p < 0.0001$).

- MR-BRT results indicate non-linear associations between **myocardial infarction, stroke**, and exposure to road traffic, railway, and aircraft noise.

- **Methodological differences** influence the **interpretation** of transportation noise effects on myocardial infarction and stroke, particularly in the exposure-response relationship.

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