



# Swiss TPH



Aviation Noise & Emissions Symposium,  
Davis, CA, 1 - 3 May, 2022

## Updating Swiss guidelines for transportation noise

From Local to National; Three Perspectives  
on Research, Legislation, and Implementation

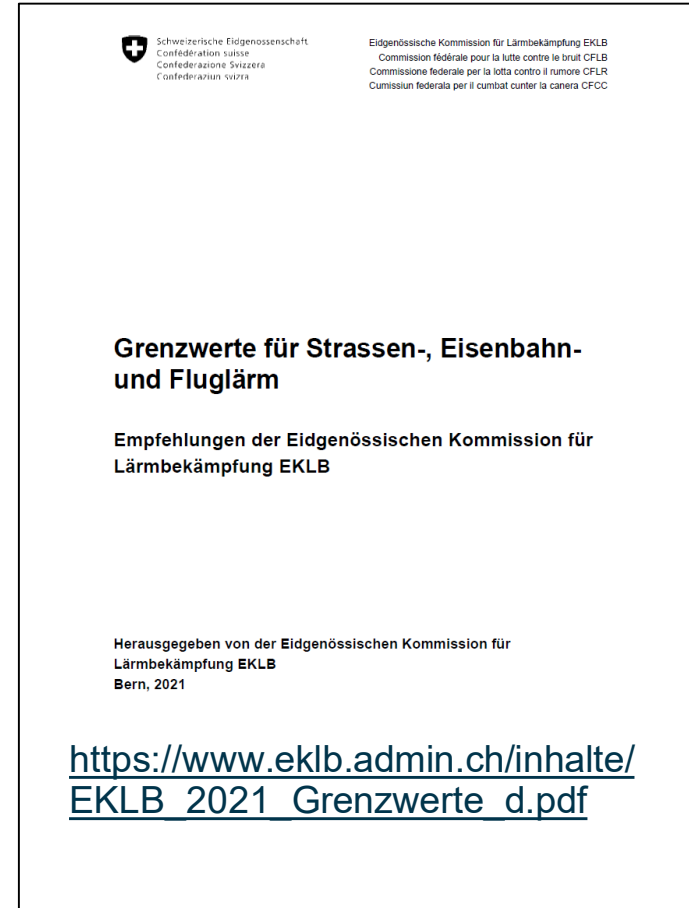
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 [@MartinRoosli](https://twitter.com/MartinRoosli)

# Content

- Legal situation in CH
- Noise research as basis for the proposed regulation
- Methods for deriving limits
- Proposed regulation
- Next steps



# Legal basis

- Federal Constitution Art. 74 - Environmental protection

<sup>1</sup>The Confederation shall issue regulations on the protection of humans and their natural environment from **harmful** or **annoying** effects.

- Environmental law Art. 15 - ambient limit values for noise and vibrations

The limit values for noise and vibrations shall be set in such a way that, according to the state of **scientific knowledge or experience**, exposure below these values do not **significantly** disturb **the well-being of the population**.

- Environmental law Art. 13 – ambient limits

<sup>2</sup>It shall also take into account the effects on **vulnerable groups of people**, such as children, the sick, the elderly and pregnant women.

# Current guidelines in Switzerland\*

	Sens level 2 Day	Sens level 2 Night	Sens level 3 Day	Sens level 3 Night
Road	60	55	65	60
Railway	65	58	70	63
Aircraft	60	22-23: 55 23-24: 50 00-05: curfew 05-06: 50	65	22-23: 55 23-24: 55 00-05: curfew 05-06: 55

\*in dB, estimated taking into account correction factors

[https://www.fedlex.admin.ch/eli/cc/1987/338\\_338\\_338/en](https://www.fedlex.admin.ch/eli/cc/1987/338_338_338/en)

Swiss noise ordinance (LSV): 1987  
(Limits road rail: 1987, aircraft: 2001)

2008: EKL/BAFU initiiert

"Preliminary study to review  
the immission limit values for  
noise"

"Input papers"

Überprüfung der Immissionsgrenzwerte für Lärm

2009: Synthesis report

ECOPLAN

Swiss TPH



2010: Konzept study  
with work packages  
+ financial needs

Forschungskonzept Lärm  
Konzeptstudie zur Aktualisierung der  
Grundlagen für die Lärmbeurteilung

**Need for action recognised!**

ECOPLAN

Proposal for new noise regulation in CH

2010: Research  
concept EKL

Forschungskonzept Lärm  
Handlungsbedarf zur Aktualisierung der Grundlagen für die Lärmbeurteilung



Martin Rööfli

EKL/BAFU: Federal Noise Abatement Commission  
<https://www.eklb.admin.ch/en/federal-noise-abatement-commission>

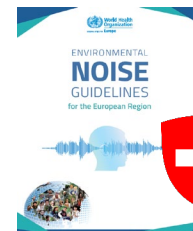
2011: No funding through  
UVEK resources

Sinergia application 2013

SiRENE-Studie  
2013-2020

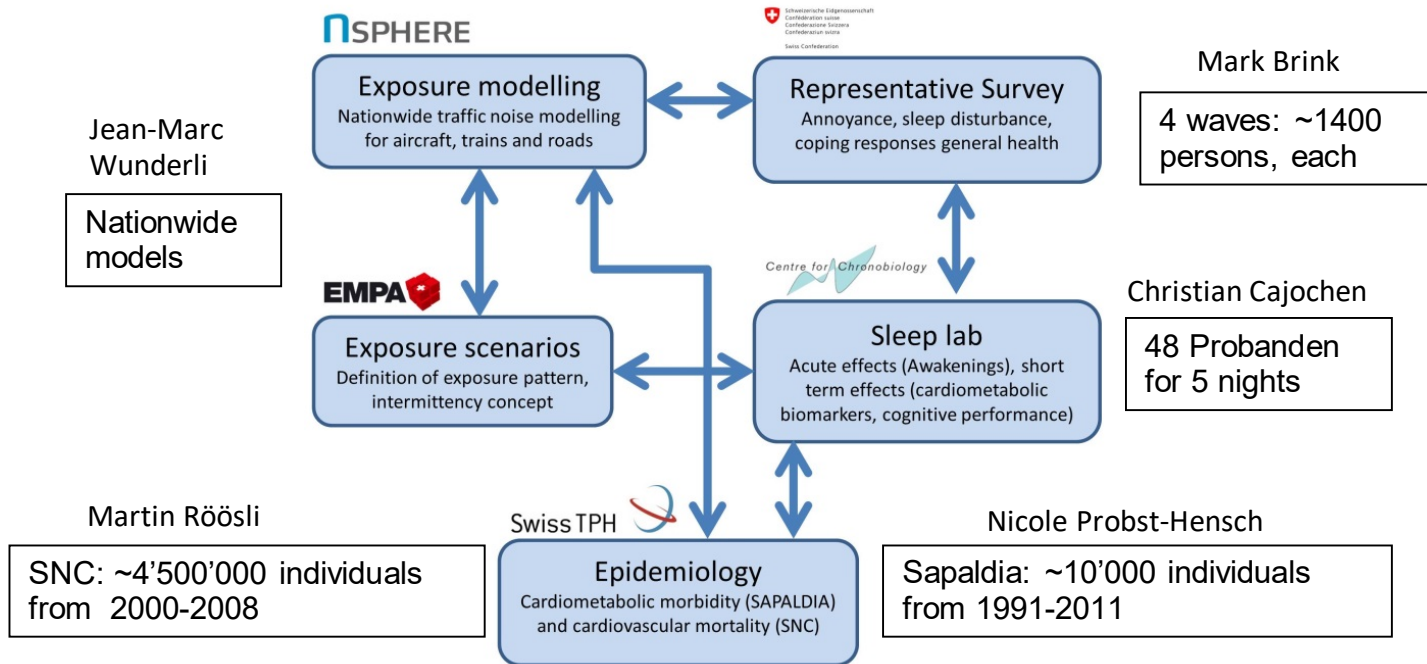


2014-2018



5

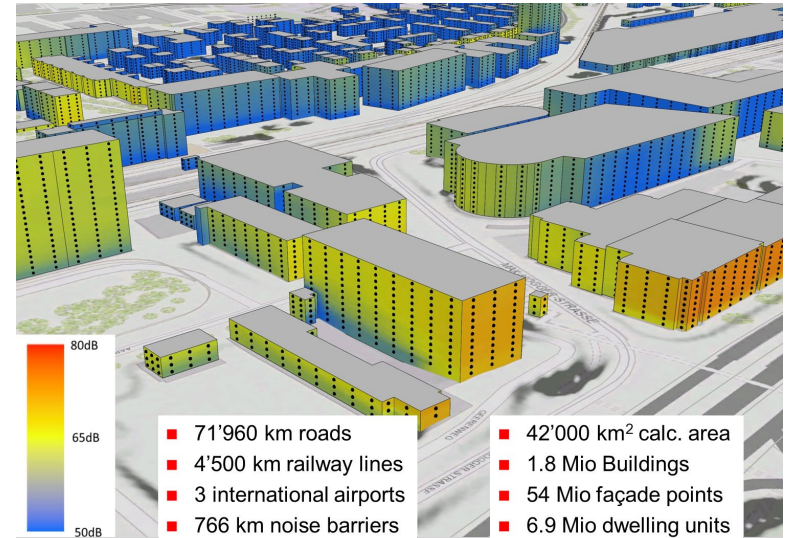
# Swiss SiRENE study: (Short and Long Term Effects of Transportation Noise Exposure)



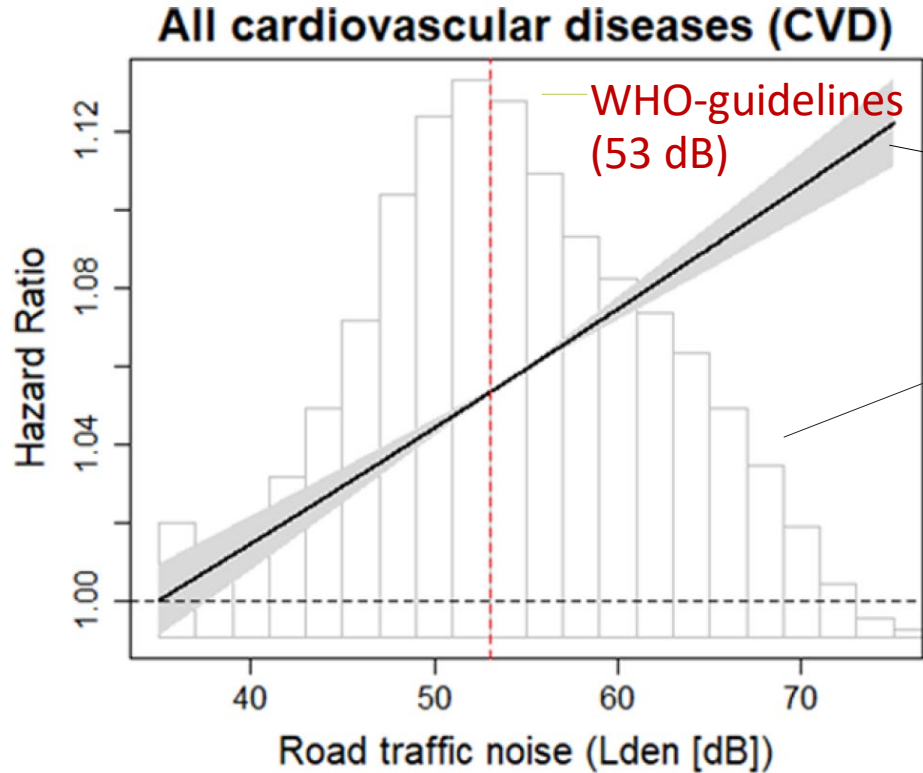
**Funding:** Swiss National Science Foundation, Federal Office for the Environment

# Swiss National Cohort (2000-2015)

- All inhabitants in Switzerland (4.41 million people aged >30 years)
- Mortality records and census data linked
  - Sex, civil status, education, mother tongue, nationality
  - Neighborhood, community and regional socio-economic position and unemployment rate
  - Noise: road, railway, aircraft
  - Air pollution (PM2.5)



# Result



Non-parametric exposure-response curve

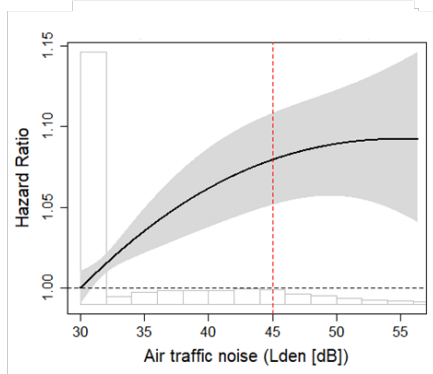
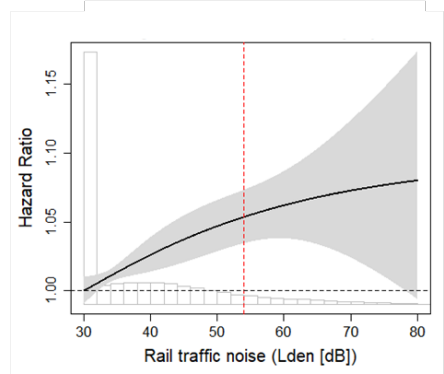
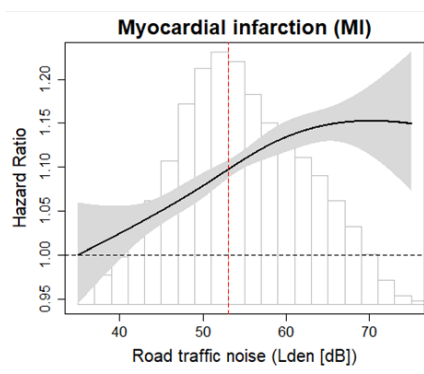
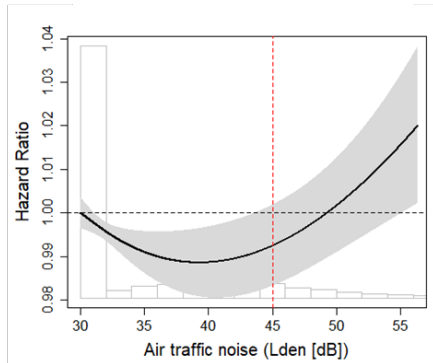
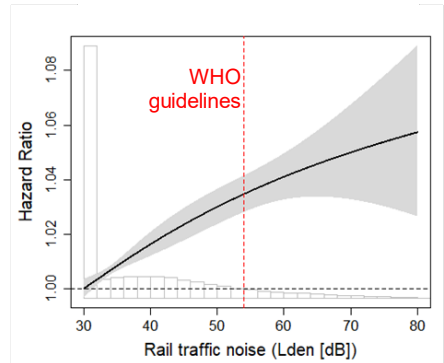
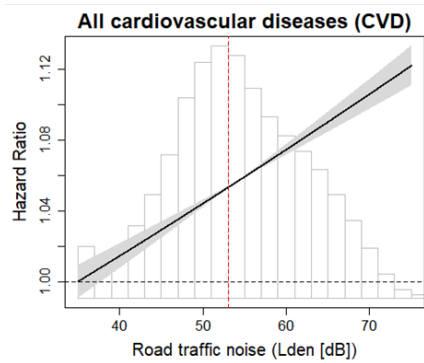
Histogram: Distribution of road traffic noise in CH

**Threshold?**

Vienneau et al, 2022  
(<https://doi.org/10.1016/j.envint.2021.106974>)



# Noise vs. cardiovascular and myocardial infarction mortality



Source	Excess risk per 10 dB (%)
$L_{den}$ Road	2.9 (2.4-3.4)
$L_{den}$ Railway	1.3 (1.0-1.7)
$L_{den}$ Aircraft	0.3 (-0.4-1.0)

Source	Excess risk per 10 dB (%)
$L_{den}$ Road	4.3 (2.9-5.8)
$L_{den}$ Railway	2.0 (1.0-3.0)
$L_{den}$ Aircraft	4.0 (2.0-6.0)

Vienneau et al, Env Int. 2022

# SAPALDIA

## Swiss study on Air Pollution and Lung Disease in adults

- **Outcome**

**Diabetes:** 110 incident cases between 2001 and 2011 in 2'631 persons  
(Depression, Respiratory diseases, arterial stiffness)

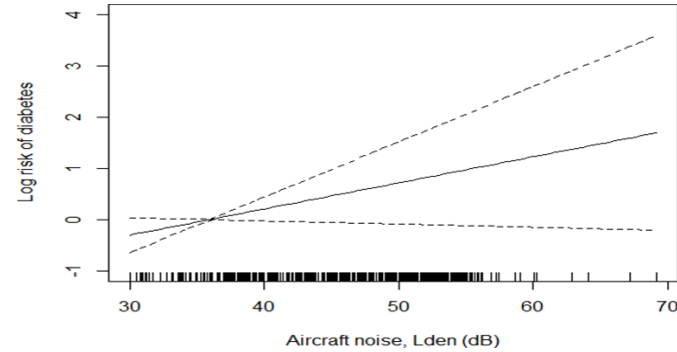
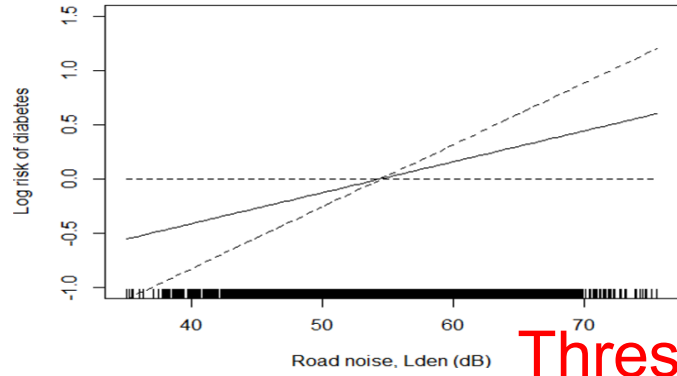
<b>Diabetes</b>			
<b>Source</b>	<b>Relative Risk per 10dB (%)</b>	<b>95% CI</b>	
L <sub>den</sub> road	1.35	1.02	1.78
L <sub>den</sub> air	1.86	0.96	3.59
L <sub>den</sub> railway	0.94	0.71	1.24

*Eze et al. Int J Epidemiol, 2017*

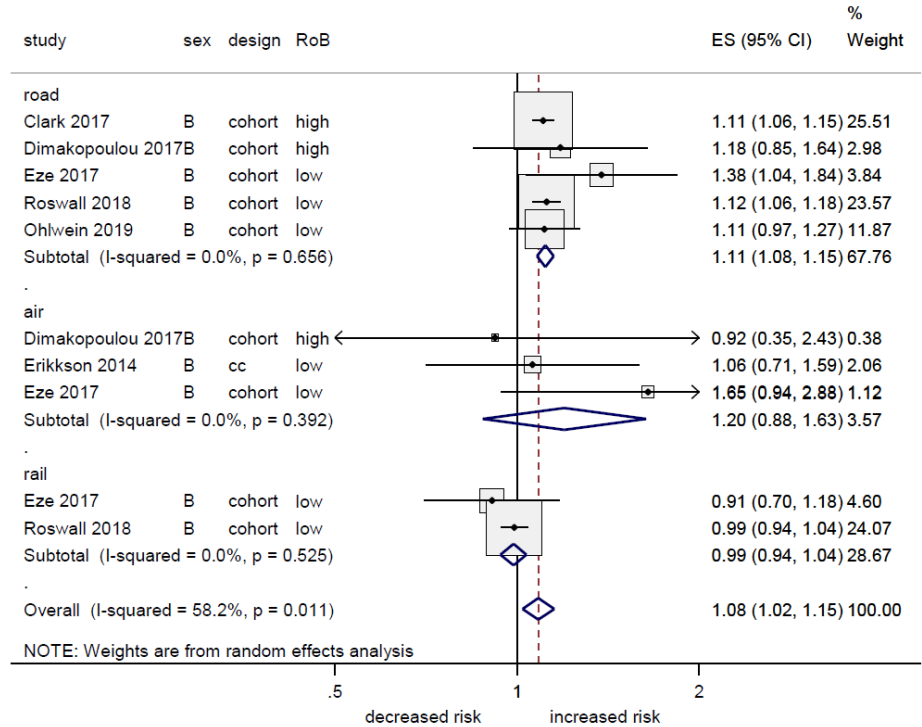
- **Statistical analysis**

Multi-exposure model for Lden (road, rail, air) adjusted for many socio-demographic and lifestyle factors (e.g. smoking, alcohol, physical activity etc.) as well as air pollution.

# Exposure-response



# Meta-analysis



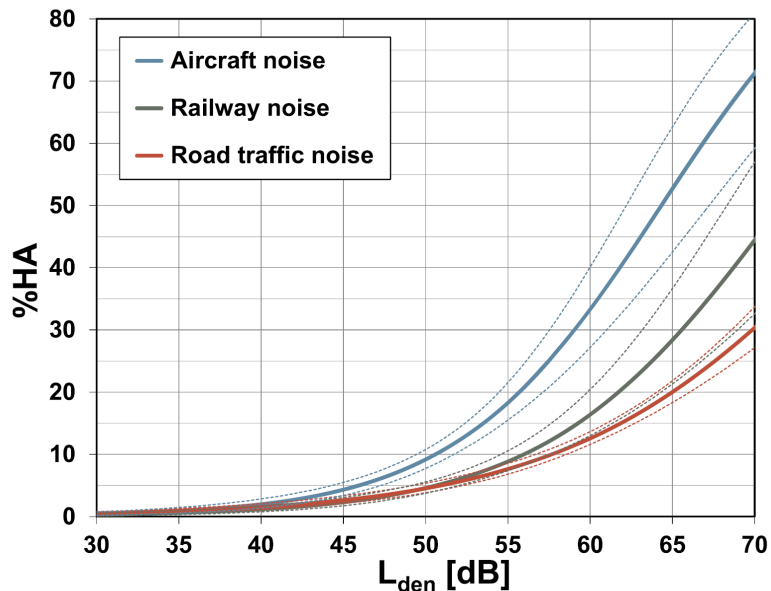
NOTE: Weights are from random effects analysis

Vienneau et al., 2019

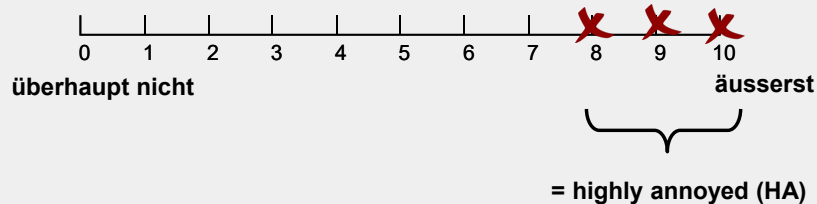
# Noise annoyance

Representative survey in Switzerland (SiRENE), n= 5'592

## Highly annoyed



Wenn Sie an die letzten 12 Monate bei Ihnen denken, welche Zahl zwischen 0 und 10 gibt am besten an, wie stark Sie sich durch Lärm von <Lärmart> insgesamt gestört oder belästigt fühlten?



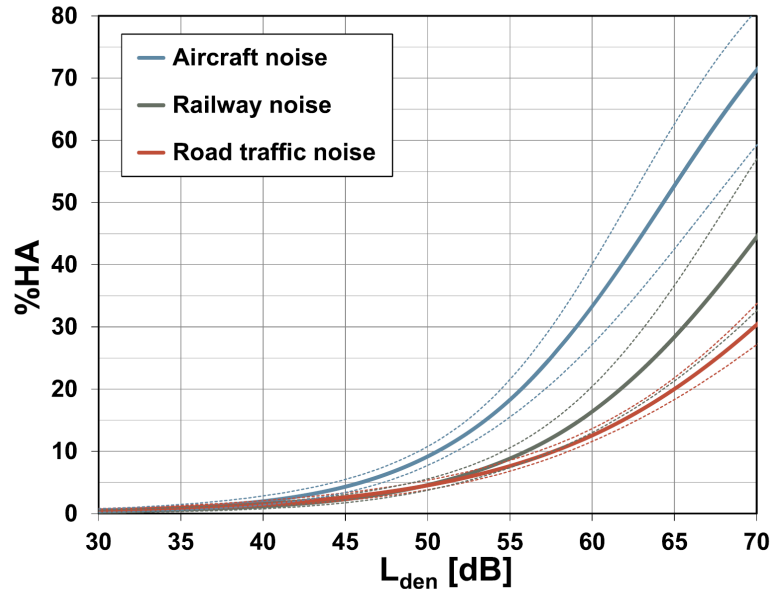
## Threshold?

Brink et al, 2019  
<https://doi.org/10.1016/j.envint.2019.01.043>

# Highly annoyed and sleep disturbed

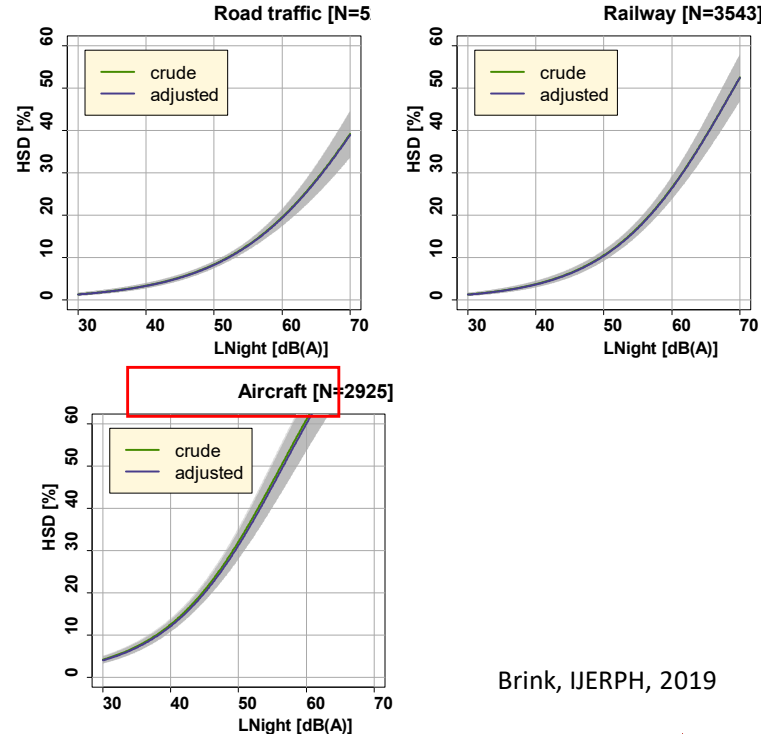
Representative survey in Switzerland (SiRENE), n= 5'592

## Highly annoyed



Brink, Env Int, 2019

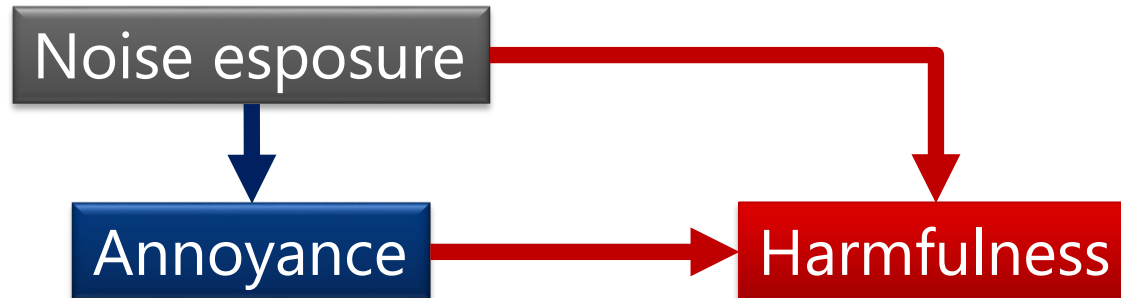
## Highly sleep disturbed



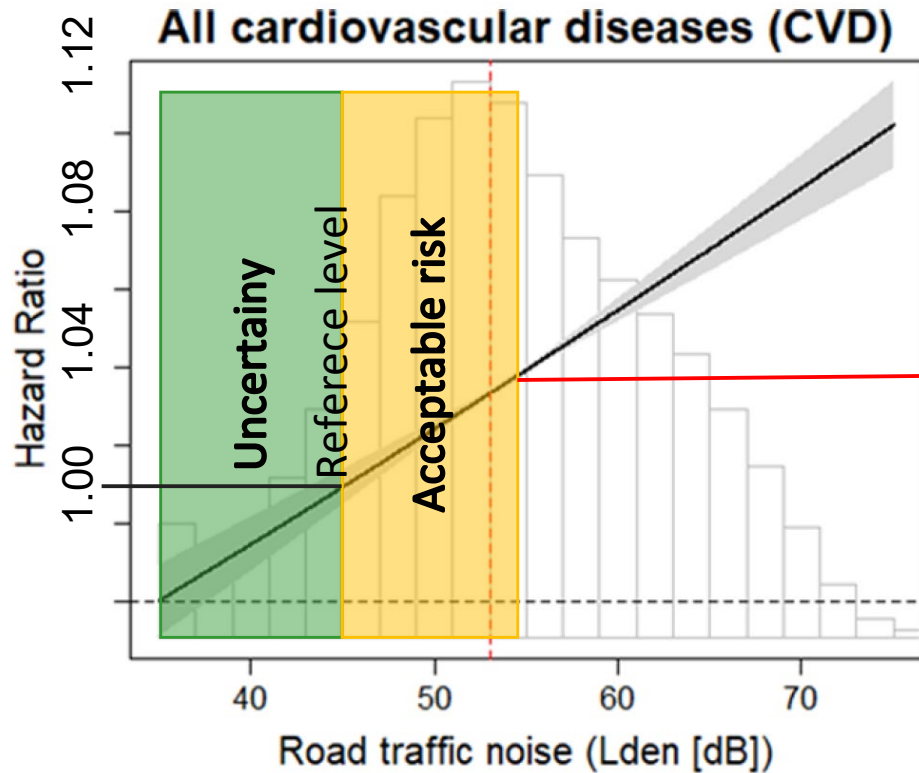
Brink, IJERPH, 2019

# Methods guidelines development

- **Science-based** and objective derivation with the same approach as the WHO in the development of the "Environmental Noise Guidelines", 2018.
- Separate assessment of **road, rail and aircraft noise**.
- **Subjective** noise effects are relevant to health and have the same weight as **somatic** health effects.



# General approach



Same approach as WHO

Limit

Vienneau et al, 2022  
(<https://doi.org/10.1016/j.envint.2021.106974>)

# Deriving scientific evidence

- Evidence evaluation criteria:
  - Causal relationship plausible from a pathophysiological point of view, evidence evaluation criteria WHO.
  - Solid exposure-response relationships exist.
  - In addition to international studies, there is at least one good-quality study from Switzerland.
  - Results from Swiss studies do not contradict the results from international meta-analyses (and vice versa).
- Derivation of exposure-response relationships for each outcome:
  - Meta-analysis of international data (50% weight)
  - Swiss study data (50% weight)



# Accepted risks

## Nuisance (self-reported)

- Noise annoyance
- Sleep disturbance

## Accepted proportion of affected people:

- 25% highly annoyed
- 15% highly sleep disturbed

## Diseases

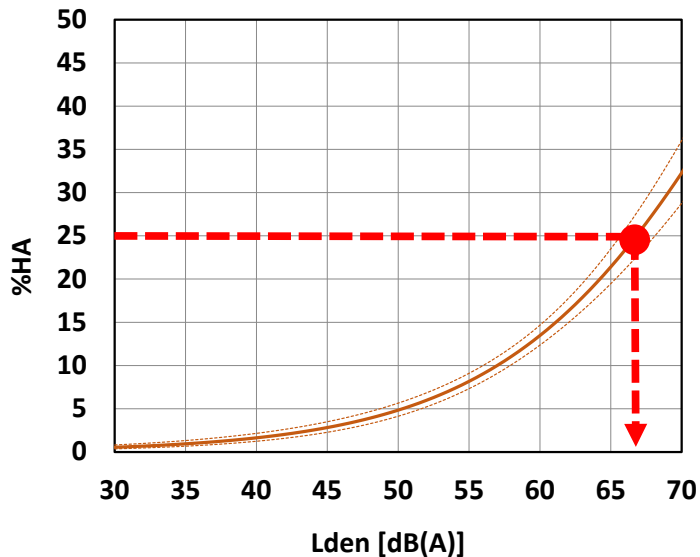
- Cardiovascular system
- Diabetes

## Accepted relative excess risk:

- 5% ischemic heart disease incidence
- 2.5% cardiovascular mortality
- 20% diabetes incidence

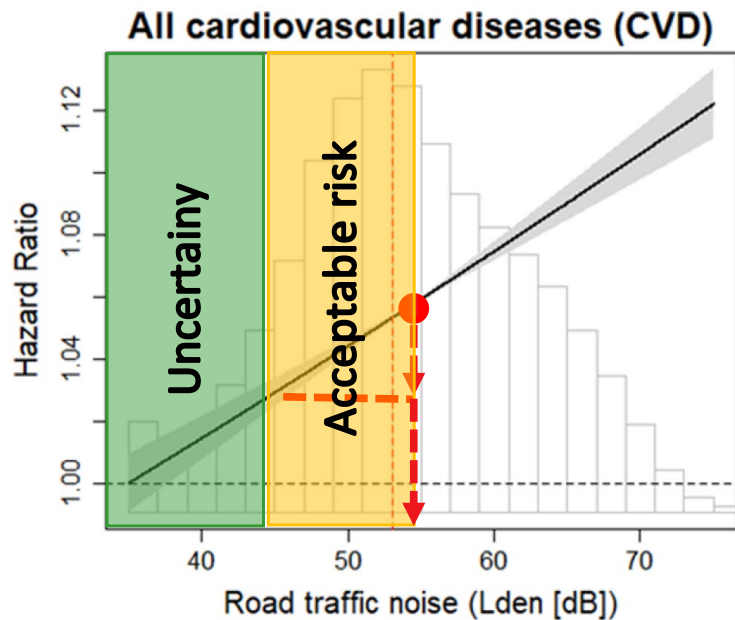
# Definition of thresholds

Road traffic: 25% HA



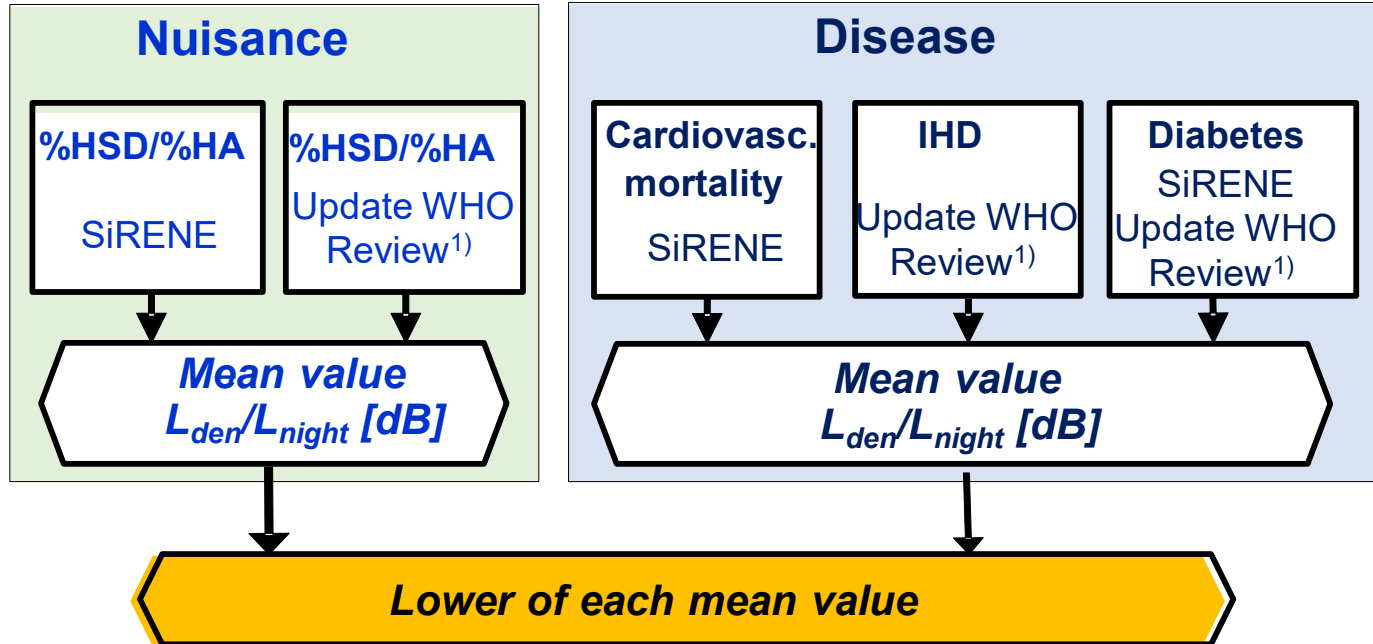
Brink et al, 2019  
(<https://doi.org/10.1016/j.envint.2019.01.043>)

Road traffic:  
2.5% increase in CVD mortality



Vienneau et al, 2022  
(<https://doi.org/10.1016/j.envint.2021.106974>)

# Evidence synthesis



<sup>1)</sup> Vienneau et al., 2019. <https://edoc.unibas.ch/70857/>

# Overview Regulatory limits

	CH day	CH night	WHO day <sup>\$</sup>	WHO night
Road	60	52	51.5	45
Railway	59	56	48	44
Aircraft	54	43*	43.5	40

## Relevant effects

Nuisance

Adverse effects

Nuisance and adverse effects

## \*Night hours aircraft

22.00-23.00: 52 dB

23.00-24.00: 49 dB

05.00-06.00: 49 dB

06.00-07.00: 52 dB

(flight curfew: 0.00-5.00):

<sup>\$</sup>estimated from WHO Lden guidelines

# Additional recommendations

- **Application**

Focus on residential; more flexible for rooms without long-term residential purpose (office, hotel)

- **Point of measurement**

Loudest point on facade → Pressure on mitigations measures at source

- **Time periods**

Extension of the night period to 9 hours (22-07 h) → Protection of sleep  
Additional single hour limit between 06 and 07 o'clock for aircraft noise

- **Uniform protection of residential areas**

Same limits in sensitivity areas II and III

- **No corrections due to little traffic**

→ Road and railways noise

# Conclusions

- The recommendation is based on the current state of scientific knowledge.
- The proposed limit values protect the population better from noise.
- The health consequences of traffic noise cause CHF 2.8 billion in external costs every year (<https://www.are.admin.ch/are/en/home/mobility/data/costs-and-benefits-of-transport.html>). Investments in noise protection are worthwhile.
- Noise abatement at the source is central.

The existing limits for traffic noise underestimate the negative effects of noise on the population and no longer meet the requirements of the Environmental Protection Act.

➔ Report is with the Federal Council