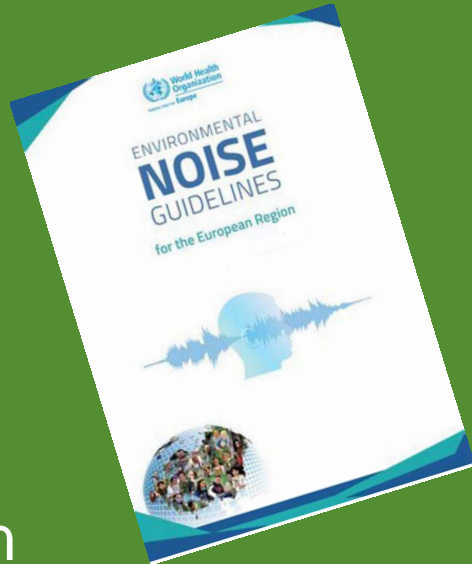


Development of the WHO Environmental Noise Guidelines



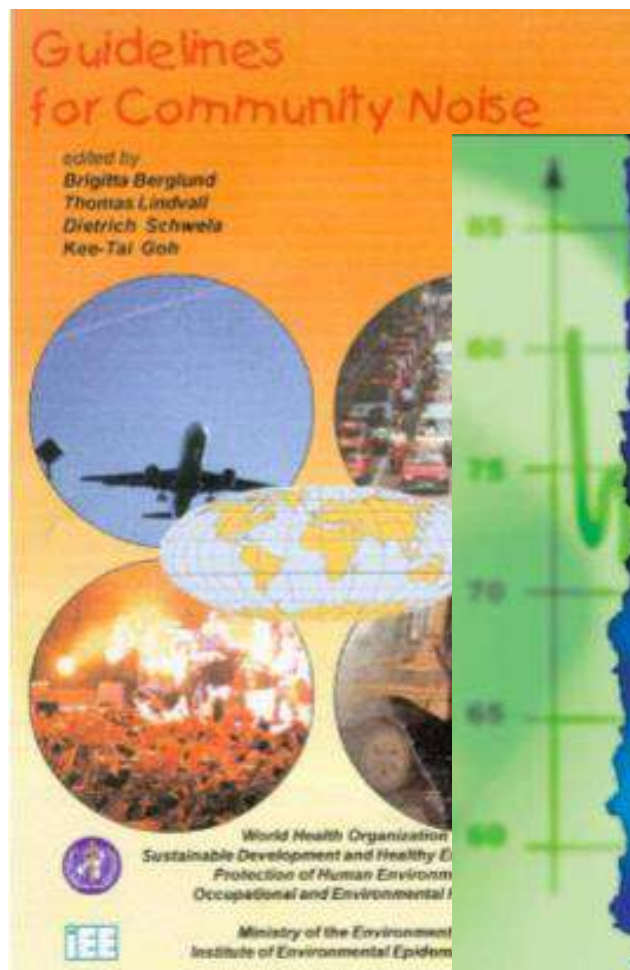
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and Water Management*

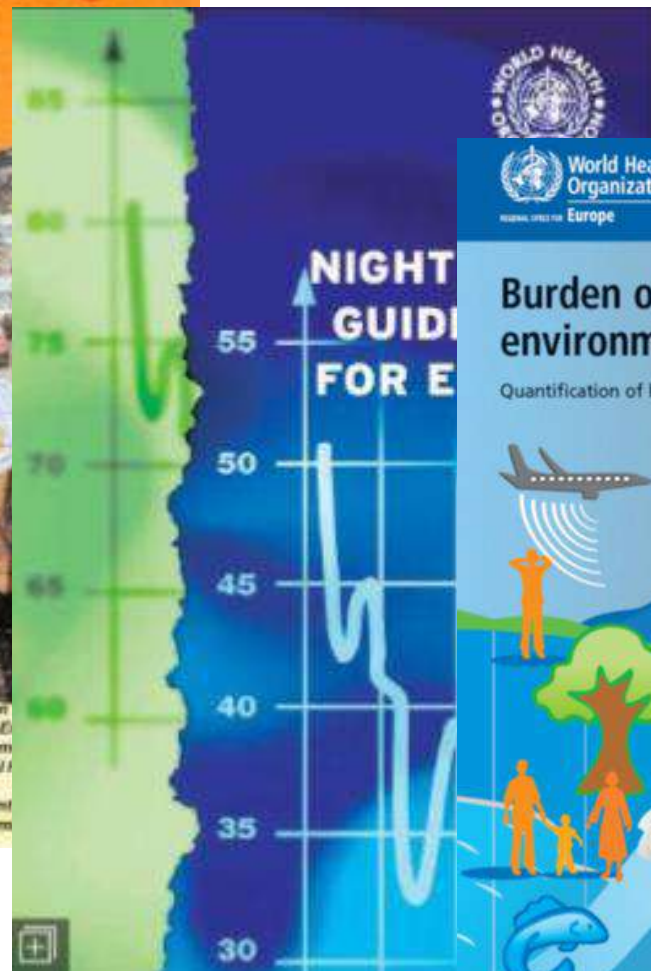
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19 March 2019
Paris, UIC Headquarters



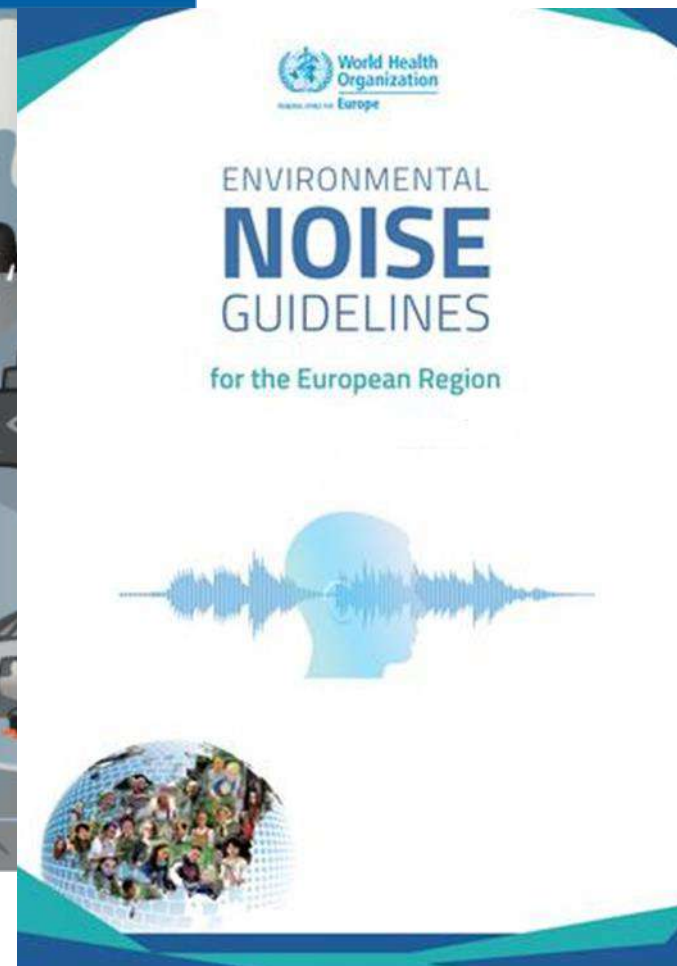
1999



2009



2011



2018

Noise sources considered

Road traffic



Railway



Wind turbines



Aircraft



Leisure

Environmental noise indicators

- L_{den} A-weighted average sound pressure level, measured over a 24 hour period, with a 10dB penalty for night and a 5dB penalty for evening
- L_{night} A-weighted average sound pressure level measured over at 8 hour period during night time, usually 23:00 to 07:00 hrs
- Noise exposure at the most exposed façade, outdoors
- $L_{A,max}$ Maximum sound pressure level for single events - important in sleep studies

Guideline development process - guideline groups and main steps



Systematic Reviews

1. Cardiovascular disease and metabolic effects
2. Annoyance
3. Sleep disturbance
4. Cognitive impairment
5. Hearing impairment and tinnitus
6. Adverse birth outcomes
7. Quality of life, mental health and wellbeing
8. Interventions to reduce noise and improve health

Grading the evidence

Assessment of the overall quality of evidence by Systematic Review Teams:

- Study limitations
- Inconsistency of results
- Indirectness of evidence
- Imprecision of effect estimate
- Publication bias
- Magnitude of effect
- Plausible confounding
- Dose-response gradient

OVERALL QUALITY OF EVIDENCE

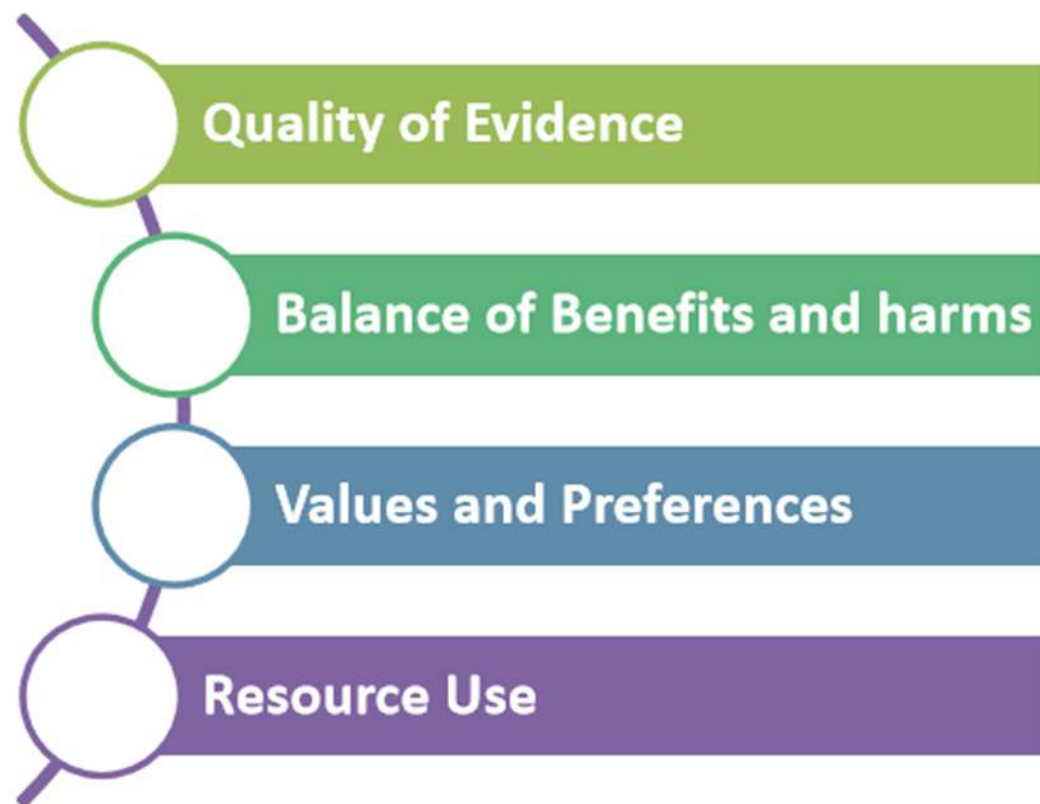
- High quality
- Moderate quality
- Low quality
- Very low quality

GRADE interpretations of quality of evidence

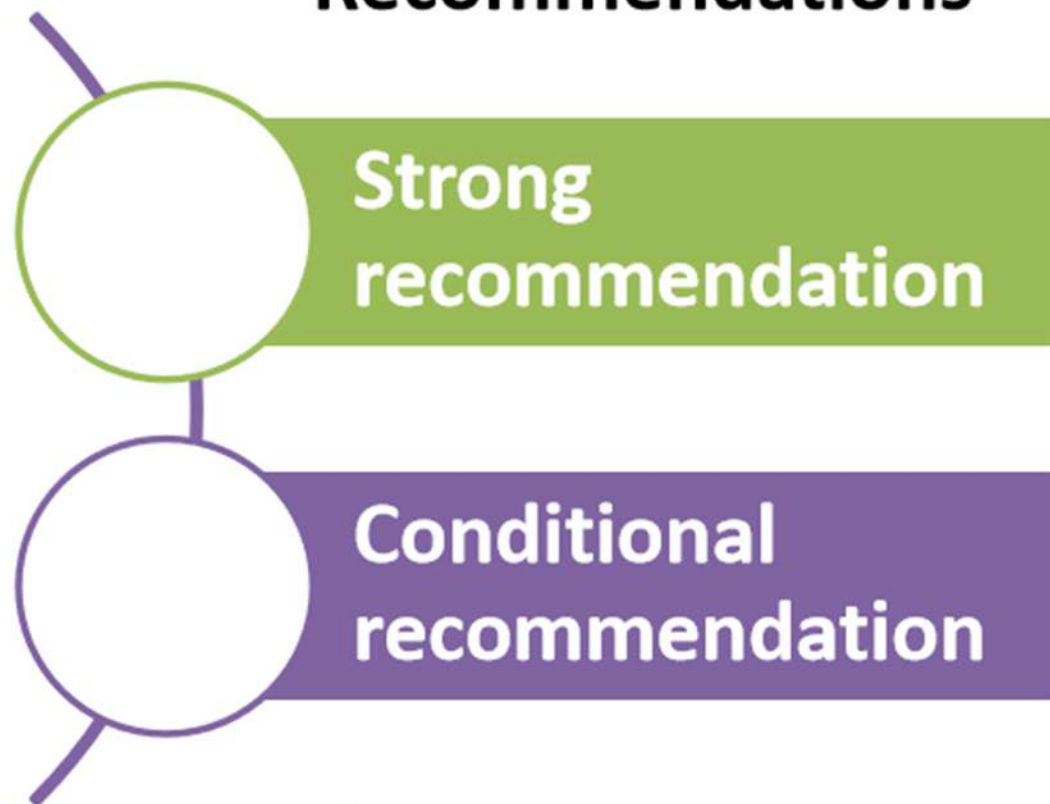
- **High quality:** further research very unlikely to change certainty of effect estimate
- **Moderate quality:** further research is likely to have an important impact on the certainty of the effect estimate and may change the estimate
- **Low quality:** further research is very likely to have an important impact on the certainty of the effect estimate and is likely to change the estimate
- **Very low quality:** any effect estimate is uncertain

Developing recommendations

Factors to be considered



Types of Recommendations



Priority health outcomes and relevant risk increases

| Priority health outcomes (DW) | Relevant risk increase for setting guideline level |
|--|--|
| Incidence of IHD (0.405) | 5%RR increase |
| Incidence of hypertension (0.117) | 10% RR increase |
| % Highly annoyed (0.02) | 10% absolute risk |
| % Highly sleep disturbed (0.07) | 3% absolute risk |
| Permanent hearing impairment (0.0150) | No risk due to environmental noise |
| Reading and oral comprehension (0.006) | One month delay in reading age |

Rationale for guideline for Road Traffic Noise - average exposure levels for priority health outcomes

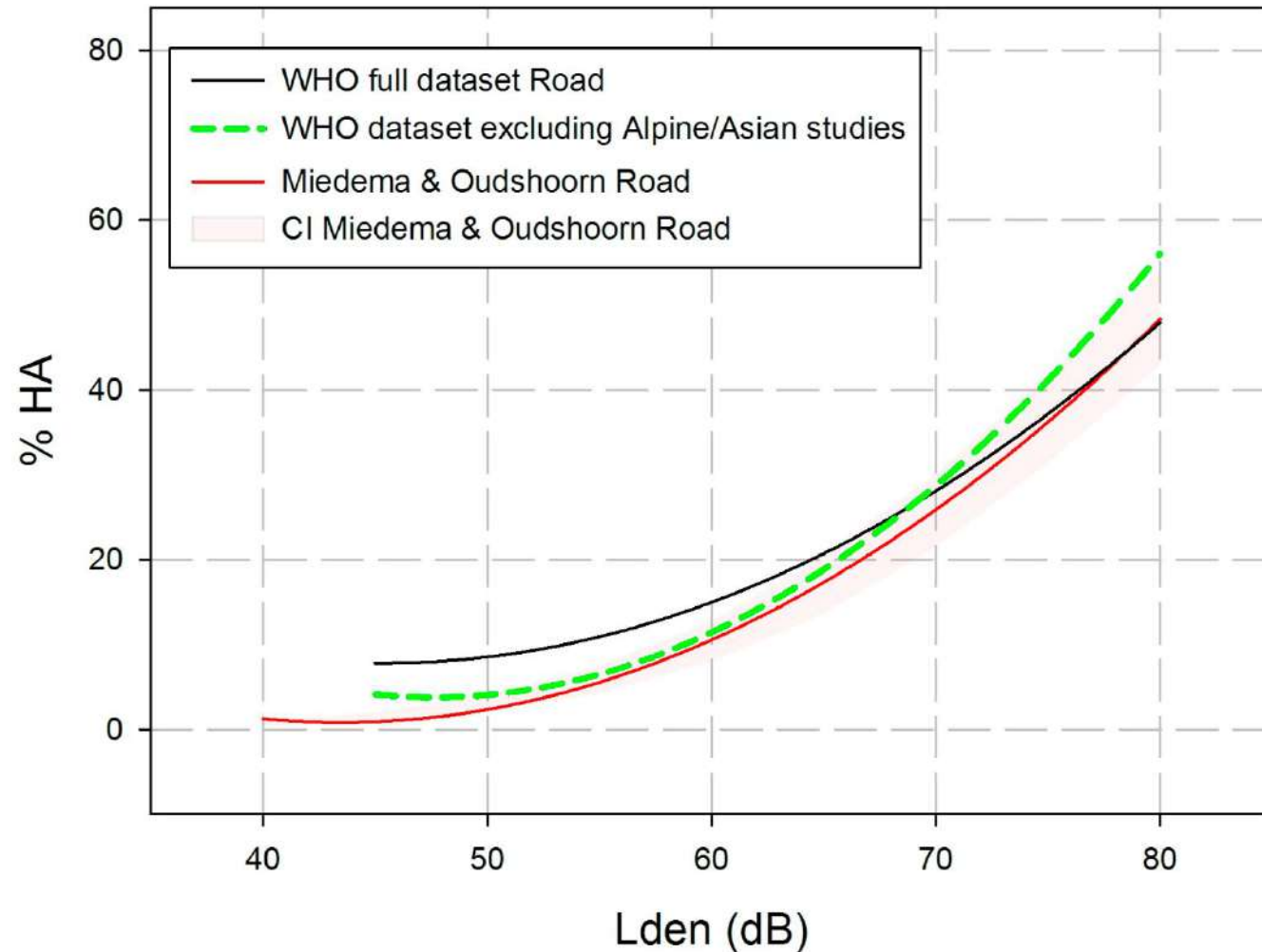


| Summary of health outcome evidence | Benchmark level | Evidence quality |
|---|--------------------|------------------|
| Incidence of IHD: 5% RR increase at 59.3dB _{L_{den}} RR=1.08 per 10dB increase | 5% increase of RR | High |
| Incidence of hypertension: One study met inclusion criteria. No noise effect | 10% increase of RR | Low |
| Prevalence of highly annoyed: Absolute risk of 10% HA at 53.3dB _{L_{den}} | 10% absolute risk | Moderate |
| Sleep disturbance: 3%HSD at 45.4dB L _{night} | 3% absolute risk | Moderate |

← 53dB L_{den}

← 45dB L_{night}

Exposure-response relationship road traffic noise annoyance



WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance.

Guski, Schreckenberg & Schuemer, Int. J. Environ. Res. Public Health 2017, 14, 1539

Rationale for guideline for Railway Noise - average exposure levels for priority health outcomes

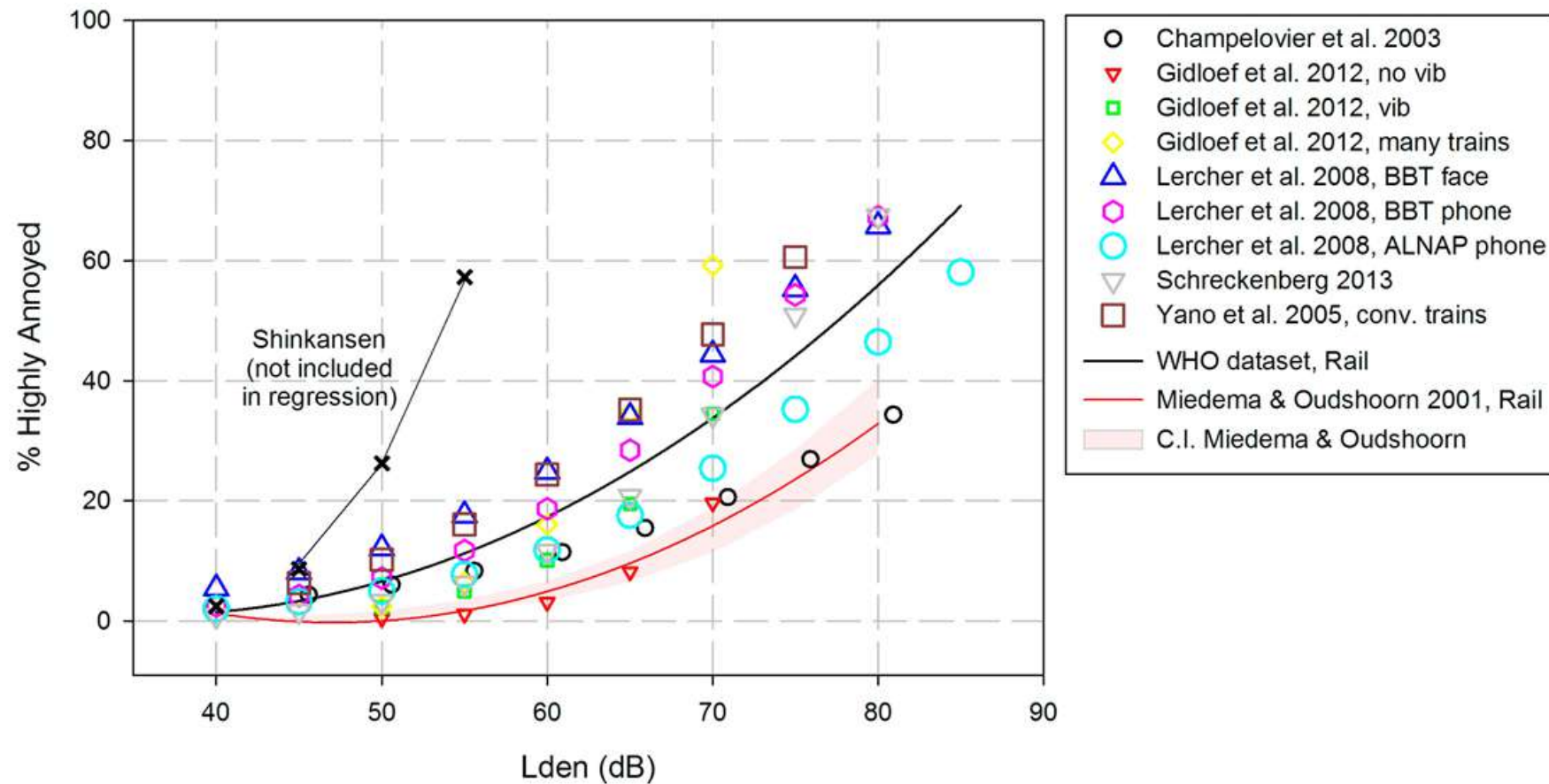


| Summary of health outcome evidence | Benchmark level | Evidence quality |
|--|--------------------|------------------|
| Incidence of IHD: No studies available | 5% increase of RR | - |
| Incidence of hypertension: One study met inclusion criteria. No noise effect | 10% increase of RR | Low |
| Prevalence of highly annoyed: Absolute risk of 10%HA at 53.7dB L _{den} | 10% absolute risk | Moderate |
| Sleep disturbance: 3%HSD at 43.7dB L _{night} | 3% absolute risk | Moderate |

← 54dB L_{den}

← 44dB L_{night}

Exposure-response relationship railway noise annoyance



WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance.

Guski, Schreckenberg & Schuemer, Int. J. Environ. Res. Public Health 2017, 14, 1539

Rationale for guideline for Aircraft Noise - average exposure levels for priority health outcomes



| Summary of health outcome evidence | Benchmark level | Evidence quality |
|--|--------------------|------------------|
| Incidence of IHD: Relevant risk increase occurs at 52.6dB L _{den} RR=1.09 per 10dB increase | 5% increase of RR | Very low quality |
| Incidence of hypertension: One study met inclusion criteria. No noise effect | 10% increase of RR | Low |
| Prevalence of highly annoyed: Absolute risk of 10%HA at 45.4 dBL _{den} | 10% absolute risk | Moderate |
| Sleep disturbance: 11% HSD at 40dB L _{night} | 3% absolute risk | Moderate |

← 45dB L_{den}

← 40dB L_{night}

Rationale for guideline for Wind Turbine Noise - average exposure levels for priority health outcomes



| Summary of health outcome evidence | Benchmark level | Evidence quality |
|---|--------------------|------------------|
| Incidence of IHD: Could not be used | 5% increase of RR | No studies |
| Incidence of hypertension: Could not be used | 10% increase of RR | No studies |
| Prevalence of highly annoyed: Exposure-response of four studies absolute risk of 10%HA (outdoors) at 45 dB L _{den} | 10% absolute risk | Low quality |
| Sleep disturbance: 6 studies - no consistent results | 3% absolute risk | Low quality |



45dB L_{den}

To protect health

WHO/EUROPE NOISE GUIDELINES

recommend reducing noise
levels below:



53 dB (45 dB for night)



54 dB (44 dB for night)



45 dB (40 dB for night)



45 dB

Scope and implementation of the guidelines

- WHO provides **health based guideline values**
- Not **limit values** to directly use in legislation
- Implementation requires balancing benefits and harms, values/preferences
- Impact or cost-benefit analyses are not within scope of the WHO guidelines
- NL started impact analysis of (partly) implementing insights from the guideline

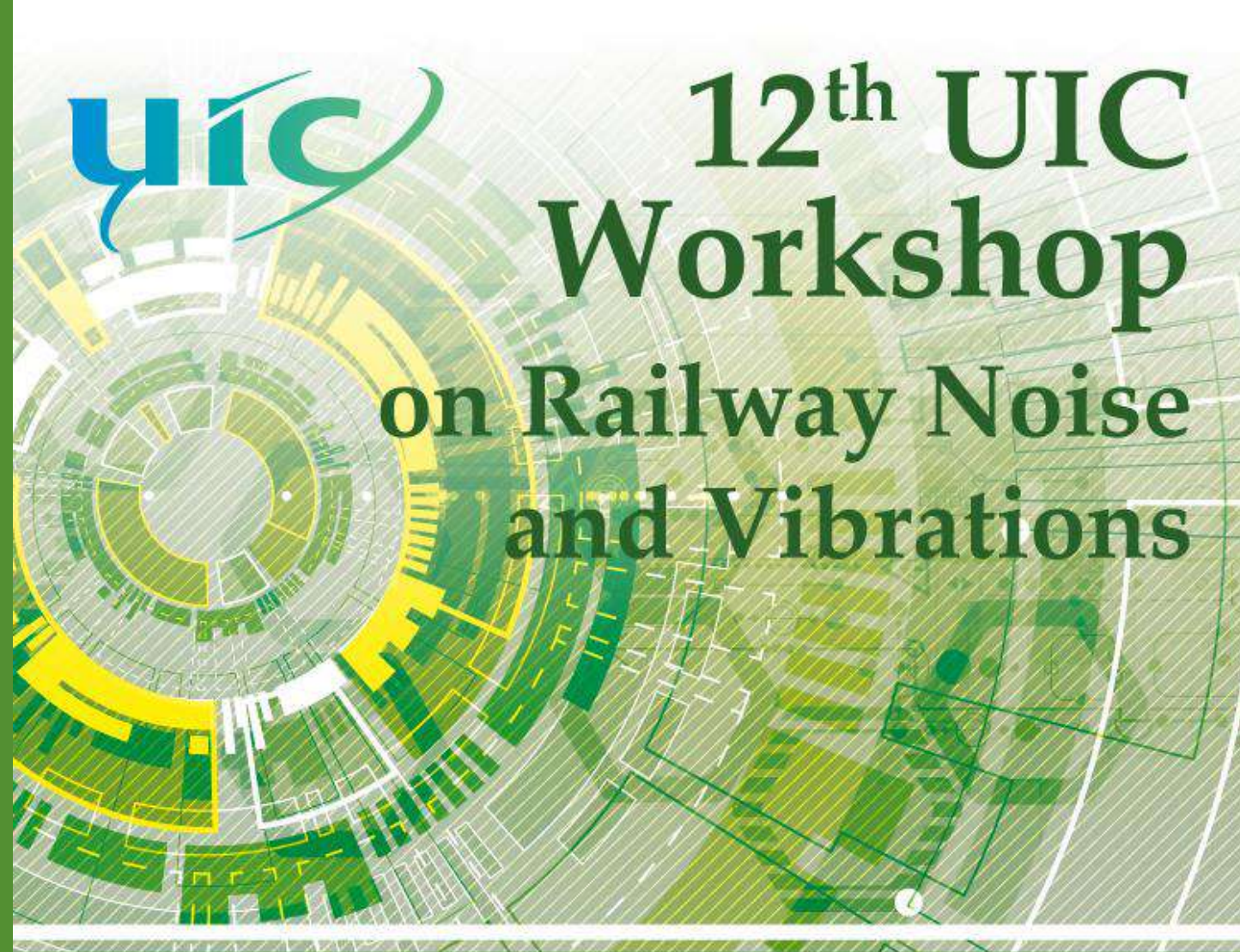
Thank you!

Sabine Janssen

Senior Policy Advisor

*The Netherlands Ministry of Infrastructure
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DG Environment & International Affairs



19 March 2019

Paris, UIC Headquarters