WHO Guidelines for Noise

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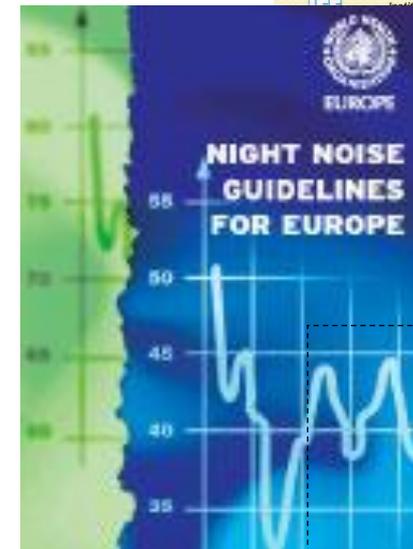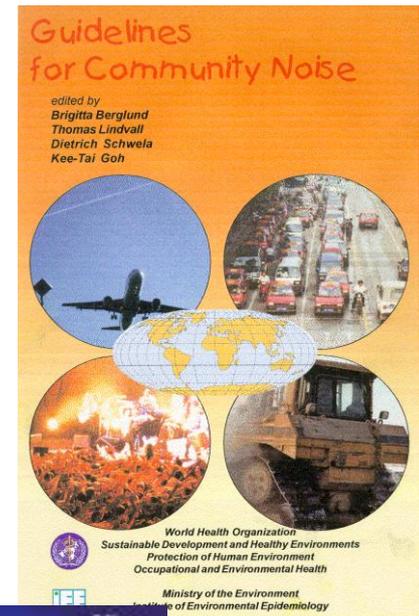
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Presentation Outline

1. **Context**

2. **WHO Guideline development process**

3. **Scope of the guidelines**

4. **Preliminary evidence on rail noise and health**

5. **Developing recommendations**

6. **Conclusions**

1 – Context
WHO guidelines on noise

- **WHO Guidelines for Community Noise (1999)**

- **WHO Night Noise Guidelines for Europe (2009)**

- **WHO Environmental Noise Guidelines for the European Region (in development)**

  - **New sources of noise?**

  - **New evidence on health outcomes?**

1 - Results of WHO report on disease burden (2011)

Every year in the EU cities, at least:

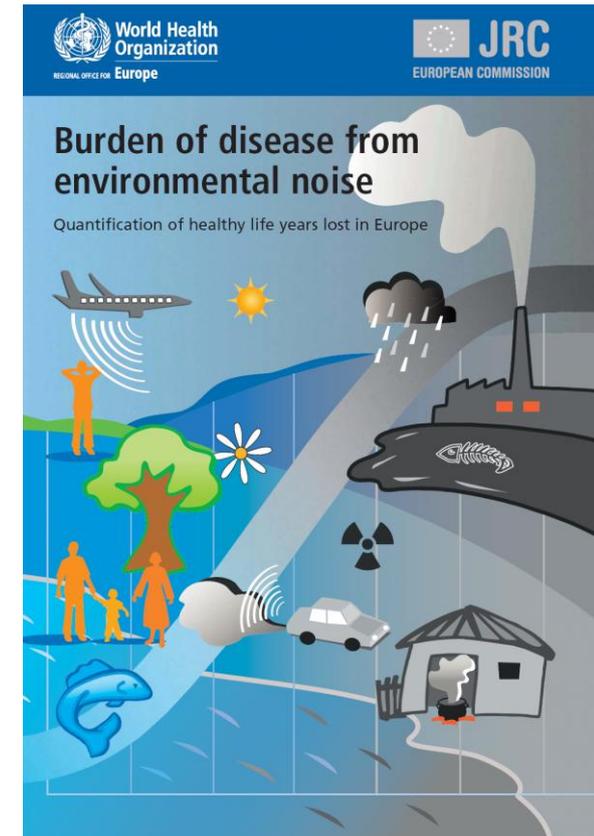903 000 DALYs for sleep disturbance

654 000 DALYs for annoyance

61 000 DALYs for ischaemic heart disease

45 000 DALYs for cognitive impairment

22 000 DALYs for tinnitus

1~1.6 million healthy life years are lost every year from <u>transport noise</u> in the EU cities.

Sleep disturbance and annoyance related to <u>road</u> transport noise comprise the main burden.

World Health Organization
REGIONAL OFFICE FOR Europe

JRC
EUROPEAN COMMISSION

Burden of disease from environmental noise

Quantification of healthy life years lost in Europe

1 – European Context

- **The Guidelines will focus on the WHO European Region (53 Member States):**

  - **Commitment to Act from European Ministers of Environment and Health to reduce children's exposure to noise, and urges WHO to produce appropriate noise guidelines (Parma Declaration, 2010)**

  - **European Union Directive relating to the assessment and management of environmental noise requires Members States to map noise exposure and establish action plans to control and reduce the harmful effects of noise exposure**

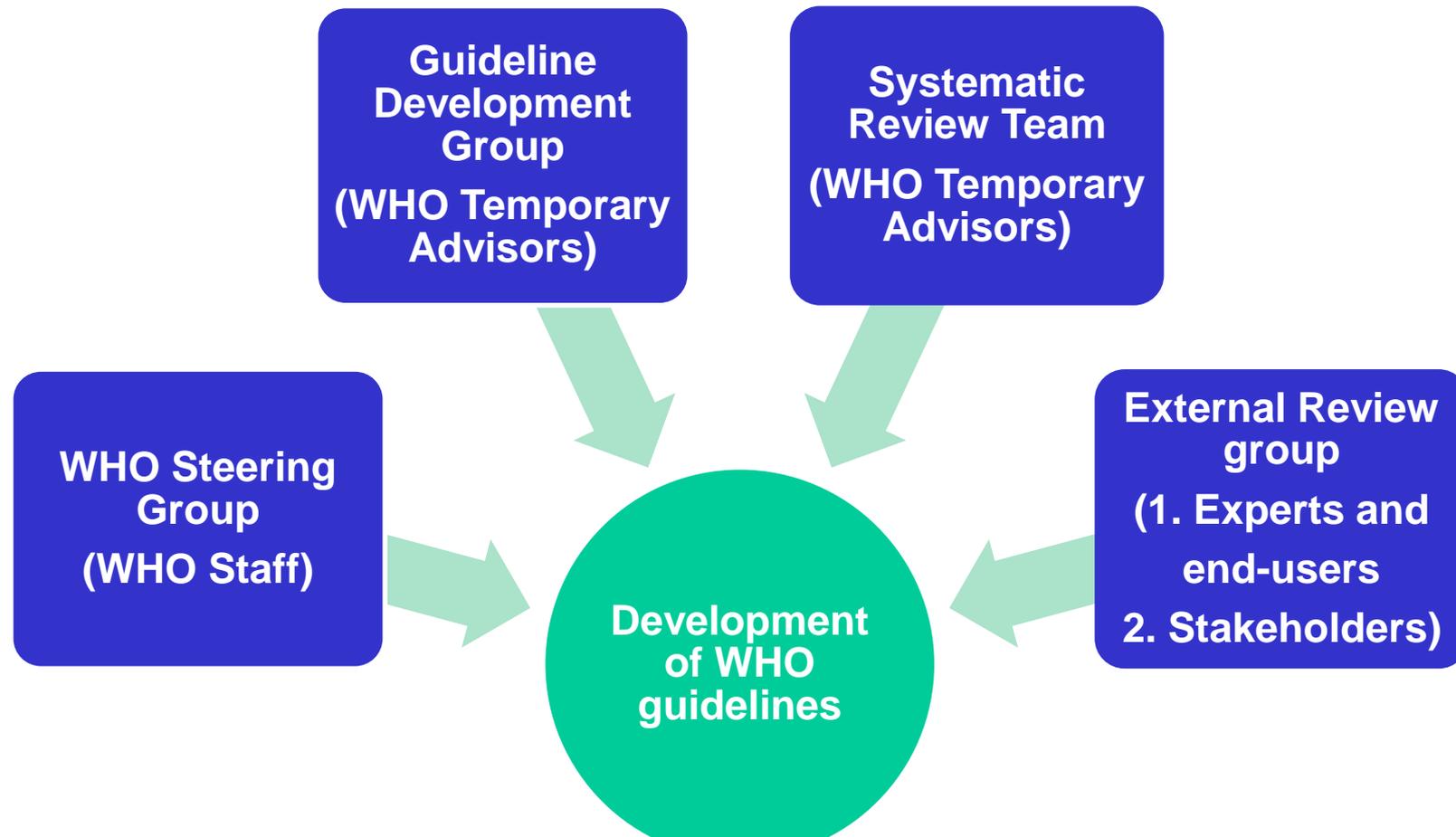   - *In particular, Annex III on "dose effect relations"*

World Health Organization
REGIONAL OFFICE FOR Europe

EUROPEAN ENVIRONMENT AND HEALTH PROCESS

2 - WHO Guidelines

✓ Represent the most widely accepted set of **public health recommendations,** intended **to assist policy-makers, health-care providers, and other relevant stakeholders** to make informed decisions for the protection of public health.

✓ Based on a **comprehensive** and **objective assessment of the available evidence.**

✓ **Generally intended for worldwide use**, and therefore recognize the heterogeneity on technological feasibility, economic development and other political and economical factors.

✓ In 2007, WHO adopted internationally recognized standards and methods to ensure that guidelines are **free from biases** and **meet public health needs**.

2 - Groups involved in WHO guideline development

Guideline Development Group
(WHO Temporary Advisors)

Systematic Review Team
(WHO Temporary Advisors)

WHO Steering Group
(WHO Staff)

External Review group
(1. Experts and end-users
2. Stakeholders)

Development of WHO guidelines

3 – Scope of the guidelines

Scoping questions:

1. Exposure-response relationships:

   In the **general population** exposed to environmental noise, what is the **exposure-response relationship** between exposure to **environmental noise** (reported as various indicators) and the proportion of persons with a **validated measure of health outcome** when adjusted for confounders?

2. Effectiveness of interventions:

   In the **general population** exposed to environmental noise, what is the effect of **interventions** to reduce exposure to environmental noise on **adverse health outcomes**?

3 - Noise sources and settings included

- **Noise sources:**
  - **Aircraft noise**
  - **Railway noise**
  - **Road noise**
  - **Wind turbine noise**
  - **Leisure noise (including personal listening devices)**

- **Combined noise sources:**
  - **Occupational noise?**
  - **Vibration from railway traffic?**
  - **Air pollution?**
  - **Visual aspects of wind turbines?**

- **Noise settings:**
  - **Residences**
  - **Hospitals?**
  - **Educational settings?**
  - **Public venues?**

3 - Health outcomes included in the review

WHO definition of health:

State of complete physical, mental, and social well-being and not merely the absence of disease or infirmity

Health outcomes included:

- **effects on sleep (subjectively and objectively reported)**

- **annoyance**

- **cognitive impairment, mental health and wellbeing**

- **cardiovascular diseases (ischemic heart disease, stroke, hypertension), diabetes and metabolic diseases**

- **hearing impairment and tinnitus**

- **adverse birth outcomes (pre-term delivery, low birth weight, birth defects)**

3 - Interventions

Review of evidence on interventions and their effect on change in population exposure and on adverse health outcomes

Interventions can be defined as:

- **Source interventions**
- **Path interventions**
- **Infrastructure change interventions**
- **Indirect interventions**
- **Change in behaviour interventions**

4 Preliminary evidence review on rail noise and annoyance

11 studies 1997-2010: meta-analysis

12,591 respondents

Annual noise levels range 24-85dB$_{LAeq\ 24h}$

$L_{Aeq\ 24h}$ and L_{den} against full range of annoyance scale (10 studies used ICBEN/ISO annoyance scale)

% highly annoyed >=60% of the annoyance scale compared to >=72% in previous EU studies

2 High speed train studies

4 Preliminary evidence review on rail noise and annoyance

11 studies 1997-2010

Pearson correlation 0.412, 95%CI 0.28-0.53 between L_{Aeq24h} and noise annoyance raw scores

% Highly annoyed with 10dB increase in noise OR=3.39 95%CI 2.05-5.61 (OR=3.53 in modelled data)

Large variance between studies – only reduced slightly by excluding Shinkansen studies (vibration?)

Important non-acoustical variables: ground-borne vibrations, distance from track, residence construction type, passenger/freight, conventional/high speed
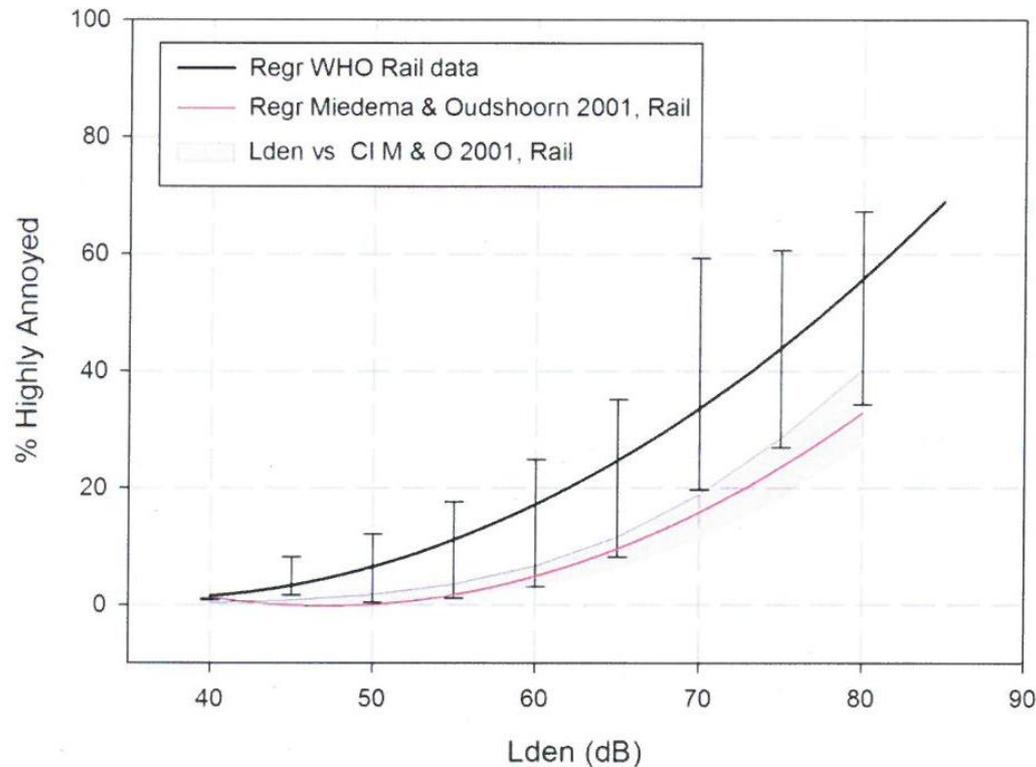
Lden and % highly annoyed (9 studies)

Figure 21: Quadratic regression of the relation between L_{den} and the calculated % Highly Annoyed for 9 railway noise studies (black), together with their 5% and 95% percentiles (black verticals). For comparison, the exposure-response function by Miedema & Oudshoorn (2001, rail) is shown (red), together with the confidence interval.

4 Preliminary evidence review on rail noise and sleep

Polysomnography: re-analysis of DEUFRAKO Study

33 individuals, 22-68 years living near Cologne/Bonn rail

9 consecutive nights, indoor noise measurements

Exposure response relationships for transitions to stage 1 sleep or waking

7,631 train events contributed to the analysis

Spontaneous awakening rates for rail study 6.1%

Noise level at which probability of additional awakenings due to train noise 33-38dBA

4 Preliminary evidence review on rail noise and sleep

DEUFRAKO Study

Odds of transition to stage 1 sleep based on 10dBA change ($L_{AS\ max}$) OR=1.22 95%CI 0.9,1.5

For freight trains   OR=1.40 95%CI 1.2,1.6

For passenger trains OR=1.21 95%CI 0.97,1.5

Little change after adjustment for age, gender, day of the week, time from sleep onset

'Significant positive association between indoor maximum noise level of single events and probability of sleep stage changes to wake or stage 1 sleep'

Problem of selection bias

4 Preliminary evidence review on rail noise and sleep

Self-reported sleep disturbance: meta-analysis of 30 studies (7 on rail noise) since 2000

L_{night} at the most exposed façade

Modelled the possibility of being highly sleep disturbed

Rail noise: 2% highly sleep disturbed at 40dBA L_{night}

Per cent highly sleep disturbed greater for rail than for road noise (different methodologies, recency, Asian studies included)

4 Preliminary evidence review on rail noise and sleep

Self-reported sleep disturbance: meta-analysis

Lnight per 10dBA (falling asleep) OR=2.57 95%CI 1.9,3.5

Lnight per 10dBA (awakening) OR=2.54 95%CI 1.5,4.3

Lnight* per 10dBA (falling asleep) OR=2.01 95%CI 1.4, 2.8

Lnight* per 10dBA (awakening) OR=1.12 95%CI 0.9,1.4

* Did not refer to noise in question

Other evidence reviews

Little evidence on cognitive impairment, mental health

No evidence on hearing impairment or birth outcomes

Evidence review on cardiovascular health is yet to report

5 – Grading the evidence

- Assessment of the overall quality of evidence for relationship between environmental noise and a certain health outcome / effectiveness of intervention:

  - **Study limitations**

  - **Inconsistency of results**

  - **Indirectness of evidence**

  - **Imprecision**

  - **Publication bias**

  - **Magnitude of effect**

  - **Plausible confounding**

  - **Dose-response gradient**

OVERALL QUALITY OF EVIDENCE:
- **High quality**
- **Moderate quality**
- **Low quality**
- **Very low quality**

5 – Developing recommendations

- Recommendations are developed considering:

  - Quality of evidence (high / moderate / low / very low)

  - Balance of benefits and harms (when implementing the recommendation)

  - Values and preferences (of general population and/or specific groups)

  - Resource use (more or less resource-intensive to implement a recommendations?)

6 - Conclusion

- **Environmental noise is an important public health concern**
  - *Only second to air pollution in terms of disease burden*
- **New scientific evidence in the field of environmental noise and public health**
- **WHO will develop the *WHO Environmental Noise Guidelines for the European Region***
  - **Updated exposure-response functions for noise sources / health outcomes**
  - **Recommendations on effectiveness of interventions**
- **The Guidelines will provide evidence-based recommendations in order to support WHO European Member States in their efforts to prevent and control exposure to excessive noise.**
- **The Guidelines development is ongoing with a view of completion in 2016.**

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