Elaboration of a methodology for the definition of an indicator of health risk induced by noise in urban areas

S. Marry,
M. Baulac, D. Bourgeois, J. Defrance, C. Goeury
Contents

1. Introduction
2. Methodology
3. Results
4. Public Health perspectives
5. Conclusions & perspectives
Noise is a current issue which is at stake in public health field.
The aim of this work is to better evaluate the health effects of noise in urban areas.
Several parameters are going to be gathered in order to create an indicator which could give sanitary information related to noise exposure and at a French local scale named IRIS (more or less 2000 people).
Introduction (2/4)

- **Health impact of noise**

  **Biological effects**
  Sleep disturbance, physiological effects (digestive and cardiovascular systems)

  **Non-hearing effects**

  **Subjective effects**
  Annoyance, tiredness, lack of concentration, interference with communication

  **Behaviour effects**
  Scholar or working achievements, drug consumption, psychological troubles

  **Hearing effects**
  Hearing fatigue, temporary or definitive deafness
Introduction (3/4)

Sanitary data available concerning Noise & Health:

- WHO guidelines

- Exposure-response relationship

- Percentage of annoyed people depending on the noise exposure and of the source type (road, rail and air traffic)

- Percentage of people disturbed in their sleep depending on the noise exposure and of the source type (road, rail and air traffic)

- Increasing of the risk of a cardio-vascular disease depending on the road traffic noise exposure
Introduction (4/4) – available data

- Noise levels: Lden, Lnight and Lday (END)
- Road surface transportation (roads and railways)
- IRIS scale population data
- GIS tool (SIS software)

- Sanitary effects:
  - Annoyance
  - Sleep disturbance
  - Cardio-vascular diseases

- Urban context:
  - Specific building
  - « Green area » accessibility
Contents

1. Introduction
2. Methodology
3. Results
4. Public Health perspectives
5. Conclusions & perspectives
Methodology (1/4) – general approach

- Lden, Ln and Lday noise levels
- Demographic data
- Sanitary data
- Town planning data
- Indicator representing the sanitary impact

BUILDING  IRIS
Methodology (2/4) – synthesis 1

Exposure-response relationship

% annoyed people

Number of people in each living building

Nb. annoyed people

∑ annoyed people

% annoyed people

Nb. people disturbed in their sleep

∑ people disturbed in their sleep

people disturbed in their sleep

∑ % annoyance & sleep/10

I_1
Methodology (3/4) – synthesis 2

**BUILDING**

- **Lday**
  - % people > 60 dB(A)

**IRIS**

- **I_1**
  - \( \sum \text{% annoyance & sleep}/10 \)

- **I_2**
  - % people > 60 dB(A)
  - + Contrib

- **I_3**
  - Sensible buildings
  - + Contrib

- **I_4**
  - % people near a green area
  - - Contrib

**Final indicator**

---

Additional notes:

- **Green areas**
  - % people near a green area

- **Nature of buildings**
  - Sensible buildings

---

**Note:** The image contains a flowchart illustrating the relationship between various factors and indicators, including the calculation of the final indicator (I_4). The flowchart shows how different variables contribute to the overall assessment of building noise impact and environmental factors.
Methodology (4/4) – Limits

- Data from the END and acoustical models
- Population and data exposure
- Sanitary data
- Urban data
- The methodology
Contents

1. Introduction
2. Methodology
3. Results
4. Public Health perspectives
5. Conclusions & perspectives
Results 1/3

Real IRIS

Imaginary IRIS

Superimposition
Results 2/3

Map representing $I_1$ (annoyance and sleep disturbance criterion applied for both roads and railways)
Results 3/3

Map representing $I_4$ (annoyance, sleep, cardiovascular diseases, sensible buildings and green areas criterion applied)
Contents

1. Introduction
2. Methodology
3. Results
4. Public Health perspectives
5. Conclusions & perspectives
Public health perspectives

The indicator could be used:

- as a diagnostic tool for public authorities

- for public policies since it gives information about the sanitary situation related to noise

- to evaluate the impact of some solutions and give the opportunity to compare several scenarios.
Contents

1. Introduction
2. Methodology
3. Results
4. Public Health perspectives
5. Conclusions & perspectives
Conclusions & perspectives

Conclusions

- This study proposes a methodology to evaluate the sanitary impact of noise with a unique indicator at the IRIS scale.
- There are limits and uncertainties but the feasibility is shown with first results and the public policies could be interested by this methodology.
- The flexibility of the methodology is a strength, the indicator can be adapted depending on the situation.
- The main weakness is the fact that the methodology is based on results of the END and is not suitable for cities not concerned by this directive.

Perspectives

- Work is still in progress in order to improve the indicator (taking into account multi-exposition and psycho-social approaches). The long term aim is also to consider the whole exposition during 24h since regarding health, other sources than transports and industries should be taken into account.
Thank you for your attention

Solene.marry@cstb.fr
Marine.baulac@cstb.fr