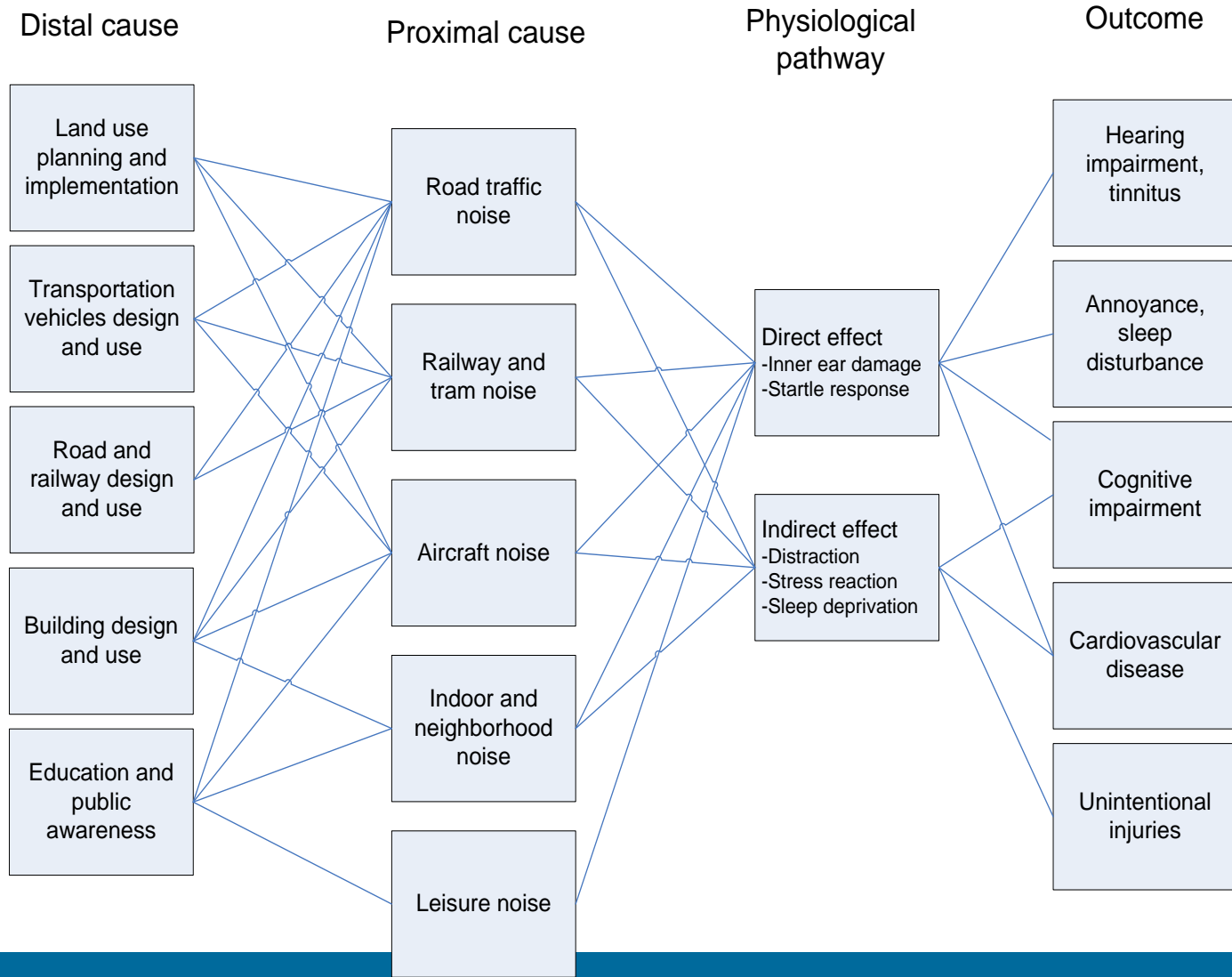


# Quantification des impacts sanitaires associés à la pollution sonore: application de la méthode «DALYs» en Ile-de-France

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# Causal web of noise and health



# WHO activities on noise

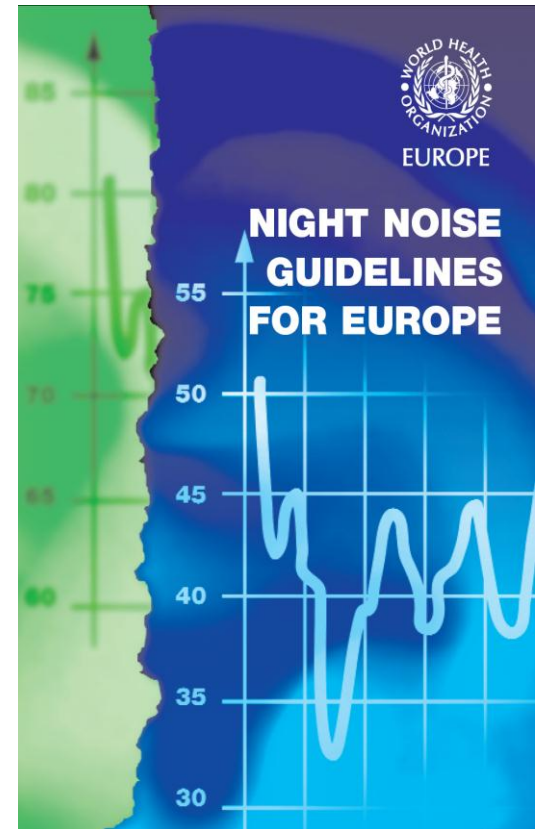
## ***Noise and health programme in WHO/Europe***

- Guidelines for noise exposure level
  - Community noise (1999)
  - Night noise (2009)
- Information pamphlets for local authorities
- Evidence review
  - Aircraft noise and health
- Quantitative risk assessment
  - Burden of disease from environmental noise (2011)
- Environmental health indicator on noise exposure

# Night Noise Guidelines for Europe (2009)

- No substantial biological effects up to 30 dB  $L_{\text{night}}^*$
- Night Noise Guideline (NNGL) 40 dB  $L_{\text{night}}$
- Interim Target (IT) 55 dB  $L_{\text{night}}$ 
  - Public health concern due to increased risk of cardiovascular diseases

\* As defined by European Noise Directive (2002/49/EC)



# Burden of disease from environmental noise (2011)

## Specific aims:

- Review the *evidence* on health effects
- Estimate the *total burden* of environmental noise using the noise maps produced by END
- Provide policy-makers with *health* arguments
- Demonstrate the *procedure* of quantitative assessment for national and local applications

# Burden of disease from environmental noise (2011)

## Selected health effects:

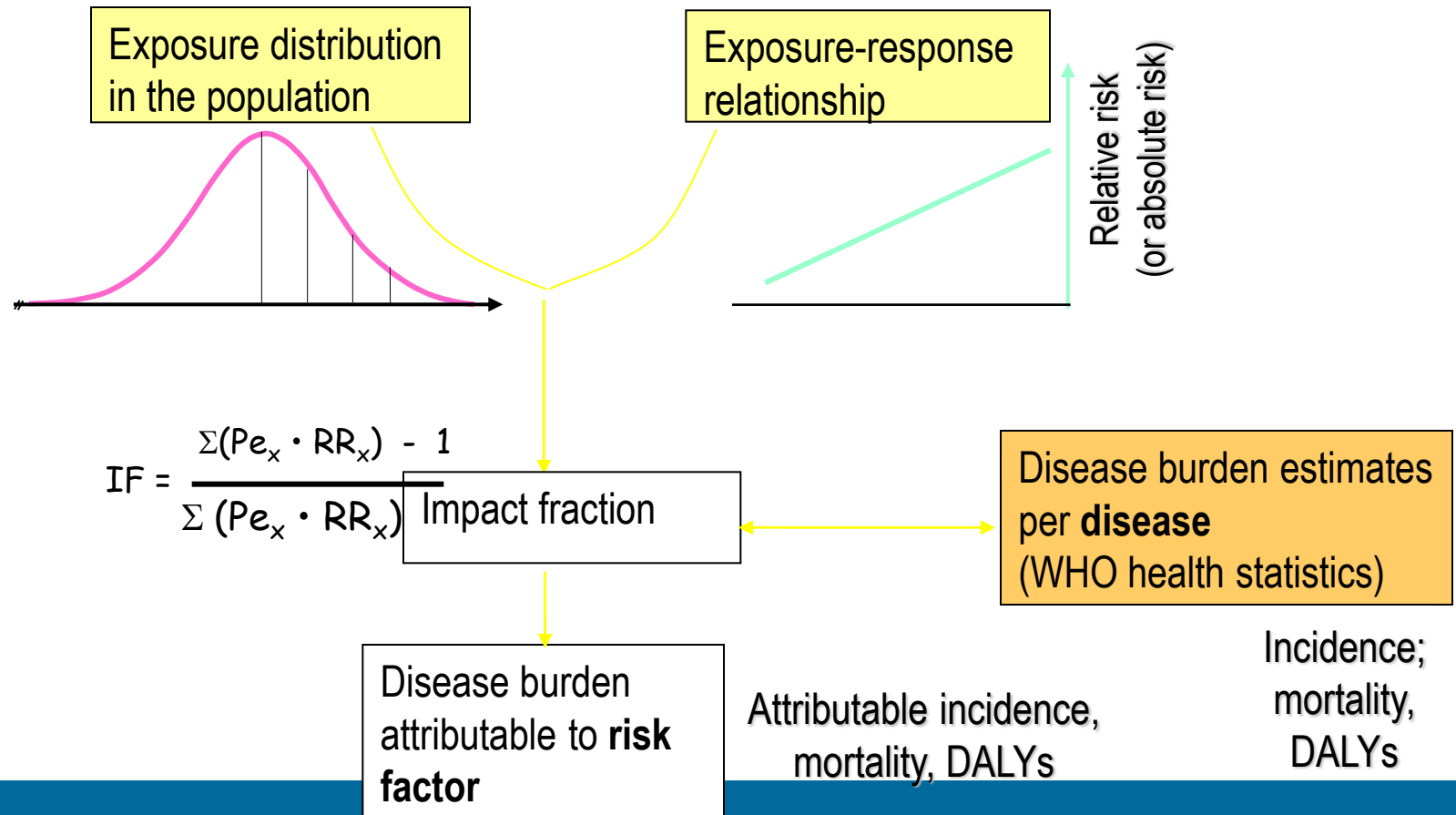
- Cardiovascular disease
- Cognitive impairment
- Sleep disturbance
- Tinnitus
- Annoyance



# What is environmental burden of disease (EBD)?

- EBD is the quantification of health impacts caused by various environmental risk factors at population level, using a comparable framework, definitions and outcome measures
- DALYs (disability-adjusted life years) are used for comparability of EBDs from different risk factors
- One DALY is equivalent to one healthy life year lost from specific risk factor

# Exposure-based approach

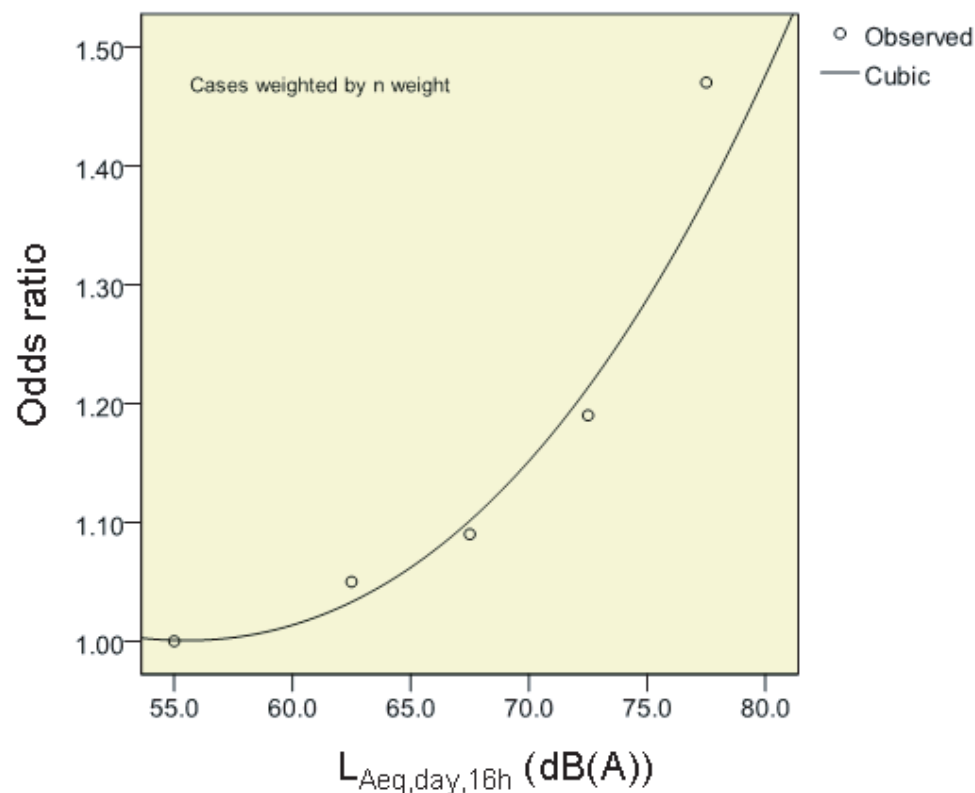




# Outcome-based approach

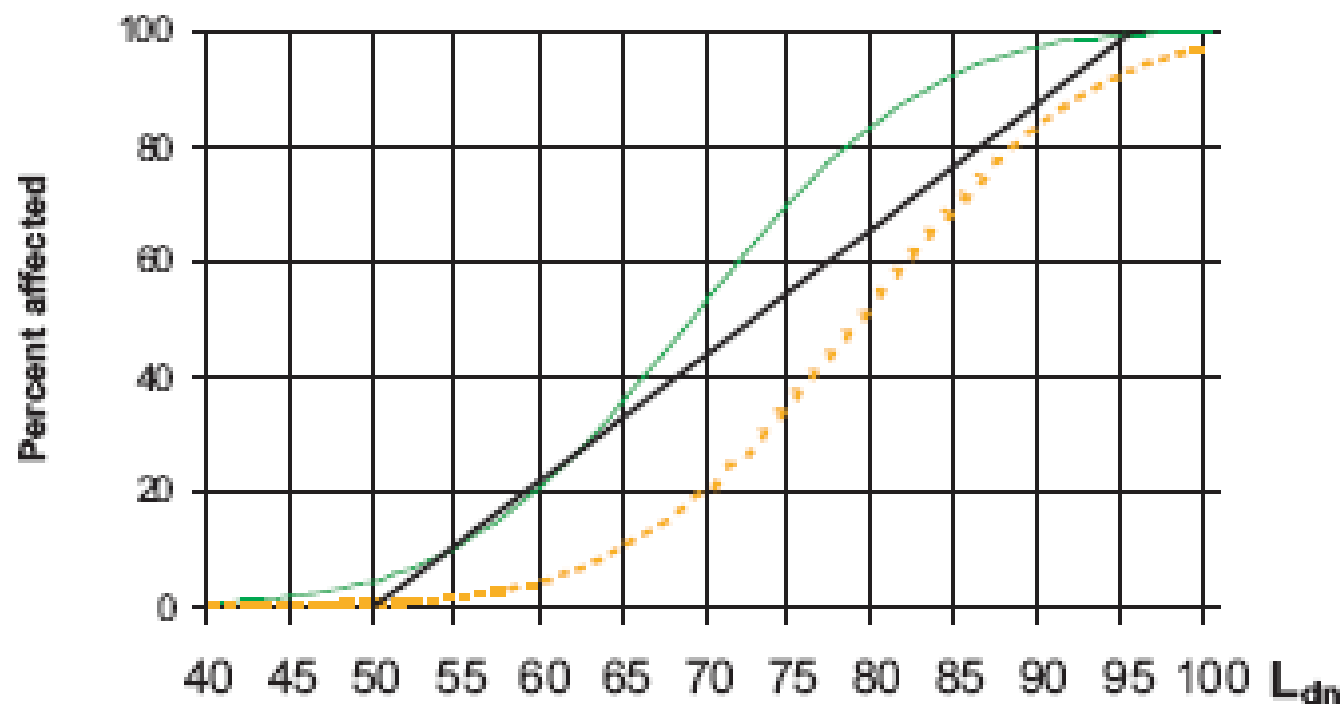
- Estimate the prevalence of the outcome attributable to environmental noise
  - Survey on the prevalence
  - Experts' estimate of attributable fraction
- Determine the value of DW for the outcome
- $DALYs = \text{number of attributable cases} \times DW$

# Cardiovascular disease



# Cognitive impairment

Fig. 3.2. Hypothetical exposure-risk curves and estimated percentage of affected people



# Sleep disturbance

Aircraft:	$\% \text{ HSD} = 18.147 - 0.956 (L_{\text{night}}) + 0.01482(L_{\text{night}})^2$
Road traffic:	$\% \text{ HSD} = 20.8 - 1.05 (L_{\text{night}}) + 0.01486(L_{\text{night}})^2$
Railways:	$\% \text{ HSD} = 11.3 - 0.55 (L_{\text{night}}) + 0.00759 (L_{\text{night}})^2$

**Table 4.4. DALYs for highly sleep-disturbed people due to road traffic noise in the EU**

Exposure category $L_{\text{night}}$ (dB(A))	Percentage of population exposed <sup>a</sup>	Percentage of people highly sleep-disturbed <sup>b</sup>	Number of cases per million <sup>b</sup>	DALYs lost in the urban population <sup>c</sup>		
				DW = 0.04	DW = 0.07	DW = 0.10
< 45	44 <sup>d</sup>	NA	NA	NA	NA	NA
45–49	20 <sup>d</sup>	4.5	8 906	101 526	177 670	253 814
50–54	20	6.6	13 266	151 230	264 652	378 074
55–59	10	9.6	9 556	108 937	190 640	272 342
60–64	5	13.2	6 611	75 365	131 888	188 412
65–69	1	17.6	1 763	20 099	35 174	50 248
Total	100		40 102	457 156	800 023	1 142 890

<sup>a</sup> The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.

<sup>b</sup> The percentage and number of cases were calculated with the polynomial equation, using the mid-level values of exposure categories.

<sup>c</sup> DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.

<sup>d</sup> Noise maps do not provide data for the categories of < 45 dB(A) and 45–49 dB(A) for  $L_{\text{night}}$ . Therefore, the percentages of population in these categories were interpolated using a very conservative assumption: the percentage for the 45–49 dB(A) is the same as that for 50–54 dB(A).

# Tinnitus

**Table 5.6. Calculation of DALYs for environmental noise induced tinnitus by severity level for the WHO EUR-A epidemiological subregion, 15 years of age and over, 2001**

Severity	Prevalent cases	Disability weight	Population-attributable fraction	DALYs
Slight	11 845 523	0.01	0.03	3 554
Moderate	4 122 166	0.11	0.03	13 603
Severe	1 407 670	0.11	0.03	4 645
Total	17 375 359	—	—	21 802

# Annoyance

Aircraft:

$$\%HA = -9.199 \cdot 10^{-5} (L_{den} - 42)^3 + 3.932 \cdot 10^{-2} (L_{den} - 42)^2 + 0.2939 (L_{den} - 42)$$

Road traffic:

$$\%HA = 9.868 \cdot 10^{-4} (L_{den} - 42)^3 - 1.436 \cdot 10^{-2} (L_{den} - 42)^2 + 0.5118 (L_{den} - 42)$$

Railways:

$$\%HA = 7.239 \cdot 10^{-4} (L_{den} - 42)^3 - 7.851 \cdot 10^{-3} (L_{den} - 42)^2 + 0.1695 (L_{den} - 42)$$

**Table 6.1. DALYs for highly annoyed people due to road traffic noise in the EU**

Exposure category $L_{den}$ (dB(A))	Percentage of population exposed <sup>a</sup>	Percentage of people highly annoyed <sup>b</sup>	Number of cases per million <sup>b</sup>	DALYs lost in the urban population <sup>c</sup>		
				DW = 0.01	DW = 0.02	DW = 0.12
< 55	50	2.77	13 835	39 430	78 859	473 155
55–59	17	8.16	13 868	39 524	79 047	474 285
60–64	19	12.96	24 621	70 170	140 341	842 044
65–69	9	20.08	18 068	51 494	102 989	617 933
70–74	4	30.25	12 100	34 485	68 969	413 815
> 75	1	30.25 <sup>d</sup>	3 025	8 621	17 242	103 454
Total	100		85 517	243 724	487 448	2 924 686

<sup>a</sup> The source of exposure data is the Noise Observation and Information Service for Europe (NOISE) as of June 2010.

<sup>b</sup> The percentage and number of cases were calculated using the mid-level value of each exposure category. For the category of < 55 dB(A), the mid-level value was conservatively set to 48 dB(A).

<sup>c</sup> DALYs were calculated for the 285 million persons living in agglomerations with > 50 000 inhabitants.

<sup>d</sup> As the exposure–response function does not apply to the range over 75 dB(A), the percentage of people highly annoyed in this exposure category was assumed to be the same as in the 70–74 dB(A) category.



# Burden of disease from environmental noise

***1.0 - 1.6 million healthy life-years lost every year in the EU cities***

- 61 000 years for heart disease
- 45 000 years for cognitive impairment
- 903 000 years for sleep disturbance
- 22 000 years for tinnitus
- 654 000 years for annoyance



# Key messages

- Environmental noise is among the most important pollutants in terms of health impacts.
- Sleep disturbance and annoyance related to traffic noise comprise the main burden.
- The quantification procedure can be used by international, national and local authorities to estimate disease burdens using noise maps.
- Assumptions, limitations and uncertainties should be carefully taken into account.

# For further information

Burden of disease from environmental noise

[http://www.euro.who.int/\\_data/assets/pdf\\_file/0008/136466/e94888.pdf](http://www.euro.who.int/_data/assets/pdf_file/0008/136466/e94888.pdf)

Night noise guidelines for Europe

<http://www.euro.who.int/noise>

Guidelines for community noise

<http://whqlibdoc.who.int/hq/1999/a68672.pdf>

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*Thank you very much*

