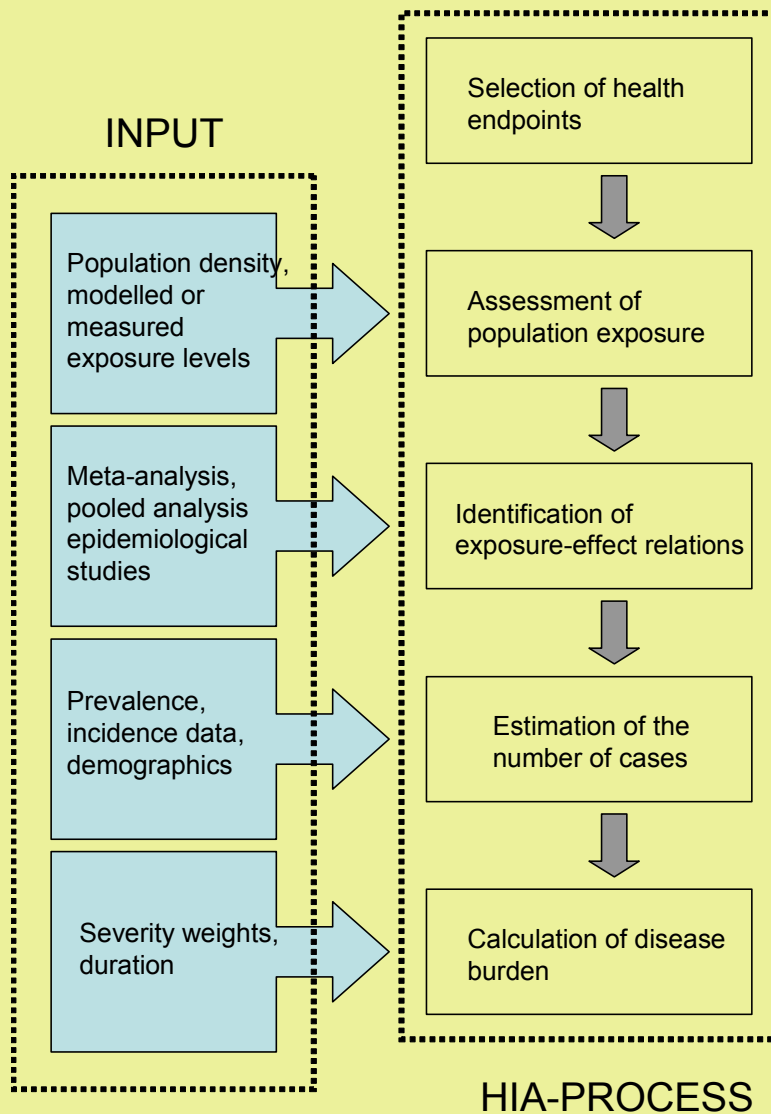


Brigit Staatsen, Elise van Kempen | 25-06-07

Health impact assessment of transport-related noise



Steps in health impact assessment



Step 1: Selection criteria health impacts

- Sufficient proof for a relation between exposure and health effect
 - *consultation experts and recent reviews of evidence (WHO, HCN)*
- Effects which are likely to occur at typical levels of transportation noise

Step 1: Selection of health impacts

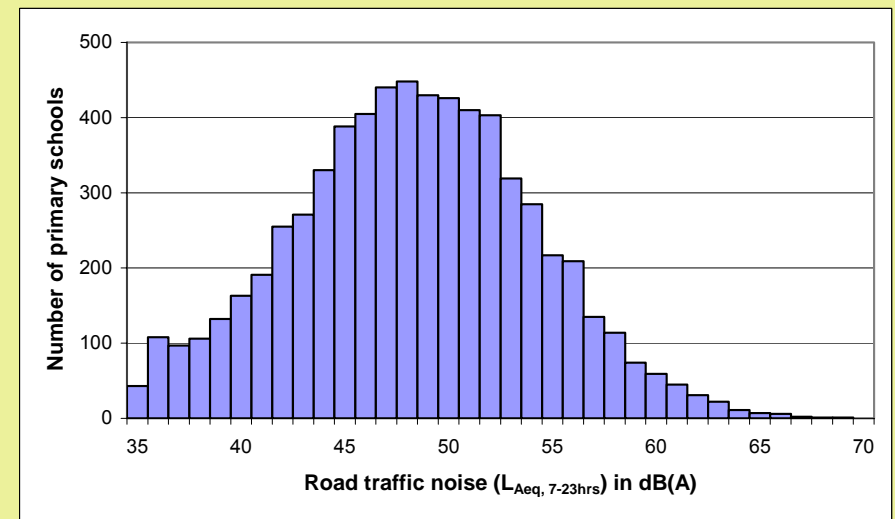
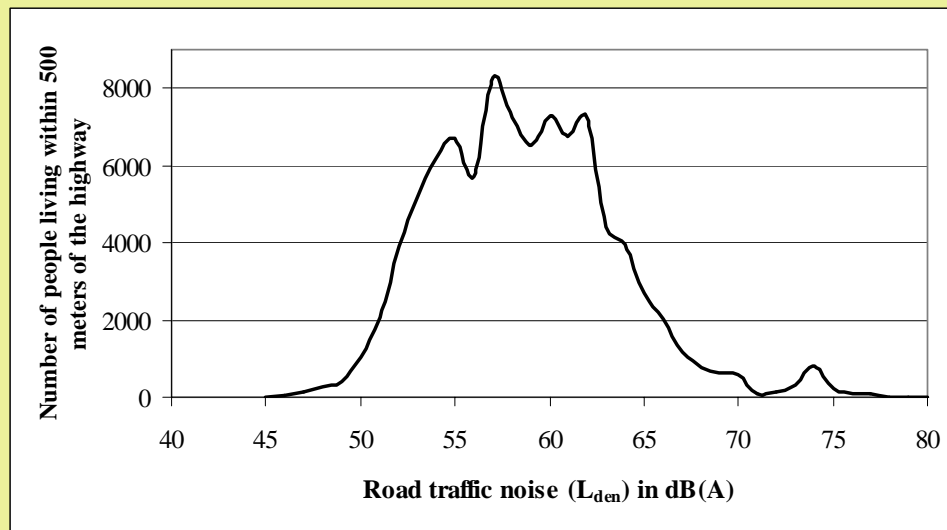
Table 1. Overview of selected health endpoints related to traffic noise exposure in adults.

Health end point	Exposure indicator	Weigh of evidence**
Annoyance	L_{den}	Sufficient
Sleep quality	L_{night}	Sufficient
Sleep disturbance	L_{night}	Sufficient
Insomnia	L_{night}	Sufficient
Ischemic heart disease (myocardial infarction)	L_{den}	Limited-sufficient

** weigh of evidence for an association with noise exposure according the WHO (1999) and/or Dutch Health Council (1994; 2004);

Step 2: Assessment of population exposure

- Combining data on place of residence with environmental quality data (modelled noise levels) using Geographic Information Systems
- Sometimes: noise measurements (monitoring systems)
- Examples of exposure distributions:



Step 3: Identification of exposure-response functions

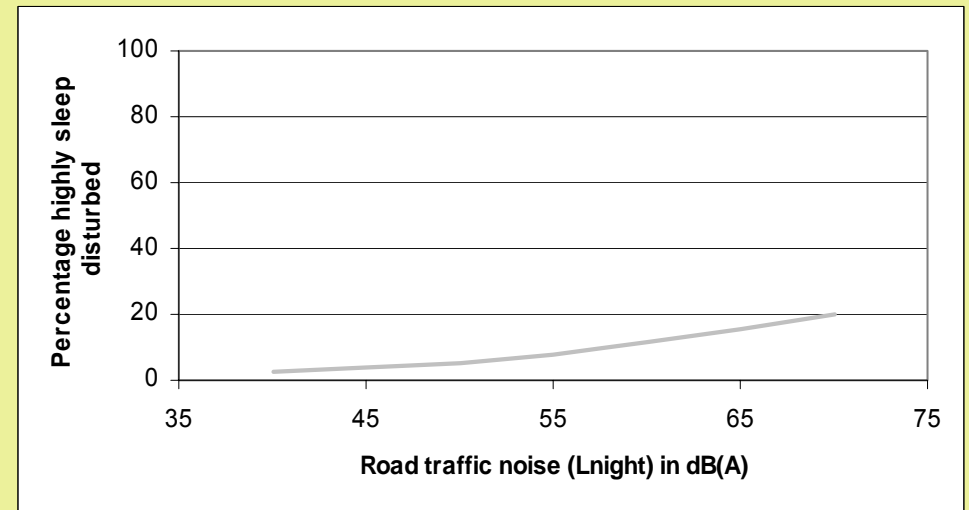
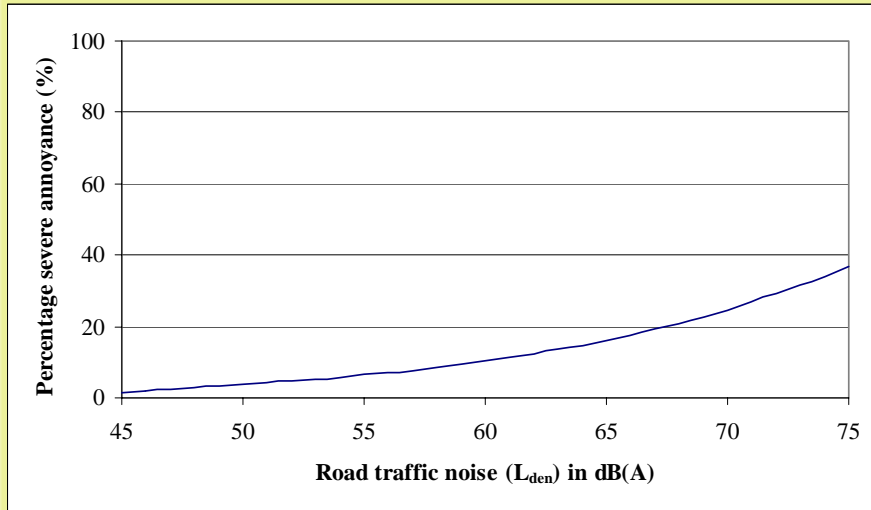
- quantitative summary of data (pooled analysis; meta-analysis)
- single epidemiological studies of good quality

Table 2. Overview of identified exposure-response functions for the selected health endpoints related to traffic noise exposure in adults.

Health end point	Exposure indicator	Weigh of evidence**	Valid exposure-effect relation available ?
Annoyance	L _{den}	Sufficient	Miedema & Oudshoorn, 2001
Sleep quality	L _{night}	Sufficient	Not available
Sleep disturbance	L _{night}	Sufficient	Miedema et al., 2002
Insomnia	L _{night}	Sufficient	Not available
Ischemic heart disease (myocardial infarction)	L _{den}	Limited-sufficient	Only indicatively ⁺

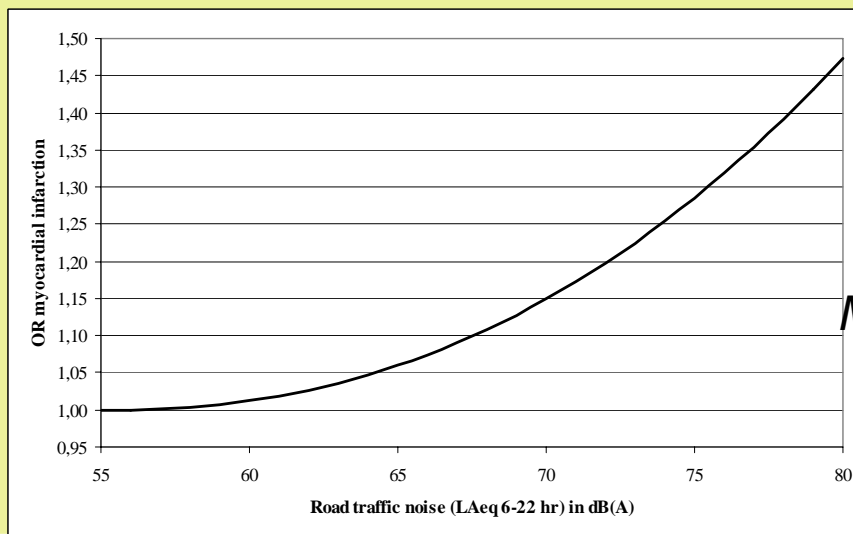
** weigh of evidence for an association with noise exposure according the WHO (1999) and/or Dutch Health Council (1994; 2004); ⁺ at the moment exposure-effect relations are updated. Until this update is available, the relations of Van Kempen (2002) and/or Babisch (2006) can be best used.

Step 3: Examples exposure-response functions



Annoyance (Miedema & Oudshoorn, 2001)

Sleep disturbance (Miedema et al., 2003)



Myocardial infarction (Babisch, 2006)

Step 4: Estimation number of attributed cases

- Example-1: severe annoyance

Table 3. The percentage of people exposed to and severely annoyed by road traffic noise (adults only).

Exposure category (dB(A))	Average Noise level (dB(A))	% of population exposed	% severely annoyed	Number per 1,000,000
<40		40	7.5	0
41-45		43	11.8	0.5
46-50		48	23.1	2.7
51-55		53	29.4	5.4
56-60		58	20.2	8.8
61-65		63	6.7	13.8
66-70		68	1.2	21.3
>71		73	0.1	31.8
Total			100	52,751

Adapted from: Knol and Staatsen (2005)

- Example-2: myocardial infarction

Table 4. Estimation of the number of attributable cases of myocardial infarction due to road traffic noise exposure in Germany (source: Babisch, 2006)

Road traffic noise (L_{Aeq} 6-22hr) in dB(A)	% of population exposed	OR	Attributable fraction (AR%) ^{a)}	Population Attributable Risk (PAR %) ^{b)}	Number of subjects ^{c)}
≤ 60	69.1	1.00	0.00	0.00	0
60-65	15.3	1.05	4.76	0.76	1011
65-70	9.0	1.09	8.26	0.80	1070
70-75	5.1	1.19	15.97	0.96	1278
> 75	1.5	1.47	31.97	0.70	932
Total				3.22	4289

a) $AR\% = (OR - 1)/OR * 100$; b) $PAR\% = P_d/100 * (OR-1)/(P_d/100*(OR-1)+1)*100$; c) $N_d * PAR\%$
 where N_d = disease occurrence

Step 5 : Calculation disease burden/ health loss

Example integrated measure:

Disability Adjusted LifeYears (DALYs)=

Number of people with environment-related morbidity
or mortality

X

Severity factor (0 = healthy, 1 = death)

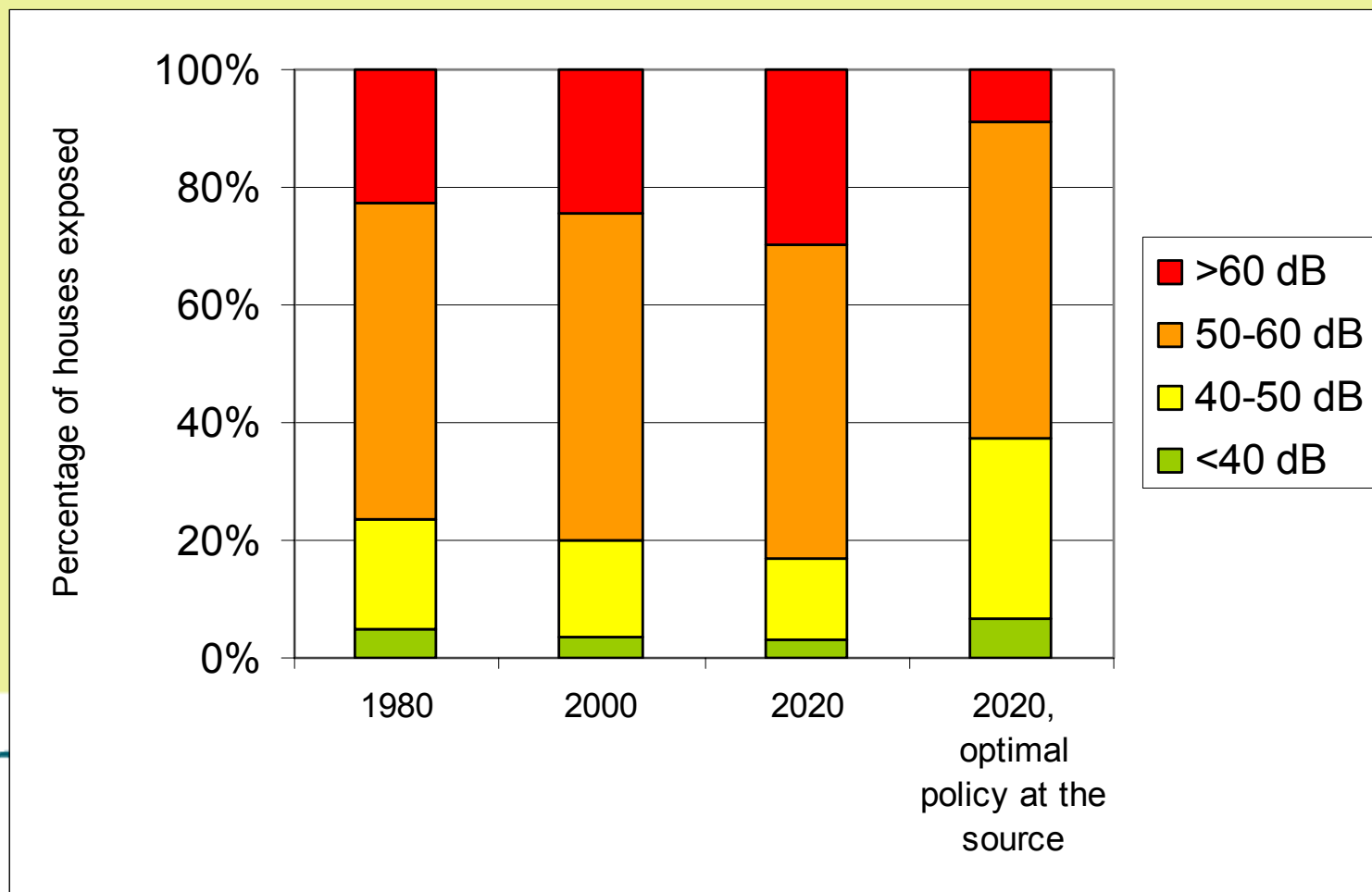
X

Duration of disease (*years of life lost* for mortality)

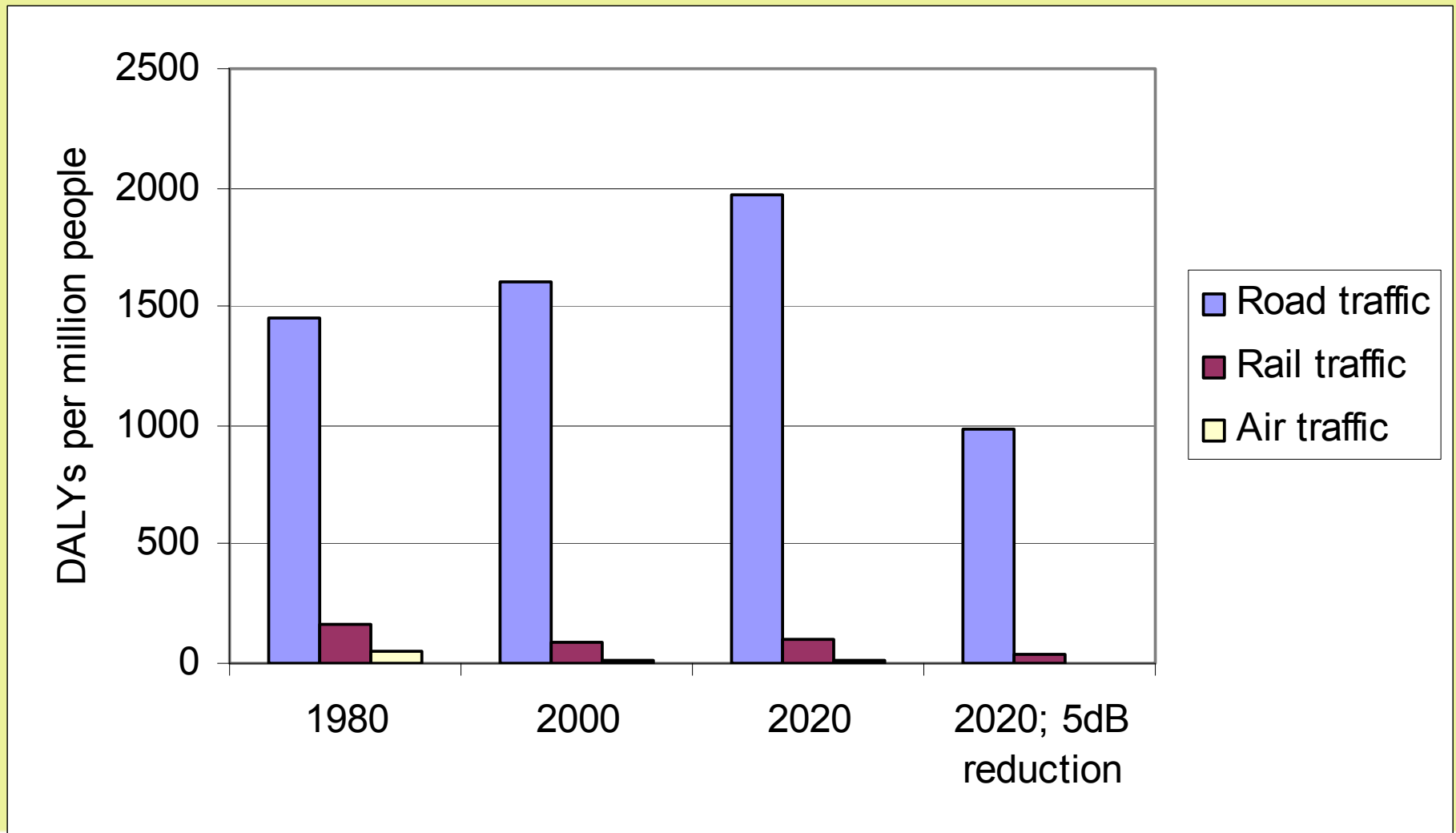
Step 5: Calculation of disease burden

- Exposure

- EMPARA model: noise maps
- Rail, road (municipal, provincial, national) and air traffic
- 2020: two scenarios (business-as-usual and increased policy efforts: 5dB reduction)



Step 5: Noise-related disease burden NL



Conclusions health impact assessment noise

- Annoyance and sleep disturbance: Generalizability of the exposure-effect curves to different countries, due to e.g. situational factors peoples' annoyance and/or sleep disturbance differs between locations and/or situations
 - *Use national reference data if available*
- Ischemic heart disease: Thresholds of no effect and the shape of the curve are still debatable; RR from studies among elderly men; in HIA also include the women
 - *Carry out sensitivity analysis in order to get insight how the different assumptions affect outcomes*
- Impacts children: cognition (air traffic) – no ERF available for road transport