Noise and Health

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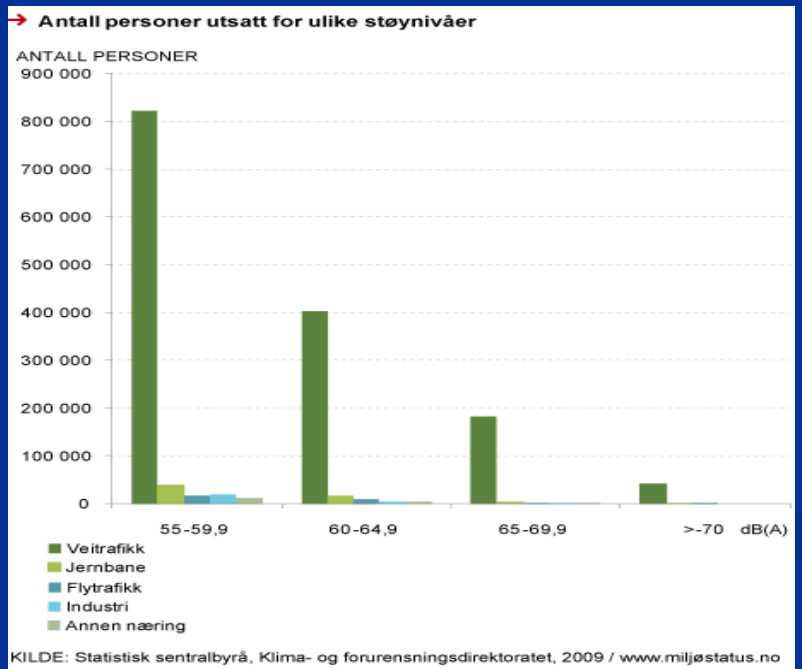
Environmental noise in Norway

- Approximately 1.6 million Norwegians are exposed to noise levels above the recommended levels (L_{den} = 55 dB)
- About half a million are very or extremely annoyed by noise
- Road traffic contribute to 80 % of the total noise annoyance
- 5 % reporting sleep disturbances due to noise (SSB 1997, 2004)

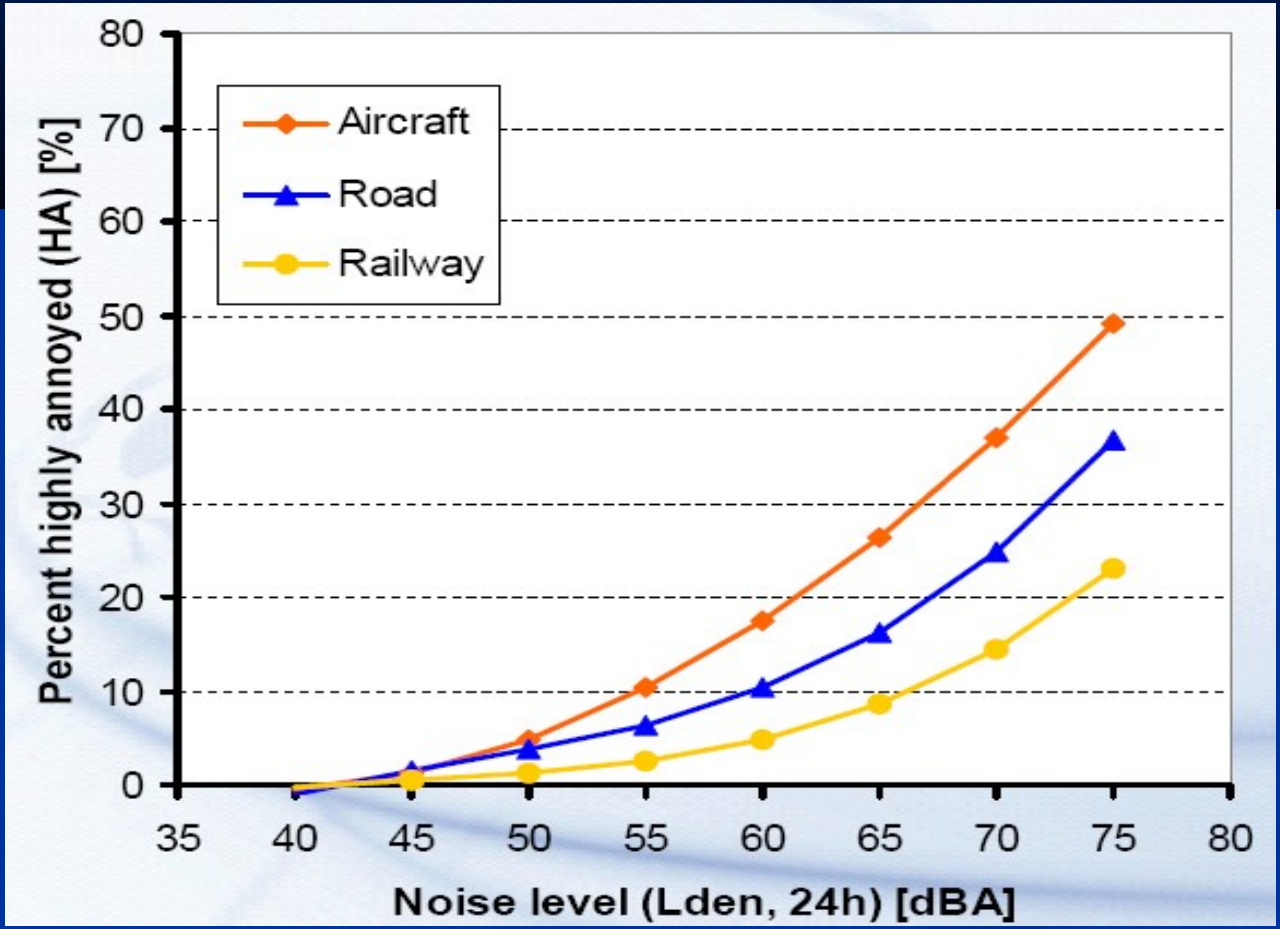


Noise and health
Proposed mechanisms

Exposure	Appraisal/ immediate effects	Health outcomes Long term
Environmental Noise	**Sleep disturbances** •Awakenings •Sleep stage changes **Physiological responses** •Increasing blood pressure •Increasing heart rate •Elevated levels of “stress” hormones **Annoyance**	**Chronic insomnia** **Hypertension** **Cardiovascular disease**

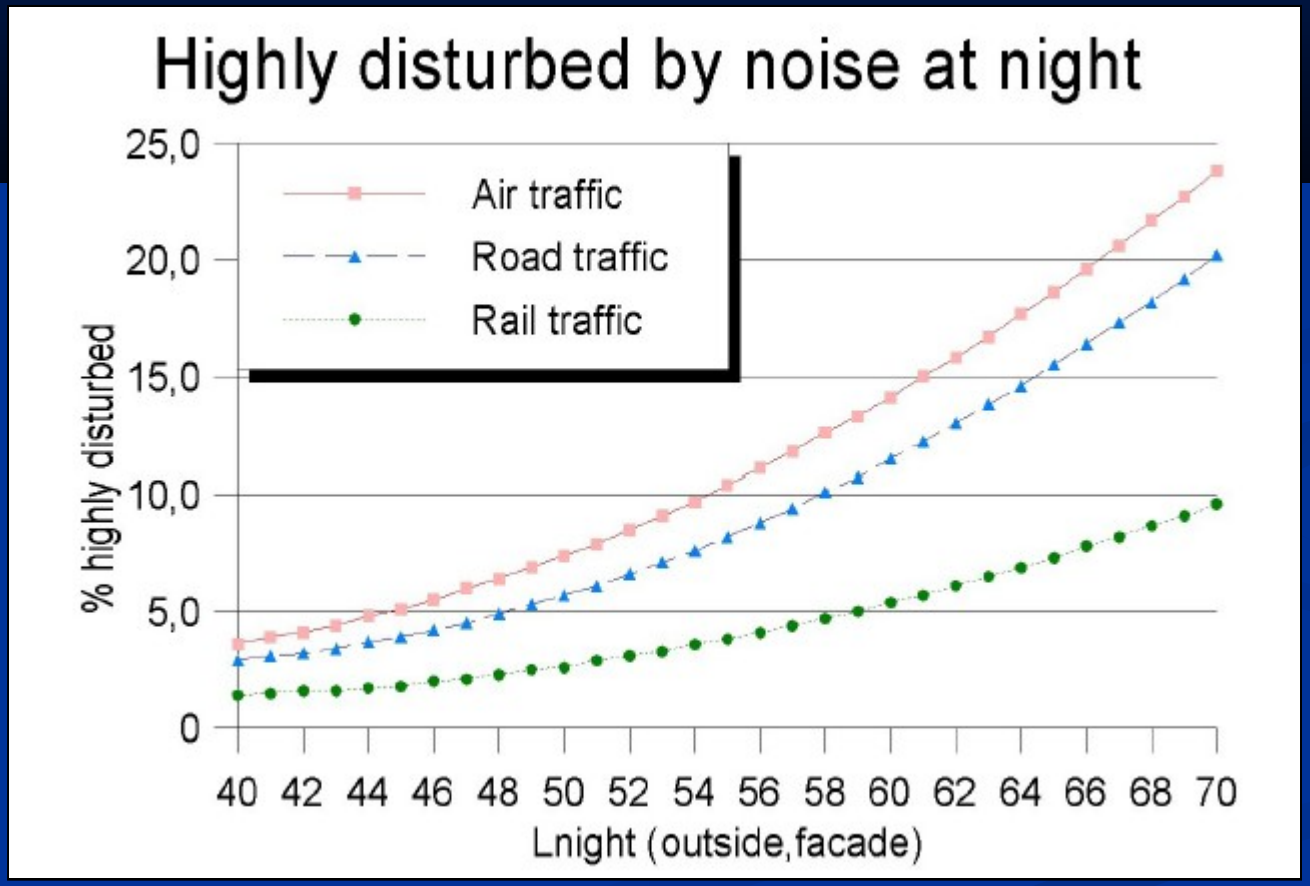
(Simplified version of models proposed by Babisch, 2005, and in Night Noise Guidelines, WHO 2009

Noise annoyance
Exposure-response relationships



(Miedema & Oudshoorn, 2001)

Self-reported sleep disturbances due to noise

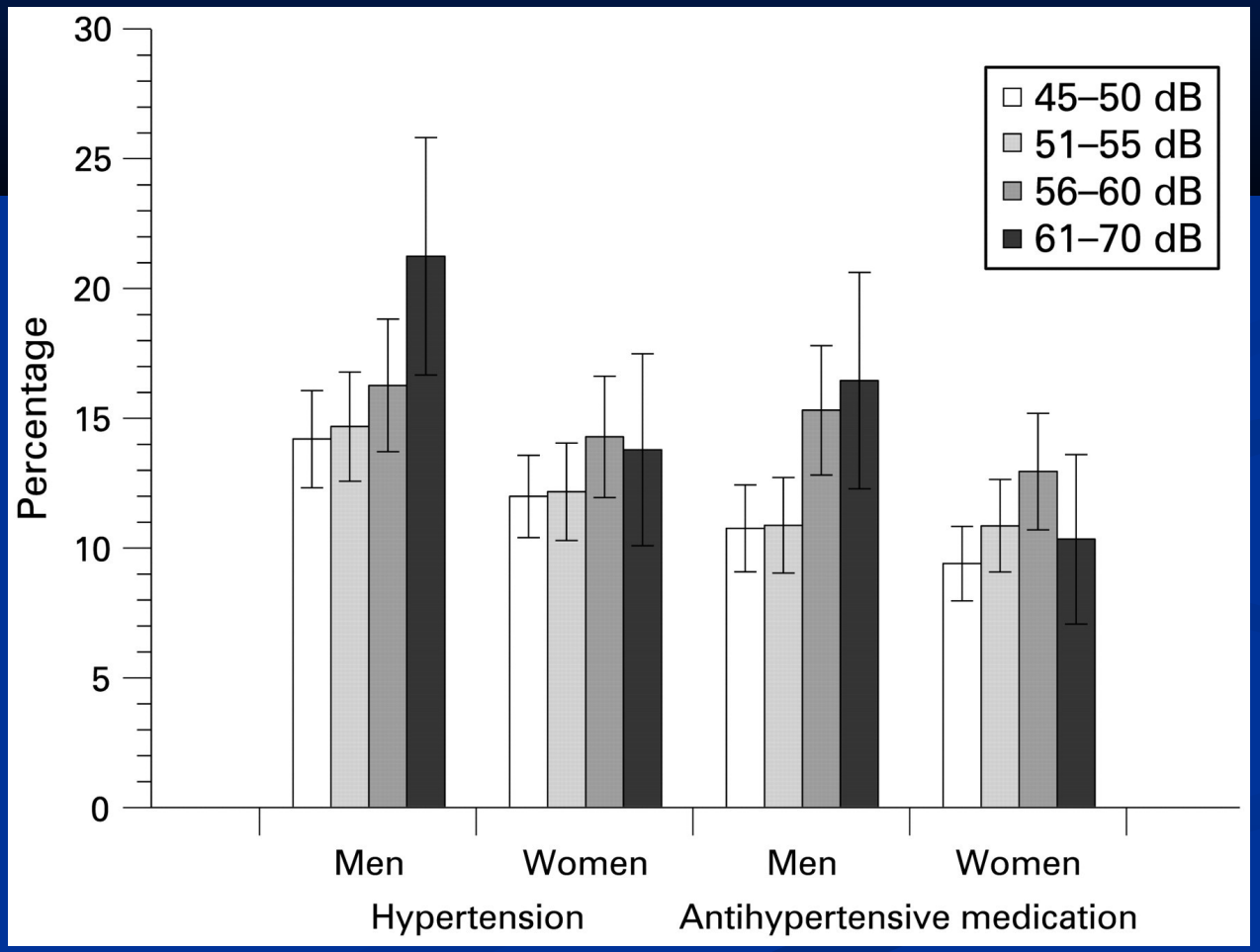


(Night Noise Guidelines, 2010, Miedema & Vos, 2007)

Can noise cause injuries or diseases?

Road traffic noise and hypertension

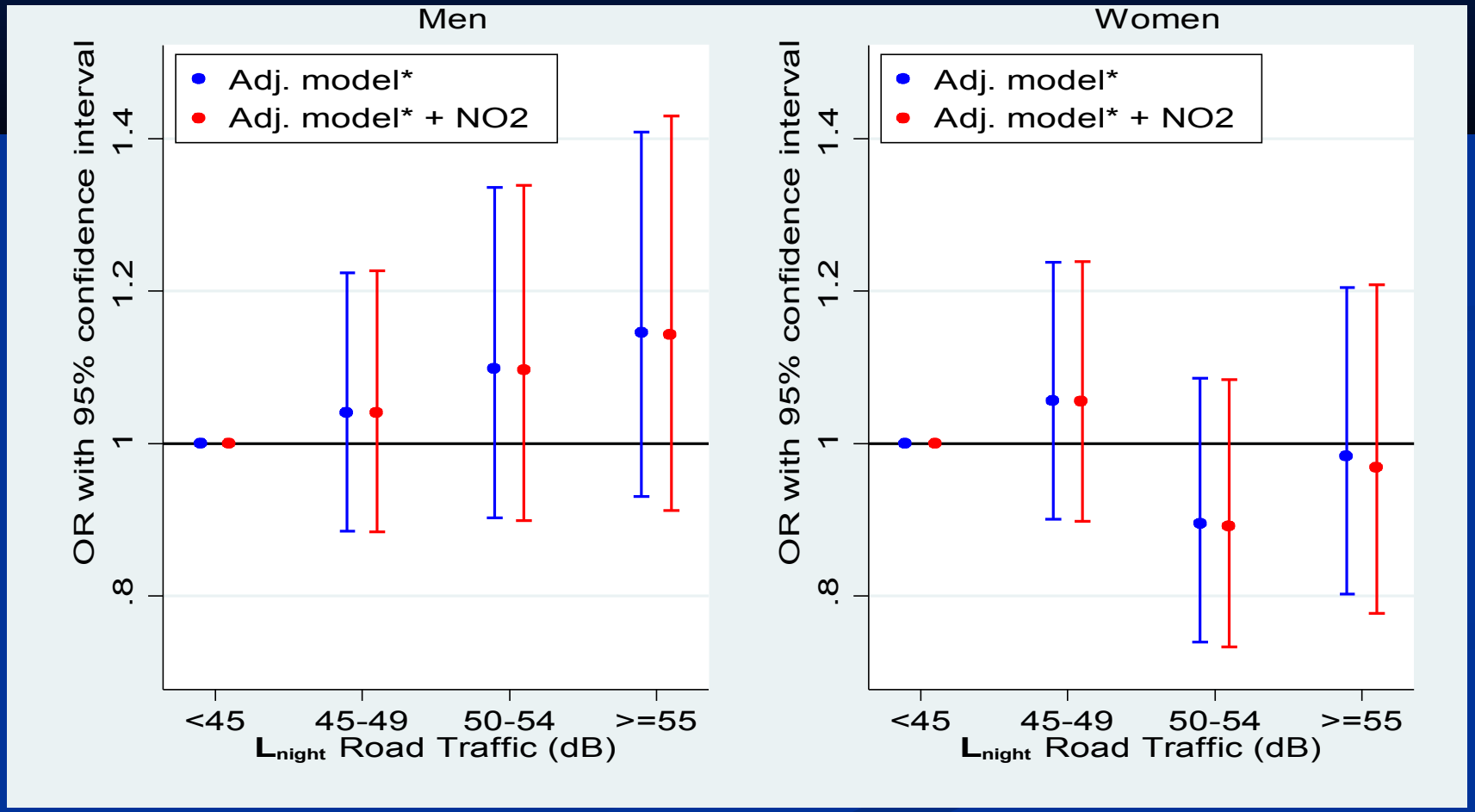
Study from Göteborg (N=1 953)



(Barregard, L *et* al. *Occup Environ Med,* 2009)

Nocturnal road traffic noise and hypertension

A study from Oslo (N=13 174)



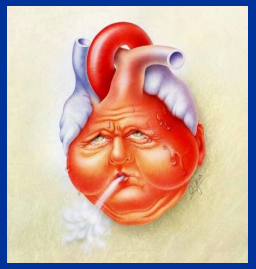
(Oftedal et al., 2011)

Main risk factors for cardiovascular disease

Smoking

Obesity

Cholesterol



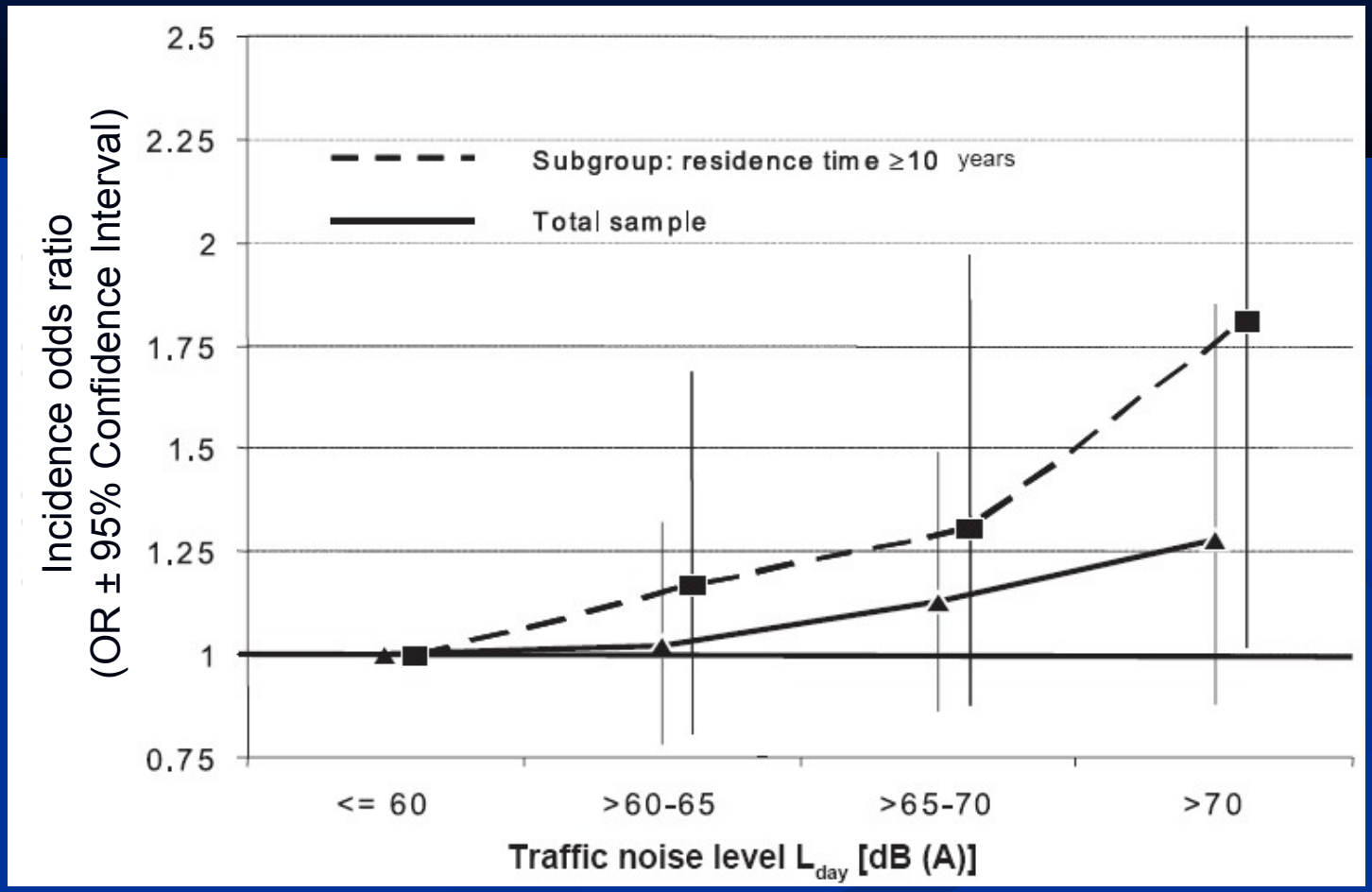
High blood pressure

Lifestyle

Cardiovascular disease

Road traffic noise and myocardial infarction

Study from Berlin (N=4 115)



(Babisch *et* al., *Epidemiology*, 2005)

Road traffic noise and stroke Study from Denmark (Sørensen *et* al., 2011)

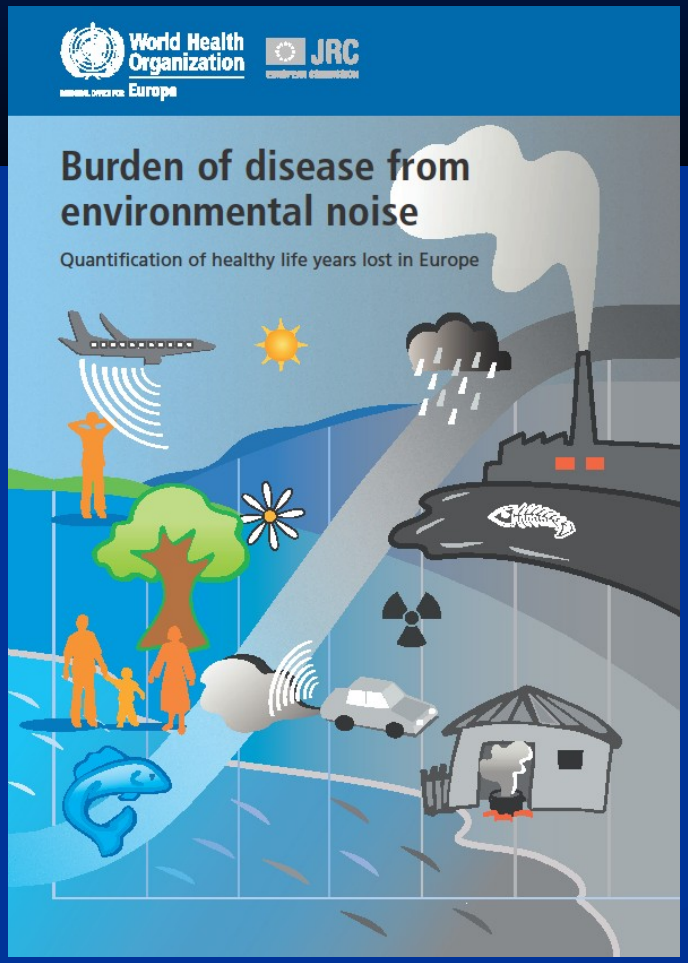
- 27% increased risk of stroke for every 10 dB increase (L_{den})
- Increased risk for persons above 64 years of age
- Male most at risk
- Large well conducted study, in which both traffic related air pollution and other risk factors were taken into account

Noise and mortality

- Motorised traffic is an important source of both air pollution and noise
- A Dutch study (Beelen et al., 2009) has reported for the first time the joint association between long-term exposure to air pollution, traffic intensity and road traffic noise with cardiovascular mortality
- Background black smoke concentrations, traffic intensity on the nearest road and traffic noise above 65 dB were associated with specific cardiovascular causes of death
- However, the associations between black smoke concentrations and traffic intensity on the nearest road with specific associations were insensitive for adjustment by traffic noise and were thus not explained by traffic noise in this study
- Traffic-related air pollution is associated with cardiovascular mortality, while the independent contribution of exposure to traffic-related noise is less clear

Burden of disease from environmental noise

Report from WHO, 2011



- Quantitative risk assessment of environmental noise
- Based on current scientific knowledge
- Included health outcomes:
  - Noise annoyance
  - Noise induced sleep disturbances
  - Cognitive impairment in children
  - Tinnitus

Burden of disease from environmental noise (WHO, 2011)

- DALY = Disability adjusted life years
- DALY = time lived with disability (YLD) + time lost due to premature mortality (YLL)

Based on:

- Current knowledge about health effects of noise (Exposure-response relationships)
- The number of people exposed to noise (Noise maps)
- The number of people with disease
- Disability weights (DW) between 0 and 1 (0 is perfect health and 1 is death) for each health outcome
  - Highly annoyed by noise, DW = 0.02
  - Highly sleep disturbed due to noise, DW= 0.07
  - Myocardial infarction, DW = 0.0405

Burden of disease from environmental noise

Effect	DALYs
Tinnitus*	22 000
Cognitive impairment in children**	45 000
Ischaemic heart disease	61 000
Noise annoyance	**587 000**
Sleep distubances	**903 000**

*Mainly attributed to leisure exposure
** Mainly attributed to aircraft noise

Appr. 1.8 % of all myocardial infarctions are attributable to road traffic noise in western European countries (WHO, 2011)

Summary

- Traffic noise is increasing and is a considerable contributor to burden of disease from environmental factors
- Both traffic related air pollution and noise have been shown to increase the risk of cardiovascular disease, and more knowledge is needed to disentangle their separate contribution
- Noise annoyance and sleep disturbances are the major contributors to burden of disease (DALY) due to noise in EU and Norway

Thanks for your attention ☺