

# The European Network on Noise and Health (ENNAH): new directions in noise and health research

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AVIATION NOISE IMPACTS ROADMAP ANNUAL MEETING  
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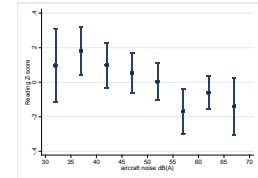
# The Policy Background in Europe

- It is estimated that roughly 20 % of the Union's population [approx 80 million people] suffer from noise levels which scientists and health experts consider unacceptable (European Commission Green paper, Future noise policy, Brussels, 1996)
- The Environmental Noise Directive" [END] [Directive 2002/49/EC] defines a common approach across the European Union for avoiding, preventing or reducing the harmful effects of environmental noise exposure
- Develop **noise maps** to describe the exposure of the population to noise from sources including aircraft, road, railway, industry: and develop **action plans** to enable the preservation of quality areas and to reduce noise pollution where necessary



# The Research Background in Europe

- Have established exposure-response relationships for aircraft noise and annoyance, reading impairment and hypertension [RANCH & HYENA studies]
- Many gaps
  - What are the effects of combined exposures e.g. air pollution; more than one noise source?
  - Noise characterization – role of peak sound events; no. of events?
  - Can noise maps be used to establish adverse effects of noise on health?
  - How do acute exposures and effects relate to chronic effects?
  - Are there effects on respiratory health, reproductive outcomes, mental health, long term hormonal responses?



## Scope of ENNAH

- A 2 year European Union funded network of 33 partners from 16 countries [September 2009-August 2011]
- Focus on environmental noise sources & transport noise
- To share knowledge and expertise
- To form a common view of future research directions in Europe
- To inform the development of the European Noise Directive
- Lead Users - researchers (inside/outside network, EU/World), policymakers, national governments and local authorities, industry

# Objectives of ENNAH

1. To set up a network of European scientists on noise and health research
2. To review the literature on environmental noise exposure and health: identification of evidence gaps and research needs
3. To improve the noise exposure assessment in health studies
4. To build complex models of noise and health effects taking mediating, moderating and confounding factors into account (including the effects of air quality and noise)
5. To establish communication between researchers on noise and researchers on air quality

# Objectives of ENNAH

6. To improve the measurement of health outcomes relevant to noise research
7. To extend analyses on existing data including RANCH and HYENA to inform policy
8. To train junior researchers in noise and health through setting up an exchange network across Europe
9. To provide the EU with a new strategy for the future development of noise research



# Workpackages of ENNAH

## WP 1 Management

Stephen Stansfeld, Charlotte Clark,  
QMUL, UK

## WP 2 Review of the Evidence

Anna Hansell  
Imperial College, UK

## WP 7

**Dissemination**  
Stelios Kephelopoulos  
JRC, Italy

## WP 3

### Noise Exposure Assessment

Danny Houthuijs  
RIVM, Netherlands

## WP 6

### New Research Directions

Stephen Stansfeld,  
QMUL, UK

## WP 4

### Moderating & Confounding Factors

Goran Pershagen  
Karolinska Institute, Sweden

## WP 5

### Health Outcomes

Francesco Forastiere  
ASL, Rome



# Workpackage 2: Review of the Evidence

- Two workshops held to discuss the evidence
- Review of evidence of noise effects on health
  - identifying gaps
  - areas for research investment
- Summary leaflet available [[www.ennah.eu](http://www.ennah.eu)]



**ENNAH WP2 "Review of the evidence"**  
 Hilda Chiu Liao and Anna Hurns, Imperial College London

Urbanisation and increasing transportation may give rise to noise pollution. This has become a serious and widespread problem in the last couple of decades. Several studies have suggested that high environmental noise levels can have various harmful physiological and psychological effects on the human body including increasing the risk of coronary heart disease.

The aim of ENNAH work package 2 (WP2) is to assess critically previous reviews and identify new studies to provide a state of the art summary of knowledge and to make recommendations for further research on environmental noise and its health effects (other than those on hearing, which are already well-documented). The following paragraphs give a short overview of the WP2 findings.

Noise pollution has been found to be associated with cardiovascular disease including hypertension, also disturbed sleep, increased stress hormone levels and with mood and performance changes. Although some of these effects have been examined in a number of studies, the evidence for the strength and consistency of the relationship still needs more work (Table 1). For other conditions, such as birth outcomes and mental health, surprisingly few studies are available and available evidence is therefore limited. A valid dose-response relationship for all possible health outcomes has not been established (Boersch et al. 2009).

A further complication is that health studies have used different acoustical measures of noise exposure therefore it is difficult to set a general noise exposure limit. Average A-weighted dB based noise exposure is often used, but may not be the best measure for some exposures e.g. low frequency noise. The relationship between health outcomes and other metrics e.g.  $L_{day}$ , C-weighting, or other sound characteristics e.g. spectrum, impulsiveness should be investigated.

Traffic noise is generally a result of combined noise sources. The evidence of an association between aircraft noise and hypertension, for example, was ranked as 'sufficient' by Bobbich (2004) to indicate a causal relationship. However, the strength of the evidence is limited for other noise sources (Bobbich 2006, Bobbich and Van Kamp 2006), such as road traffic or rail noise, or a combination of noise sources, including aircraft. Recent studies suggest that different groups, especially children, might show different responses to environmental noise (Bobbich 2006). While sufficient evidence indicates that noise exposure is associated with annoyance and sleep disturbance among adults, it is uncertain whether these relationships are applicable for children (Boersch et al. 2009). Therefore, future noise and health research needs to include consideration of vulnerability and separate investigation of vulnerable groups.

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**Effects of noise on health and wellbeing**

Outcome	Acoustical noise measures		Subjective noise measures		Mild annoyance		High annoyance	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Cardiovascular disease	1.05	1.01-1.09	1.03	1.01-1.05	1.02	1.01-1.03	1.04	1.03-1.05
Hypertension	1.02	1.01-1.03	1.01	1.01-1.02	1.01	1.01-1.02	1.02	1.01-1.03
Sleep disturbance	1.03	1.02-1.04	1.02	1.01-1.03	1.01	1.01-1.02	1.03	1.02-1.04
Mental health	1.01	1.00-1.02	1.01	1.00-1.02	1.01	1.01-1.02	1.02	1.01-1.03
Birth outcomes	1.01	1.00-1.02	1.01	1.00-1.02	1.01	1.01-1.02	1.02	1.01-1.03
Stress hormones	1.01	1.00-1.02	1.01	1.00-1.02	1.01	1.01-1.02	1.02	1.01-1.03
Mood and performance	1.01	1.00-1.02	1.01	1.00-1.02	1.01	1.01-1.02	1.02	1.01-1.03

- Evidence has increased for cardiovascular disease, cognitive performance, and sleep
- Dose-response relationships still needed for most outcomes

## RESEARCH GAPS

- Birth outcomes
- Social behaviour
- Mental health
- Effects of interventions
- Role of air pollution
- Effect of combined noise exposure
- Low frequency noise

## NEED TO CONSIDER

- Vulnerable groups – children, chronically ill, elderly
- Role of noise sensitivity
- Role of annoyance
- Gender differences



## WP3: Noise exposure assessment – preliminary conclusions

- The applicability of maps for health studies has to be evaluated
- Different approaches for the collection and use of input data leads to differences in quality and accuracy between countries and cities/towns
- Other concerns relate to the detail of the assessment, the assessment of low levels and the negligence of source spectral characteristics
- The accuracy of a noise - maps should be reported in a standardised form
- Noise maps should aim for lower cut-off values to increase the exposure contrast in health studies; individual levels and not 5 dB contours bands

## WP6: Preliminary suggestions for future research

- Workshop in February 2011 to identify and agree upon new strategies for noise and health research in Europe
- Bring together information from WP2 (gaps), WP3 (exposure), WP4 (moderators) and WP5 (outcomes)
- **Overarching themes**
  - Need for evidence from longitudinal studies
  - Policy need – identify thresholds for effects
  - More detailed noise characterization - little is known about effect of the number of noise events or peak sound events
  - Combined exposure – how noise interacts with other environmental stressors such as air pollution
  - Mechanisms



## WP6: Preliminary suggestions for future research

- **CHD/Hypertension**
  - Need to increase precision of dose-response relationships
  - Use classic CVD end-points as well as indicators on pathway
  - Prospective studies needed but would have to be very large scale
  
- **Mental Health**
  - Longitudinal studies
  - Use of standardised clinical interviews
  - Studies of multiple environmental and social stressors
  - Mental health accompanied by hormonal and physiological measures
  - Inclusion of appraisal of noise and coping, negative affectivity, and noise sensitivity,

## WP6: Preliminary suggestions for future research

- **Annoyance**

- Likely to be involved in all other adverse health effects
- Need to study annoyance responses to combined noise exposures

- **Sleep**

- Sleep structure e.g. eeg is little affected by noise
- Propose epidemiological studies and extended field studies
- Focus on autonomic reactions to noise – e.g. Heart rate, cardiac arousals
- New methods that enable cardiac arousals to be recorded, as well as actimetry, and subjective assessment. Will also need new data handling techniques and statistics

## WP6: Preliminary suggestions for future research

### ▪ **Children's Health**

- Prenatal noise exposure and noise exposure in infancy
- Reproductive outcomes
- More understanding of effects of noise on social behaviour and psychological health

### ▪ **Cognition/Performance**

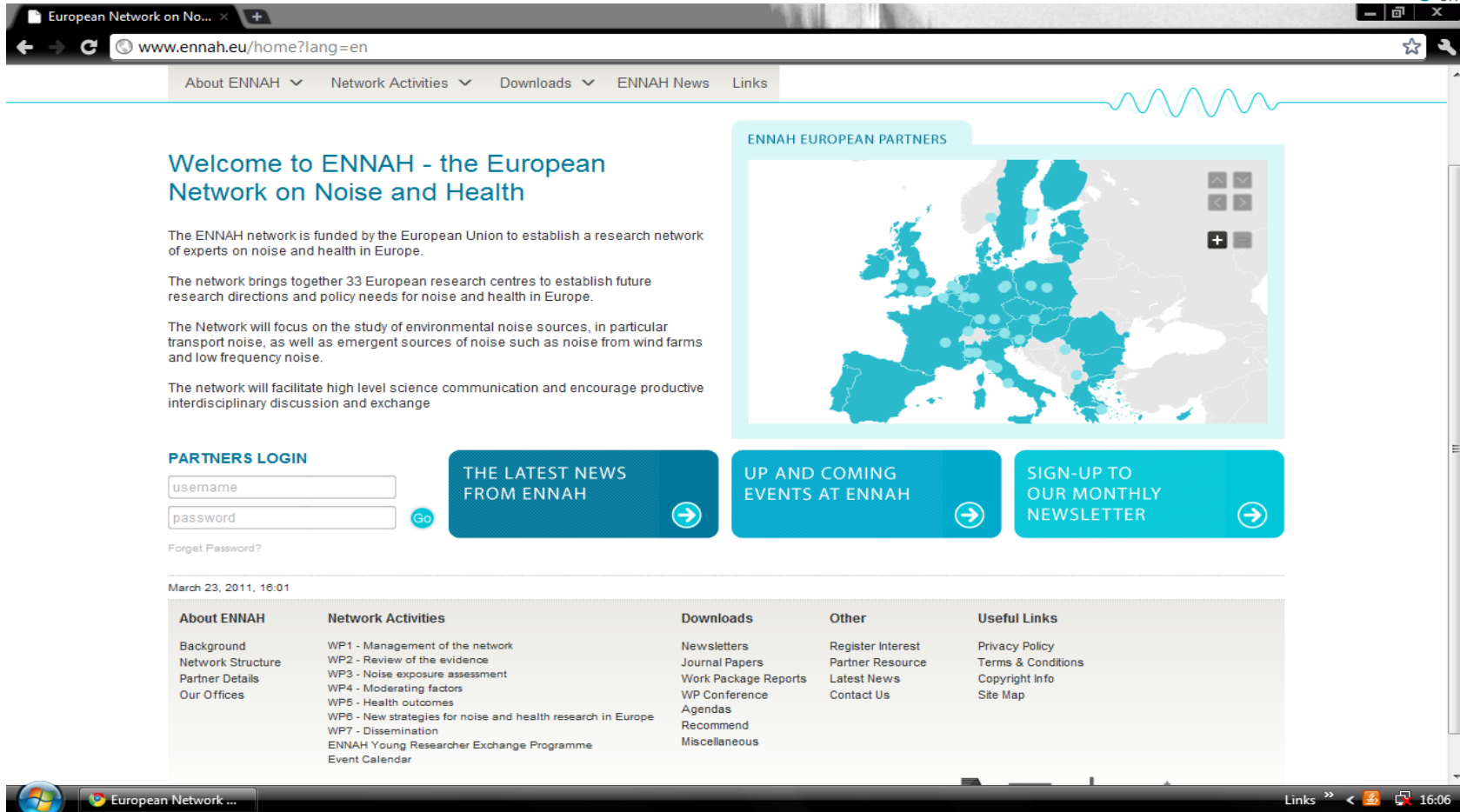
- Relate classroom acoustics to performance/academic achievement
- Studies of insulation – does performance improve if install insulation?
- Longitudinal Studies –taking history of exposure into account
- Very few studies of adolescents
- Workplace performance

# Dissemination

- Website [www.ennah.eu](http://www.ennah.eu) updated throughout the project
- Report to EU for each workpackage, as well as a final report
- Summary brochures for the public – downloads
- Final meeting in Brussels for policy makers/stakeholders July 6<sup>th</sup> 2011
- Brief films being made for YouTube
- Publications in Peer-reviewed Journals
- Register interest via the website



# Thanks for your attention



The screenshot shows the ENNAH website homepage in a browser window. The browser address bar shows 'www.ennah.eu/home?lang=en'. The navigation menu includes 'About ENNAH', 'Network Activities', 'Downloads', 'ENNAH News', and 'Links'. The main content area features a welcome message, a description of the network's purpose, and a map of Europe titled 'ENNAH EUROPEAN PARTNERS'. Below the map are three buttons: 'THE LATEST NEWS FROM ENNAH', 'UP AND COMING EVENTS AT ENNAH', and 'SIGN-UP TO OUR MONTHLY NEWSLETTER'. A 'PARTNERS LOGIN' section contains a username and password field with a 'Go' button and a 'Forgot Password?' link. At the bottom, there is a table of navigation links categorized into 'About ENNAH', 'Network Activities', 'Downloads', 'Other', and 'Useful Links'.

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www.ennah.eu/home?lang=en

About ENNAH Network Activities Downloads ENNAH News Links

## Welcome to ENNAH - the European Network on Noise and Health


The ENNAH network is funded by the European Union to establish a research network of experts on noise and health in Europe.

The network brings together 33 European research centres to establish future research directions and policy needs for noise and health in Europe.

The Network will focus on the study of environmental noise sources, in particular transport noise, as well as emergent sources of noise such as noise from wind farms and low frequency noise.

The network will facilitate high level science communication and encourage productive interdisciplinary discussion and exchange

### ENNAH EUROPEAN PARTNERS



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Go

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March 23, 2011, 16:01

About ENNAH	Network Activities	Downloads	Other	Useful Links
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<a href="#">Network Structure</a>	<a href="#">WP2 - Review of the evidence</a>	<a href="#">Journal Papers</a>	<a href="#">Partner Resource</a>	<a href="#">Terms &amp; Conditions</a>
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	<a href="#">WP5 - Health outcomes</a>	<a href="#">Agendas</a>		
	<a href="#">WP6 - New strategies for noise and health research in Europe</a>	<a href="#">Recommend</a>		
	<a href="#">WP7 - Dissemination</a>	<a href="#">Miscellaneous</a>		
	<a href="#">ENNAH Young Researcher Exchange Programme</a>			
	<a href="#">Event Calendar</a>			

European Network ...

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