



AUN2014 : Airports in Urban Networks
15-16 Apr 2014 CNIT - Paris la Défense (France)



Health effects of aircraft noise near three French airports

Results from the pilot epidemiological study of the DEBATS research program

AS Evrard - IFSTTAR Lyon France

I Khati - IFSTTAR Lyon France

P Champelovier - IFSTTAR Lyon France

J Lambert - IFSTTAR Lyon France

B Laumon - IFSTTAR Lyon France



Background



- **Transport** : major source of exposure to environmental nuisances
- A national survey (2005) shows that 6.6% of the French population are annoyed by aircraft noise
- Health effects of aircraft noise very seldom studied in France
- **No prospective study in France**
- The French Ministry of Health (DGS), and the Airport Pollution Control Authority (Acnusa) asked for implementing an epidemiological research program named **DEBATS**



Objectives



DEBATS aims to characterize the relations between aircraft noise exposure and the health status of the French population living in the vicinity of airports.

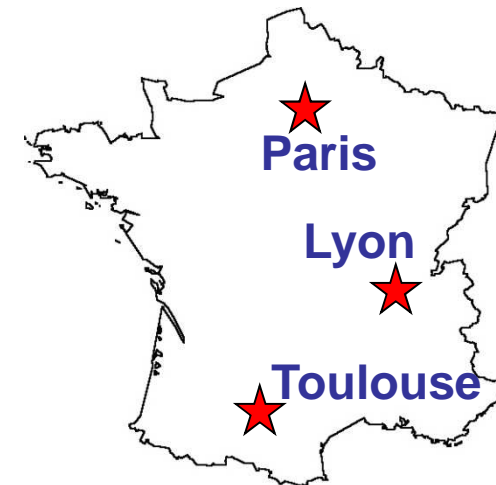
The health status will be assessed both physically and mentally but also in terms of annoyance.



Methods (1)

- **An on-going research program (2011-2018) involving residents around three French airports**

- Paris-Charles de Gaulle
- Toulouse-Blagnac
- Lyon Saint-Exupéry



- **3 studies involving 3 different methodological approaches**

- an ecological study
- a longitudinal field study
- a sleep study



Methods (2)



- **Ecological study**

To investigate the relationship between weighted average aircraft noise exposure (L_{den}) and drug prescriptions, nonprescription drug sales or mortality at the commune (the smallest administrative unit in France) level.

- **Longitudinal field study**

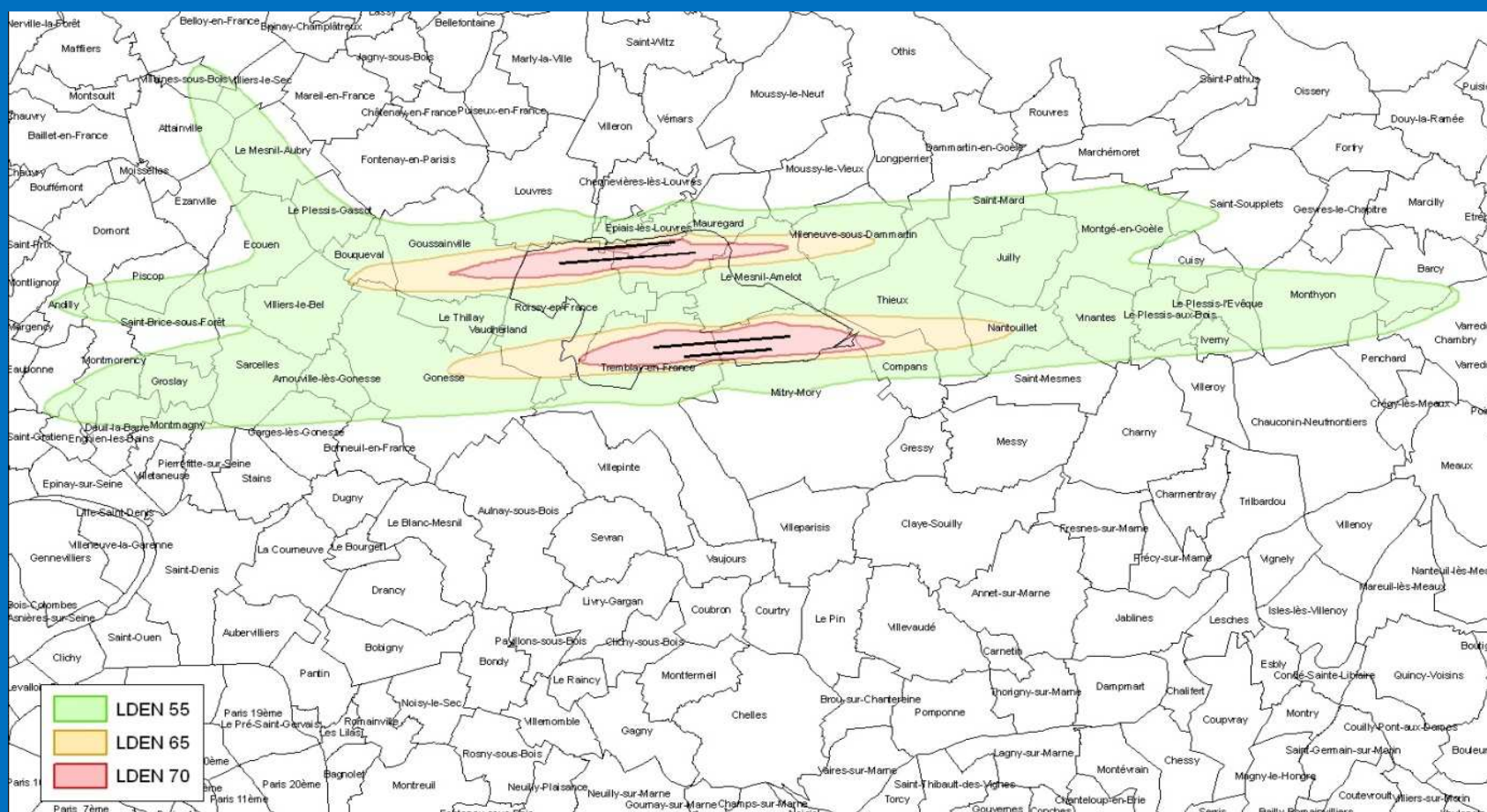
To follow-up approximately 1,200 of the above-mentioned airports residents during four years.

- **Complementary study**

To characterize specifically and in detail acute effects of aircraft noise on sleep quality using precise noise exposure measurements.



Study area Noise maps



Noise map of Paris – Charles de Gaulle airport



Longitudinal study

- **Health effects assessed by a questionnaire**
 - Sleep disturbances
 - Hypertension and cardiovascular diseases
 - Anxiety and depressive disorders
 - Annoyance

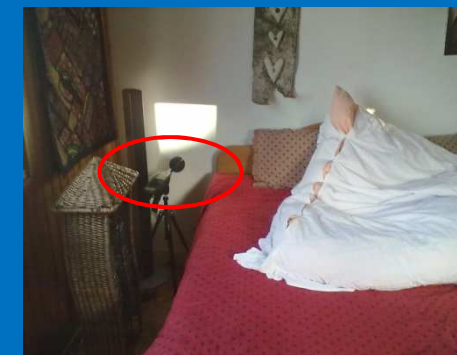
- **Health effects assessed by objective measurements**
 - Blood pressure and heart rate
 - Salivary cortisol



Sleep study



- **Population** : a sub-sample of 100 individuals included in the longitudinal study and living in the vicinity of Paris-Charles de Gaulle airport
- **Noise exposure measurements**
 - One sonometer located in the bedroom, a second sonometer set up outside, at the bedroom façade (7 days)
 - One dosimeter (1 day)
- **Health effects : sleep quality**
 - An actiwatch and a sleep diary





DEBATS' originalities (1)



- The health effects study: many surveys in France address aircraft noise annoyance or report adverse effects on sleep quality, much fewer consider the physiological effects of this noise exposure.
- Similar health effects relevant to road traffic noise. But many surveys address those health effects in relation with road traffic noise, much fewer consider aircraft noise. Studies regarding railway noise are very sparse.
- The follow-up of the participants over the time will allow us:
 - To study the health status evolution in terms of habituation, changes in the behaviours, and adaptation to the environment,
 - To highlight a latency time for health effects,
 - To characterize the residential mobility of people living around French airports.
- The evaluation of a link between the psychosociological effects of aircraft noise and the physiopathological effects.



DEBATS' originalities (2)



- The use of noise event indicators to characterize aircraft noise exposure: most of the epidemiological studies on this topic used energetic indicators. The number and frequency of events could have an impact on sleep quality but it has been seldom studied. Noise events indicators are less relevant for road traffic noise.
- Acoustic measurements inside the dwellings will make it possible to take into account the building outdoor insulation and the opening/closing practice of the windows unlike French and European regulations as well as epidemiological studies which are based on noise exposure at the façade of the buildings.
- Actimetric measurements very seldom used in epidemiological studies will make it possible to assess the objective sleep quality of the participants



Objective of the pilot study



- **Objective** : did not consist in evidencing any scientific relationships but in testing and validating the protocols of the longitudinal and sleep studies

Different stages of the protocols were tested

- Interviewers' recruitment
- Participants' selection
- Data collection
- And data analyses

- **Population : 100 residents around Paris-Charles de Gaulle airport**

Ten out of these 100 participants were included in the sleep study



Participants' selection



- **Objective**

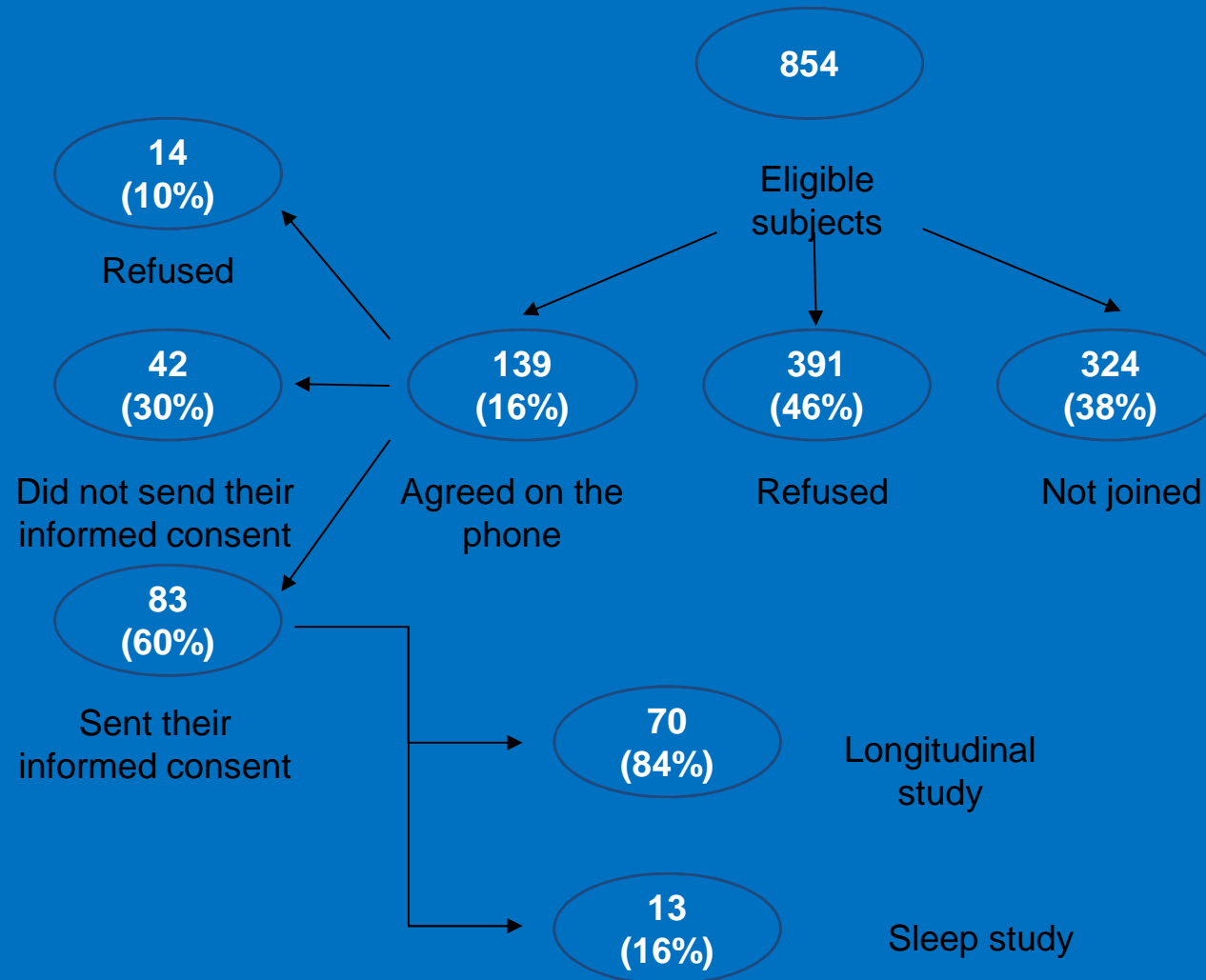
A sample of 100 participants and a sub-sample of 10 for the sleep study

	Noise exposure level (L_{den})				TOTAL
	Area 1 < 50 dB	Area 2 50 – 54 dB	Area 3 55 – 59 dB	Area 4 60 dB et plus	
Longitudinal study	23	22	22	23	90
Complementary study	2	3	3	2	10
TOTAL	25	25	25	25	100

- **Method** : selection at random based on a phone numbers list



Participation rate





Participation rate according to noise areas



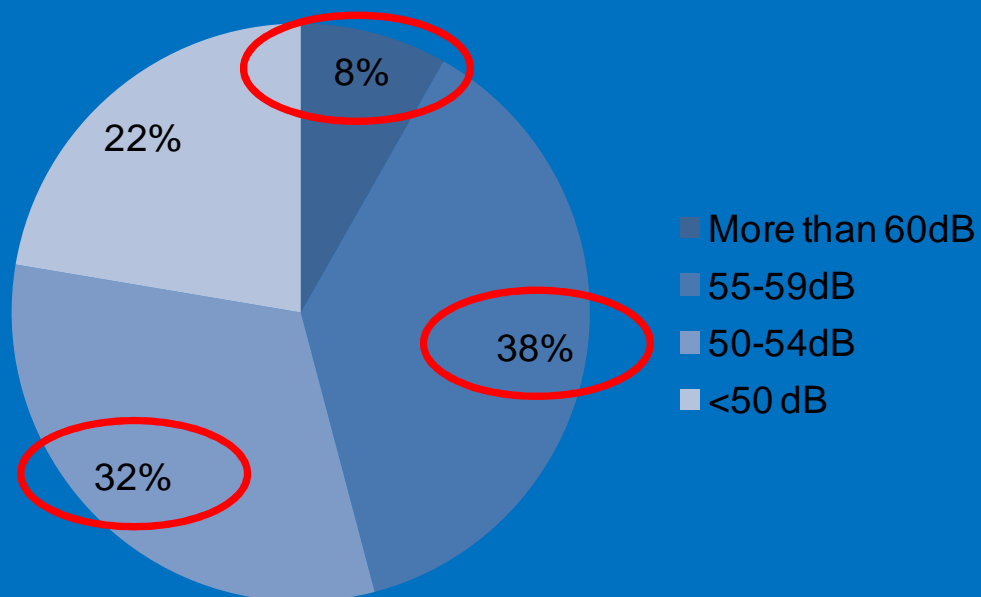
	Participation rate
Area 1 (<50 dB)	12%
Area 2 ([50- 55[dB)	9%
Area 3 ([55-60[dB)	10%
Area 4 (≥ 60 dB)	16%
Area 5 (unknown)	6%
Total	10%



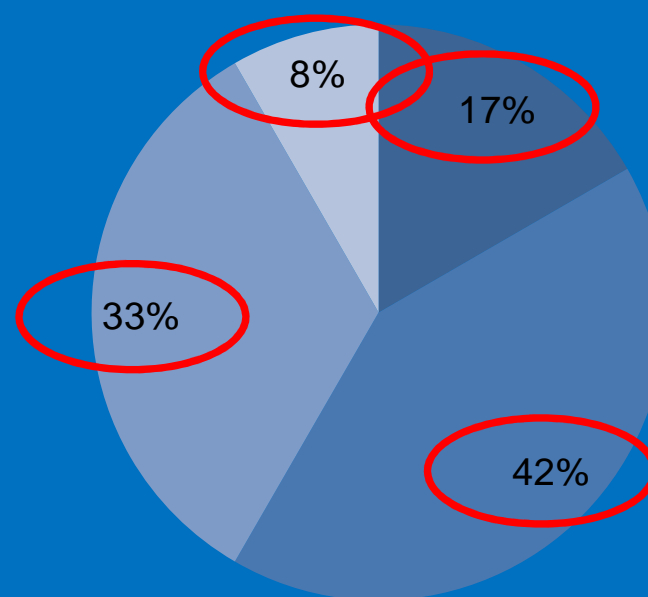
Number of participants in each noise area



Longitudinal study



Complementary study





Characteristics of the participants



	Longitudinal study	Sleep study	Area study
Gender			
Female	52%	75%	52%
Male	48%	25%	48%
Age			
18-24 years	5%	8%	15%
25-34 years	0%	17%	17%
35-44 years	32%	42%	20%
45-54 years	26%	25%	18%
55-64 years	19%	8%	14%
65-74 years	5%		8%
≥ 75 years	5%		8%
Marital status			
Single	22%	25%	40%
Married/In couple	66%	67%	48%
Divorced	0%	8%	7%
Widowed	2%		6%
Educational level			
< French high-school certificate	31%	17%	61%
French high-school certificate	10%	25%	17%
> French high-school certificate	53%	58%	22%
Housing tenure			
Owner occupancy	76%	83%	41%
Tenancy	24%	17%	59%



Results (1)

- **Subjects easily agreed to participate in the sleep study**
- **Participants followed the protocol very well**
 - Blood pressure and heart rate measurements were available for all the participants.
 - One participant finally refused to take a sample of saliva, and the determination of cortisol levels in saliva was not possible for two other participants.
 - Acoustic measurements were available for 10 of the 12 participants due to technical problems of the sonometers and actimetric measurements were available for all the 12 participants.



Results (2)

- **Finally, the database includes 62 nights for which noise indicators and sleep variables were simultaneously available.**
- ⇒ A principal component analysis (PCA) was conducted on these 62 nights to determine which energetic indicators and noise events indicators are more correlated with sleep quality.
- **The strongest associations were evidenced between sleep quality and noise events indicators (NA37, NA40 and NA45) that were estimated inside, in the participants' bedroom.**



Discussion (1)

- Participation rate generally a little lower than those observed in previous epidemiological studies carried out in France
- Compared with people living in the study area, people between 35 and 54 years of age and well-educated people are overrepresented in the pilot study population
- Very few participants (8%) were living in the most exposed area



Discussion (2)



- Actigraphy/Heart rate monitoring
- The strongest associations were evidenced between sleep quality and noise events indicators that were estimated in the participants' bedroom
- Energetic indicators do not seem to be sufficient when sleep quality is considered and need to be completed
- However, these results are only based on a dozen of participants. They need to be replicated on more individuals
- Statistical models needed



DEBATS progress



■ Longitudinal study

- 1 244 participants interviewed in 2013 at their place of residence: 620 for Paris-Charles de Gaulle airport, 213 for Lyon-Saint-Exupéry airport and 411 for Toulouse-Blagnac airport

■ Sleep study

- Acoustic and actimetric measurements completed for 49 participants for Paris-Charles de Gaulle airport

First results in 2014!



<http://debats-avions.ifsttar.fr>



DEBATS

Discussion sur les Effets du Bruit des Aéronefs Touchant la Santé



[Accueil](#)

[Pourquoi ?](#)

[Comment ?](#)

[Qui sommes-nous ?](#)

[Notre recherche](#)

[Financement](#)

- [Actualités](#)
- [Emploi](#)
- [Lexique](#)
- [Publications](#)
- [Espace partenaires](#)

DEBATS en bref

L'exposition au bruit des avions pourrait avoir des conséquences importantes pour la santé. Toutefois, celles-ci ont été insuffisamment évaluées en France. Il n'existe pas à notre connaissance dans notre pays de large étude prospective permettant de mesurer un effet de l'exposition au bruit des avions sur la santé des populations exposées. C'est la raison pour laquelle une étude scientifique appelée DEBATS (Discussion sur les Effets du Bruit des Aéronefs Touchant la Santé) a été lancée en 2012 sur ce sujet.

En apportant une connaissance élargie et approfondie de la situation sanitaire française résultant de l'exposition au bruit des avions, DEBATS permettra de répondre à la demande des populations riveraines des zones aéroportuaires en France. Il permettra également à l'avenir de mieux orienter les actions de prévention des nuisances environnementales à proximité des aéroports.

DEBATS a été confié à l'[Ifsttar](#) (Institut français des sciences et technologies des transports, de l'aménagement et des réseaux) par le Ministère en charge de la Santé ([DGS](#)) et l'Autorité de Contrôle des Nuisances Aéroportuaires ([Acnusa](#)). Il est financé par le Ministère en charge de la Santé, le Ministère de l'Écologie, du Développement Durable et de l'Énergie ([MEDDE](#)), et par la Direction Générale de l'Aviation Civile ([DGAC](#)).

DEBATS a reçu l'agrément du Comité Consultatif sur le Traitement de l'Information en matière de Recherche dans le domaine de la Santé ([CCTIRS](#)), et de la Commission Nationale de l'Informatique et des Libertés ([CNIL](#)).

[Contacts](#)

[Mentions légales](#)