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## **The effects of aircraft noise exposure on psychological distress: the results of the DEBATS study in France**

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### **ABSTRACT**

18% of the French population suffer from mental disorders. Some studies suggested that aircraft noise exposure may increase psychological distress, but the number of these studies is limited and no one exists in France. We investigated associations between aircraft noise exposure and psychological distress for people living near airports in France.

The DEBATS longitudinal study included 1,244 residents around three French airports: Paris-Charles-de-Gaulle, Toulouse-Blagnac, and Lyon-Saint-Exupéry. Information about psychological distress was assessed by a face-to-face questionnaire, including the 12-version of the General Health Questionnaire. Aircraft noise exposure was evaluated for each participant's home address using the integrated noise model. Associations with psychological distress were investigated using logistic and linear regressions including relevant confounders. 13% of the participants reported symptom of depression and 22% were considered to have psychological distress according the GHQ-score. No association was found between exposure to aircraft noise and symptom of depression or psychological distress. This result partly confirms the findings of the few studies investigating this association.

### **INTRODUCTION**

Many studies have evidenced adverse effects of exposure to aircraft noise on health, such as annoyance, cardiovascular diseases, sleep disorders or altered cognitive performance [1]–[6]. Some studies have investigated low birth weights, obesity or diabetes [7], [8], but these effects remain discussed because of divergent results.

It's also the case for psychological distress: some studies showed a significant association between aircraft noise exposure and psychological disorders [9]–[11], and some other did not [12]–[14].

DEBATS (Discussion on the health effects of aircraft noise) is the first research program to investigate the health effects of aircraft noise exposure in France.

One of the specific objectives of the study was to evaluate the effects of aircraft noise exposure on psychological distress in people living in the vicinity of French airports.

## **METHODS**

### ***Participants***

1,244 individuals older than 18 and living in the vicinity of three French airports (Paris-Charles de Gaulle, Lyon-Saint-Exupéry and Toulouse-Blagnac) were randomly selected to participate in the longitudinal study of DEBATS. The study population was stratified on aircraft noise contours. These contours are based on the day–evening–night equivalent level ( $L_{den}$ ) defined in four categories, <50, 50–54, 55–59 and  $\geq 60$  dB(A). All participants responded to a questionnaire administered by an interviewer at their place of residence. The questionnaire collected in particular socio-demographic information, the personal medical history of the participants and lifestyle factors such as smoking and alcohol consumption.

### ***Psychological distress***

Psychological distress was evaluated within this questionnaire by two ways:

- with a single question about the existence of depression's symptoms: *“During the past 12 months, was there ever a time when you felt sad or depressed: extremely, very, moderately, slightly, not at all?”*. It was then categorized into two classes for the statistical analyses: extremely or very versus moderately, slightly or not at all;
- with the General Health Questionnaire, version in 12 items (GHQ-12)[15], which evaluates psychological disorders covering four domains: mood, behavior, and current or recent feelings, in the period of recent weeks. A GHQ-score was then calculated and treated either as a continuous variable, or as a dichotomous variable, with a 2/3 threshold.

### ***Confounders***

Several factors which could affect psychological distress were obtained from the questionnaire: age (six categories: 18-34; 35-44; 45-54; 55-64; 65-75; >75 years old), country of birth (France-born/foreign-born), gender, occupational activity (yes/no), alcohol consumption (no/light/moderate/heavy), smoking (non-smoker/ex-smoker/occasional smoker/daily smoker), number of stressful life events (0/1/ $\geq 2$ ), and income (<2,300€/month ; 2,300€ to 4,000€/month ;  $\geq 4,000$ €/month).

### ***Aircraft noise exposure assessment***

Exposure to aircraft noise was estimated with a 1-dB(A) resolution at the place of residence of the participants with noise maps produced by the French Civil Aviation Authority with the INM (Integrated Noise Model) [16]. Four noise indicators were derived and used in the statistical analyses:  $L_{den}$ ,  $L_{Aeq24h}$ ,  $L_{Aeq6h-22h}$ , and  $L_{night}$ .

### ***Statistical analysis***

Logistic and linear regression models were estimated in order to study the relationship between aircraft noise exposure and psychological distress. They were adjusted for the confounding factors previously defined.

Subgroups analyses were also performed separately for women and men.

## RESULTS

About 13% of the participants felt extremely or very sad or depressed during the past 12 months: 18% of women and 7% of men. According to the GHQ-12, 22% of the participants had psychological disorders: 25% of women and 17% of men.

No significant association was shown between aircraft noise exposure and psychological distress, evaluated with the single question about the existence of depression's symptoms or with the GHQ-12, and whatever the noise indicator.

When analyses were carried out separately for women and men, this association remained non-significant.

Table 1: OR of psychological distress per aircraft noise levels

	Single question on the existence of depression's symptoms		GHQ-12	
	OR	95%CI	OR	95%CI
<b>L<sub>den</sub></b>				
<50dB(A)		ref		ref
50-54dB(A)	0.88	(0.54-1.44)	0.84	(0.56-1.25)
55-59dB(A)	0.95	(0.59-1.53)	0.82	(0.55-1.23)
60dB(A) and +	0.83	(0.50-1.36)	0.88	(0.59-1.31)
<b>L<sub>Aeq 24h</sub></b>				
<45dB(A)		ref		ref
45-49dB(A)	0.84	(0.50-1.42)	0.77	(0.50-1.17)
50-54dB(A)	0.87	(0.51-1.49)	0.74	(0.48-1.14)
55dB(A) and +	0.87	(0.53-1.42)	0.79	(0.53-1.19)
<b>L<sub>Aeq 6h-22h</sub></b>				
<45dB(A)		ref		ref
45-49dB(A)	1.01	(0.55-1.84)	0.74	(0.46-1.20)
50-54dB(A)	0.94	(0.50-1.76)	0.79	(0.48-1.29)
55 dB(A) and +	0.95	(0.54-1.69)	0.72	(0.46-1.13)
<b>L<sub>night</sub></b>				
<40dB(A)		ref		ref
40-44dB(A)	0.66	(0.39-1.12)	0.65	(0.43-1.00)
45-49dB(A)	0.69	(0.41-1.17)	0.77	(0.50-1.18)
50dB(A) and +	0.90	(0.57-1.41)	0.76	(0.52-1.11)

## DISCUSSION

In France, the prevalence of depression's symptoms varies between 5% and 13% according to different studies [17], [18], [19]. The estimation highly depends on the scale used to evaluate these symptoms. Indeed, a lot of different validated tools are available for the evaluation of depression's symptoms. They differ from each other by the completion time, the collection mode, the association with other measurements, etc.

No prevalence has yet been published for the French population using the GHQ-12.

The present study did not find any significant association between aircraft noise exposure and psychological distress. This finding confirms the results of some studies [12]–[14], [20], even if others found significant associations [9]–[11].

Among the studies investigating the effect of aircraft noise on psychological disorders, different tools have also been used to evaluate these disorders. Three of them used the GHQ [12], [13], [20]: they did not find any significant association. The absence of an association observed in this study could be explained by an effect similar to the "healthy worker effect": people with psychological disorders could choose not to live in the vicinity of airports.

However, further studies are necessary in order to conclude.

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