

Self-reported health and aircraft noise exposure: the results of the DEBATS study in France

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ABSTRACT

The impact of exposure to aircraft noise on health is of growing concern because of a steady rise in flights. While many studies address the annoyance associated with aircraft noise, very few studies consider the health status perceived by the population itself. We investigated associations between aircraft noise exposure and perceived health 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 perceived health was assessed by a face-to-face questionnaire. Aircraft noise exposure was evaluated for each participant's home address. Associations with perceived health were investigated using logistic regressions including relevant confounders.

No association was found between aircraft noise exposure and perceived health. After stratification on gender, significant associations were observed for men: OR=1.55 (95%CI=1.02-2.35) per 10-dB(A) L_{night} -increase.

The associations observed in this study could be due to residual confounding or to declaration bias which cannot be excluded. Further studies are necessary in order to better understand these associations.

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 mental disorders, low birth weights, obesity and diabetes [7]–[10], but these effects remain discussed because of divergent results.

Studies dealing with the effects of aircraft noise exposure on self-reported health are very rare: only one study has been identified in the PubMed database. The authors found a worse general health reported by people living near the Schiphol airport in Amsterdam [11]. They have also highlighted a lack of studies on this subject, with similar measures of noise

exposure and of perceived health by airports' residents to allow comparisons, and thus draw conclusions.

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 specific objective of the study was to evaluate the effects of aircraft noise exposure on self-reported health 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 ≥ 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.

Self-reported health

Self-reported health was evaluated using the question: *“In general, would you say that your health is excellent, good, fair, or poor?”*. It was then categorized into two classes for the statistical analyses: excellent or good versus fair or poor.

Confounders

Several factors which could affect self-reported health 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/ ≥ 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) [12]. Four noise indicators were derived and used in the statistical analyses: L_{den} , L_{Aeq24h} , $L_{Aeq6h-22h}$, and L_{night} .

Statistical analysis

Logistic regression models were estimated in order to study the relationship between aircraft noise exposure and self-reported health. They were adjusted for the confounding factors previously defined. Subgroups analyses were also performed separately for women and men in order to assess a potential specific effect on each gender.

Linearity of the relation between the dependent variable and aircraft noise exposure was tested using generalized additive models including a smooth cubic function with linear and quadratic terms for aircraft noise exposure.

RESULTS

About 15% of the participants considered that their general health was fair or poor (16% of women, and 15% of men in the study population).

No significant association was shown between aircraft noise exposure and self-reported health when both gender were considered, whatever the noise indicator.

Subgroup analyses found a rise in OR of self-reported health with increasing aircraft noise exposure: OR=1.71 – 95%CI = 1.05-2.80 per 10 dBA increase in noise levels for $L_{Aeq\ 24h}$, OR=1.64 – 95%CI=1.06-2.55 for $L_{Aeq\ 6h-22h}$, and OR=1.55 – 95%CI=1.02-2.35 for L_{night} . Generalized Additive Models including a smooth cubic spline function suggested approximately a linear relationship between aircraft noise exposure and self-reported health.

DISCUSSION

The present study suggests that the more men were exposed to aircraft noise, the more they were likely to report a fair or poor general health. In 2012, almost 9% of the French population reported a fair or poor perceived health (8% in men, and 9% in women) [13]¹. This prevalence was slightly higher, 15%, in the DEBATS study.

In the study carried out among Schiphol airport's residents in Amsterdam [11], the prevalence of bad perceived health was 20%.

The present study suggests that aircraft noise exposure is significantly associated with a bad or a poor self-reported health in men only. It confirms the findings of Franssen et al. [11] who found a significant association between self-reported health and aircraft noise exposure for the whole study population with an OR=1.23 (95%CI=1.04-1.46) for a 10 dB(A) increase in L_{den} .

Subgroup analyses were not published separately for men and women.

In addition to the question "How is your health in general: very good, good, moderate, sometimes good and sometimes bad, bad?", Franssen et al. used a validated questionnaire in Dutch which evaluates stress symptoms with a list of different health complaints [14]. Because of very few differences in the results based on the single question or on the validated questionnaire, the authors concluded that the method used to evaluate self-reported health had almost no impact on the findings.

The associations observed in the present study could be due to residual confounding or to declaration bias which cannot be excluded. Further studies are necessary in order to better understand this association.

REFERENCES

- [1] W. Babisch *et al.*, « Annoyance due to aircraft noise has increased over the years-- results of the HYENA study », *Environ. Int.*, vol. 35, n° 8, p. 1169- 1176, nov. 2009.
- [2] A.-S. Evrard, M. Lefèvre, P. Champelovier, J. Lambert, et B. Laumon, « Does aircraft noise exposure increase the risk of hypertension in the population living near airports in France? », *Occup. Environ. Med.*, août 2016.
- [3] M. M. Haines *et al.*, « The West London Schools Study: the effects of chronic aircraft noise exposure on child health », *Psychol. Med.*, vol. 31, n° 8, p. 1385- 1396, nov. 2001.
- [4] A. L. Hansell *et al.*, « Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study », *BMJ*, vol. 347, p. f5432, oct. 2013.
- [5] S. J. Kim *et al.*, « Exposure-Response Relationship Between Aircraft Noise and Sleep Quality: A Community-based Cross-sectional Study », *Osong Public Health Res. Perspect.*, vol. 5, n° 2, p. 108- 114, avr. 2014.
- [6] S. A. Stansfeld *et al.*, « Aircraft and road traffic noise and children's cognition and health: a cross-national study », *Lancet Lond. Engl.*, vol. 365, n° 9475, p. 1942- 1949, juin 2005.

¹ http://drees.social-sante.gouv.fr/IMG/pdf/rappeds_v11_16032015.pdf

- [7] A. Pyko *et al.*, « Exposure to traffic noise and markers of obesity », *Occup. Environ. Med.*, vol. 72, n° 8, p. 594- 601, août 2015.
- [8] T. Matsui, T. Matsuno, K. Ashimine, T. Miyakita, K. Hiramatsu, et T. Yamamoto, « [Association between the rates of low birth-weight and/or preterm infants and aircraft noise exposure] », *Nihon Eiseigaku Zasshi Jpn. J. Hyg.*, vol. 58, n° 3, p. 385- 394, sept. 2003.
- [9] I. van Kamp, D. Houthuijs, C. van Wiechen, et O. Breugelmans, « Environmental noise and mental health: evidence from the Schiphol monitoring program », 2007.
- [10] M. Miyakawa *et al.*, « Relationship between subjective health and disturbances of daily life due to aircraft noise exposure—Questionnaire study conducted around Narita International Airport— », in *Proc. 9th International conference on Noise as a Public Health Problem*, 2008, p. 314–321.
- [11] E. Franssen, C. M. A. G. van Wiechen, N. Nagelkerke, et E. Lebet, « Aircraft noise around a large international airport and its impact on general health and medication use », *Occup. Environ. Med.*, vol. 61, n° 5, p. 405- 413, mai 2004.
- [12] B. He *et al.*, « Integrated Noise Model (INM) Version 7.0 User's Guide », avr. 2007.
- [13] « L'état de santé de la population en France - RAPPORT 2015 ». .
- [14] Dirken JM, « Het meten van stress in industriële arbeidssituaties [The measurement of stress in industrial working situations] », *Leiden: NIPG-TNO*, 1967.