

Residential exposure to aircraft noise and hospital admissions for cardiovascular diseases: multi-airport retrospective study

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EDITORIAL by Stansfeld

RESEARCH, p 12

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Editorial: Aviation and public health (*BMJ* 2013;346:f593)

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Watch the authors discuss their study in a video abstract at bmj.com/multimedia

STUDY QUESTION

What is the association between exposure to aircraft noise and risk of hospitalization for cardiovascular disease in older people residing near airports in the United States?

SUMMARY ANSWER

Averaged across airports, we found a statistically significant association between exposure to aircraft noise and risk of hospitalization for cardiovascular disease, controlling for individual demographics, area level socioeconomic status, air pollution, and proximity to roadways.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS

Aircraft noise has been associated with hypertension outcomes, but few studies have investigated its relation to cardiovascular disease. Long term exposure to aircraft noise is positively associated with hospitalization for cardiovascular disease.

Participants and setting

Our study included over 6 million participants in the national medical insurance (Medicare) program (aged ≥65 years) in 2009, all residing in one of 2218 zip codes surrounding 89 airports in the contiguous states.

Design

We conducted a multi-airport retrospective study to estimate the percentage increase in the zip code level cardiovascular hospital admission rate associated with aircraft noise. We constructed two exposure metrics: population weighted noise within each zip code and 90th centile of noise among populated census blocks within each zip code. We also estimated the population attributable fraction for aircraft noise, fine particulate matter, and ozone.

Primary outcome

Percentage increase in hospitalization admission rate for cardiovascular disease associated with a 10 dB increase in aircraft noise, for each airport and on average across airports.

Main results and the role of chance

Averaged across airports and using the 90th centile noise exposure metric, a zip code with 10 dB higher noise exposure had a 3.5% higher (95% confidence interval 0.2% to 7.0%) cardiovascular hospital admission rate, after controlling for covariates. We found that 2.3% of hospitalizations for cardiovascular disease in our cohort were attributable to aircraft noise. In comparison, 6.8% of hospitalizations for cardiovascular disease were attributable to fine particulate matter and 4.2% to ozone.

Bias, confounding, and other reasons for caution

The availability of only zip code level addresses can lead to exposure misclassification, with potential downward bias due to aggregation effects. We were not able to separate the effect of night time noise, which would be relevant given evidence that sleep interference may mediate the effect of noise on cardiovascular health.

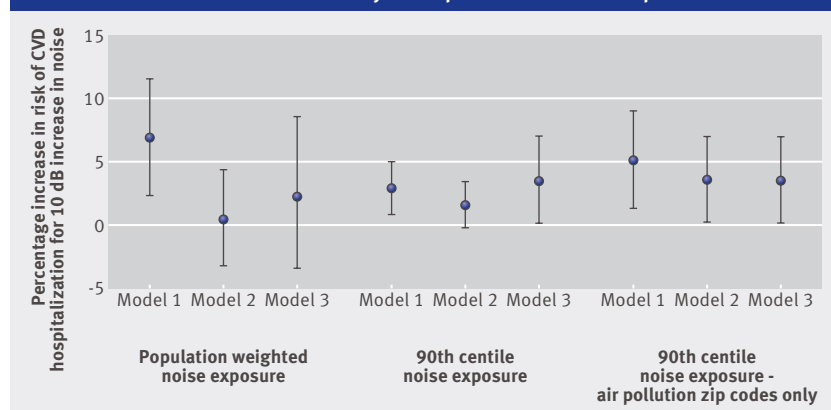
Generalisability to other populations

Our study included nearly 100% of adults aged ≥65 living near 89 airports in the United States, so our findings would generalise to older populations in developed countries with similar proximity to airports and housing types.

Study funding/potential competing interests

This study was funded by the US Federal Aviation Administration. The sponsor provided the noise contours, but had no role in the analysis or interpretation of data, writing of the article, or decision to submit the article for publication. We have no competing interests.

Overall estimates of percentage increase in hospital admission rate for cardiovascular disease (CVD) associated with 10 dB (day-night sound level) increase in noise
Model 1 controls for age, sex, and race; model 2 additionally controls for zip code level socioeconomic status and demographics; and model 3 adds to model 2 by also controlling for annual average fine particulate matter and ozone levels
Panel 3 shows models 1-3 fitted to only 779 zip codes with both air pollution variables



EDITORIAL by Stansfeld

RESEARCH, p 11

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Study funding/potential competing interests See bmj.com.

Aircraft noise and cardiovascular disease near Heathrow airport in London: small area study

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STUDY QUESTION

Do areas exposed to aircraft noise related to Heathrow airport in London have higher risks for hospital admissions or mortality for stroke, coronary heart disease, and cardiovascular disease?

SUMMARY ANSWER

Areas with high levels of aircraft noise had increased risks of stroke, coronary heart disease, and cardiovascular disease for both hospital admissions and mortality.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS

Experimental and epidemiological studies have suggested that the risk of hypertension is increased with exposure to environmental noise, but few studies have looked at

stroke, heart disease, or circulatory disease. This paper adds information on these outcomes; interpretation should consider residual confounding and ecological bias as well as possible causal explanations.

Participants and setting

General population (3.6 million) living in areas exposed to aircraft noise related to Heathrow airport.

Design

Small area study using routinely available data on hospital admissions and mortality and area level data on confounders of deprivation, ethnic composition, and smoking proxy (lung cancer mortality).

Primary outcomes

Stroke, coronary heart disease, and cardiovascular disease hospital admissions and mortality.

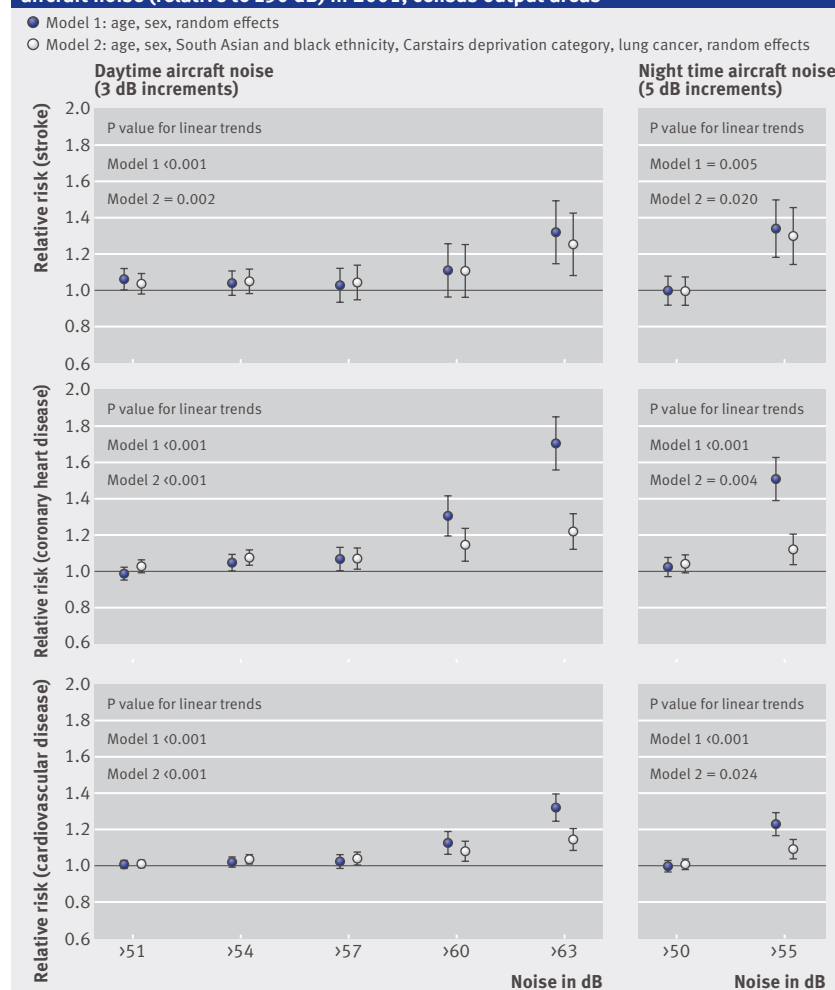
Main results and the role of chance

During 2001-05, 189 226 first episodes of hospital stay in a given year for cardiovascular disease (16 983 stroke, 64 448 coronary heart disease) and 48 347 cardiovascular disease related deaths (9803 stroke, 22 613 coronary heart disease) occurred in the study area. The risk of hospital admissions was statistically significantly increased for stroke, coronary heart disease, and cardiovascular disease for both daytime and night time aircraft noise. Comparing areas experiencing the highest with lowest levels of daytime aircraft noise (>63 dB v ≤51 dB), the relative risk of hospital admissions was 1.24 (95% confidence interval 1.08 to 1.43) for stroke, 1.21 (1.12 to 1.31) for coronary heart disease, and 1.14 (1.08 to 1.20) for cardiovascular disease. Corresponding relative risks for mortality were of similar magnitude, but with wider confidence intervals. Linear tests for trend were statistically significant for hospital admissions but not for mortality (except daytime noise and coronary heart disease). Results were robust to adjustment for particulate matter of ≤10 µm air pollution and road traffic noise, possible for London boroughs (2.6 m population).

Bias, confounding, and other reasons for caution

Adjustment for confounders may be incomplete as adjustment was made at aggregate, not individual, level. Risks (particularly hospital admissions for coronary heart disease) were noticeably reduced after adjustment for percentage population of South Asian ethnicity. Interpretation should therefore include possible alternative explanations such as residual confounding as well as potential for ecological bias.

Relative risks (95% confidence intervals) for associations between hospital admissions for stroke, coronary heart disease, and cardiovascular disease in 2001-05 and annual population weighted average daytime aircraft noise (relative to ≤51 dB) and night time aircraft noise (relative to ≤50 dB) in 2001, census output areas



Course of bereavement over 8-10 years in first degree relatives and spouses of people who committed suicide: longitudinal community based cohort study

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Editorial: Complicated grief after bereavement
BMJ 2007;334:962

Cognitive behaviour therapy to prevent complicated grief among relatives and spouses bereaved by suicide
BMJ 2007;334:994

STUDY QUESTION

Are any particular factors associated with the long term course of complicated grief, depression, and suicide ideation in relatives and spouses of people who commit suicide?

SUMMARY ANSWER

Complicated grief, depression, and suicide ideation are strongly associated in the long term bereavement course after suicide of a first degree relative or spouse.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS

Counselling can be effective in decreasing the risk of problematic grief in individuals at increased risk of adverse outcomes after bereavement. Around a fifth of people bereaved by suicide experience suicide ideation after the loss. In first degree relatives and spouses bereaved after suicide, symptoms of complicated grief, depression, and suicide ideation are strongly associated. Though a causal association cannot be claimed, received mutual support was associated with an increased risk of complicated grief.

Participants and setting

Community based sample of 153 first degree relatives and spouses of 74 people who had committed suicide in the northern part of the Netherlands.

Design, size, and duration

We investigated the 8-10 year course of bereavement in relatives and spouses after a loss due to suicide. Associations

between sociodemographic and personality features, mental health history, help seeking including four sessions of family based cognitive behavioural therapy, and symptoms of complicated grief, depression, and suicide ideation at three, 13, and 96-120 months (8-10 years) after the suicide were explored with multivariate multilevel regression models.

Main results and the role of chance

Symptoms of complicated grief, depression, and suicide ideation were strongly associated in the long term bereavement course. A history of clinical depression or anxiety was not associated with complicated grief, depression, or suicide ideation during the course of bereavement after suicide. A history of attempted suicide in the relatives was associated with long term suicide ideation (odds ratio 5.5, 95% confidence interval 1.8 to 16.7; $P=0.003$). This provides support for the stress-diathesis model of suicidal behaviour, proposing that suicidal behaviour is not only determined by a stressor (such as mental disorder, experience of loss), but also by a constitutional predisposition to this type of behaviour. Depression is more likely predicted by individual factors generally associated with an increased risk of depression, whereas complicated grief is probably predicted by the trauma of losing a child. In general, relatives bereaved by suicide recover in the course of time, though the magnitude of change in depression and complicated grief between three and 13 months is small. No particular help resources (family based cognitive behavioural therapy, mental healthcare, general practitioners' support) were significantly associated with long term symptoms of complicated grief, depression, or suicide ideation. Mutual support, however, was associated with an increased risk of complicated grief. It is possible that similar cognitions play a role in the onset of complicated grief and suicide ideation, though it is unclear whether suicide ideation is a cause or a consequence of complicated grief.

Bias, confounding, and other reasons for caution

We cannot rule out that the sample is biased by overrepresentation of relatives who feel a need for help, nor can we draw conclusions about a causal association between complicated grief and mutual support. The content, timing, and dose of mutual support remained unknown.

Generalisability to other populations

The external validity is proposed to be reasonable because of the community based nature of the sample and the relatively strong adherence of participants to the study.

Study funding/potential competing interests

This study was funded by ZONMW (Netherlands Organisation for Health Research and Development) No 60-60100-98-052.

Final prediction models of 8-10 year course of complicated grief and depression in community based sample of first degree relatives and spouses (n=153) bereaved by suicide

	B regression coefficient (95% CI), P value	
	Complicated grief	Depression
Sociodemographic/personality features:		
Female respondent	—	2.8 (4.6 to 1.1), 0.001
Neuroticism (range 0-12)	0.7 (0.1 to 1.3), 0.032	0.7 (0.4 to 1.0), <0.001
Mastery* (range 7-35)	—	4.0 (1.5 to 6.4), 0.002
Relationship to dead person (1=yes, 0=no):		
Spouse (reference)	1.0	1.0
Parent	5.5 (0.1 to 10.9), 0.046	-2.7 (-5.1 to -0.4), 0.024
Sibling	—	-2.6 (-5.2 to -0.1), 0.040
Long term mental health:		
Complicated grief (range 0-129)	NA	0.3 (0.2 to 0.3), <0.001
Depression (range 0-60)	<0.001	NA
Suicide ideation (1=yes, 0=no)	7.1 (2.8 to 11.3), <0.001	4.0 (1.5 to 6.4), <0.001
Help seeking (1=yes, 0=no):		
Mutual support	6.4 (1.8 to 11.0), 0.006	—
Time (months) since suicide:		
2.5 (T0) (reference)	1.0	1.0
13 (T1)	-2.8 (-5.5 to -0.4), 0.046	-5.5 (-7.3 to -3.8), <0.001
96-100 (T2)	-11.9 (-16.1 to -7.7), 0.046	-5.6 (-8.0 to -3.3), <0.001

NA= not applicable.

*Lower scores indicate higher sense of control.

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Exercise for lower limb osteoarthritis: systematic review incorporating trial sequential analysis and network meta-analysis

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• Research: Effectiveness of physiotherapy exercise after knee arthroplasty
(*BMJ* 2007;335:812)

STUDY QUESTION

Which types of exercise intervention are most effective in relieving pain and improving function in people with lower limb osteoarthritis?

SUMMARY ANSWER

As of 2002 sufficient evidence had accumulated to show significant benefit of exercise over no exercise. An approach combining exercises to increase strength, flexibility, and aerobic capacity is most likely to be effective for relieving pain and improving function.

WHAT IS KNOWN AND WHAT THIS PAPER ADDS

Current international guidelines recommend therapeutic exercise (land or water based) as “core” and effective management of osteoarthritis. Evidence from this first network meta-analysis, largely based on studies in knee osteoarthritis, indicates that an intervention combining strengthening exercises with flexibility and aerobic exercise is most likely to improve outcomes of pain and function. Further trials of exercise versus no exercise are unlikely to overturn this positive result.

Selection criteria for studies

Nine electronic databases were searched from inception to March 2012 to identify randomised controlled trials comparing exercise interventions either with each other or with no exercise control for adults with knee or hip osteoarthritis. Trial sequential analysis was used to investigate reliability and conclusiveness of available evidence for exercise interventions. We conducted Bayesian net-

work meta-analysis to combine both direct (within trial) and indirect (between trial) evidence and investigate the relative effectiveness of different types of exercise intervention. Exercise interventions were classified as either land or water based and as predominantly aimed at increasing strength, flexibility, and/or aerobic capacity (endurance).

Primary outcomes

The main outcomes for analysis, expressed as standardised mean difference (SMD) were changes in pain intensity reported by patients (often measured on a 0-10 numerical rating scale) and limitations in function (assessed with multi-item questionnaires).

Main results and role of chance

A total of 60 trials (44 knee osteoarthritis, 2 hip osteoarthritis, 14 mixed) covering 12 exercise interventions and 8218 patients met the inclusion criteria. Sequential analysis showed that as of 2002 sufficient evidence had been accrued to confirm significant benefit of exercise interventions over no exercise control. The network meta-analysis showed that for pain relief, five types of exercise intervention all including strengthening exercises were significantly more effective than no exercise control. For reduction in limitation in function only the combined intervention of strengthening, flexibility, and aerobic exercise (whether land or water based) was significantly more effective than no exercise control (standardised mean difference -0.63, 95% credible interval -1.16 to -0.10).

Bias, confounding, and other reasons for caution:

Most (44/60) trials included in this network meta-analysis investigated knee osteoarthritis. In a sensitivity analysis of the 44 trials focusing only on knee osteoarthritis, effect estimates tended to be slightly larger than produced by the overall analysis, which also included trials focusing on hip osteoarthritis or including a mix of patients with lower limb osteoarthritis. Adjustment for potential confounding by differences between trials in the number of supervised sessions, duration of follow-up, or publication year did not greatly impact on the results of the analysis. A further limitation was the small number of studies contributing evidence to some of the comparisons in the network, which also limited the possibility to investigate specific types of exercise, such as t'ai chi.

Study funding/potential competing interests

This study was funded by the National Institute for Health Research (NIHR) under its programme grants for applied research programme (No RP-PG-0407-10386).

Summary of results of network meta-analysis for pain relief and improvement in function (unadjusted estimates based on data from 60 randomised controlled trials)

Exercise intervention	SMD (95% CrI)	
	Pain relief	Improvement in function
No intervention control	Reference	—
Flexibility	-0.66 (-1.33 to 0.00)	-0.17 (-1.26 to 0.93)
Strengthening	-0.81 (-1.13 to -0.50)	-0.37 (-0.84 to 0.09)
Aerobic	-0.41 (-1.13 to 0.30)	-0.30 (-1.53 to 0.92)
Strengthening+flexibility	-0.50 (-0.85 to -0.16)	-0.40 (-0.92 to 0.12)
Flexibility+aerobic	-0.26 (-1.00 to 0.47)	-0.18 (-1.24 to 0.89)
Strengthening+aerobic	-0.13 (-0.88 to 0.61)	-0.17 (-1.25 to 0.91)
Combined	-0.69 (-1.04 to -0.35)	-0.63 (-1.16 to -0.10)
Aquatic:		
Strengthening	-0.75 (-1.42 to -0.07)	-0.43 (-1.42 to 0.56)
Strengthening+flexibility	-0.96 (-1.64 to -0.27)	-0.61 (-1.75 to 0.52)
Flexibility+aerobic	-0.07 (-0.98 to 0.83)	0.07 (-1.23 to 1.36)
Strengthening+aerobic	-0.92 (-2.08 to 0.25)	-0.86 (-2.52 to 0.79)
Combined	-0.45 (-1.02 to 0.11)	-0.49 (-1.32 to 0.33)

SMD=standardised mean difference; CrI=credible interval.