

EFFECTS OF AIRCRAFT NOISE ON LONG-TERM MEMORY: THE RANCH STUDY

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Introduction The effects of the exposure to noise on children's memory have been analysed using different field and laboratory studies. However, the results of these studies are not conclusive because, whilst some authors have observed that the exposure to noise has a negative effect on memory (Evans, et al., 1995), others have not proved this association (Hambrick-Dixon, 1986; Haines, et al., 2001). These contradictory results show the need for new studies which examine different variables (socio-economic, quality of the school, assistance, etc.) which may be confounding this association. The effect of these variables may explain the lack of association found in previous studies. The specific aim of this study is to examine the effect of chronic exposure to noise on long-term memory in 10 year old children in British and Spanish schools exposed to a range of noise (aircraft, traffic and both combined), bearing in mind the possible effect of the co-variables.

Method The methodology used in the study (design, school selection and noise measurement) is described in Stansfeld et al. (2003) presented at this Congress. The sample of subjects was 2,210 10-year-old boys and girls (1,028 Spanish and 1,182 British).

Cognitive tests *Episodic memory* For the measurement of episodic memory a version of the Child Memory Scale (Cohen, 1997) was used and adapted for application to a group. In particular, the test evaluated the recall capacity and the delayed recognition of two stories (reproduced on a CD), after a lapse of 30 minutes during which an interference task (children's questionnaire) was carried out.

Prospective memory This test was developed by the Queen Mary team in collaboration with J. Dockrell from the UK Institute of Education. It assessed the capacity to recall and execute an order which had previously been requested. It required the children to write their initials in different items of two tests. In the first test, the instructions were given at the beginning of the test and the children wrote their initials on two items of the test (reading comprehension). In the second test there was a lapse of fifteen minutes between the instructions and their execution, during which time the children did another test. On this occasion, the initials were written on one item only.

Analysis Analysis of covariance was used in the preliminary analyses of the Spanish and UK data, with aircraft and road traffic noise as continuous variables. Total scores of each memory test were used as a dependent variable. All analysis were initially adjusted for centre (Spain and UK), and subsequently adjusted for mother's education (measured on an index between 0-1) and for employment status of highest income holder in the family (measured as a dichotomous variable, employed or not employed).

Results In preliminary analyses of pooled data from Spain and the UK, aircraft noise was associated with a significant impairment in all memory tests (recognition, conceptual cued recall, and prospective memory) in analysis of covariance adjusting for centre, employment status and mother's education (Table 1). No effect was found for road traffic noise exposure.

Table 1. Cognitive outcomes and aircraft noise exposure; adjusted for centre, employment status and mother's education

| Cognitive Outcome | B | Confidence Interval | p |
|---|-------|---------------------|-------|
| Recognition (LTM) | | | |
| Centre adjusted | -.026 | -.036 to -.015 | .0001 |
| Centre, employment adjusted | -.023 | -.035 to -.011 | .0001 |
| Centre, mother's education | -.023 | -.035 to -.011 | .0001 |
| Centre, mother's education, employment adjusted | -.022 | -.034 to -.010 | .0001 |
| Cued recall conceptual (LTM) | | | |
| Centre adjusted | -.030 | -.041 to -.018 | .0001 |
| Centre, employment adjusted | -.030 | -.043 to -.016 | .0001 |
| Centre, mother's education adjusted | -.028 | -.042 to -.015 | .0001 |
| Centre, mother's education, employment adjusted | -.027 | -.041 to -.014 | .0001 |
| Prospective memory | | | |
| Centre adjusted | -.043 | -.073 to -.013 | .005 |
| Centre, employment adjusted | -.051 | -.087 to -.014 | .006 |
| Centre, mother's education adjusted | -.058 | -.094 to -.021 | .002 |
| Centre, mother's education, employment adjusted | -.054 | -.091 to -.017 | .004 |

B= change in outcome score associated with 1dB change in noise.

Conclusions The preliminary analyses show an effect of aircraft noise on long-term and prospective memory. These findings are consistent with Evans et al. (1995). That is, exposure to aircraft noise has a negative effect on memory. No effects were found of road traffic noise. These results suggest that aircraft noise is more disruptive than road traffic noise. This could also be due to the fact that road traffic noise levels were not high enough to effect these cognitive processes. These results are preliminary and require further analysis.

Keywords: Noise exposure, children, memory.

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