Occupational noise exposure and the risk of stroke

Z.A. Stokholm[1], J.P. Bonde[2], K.L. Christensen[3], Å.M. Hansen[4], H.A. Kolstad[1]

[1] Danish Ramazzini Center, Department of Occupational Medicine, Aarhus University Hospital, Nørrebrogade 44, building 2C, 8000 Aarhus C, Denmark. E-Mail: zarastok@rm.dk

[2] Department of Occupational and Environmental Medicine, Copenhagen University, Bispebjerg Hospital, Denmark

[3] Department of Internal Medicine and Cardiology A, Aarhus University Hospital, Denmark

[4] National Research Centre for the Working Environment, Copenhagen, Denmark

INTRODUCTION

Community noise exposure about 60 dBA has recently been associated with stroke (Beelen et al. 2009; Huss et al. 2010; Sorensen et al. 2011; Fujino et al. 2007). We aimed at investigating this relation for 81-86 dBA occupational noise exposure and report the incidence of stroke in a large 7-year follow-up study of employees from several noise exposed industries.

METHODS

We followed 113,141 industrial employees from 625 companies within 10 industrial trades (construction, manufacturers of food, wood products, non-metallic mineral products, basic metals, fabricated metals, machinery, motor vehicles, furniture, publishing and printing) and 47,686 employees in 100 companies from financial intermediation (reference) from 2001 to 2007. The companies were identified from Statistics Denmark (Statistics Denmark 1989) and the employees by linkage with the Register of the Danish Supplementary Pension Fund that for all wage earners in Denmark contains information on employment and trade annually since 1964, and thus also duration of employment (Kenborg et al. 2010; Olsen & Jensen 1987). We identified occupational titles, defined by the International Standard Classification of Occupations (ISCO-88) by linkage with Statistics Denmark (ILO 1990) and retrieved information on socioeconomic status from the Integrated Database for Labour Marked Research (IDA 1988). Vital status (emigration, disappearance or death) was retrieved from the Central Population Register.

We identified cases of stroke (n = 921, defined by the first primary diagnosis of stroke (International Classification of diseases (ICD), revision 8 codes 4310, 4319, 4320, 4329, 43309, 43399, 43409, 43499, 4360, and 4369 and ICD revision 10 codes DI61, DI63, and DI164) recorded between January 1, 2001 and December 31, 2007 in the Danish National Hospital Register, which covers all hospital contacts in Denmark (inpatient hospitalization and outpatient visits).

Full-shift noise exposure levels were estimated by personal dosimeter recordings from random subsets of employees (n = 710) sampled within each of the 10 industrial trades and the one reference trade in 2001 and ranged from 81.5 dBA to 85.8 dBA for the industrial employees and 69.7 dBA for the reference employees (Kock et al. 2004). The trade-mean noise exposure levels classified the individual employee's noise exposure year by year accounting for shift in employment over time between trades and occupations with different noise exposure levels. Individual noise exposures were analyzed by different approaches: (1) Current noise exposure was the trade-mean noise level (L_{AEq} in dBA). This level was set at the reference level (financial intermediation) if the person no longer was employed in a relevant industrial trade or occupation. (2) Cumulative noise exposure was the product of trade-mean noise exposure level (L_{AEq} in dBA) and duration of exposed employment (T) since 1964, according to the following formula: 10 x log [$\Sigma(10^{dBA/10} \times T)$] resulting in "dBA-year" on a logarithmic scale.

Rate ratios (RR) and 95% confidence intervals (CIs) for stroke were estimated by logistic regression. The analyses were performed as a discrete survival function, since person year was the unit of analysis. Models were adjusted for age, gender, socioeconomic status, calendar year, hypertension, and employment status (gainful employment: yes/no). We analyzed all data with financial employees as the reference. Because of possible life-style or other differences between the industrial and financial employees not captured in the adjusted analyses internal trend analyses restricted to the noise-exposed employees of the 10 noisy trades were also conducted.

RESULTS

Industrial employees were more often men, were slightly younger, and had lower socioeconomic status, and shorter duration of employment than the financial employees. Industrial employees showed an overall increased risk of stroke compared with financial employees (adjusted RR = 1.30, 95% CI = 1.07-1.59).

Figure 1 presents the rate ratios for stroke by current noise exposure with financial employees as the reference. RR-estimates of stroke decreased by increasing noise exposure, and there was thus no indication of a positive exposure response relationship. The risk of stroke for non-noise exposed industrial employees was significantly higher than the reference group (adjusted RR = 1.42, 95% CI = 1.07-1.89). This was as expected because a high fraction of them were retired or otherwise without employment. Similarly results were found for cumulative noise exposure.

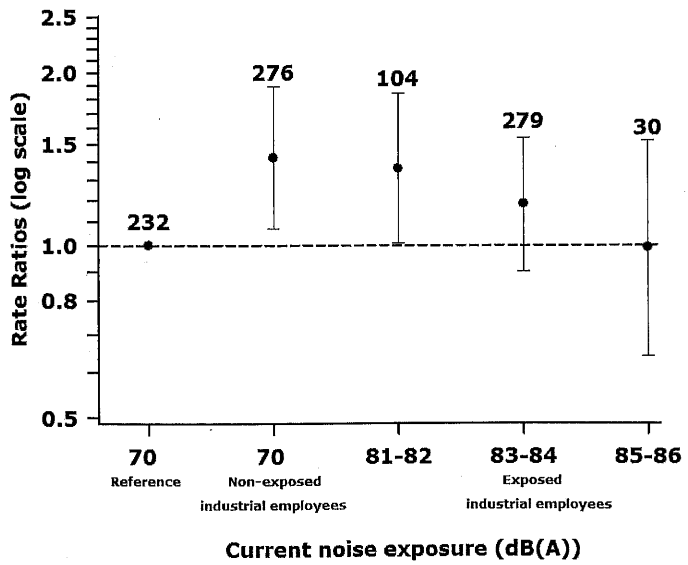

Figure 1: Current noise exposure and adjusted rate ratios of stroke among employees of industrial trades (≥81 dBA) compared with employees of the financial sector (70 dBA, reference). Numbers of cases are represented above the bars.

CONCLUSION

This study had several strengths, including the large sample size, longitudinal design with a long follow up, direct noise exposure measurements in a selected subsample, and the unique database resources for defining and identifying incident cases. However, there were also limitations such as no available individual information on the use of hearing protection devices or several relevant potential confounders such as smoking, body mass index, physical activity or alcohol consumption.

This study did not relate neither current nor cumulative occupational noise exposure with stroke. We could thus not support resent findings of such an effect for community noise. Differences in life style and social factors may explain the overall higher rate among industrial employees compared with financial employees.

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