Are occupational noise-exposure levels declining?

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INTRODUCTION

In industrialized countries chemical exposures are generally lower today than they were years or decades ago (Symanski et al. 1998), but it is unclear if this also is the case for noise exposure. In the United States noise exposure levels decreased in the 1980s and 1990s according to the Occupational Safety and Health Administration but data were collected to document consultation interventions and not for surveillance purposes (Middendorf 2004). In Europe no longitudinal surveillance data are available for noise levels but 30 % of workers report that they at least a quarter of their working time are exposed to noise so loud that they have to raise their voice and this proportion was unchanged from 2000 to 2010 (European Foundation for the Improvement of Living and Working Conditions, 2010). In Denmark 2001-2002 a mean noise level of 83.7 dBA and a two-fold increased risk of hearing handicap was recorded in a random sample of companies from manufacturing industries, construction, and children day care (Kock et al. 2004; Rubak et al. 2006). This paper reports an 8-year follow up of noise levels in this Danish population.

METHODS

In 2001-2002, we recruited companies at random from the manufacturing industries and construction trades in Denmark with the highest reporting of cases of occupational hearing loss, children day care units, and as a reference financial intermediation, in all 84 companies. In 2001-2010, 39 of the same companies agreed to participate, as well as 37 new companies recruited according to a similar procedure as in 2001-2002. From a total of 121 companies, 1,218 workers participated (743 in 2001-2002 and 475 in 2009-10). Company participation was 60.6 % in 2001-2002 and 24.3 % in 2009-2010. Participating workers recorded full-shift noise exposure levels with portable dosimeters (Bruel & Kjær model 4443). We estimated the mean full-shift noise exposure levels and the proportion workers exposed above 85 dBA in 2001-2002 and 2009-2010, and the changes during the 8-year period in linear and logistic regression models adjusted for trade and total number of employees within a company. In separate analyses we included only companies participating at both rounds.

RESULTS

The overall average full-shift noise levels were 82.5 dBA in 2001-2002 and 81.5 dBA in 2009-2010 (Figure 1). In the exposed trades (manufacturing industries, construction and children day care) these values were 83.7 dBA and 82.8 dBA, respectively and in finance 69.7 dBA and 70.5 dBA, respectively (Table 1). During the 8-year follow up the adjusted noise level decreased by 0.9 dBA (95% CI 0.3-1.6 dBA) in the exposed trades (Table 1). This corresponds with an 0.1 dBA annual decline. If we restricted the analysis to exposed companies participating at both rounds the adjusted 8-year decline was 1.2 dBA (95% CI 0.3-2.2 dBA). The proportion workers ex-

posed > 85 dBA decreased significantly from 38.4 % to 31.7 % (adjusted odds ratio 0.72, 95% CI 0.55-0.95) (Table 2). Companies with above mean noise exposure levels in 2001-2002 (> 82.5 dBA) had a lower participation rate in 2009-2010 than companies with below mean noise levels in 2001-2002 (odds ratio 0.62, 95% CI 0.26-1.49).

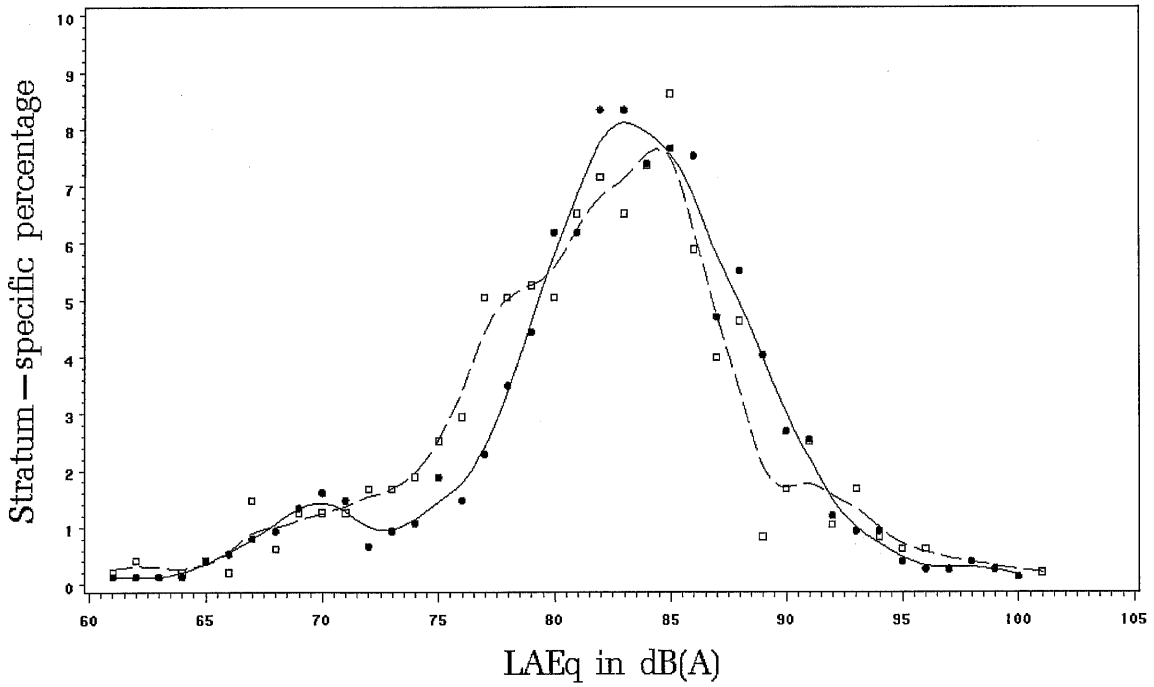

Figure 1: The distribution of mean, full shift noise levels (L_{AEq}) during 2001-2002 (solid line) and 2009-2010 (dotted line). Results from 1218 measurements of a sample of companies from manufacturing industries, construction, children day care and finance intermediation (reference)

CONCLUSION

During the 8-year period 2001-2002 to 2009-2010 the noise exposure levels in this random sample of companies from manufacturing industries, construction and children day care decreased by about 0.1 dBA annually. The proportion workers exposed above the threshold limit value of 85 dBA declined from 2001-2002 to 2009-2010 but was still substantial.

As far as we are aware this is the first time a systematic, longitudinal surveillance of noise exposure levels has been conducted in a national sample of companies. The low participation rate was a limitation and we may have under (or over) estimated the true noise levels in the industries at large. Participation rate at follow up in 2009-2010 was even lower for companies with high noise levels during the first round in 2001-2002 and this may explain at least some of the decrease seen. However, when we restricted analyses to companies participating at both rounds we observed a stronger effect and this does not suggest differential loss from follow up. Decline in production (due to the financial crisis) may explain the findings but we adjusted for change in number of employees, a measure that is expected to reflect production activity. In 2003 intensified requirements regarding the exposure of workers to noise were enacted by the European Parliament and enforced in Denmark by 2006 (European Union 2003). This study indicates that such policy changes may have had significant

impact on noise levels and thus the working conditions but can off course not exclude the possible impact of other societal or technical factors.

Table 1: Change in mean, full-shift noise levels (L_{Aeq}) from 2000-2001 to 2009-2010 within manufacture, construction, and day care and a reference of finance intermediation. Results obtained from a random sample of 1,218 workers of 121 companies

	2001-2002			2009-2010			Change from 2001-2002 to 2009-2010[§]	
Companies studied	No. of workers	Crude mean 95% CI	Adjusted mean* 95% CI	No. of Workers	Crude mean 95% CI	Adjusted mean 95%CI*	Crude mean 95% CI	Adjusted mean* 95% CI
Manufacture, construction and day care								
All companies	682	83.7 83.3-84.1	81.4 80.4-82.4	423	82.8 81.8-83.9	80.5 78.8-82.1	0.8 0.2-1.5	0.9 0.3-1.6
Companies participating at both rounds	304	83.3 82.7-83.9	80.5 79.0-81.9	202	81.8 80.3-83.4	79.3 76.9-81.6	1.5 0.5-2.4	1.2 0.3-2.2
Finance intermediation	61	69.7 68.5-70.8	69.4 68.1-70.7	52	70.5 67.6-73.4	69.8 66.9-73.2	-0.9 -2.6-0.9	-0.4 -2.5-1.7
All participating companies	743	82.5 82.1-83.0	81.2 80.2-82.1	475	81.5 80.3-82.7	80.4 78.8-81.9	1.0 0.3 - 1.8	0.8 0.2-1.4

*Adjusted means from linear regression models that included calendar year (2 levels), industry (12 levels), and number of employees (5 levels). The presented means are computed for printing industry with 30 employees except for analyses restricted to finance .
[§]A change < 0 denotes increasing noise level

Table 2: Change in number of workers exposed to full-shift noise levels (L_{AEq}) ≥ 85 dBA from 2001-2002 to 2009-2010 within manufacture, construction, and day care and a reference of finance intermediation. Results obtained from a random sample of 1,218 workers of 121 companies

	2001-2002			2009-2010			Change 2001-2002 to 2009-2010	
Companies studied	No. of workers	No. exposed ≥85dBA	Proportion exposed ≥85dBA	No. of workers	No. exposed ≥85dBA	Proportion exposed ≥85dBA	Crude OR 95% CI	Adjusted OR 95% CI
Manufacture, construction and day care								
All companies	682	262	38.4 %	423	134	31.7 %	0.74 0.58-0.96	0.72 0.55-0.95
Companies participating at both rounds	304	109	35.9 %	202	51	25.3 %	0.60 0.41-0.90	0.61 0.40-0.94
All participating companies	743	262	35.3 %	475	134	28.2 %	0.72 0.56-0.93	0.72 0.55-0.95

*Adjusted odds ratios from logistic regression models that included calendar year (2 levels), industry (12 levels), and number of employees (5 levels)

To conclude, this study suggests that noise exposure levels have declined with about 0.1 dBA annually during the beginning of this millennium and indicates that recent initiatives to reduce noise exposure levels have been successful.

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