

HEARING LOSS IN STYRENE-EXPOSED WORKERS

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Introduction Ototoxicity of styrene and the synergistic action of styrene and noise have been shown in rats. The respective data in humans are scarce and equivocal. The aim of the study was to evaluate the effects of a styrene exposure and a combined exposure to styrene and noise on hearing.

Methods The study group comprised 290 yacht yard and plastic factory workers exposed to a mixture of organic solvents, having styrene (mean concentration $61.8 \pm 51.9\text{mg}\%$) as its main compound. A subpopulation of 70 workers was co-exposed to organic solvents and noise. The reference group, totalling 223 subjects, included (1) white collar workers, exposed neither to solvents nor noise and (2) metal factory workers, exposed exclusively to noise. All subjects were assessed by means of a detailed questionnaire and underwent otorhinolaryngological and audiometric examinations (pure-tone audiometry and tympanometry).

In addition, in a subgroup of 114 styrene-only exposed subjects, 96 noise-only exposed subjects and 71 unexposed controls, a large battery of hearing tests was performed (including otoacoustic emissions, auditory brain stem-evoked potentials, wave P-300, contralateral stapedial reflex, tone decay test, besides of pure-tone audiometry and tympanometry) to assess the site of the lesion in the auditory pathway related to solvent exposure.

Results Multiple logistic regression analysis revealed almost a 4 - fold (RR 3.9; 95%CI 2.4-6.2) increase in the odds of developing hearing loss related to styrene exposure. The factors adjusted for were age, gender, current occupational exposure to noise and exposure to noise in the past. In cases of the combined exposures to styrene and noise the odds ratios were two to three times higher than the respective values for styrene-only and noise-only exposed subjects (fig. 1). The mean hearing thresholds – adjusted for age, gender, and exposures to noise – were significantly higher in the solvent-exposed group than in the unexposed to solvents reference group at all frequencies tested (1-8 kHz) (fig. 2). A positive linear relationship existed between (1) age and hearing thresholds at all frequencies tested, (2) an averaged noise exposure level over total time of employment and hearing threshold at the frequencies 2-8 kHz in the left ear and 3-8 kHz in the right ear, and (3) an averaged working life styrene concentration and hearing thresholds at the frequencies of 6 and 8 kHz. A possible site of lesion and mechanisms of styrene ototoxicity are discussed.

Conclusions This study provides the epidemiological evidence that occupational exposure to styrene is related to an increased odds of developing hearing loss. Combined exposure to noise and styrene is more ototoxic than exposure to noise alone.

Keywords styrene, ototoxicity, noise, odds ratio, hearing loss, evoked potentials, otoacoustic emissions, site of lesion, auditory pathway

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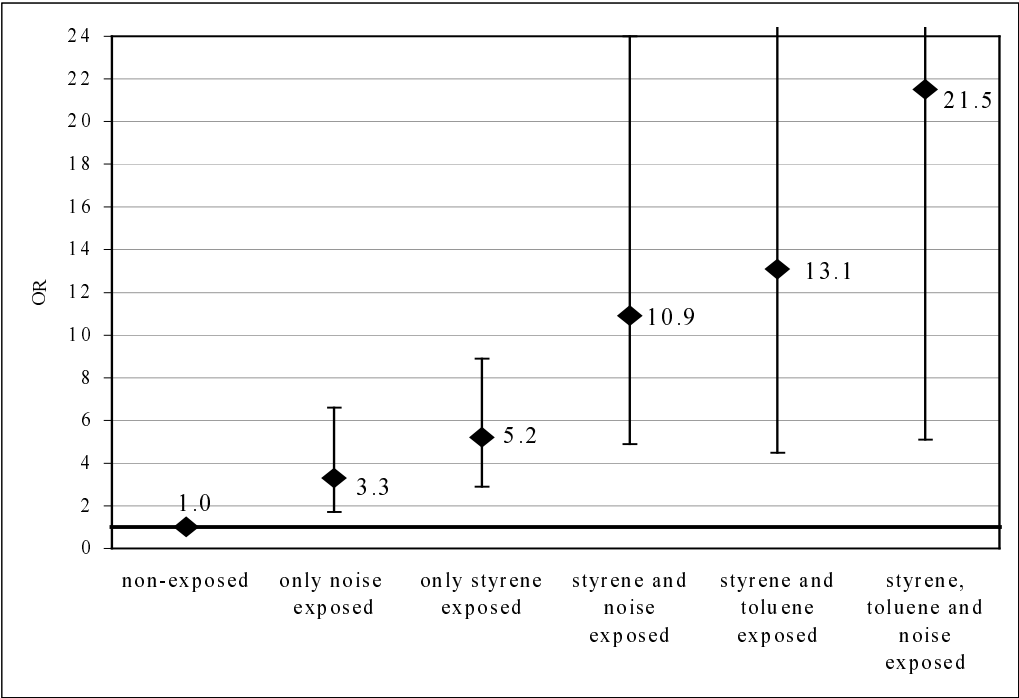


Fig 1. Odds ratios of hearing loss in the study subgroups, adjusted for age and gender

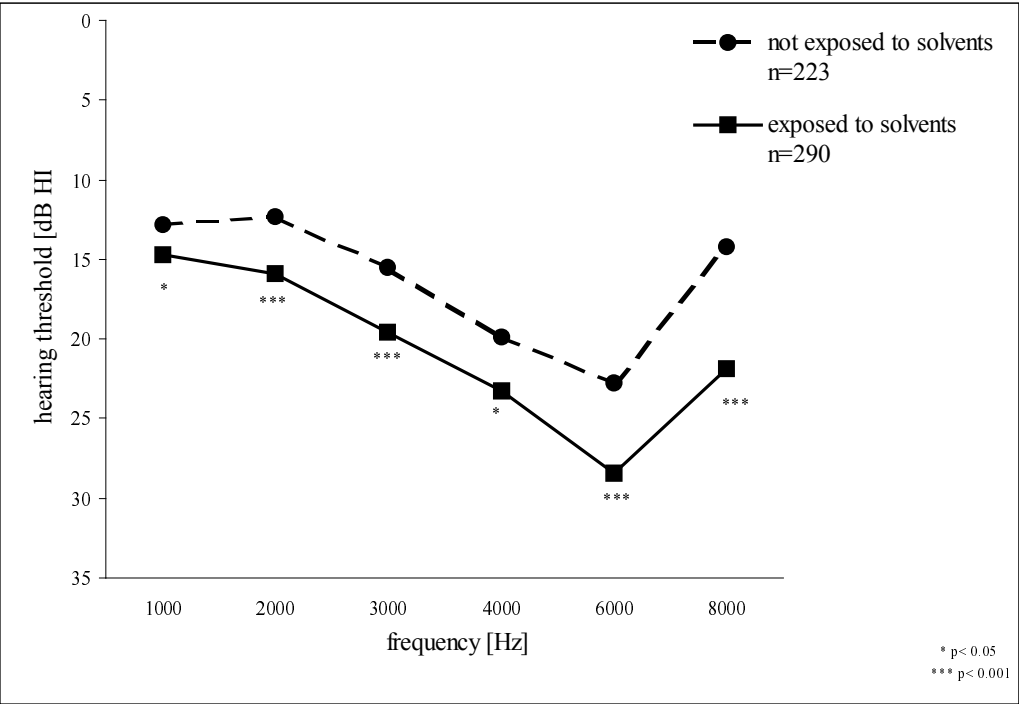


Figure 2. Mean hearing thresholds adjusted for age, gender, current exposure to noise and noise in the past (only air-conduction curves are presented)

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