

Hearing-related symptoms among women

Occurrence and risk in relation to occupational noise and stressful working conditions

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentlig försvaras i hörsal Karl Isaksson, Arbets- och miljömedicin, Medicinaregatan 16A, torsdagen den 14 juni, klockan 13:00

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Avhandlingen baseras på följande delarbeten

- I. Fredriksson S., Hammar O., Torén K., Tenenbaum A., Persson Waye K. (2015). The effect of occupational noise exposure on tinnitus and sound-induced auditory fatigue among obstetrics personnel: a cross-sectional study. *BMJ open* 5(3): e005793.
- II. Fredriksson S., Hammar O., Magnusson L., Kähäri K., Persson Waye K. (2016). Validating self-reporting of hearing-related symptoms against pure-tone audiometry, otoacoustic emission, and speech audiometry. *International journal of audiology* 55(8): 454-462.
- III. Fredriksson S., Kim J-L., Torén K., Magnusson L., Kähäri K., Söderberg M., Persson Waye K.. Increased risk of self-reported hearing-related symptoms among women who have worked in preschool: a cohort study. *Submitted for publication*.
- IV. Fredriksson S., Hussein-Alkhateeb L., Torén K., Sjöström M., Selander J., Gustavsson P., Kähäri K., Magnusson L., Persson Waye K. Occupational noise exposure and adult-onset hyperacusis in a cohort of Swedish women. *Manuscript*.

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Abstract

A considerable amount of research has been devoted to the risk of noise-induced hearing loss among industry workers – the majority of whom are men. Much less research has been done in female-dominated human service occupations, including obstetrical care and preschools. These work environments can be characterised by noise from intense speech communication and screaming and by stressful working conditions. To address the lack of studies in female-dominated workplaces we have assessed the occurrence and risk of hearing-related symptoms among obstetrical personnel (n 115), the diagnostic validity of self-reported symptoms (n 55), and the relative risk of hearing-related symptoms among female preschool teachers (n 4718) compared to women in the general population (n 4122).

The main finding of this thesis was that women working in obstetrical care and preschools have an increased risk of hearing-related symptoms. We found that equivalent sound levels measured in the obstetrical ward exceeded 80 dBA in 45% and 85 dBA in 5% of the work shifts measured. Maximum levels >115 dBA were measured during ongoing labours. We found an increased risk of tinnitus and sound-induced auditory fatigue in association with occupational noise exposure among obstetrical personnel. Sound-induced auditory fatigue was also associated with noise annoyance. Work-related stress slightly missed significance in a multivariable model. We found an acceptable diagnostic validity for the questionnaire item assessing sound-induced auditory fatigue. It identified >85% of women with fairly mild hearing disorder diagnosed by pure-tone audiometry and by otoacoustic emissions and simultaneously correctly dismissed 70%. The items assessing hearing loss and tinnitus had a sensitivity around 70% in relation to pure-tone audiometry, but wide confidence intervals. Items had low validity in relation to very mild diagnosed hearing disorder. We also found that preschool teachers had higher prevalence of hearing-related symptoms and reported symptom onset earlier in life compared to women in the general population. The relative risk was more than twofold for sound-induced auditory fatigue, hyperacusis and difficulty perceiving speech and less pronounced for hearing loss and tinnitus. The risk of hyperacusis was pronounced among preschool teachers who reported exposure to loud noise. Stressful working conditions had a similar effect on sound-induced auditory fatigue, but the prevalence of sound-induced auditory fatigue was much higher among those reporting noise exposure. We found that working in equivalent sound levels in the range of 75–85 dBA (assigned by a Job-Exposure Matrix) increased the hazard of adult-onset hyperacusis among women in general, and particularly among women working in preschools who had a threefold hazard ratio compared to women working in exposure to equivalent sound levels below 75 dBA.

Prospective longitudinal studies are needed to ascertain causality. Nevertheless, the pronounced risk of hearing-related symptoms in the occupations studied should be taken seriously and consequences need further study. In addition, our studies showed that hearing protection is rarely used by obstetrical personnel and by preschool teachers. Hence, suitable and acceptable hearing preventive methods and noise-mitigating measures need further development in communication-intense sound environments.

Keywords: Hearing-related symptoms, occupational noise, stressful working conditions