

# Hoarseness among nurses

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**Abstract:** While many occupations are at risk for vocal health issues much of the current research has focused on teachers. The prevalence of hoarseness among nurses has not received much attention. The aim of this study was to determine the current prevalence of hoarseness among nurses and also to identify potential environmental risk factors from their working environment. The health data was collected from Finnish healthcare workers. Our findings are based on 13,560 health questionnaires which were statistically analyzed. Our results suggest that the one-year period prevalence of hoarseness was 30% and all the environmental problems which we evaluated (draft, room temperature too high, variable room temperature, room temperature too low, dry air, stuffy indoor air, moist air/ high humidity, inadequate ventilation, smell of mold or cellar, sewer odor, other unpleasant odors, tobacco smoke, noise and detectable dust or dirt) had an increasing effect on hoarseness. In conclusion, clear associations were found between environmental problems and hoarseness in nurses. Furthermore, efforts should be made to repair defective ventilation systems, remediate indoor air problems due to moisture damage and improve overall maintenance to protect the vocal health of nurses.

**Key Words:** Vocal disorders—Hoarseness—Occupational health—Nurses—Environmental problem—Indoor air quality.

## INTRODUCTION

Nearly one in three of the general adult population suffers from hoarseness at some point in their life, whereas the point prevalence is somewhere between 6.6 to 10%.<sup>1-5</sup> The risk of developing a voice problem are the highest among voice professionals,<sup>6</sup> being up to 70% among teachers.<sup>7</sup> There are a number of studies of voice disorders in different occupations, however, the most commonly studied occupational group is teachers.<sup>1,6-10</sup> As far as we know, there is only one previous study where the prevalence of vocal symptoms in nurses has been studied; an epidemiological study among day care center teachers in which hospital nurses were used as a control group. Based on that study, the 1-year prevalence of hoarseness among nurses was 10%.<sup>11</sup>

The primary risk factors for hoarseness include prolonged voice use and environmental factors, such as background noise or indoor air quality.<sup>6,8</sup> The concept of indoor air quality covers a wide range of factors, such as temperature, humidity, various indoor air pollutants and ventilation<sup>12,13</sup>, which are inextricably linked to each other and can cause voice symptoms either alone or in combination<sup>8</sup>; For instance, in a relative humidity that is too high or too low, viscosity and stiffness of the laryngeal mucosa increases significantly which may affect voice production<sup>14</sup>; moreover, the ambient temperature directly affects the relative humidity. In addition, organic or chemical contaminants in the indoor air can also cause inflammatory or irritating reactions.<sup>15</sup> However, well-functioning ventilation systems are

designed to remove or dilute contaminants and control the temperature and humidity in buildings.<sup>16</sup>

Although hoarseness is often due to benign or self-limiting factors, it has a significant negative impact not only on an individual's quality of life but also on the national economy; it increases health care visits as well as reduces productivity due to absences.<sup>5</sup> The aim of this study was to determine the current prevalence of hoarseness among nurses and also to identify potential environmental risk factors in their working environment. By finding and identifying these risk factors, it should be easier to prevent work-related voice problems among nurses.

## MATERIAL AND METHODS

The data was collected by email during the spring and summer of 2016, in collaboration with the trade union for health care professionals and social workers in Finland. The trade union forwarded the survey through its own membership register and because of their privacy protection policy the exact number of surveys mailed is not known to us. The survey was originally designed to evaluate the health status and well-being of Finnish health care professionals. Permission to use the material from the data for research purposes were obtained from the participating trade union and from the participants. The research permissions were obtained from the Ethics Committee of the University of Turku.

A validated questionnaire, based on two widely used questionnaires, MM40- and the Tuohilampi-questionnaires, was used.<sup>17</sup> The MM40-questionnaire is a standardized and validated questionnaire for occupants at workplaces to investigate indoor air quality.<sup>18,19</sup> Out of the questionnaire, many different versions have been developed directed at specific environments such as to schools, day care centers or residential buildings and all the different versions are based on the same core questions.<sup>20</sup> Whereas the Tuohilampi-questionnaire, has been constructed originally by Susitaival

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and Husman in 1996<sup>21,22</sup> and it been validated for epidemiological use by a Finnish expert group in 2001.<sup>23</sup>

The used broad health questionnaire consists of the following parts: (1) the work environment; (2) the work arrangements; (3) well-being at work; (4) perceived environmental problems and work-related symptoms during the past 12 months and (5) employees' medical history (possible infections and their care, and the use of medication and diseases diagnosed by a physician). The background questions consisted of: age and sex; smoking; passive smoking/exposure to cigarette smoke; contact with domestic animals; and exposure and symptoms related to unspecified environmental factors such as street dust, perfumes and nature. For participants, it took somewhere around 15-30 minutes to complete the survey.

For this study, the exclusion criteria were those nurses, who worked abroad, were unemployed or had retired. The questions chosen for the statistical analysis were questions regarding perceived environmental problems and out of all the perceived symptoms, only hoarseness was reported. Except for the general information, such as age, gender and smoking habits, all the other questions were excluded. For symptoms and perceived environmental problems, an ordinal four-point scale were used with the alternatives 'never, almost never', 'once or a few times per month', 'every week', and 'daily or almost daily'. For the statistical analysis, the answer alternatives for the questions were merged into two groups; 'Never, almost never' and 'once or a few times per month' were combined to 'more seldom or never' and 'every week' and 'daily or almost daily' to 'weekly or more often'. In analyzing the data, the nonparametric tests in the IBM SPSS Statistics v. 25 (IBM Corp. Armonk, NY) were used. Associations between hoarseness and different environmental factors were calculated using cross-tabulations and the chi-square test (p-values). Predictors for hoarseness that occurred weekly or more often were explored using multiple logistic regressions.

## RESULTS

In this study, our findings are based on 13,560 health questionnaires. The participants were predominantly female (94%) and non-smokers (92%) with an average age of 44.8 years.

Thirty percent of respondents had had hoarseness weekly or more often over the past 12 months. Its prevalence was more common in women (30%) than men (22%). In 69% of cases, the symptom disappeared or were alleviated when the participant was outside the workplace.

About 55% (n=7397) of the respondents had perceived environmental problems in their work either weekly or more often over the past 12 months. Perceived indoor air problems were mostly more common in women's responses. High temperature and humid air affected both men and women equally. Dry air, stuffy air, and inadequate ventilation were the most common perceived disadvantages in both genders. (Table 1). A multiple logistic regression analysis was used to explore predictors for hoarseness. The associations between perceived environmental problems and hoarseness are presented in Table 2.

## DISCUSSION

Our results suggest that the one-year prevalence of hoarseness among Finnish nurses was 30%. The prevalence was lower in men than in women, and this has been the case also in previous studies and is due to the physiological differences between the genders.<sup>2,10,24,25</sup> The fact that in 69% of the cases, the symptom disappeared or were alleviated outside the workplace suggests that the symptoms are the most likely work-related either caused by vocal loading due to work or related to environmental problems in the work environment.

The quality of indoor air is important not only for workers' comfort and productivity but also for their health. In addition, the healthcare facilities require special attention to ensure healthy indoor air quality to also protect the patients.

**TABLE 1.**  
**Perceived Environmental Problems Weekly or More Often Over the Past 12 Months**

Environmental problem	women n, (%)	men n, (%)	total n, (%)	P-value
Draft	4139 (35)	224 (32)	4363 (35)	0.002
room temperature too high	3455 (29)	208 (29)	3663 (29)	0.74
variable room temperature	4023 (34)	213 (30)	4236 (34)	0.002
room temperature too low	2722 (23)	112 (16)	2834 (23)	<0.001
dry air	6506 (55)	336 (27)	6842 (54)	<0.001
stuffy indoor air	6815 (56)	333 (47)	7148 (56)	<0.001
moist air/ high humidity	1146 (10)	71 (10)	1217 (10)	0.68
inadequate ventilation	6297 (52)	296 (41)	6593 (52)	<0.001
smell of mold or cellar	2908 (24)	141 (20)	3049 (24)	0.002
sewer odor	2748 (23)	134 (19)	2882 (23)	<0.001
other unpleasant odors	3917 (33)	208 (29)	4125 (33)	<0.001
tobacco smoke	1255 (11)	111 (16)	1366 (11)	<0.001
noise	5060 (43)	270 (38)	5330 (43)	<0.001
detectable dust or dirt	3015 (26)	146 (21)	3161 (25)	0.001

**TABLE 2.**  
**Odds Ratios (OR) and 95 % Confidence Intervals (CI) for Environmental Problems and Hoarseness Perceived Weekly or More Often, Standardized in Regard to Age, Gender and Smoking.**

Environmental problem	The frequency of exposure	OR (95% CI)
Draft	weekly or more often	1.94 (1.79 – 2.10)
	more seldom or never	1
room temperature too high	weekly or more often	2.04 (1.87 – 2.22)
	more seldom or never	1
variable room temperature	weekly or more often	2.05 (1.89 – 2.23)
	more seldom or never	1
room temperature too low	weekly or more often	1.78 (1.62 - 1.95)
	more seldom or never	1
dry air	weekly or more often	3.48 (3.19 – 3.80)
	more seldom or never	1
stuffy indoor air	weekly or more often	4.78 (4.36 – 5.25)
	more seldom or never	1
moist air/ high humidity	weekly or more often	3.02 (2.66 – 3.43)
	more seldom or never	1
inadequate ventilation	weekly or more often	3.57 (3.27 – 3.89)
	more seldom or never	1
smell of mold or cellar	weekly or more often	4.51 (4.13 – 4.94)
	more seldom or never	1
sewer odor	weekly or more often	3.15 (2.88 – 3.35)
	more seldom or never	1
other unpleasant odors	weekly or more often	2.76 (2.54 – 3.00)
	more seldom or never	1
tobacco smoke	weekly or more often	1.72 (1.52 – 1.94)
	more seldom or never	1
Noise	weekly or more often	1.55 (1.43 – 1.68)
	more seldom or never	1
detectable dust or dirt	weekly or more often	2.24 (2.20 – 2.63)
	more seldom or never	1

It is well-known that poor indoor air quality has been associated with many irritating and general symptoms such as a runny or stuffy nose or headaches. Despite the importance of indoor air quality, based on this study, more than half of the Finnish nurses that participated perceived indoor air-related environmental problems in their work environment on a weekly or more frequent basis during the last 12 months. The most common perceived disadvantages were directly or indirectly related to inadequate ventilation, but a significant number of perceived disadvantages were probably due moisture problems in collaboration with poor maintenance, eliciting answers such as a 'smell of mold or cellar' or a 'sewer odor'. In addition, it was somewhat surprising that 11% reported that they experienced weekly harm from tobacco smoke, even though indoor smoking is no longer allowed in workplaces. Moreover, one in four people suffered from dust and dirt in their work environment, which seems unexpected in a healthcare environment that should be very clean, almost sterile. However, these findings are in line with previous studies, where Finnish hospitals were found to be in obvious need of renovation in both their buildings and ventilation systems; in addition, 15% of the hospital facilities were in need of immediate repair because of moisture damage.<sup>26,27</sup>

In the assessment of environmental risk factors, which were mainly indoor air quality-related, with the exception of 'noise' and 'detectable dust or dirt', they all associated with hoarseness. The two most significant risk factors were 'stuffy indoor air' and a 'smell of mold or cellar'. However, the consistent associations between indoor dampness or mold and respiratory health outcomes are generally accepted and in addition to which, a significant correlation has been found between moisture damage-related indoor air problems and the frequency of hoarseness.<sup>28,29</sup> Another interesting finding was that even though background noise is one of the most recognized environmental risk factors for hoarseness<sup>6</sup>, in this study, all the other environmental problems which we considered, seemed to have had an even stronger association with hoarseness.

The strength of this study lies in the large sample size and the broad national coverage. Our sample was representative in terms of the distribution of gender and age of nurses in Finland.<sup>30</sup> Therefore, the results can be generalized for nurses in Finland. In addition, as it is commonly known that smoking increases the prevalence of voice disorders; it irritates the vocal cords and dries the vocal cord mucosa. In our study, among the participating nurses, smoking was significantly less frequent in comparison with Finnish adults

on average. At the time the data was collected, 17% of working-age men and 14% of women reported daily smoking according to Finnish Statistics<sup>31</sup>, while the corresponding percentages in this study were 10% and 8% respectively. This also contributes to a reinforcement of the assumption that the work environment plays a significant role.

The study was limited by the fact that only self-reported data, with no objective measurements were used. It is possible that the participants overestimated or underestimated their personal symptoms and/or perceived environmental problems. In addition to this, because in many places there appeared to be problems in arranging adequate ventilation some proportion of the symptoms might be associated with other chemical risk factors, such as anesthetic gases or pharmaceuticals.

### CONCLUSIONS

In conclusion, although cross-sectional studies are limited to causal conclusions, the results of this study showed that perceived environmental exposures occurring weekly or more often increases the risk of hoarseness. The results suggest that the current indoor air problems in many Finnish hospitals are real and harmful to the voice health of nurses. Rapid action is needed to address inadequate ventilation systems, possible moisture damage and maintenance deficiencies to ensure healthy and safe working conditions.

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