

# Prevalence of Hoarseness in Primary Health Care and Hospitals—Associations With Different Work Tasks and Environmental Factors Among Nurses

\*<sup>†</sup>Liisa Vilén, <sup>†‡</sup>Janne Atosuo, and \*<sup>†</sup>Tuula Putus, \*<sup>†‡</sup>Turku, Finland

**Summary: Objectives:** The voice is one of the most essential tools necessary for nurses achieve high care satisfaction and safety. Research on hoarseness has mainly focused on professional speakers, like teachers. The aim of this study was to determine the current prevalence of hoarseness among six subgroups of nurses (registered nurses, primary care nurses, pediatric nurses, laboratory nurses, dental nurses, and midwives) and also to identify potential environmental risk factors in their working environment.

**Methods:** The health data was collected in collaboration with two health care professional trade unions. The findings are based on 15,553 returned health questionnaires which were statistically analyzed.

**Results:** The 1-year prevalence of hoarseness among all participating nurses was 30.2 % in this data, but the variation between different occupational subgroups was significant; ranging from 25 % for laboratory nurses to 38 % for midwives. These findings were in line with perceived environmental problems and the differences between the sub-groups were not explained by the participants suffering from asthma, sinusitis, rhinitis, or common respiratory infections; there were no explanatory differences in the prevalence's of the above-mentioned diseases.

**Conclusions:** The variation in prevalence of hoarseness between the different occupational subgroups was significant and the prevalence was found to be in line with perceived environmental problems. The most common problems were stuffiness, dry air, and inadequate ventilation. In addition, both a perceived “sewer odor” and “smell of mold or cellar” in one's own working environment were also found to be significant risk factors for hoarseness. Based on this study, the current indoor air problems in Finnish health care facilities can be verified and are a source of risk to nurses' voices.

**Key Words:** Vocal disorders—Hoarseness—Air quality—Indoor—Health—Occupational—Nurses.

**Abbreviations:** CI, Confidence interval—OR, Odds Ratio.

## INTRODUCTION

To achieve high care satisfaction and safety, in health care, the quality of communication plays an important role. It is one of the most essential tools for nurses; they spend about half of their working time in direct patient care which includes communications with patients and often with their relatives too.<sup>1</sup> In primary health care and in hospitals, the contact with the patient and coworkers often occurs behind a plexiglass, a face mask or during the coronavirus disease 2019 pandemic via the telephone or internet remote connections. When the patient is an elderly person with a hearing aid, a clear and loud voice is of utmost importance. Behind a mask, facial expression cannot be seen, so the verbal communication is even more important. In the future, we expect that with both patients and coworkers remote work and internet connections will increase. Therefore, it can be stated that the ability to enhance voice clarity and ensure every

nance is heard and understood is important in successful communication.

In describing voice problems, the term “hoarseness” refers to a breathy, raspy, strained voice, or a change in pitch.<sup>2</sup> Although hoarseness is a common symptom, mostly caused by benign or self-limiting factors, it has a significant impact not only on the quality of life in general but, in the health care field, also affects the safety of patients because it causes impaired communication abilities.

Vocal demands vary a great deal between different occupations.<sup>3,4</sup> Research on occupations and voice problems have mainly focused on the voice problems of the typical occupational of voice users, such as teachers. In Finland, the prevalence of hoarseness among nurses in general was recently found to be 30%<sup>5</sup>; however, in the health-care field as nurses work in various facilities and departments and do various work tasks the demand on their voices probably varies a great deal.

The aim of this study was to determine the current prevalence of hoarseness among the nurses in six different occupational subgroups (registered nurses, primary care nurses, pediatric nurses, laboratory nurses, dental nurses, and midwives) in order to determine whether different occupational subgroups have different environmental risk factors for hoarseness. The assumption was that there would be significant differences between the different subgroups that could be explained by work-related exposures; dental nurses for example have more exposure to chemicals at work than

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From the \*Department of Clinical Medicine, Environmental Medicine and Occupational Health, University of Turku, Turku, Finland; †Clinical Research Unit TROSSI, University of Turku, Turku, Finland; and the ‡Department of Biotechnology, The Laboratory of Immunochemistry, University of Turku, Turku, Finland.

Address correspondence and reprint requests to Liisa Vilén, University of Turku, 20014 Turun yliopisto, Finland. E-mail: [liisa.k.vilen@utu.fi](mailto:liisa.k.vilen@utu.fi)

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practical nurses who predominantly work in health care centers, homecare environments, day nurseries and nursing and residential homes. Identifying the specific risk factors for different occupational subgroups is a prerequisite for preventing voice problems in the future.

### MATERIAL AND METHODS

The data was collected via email in collaboration with two trade unions of which the largest groups of members were registered nurses and practical nurses. Because of the privacy protection policy of the trade unions, they forwarded the surveys through their own membership registers. Therefore, the exact number of surveys mailed is not known to us. Permission to use the collected data for further research purposes were obtained beforehand from the participating trade unions and the participants. Research permission was approved by the Ethics Committee of the University of Turku.

The origin of the study was the requirement expressed by the trade unions to investigate and evaluate the health status and well-being of Finnish health care professionals in view of effect of the possible environmental problems in their working environment. The surveys were conducted with a validated questionnaire based on the MM40- and the Tuohilampi-questionnaires.<sup>6</sup> The MM40-questionnaire is a standardized and validated questionnaire for the occupants of workplaces which investigates indoor quality, covering factors like temperature, humidity, various indoor air pollutants, and ventilation<sup>7,8</sup>; the Tuohilampi-questionnaire is validated for epidemiological use.<sup>9</sup> In addition to background questions (age, sex, height, weight, smoking, passive smoking/exposure to cigarette smoke and domestic animal contacts), the questionnaire used was divided in five parts: (1) the work environment, (2) the work arrangements, (3) well-being and job satisfaction, (4) perceived environmental problems at work and (5) employees' health status and medical history.

For this study, the exclusion criteria omitted nurses who were over 68 or had retired. The reason for this criterion was to limit the participants in this study to those in employment; the upper retirement age is 68 in Finland and the questionnaires were also sent to retirees. Based on the reported occupation, participants were divided into six subgroups; registered nurses, primary care nurses, pediatric nurses, laboratory nurses, dental nurses, (which included both mouth hygienists and dental nurses) and midwives. The reason for the grouping was the differences in the work tasks and working conditions of the nurses in the different subgroups.

Because the questionnaire we used was extensive and covered many different areas, we selected only the sections on environmental problems and hoarseness-related questions for statistical analysis. In addition, we selected, out of the medical history-section, a selection of the potential causes for hoarseness, including asthma, sinusitis, rhinitis, and common cold.

For symptoms and perceived environmental problems, an ordinal four-point scale was 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," "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. The *P* values between symptoms and different environmental factors were calculated using cross-tabulations and the chi-square test. *P* values <0.001 were considered highly significant, ≥0.001 to <0.01 moderately significant, ≥0.01 to <0.05 weakly significant and ≥0.05 non-significant.<sup>10</sup> Risk factors for hoarseness were explored using multiple logistic regressions. In logistic regression models odds ratio (OR) and 95% confidence interval were calculated (equal to *P* value <0.05).

### RESULTS

The findings are based on a total of 15,553 health questionnaires of which 808 (5.2 %) were men and 14,491 (93.2 %) were women. A small number of respondents (*n* = 254, 1.6 %) did not reveal their age or gender. The participants were predominantly non-smokers (91.5 %) with an average age of 44.9 years. According to occupational groups, nurses were divided into six subgroups. The responders by occupational subgroups are shown in Table 1.

Over the past year, 30.2 % of the respondents had reported hoarseness weekly or more often. We found significant differences in the prevalence of hoarseness. The corresponding percentages in the different occupational subgroups were 28.7 % among registered nurses, 32.2 % among practical nurses, 24.5 % among laboratory nurses, 31.8 % among pediatric nurses, 37.7 % among midwives, and 34.7% among dental nurses.

More than half of the respondents had perceived some environmental problems in their work either weekly or

**TABLE 1.**  
**The Respondents by Occupational Subgroups (Data of Gender Missing = 280)**

Occupational Subgroup	Men	Women	Total	Smokers (%)
Registered nurses	421	7294	7715	7.9
Practical nurses	195	3188	3383	15.4
Laboratory nurses	18	677	695	4.3
Pediatric nurses	7	664	671	5.4
Midwives	1	554	732	4.6
Dental nurses	5	727	540	5.0
Total	806	14467	15273	8.6

**TABLE 2.**  
**Weekly or More Often Perceived Indoor Air Related Environmental Problems During the Previous 12 mo (Never and More Seldom Combined, Weekly, and Daily Combined, n (%) of the Respondents)**

Environmental Problem	Registered Nurses n (%)	Practical Nurses n (%)	Laboratory Nurses n (%)	Pediatric Nurses n (%)	Midwives n (%)	Dental nurses n (%)	Total n (%)	P-value
Draft	2685 (36.1)	414 (30.2)	283 (42.5)	193 (35.0)	202 (37.5)	146 (29.1)	4418 (34.9)	<0.001
Room temperature too high	2092 (28.1)	564 (40.7)	175 (26.4)	113 (20.5)	174 (31.7)	200 (39.8)	3708 (29.2)	<0.001
Variable room temperature	2576 (34.7)	493 (36.0)	189 (29.0)	176 (31.6)	208 (38.6)	186 (37.6)	4294 (33.9)	<0.001
Room temperature too low	1778 (24.0)	248 (18.5)	137 (21.3)	116 (21.5)	146 (27.5)	94 (19.5)	2832 (22.9)	<0.001
Dry air	4264 (56.7)	745 (53.9)	308 (46.5)	261 (46.9)	372 (68.1)	200 (41.1)	6930 (54.3)	<0.001
Stuffy indoor air	4188 (55.1)	918 (64.6)	320 (47.3)	300 (52.1)	378 (69.0)	298 (56.9)	7239 (55.7)	<0.001
Moist air/high humidity	708 (9.6)	227 (16.9)	35 (5.5)	29 (5.5)	46 (8.6)	49 (10.4)	1233 (9.9)	<0.001
Inadequate ventilation	3862 (51.1)	849 (60.9)	274 (41.1)	294 (51.9)	334 (60.8)	302 (58.8)	6678 (51.8)	<0.001
Smell of mold or cellar	1773 (23.6)	1004 (30.7)	116 (17.5)	136 (22.2)	161 (29.6)	142 (28.2)	3731 (25.3)	<0.001
Sewer odor	1634 (21.7)	976 (29.8)	115 (17.1)	167 (26.2)	166 (30.3)	132 (25.9)	3505 (23.7)	<0.001
Other unpleasant odors	2524 (33.8)	571 (41.3)	172 (26.1)	126 (22.8)	190 (35.1)	163 (32.7)	4177 (32.9)	<0.001
Tobacco smoke	835 (11.2)	235 (17.3)	35 (5.4)	18 (3.4)	40 (7.4)	38 (7.8)	1381 (10.9)	<0.001
Noise	2911 (39.1)	651 (47.5)	323 (48.4)	432 (76.2)	228 (42.3)	30 (60.4)	5405 (42.6)	<0.001

more often over the past 12 months. The most common annoying factors were the stuffiness of the indoor air, dry air, and inadequate ventilation [Table 2](#). presents, by subgroups, the perceived environmental problems during the previous 12 months. The associations were highly significant ( $P < 0.001$ ) between the subgroups. The highest percentages with statistically significant difference were mainly found in the responses of practical nurses and midwives. The impact of environmental problems on the risk of hoarseness among all the participants when adjusted for age, gender, smoking, and occupational subgroups are presented in [Table 3](#).

In the medical history of the participants, we looked for possible connections to the variations of the prevalence of hoarseness. Asthma, rhinitis, and common respiratory infections were chosen for further analyses. The above-mentioned diseases were further examined according to whether the symptomatology was associated with hoarseness or not. ([Table 4](#)).

Asthma with hoarseness was significantly more often reported ( $P = 0.01$ ) than asthma without hoarseness but there were no significant differences in this regard between the subgroups. Whereas the prevalence of asthma without hoarseness was significantly different ( $P < 0.05$ ); the dental nurses had a notably lower prevalence than others, but otherwise, the prevalence was relatively evenly distributed between the other subgroups.

No significant differences were observed in the prevalence of allergic rhinitis with or without hoarseness. A common cold without hoarseness was most often reported by the midwives and least often by the dental nurses. A common cold with hoarseness was significantly more common than a common cold without hoarseness. Sinusitis and hoarseness were significantly more often reported together than sinusitis without hoarseness ( $P < 0.01$ ), but there were no significant differences in the prevalence of either one between the subgroups. However, in sinusitis with hoarseness, a tentative trend was observed showing the highest prevalence among practical nurses and lowest among laboratory nurses.

## DISCUSSION

Our data results suggest that the 1-year prevalence of hoarseness among all the participating nurses was 30.2 %, which is the same level as in the previous study conducted by Vilén and Putus.<sup>5</sup> The prevalence of hoarseness between different occupational subgroups was significant; the lowest being among laboratory nurses (24.5 %) and the highest among midwives (37.7 %). These findings were in line with perceived environmental problems; the midwives also experienced more disadvantages in their working environment than the other groups. In addition, when we looked at the medical data of the participants to discover any possible connection between hoarseness, and asthma, rhinitis, and common respiratory infections ([Table 4](#)), the findings between the sub-groups were mainly insignificant. Statistical differences in the prevalence of symptoms/diseases between

**TABLE 3.**  
**Odds Ratios (OR) for Hoarseness When Exposed to Different Environmental Problems Weekly or More Often, and When Adjusted for Age, Gender, Smoking, and Occupational Subgroups**

Environmental Problem	OR		95% CI	P-value
	The Frequency of Exposure:			
	More Seldom or Never	Weekly or More Often		
Draft	1	1.46	1.29–1.64	<0.001
Room temperature too high	1	1.51	1.87–2.22	<0.001
Variable room temperature	1	1.48	1.31–1.67	<0.001
Room temperature too low	1	1.41	1.62–1.95	<0.001
Dry air	1	2.18	1.89–2.50	<0.001
Stuffy indoor air	1	3.00	2.57–3.50	<0.001
Moist air/high humidity	1	1.96	1.67–2.31	<0.001
Inadequate ventilation	1	2.34	2.04–2.68	<0.001
Smell of mold or cellar	1	3.00	2.68–3.36	<0.001
Sewer odor	1	2.14	1.91–2.40	<0.001
Other unpleasant odors	1	1.89	1.68–2.14	<0.001
Tobacco smoke	1	1.54	1.30–1.81	<0.001
Noise	1	1.17	1.04–1.32	<0.01

Abbreviation: CI, confidence interval.

the different sub-groups were only found in asthma without hoarseness and common colds without hoarseness.

In the assessment of environmental factors, over half of the participants perceived ventilation-related issues, such as stuffy air, inadequate ventilation and/or dry air. The high percentages in ventilation-related problems were not of themselves surprising, because based on an earlier study by Hellgren and Reijula,<sup>11</sup> up to 40% of the ventilation technology in health care units in Finland are in a poor condition and in need of major repairs. However, in addition to ventilation-related problems, there were also a significant number of perceived defects, like a “smell of mold or cellar” or a “sewer odor.” The smell of mold is a sign of mold spreading in the air, and the reason for the growth of mold indoors is always a moisture problem<sup>12,13</sup> which is a result from either water damage or excessive high humidity. Exposure to mold spores has been associated with the varying degrees of health problems, such as mucous membrane irritations, allergic reactions, and asthma.<sup>13,14</sup> In addition to possible health effects, mold growth indoors is always a hygienic problem, especially in health care environments. This result was surprising as it was assumed that healthcare units would take better care of their working environments for the sake of the patients and employees’ health and safety.

It is well-known that smoking can affect the voice; it irritates the vocal cords and dries the vocal cord mucosa which can result in inflammations and therefore an abnormal voice. In Finland, as in many other countries, smoking has decreased steadily and is now around 12%,<sup>15</sup> which is considerably more than the average in this data. The only exception was the sub-group of practical nurses where smokers accounted for more than 15%. The practical nurses also perceived more tobacco smoke in their working

environment which can probably be explained by the fact that less than 30 % works in health services and over 70% works in social services, such as in home care or residential homes.<sup>16</sup> Smoking inside the hospitals is strictly forbidden and is allowed only in outdoor smoking shelters; the passage of tobacco smoke back into the hospital can also be considered a ventilation problem.

Another interesting finding was that noise, even though it is one of the known environmental risk factors for hoarseness<sup>17</sup> is not a very prominent risk factor in healthcare environments. Although it is well-known that most hospitals are extremely noisy, with high background noise levels on wards (eg, noise from staff, patients, alarm signals and medical equipment),<sup>18–20</sup> all the other risk factors we considered seemed to have even stronger associations with hoarseness than noise.

In the case of midwives, the findings were quite unexpected. One explanation for the high level of perceived environmental problems among midwives could be that the maternity wards are mainly located on the lowest floors of hospitals, often at street level or on the ground floor; the lowest floors of buildings with base floor structures and/or walls in contact with the ground, have a greater risk of being damaged by external moisture.<sup>21</sup> In addition to the possible external risk factor for moisture damage, the use of water in maternity wards is more abundant than in most other wards, and mothers taking showers or baths for comfort and pain relief during labor may also increase the possible risks of moisture damage. However, this is mere speculation and requires further investigation.

Similar to all studies, this has its strengths and weaknesses. The strength of our study is the size of the data and the broad national coverage. In Finland, the degree of organization in the care sector is high and about 90% of those

**TABLE 4.**  
**The Association of Asthma, Rhinitis, and Common Respiratory Infections With Reporting of Hoarseness in Different Occupational Groups**

Diagnosed Disease or Respiratory Infection During the Previous 12 mo	Registered Nurses n (%)	Practical Nurses n (%)	Laboratory Nurses n (%)	Pediatric Nurses n (%)	Midwives n (%)	Dental Nurses n (%)	P-value Between Occupational Groups	P-value Between Symptom/Disease Groups
Respondents with asthma, no hoarseness	477 (10.3)	242 (11.0)	52 (10.2)	46 (11.5)	37 (11.5)	21 (6.1)	0.04	0.01
Respondents with asthma and hoarseness	453 (24.2)	253 (24.2)	38 (23.0)	51 (27.4)	61 (31.4)	29 (15.9)	0.13	
Respondents with hoarseness, no asthma	1416 (25.4)	794 (28.9)	127 (21.7)	135 (27.6)	133 (31.9)	153 (32.2)	0.001	
Respondents with allergic rhinitis, no hoarseness	966 (20.8)	441 (20.0)	99 (19.4)	91 (22.8)	61 (19.0)	61 (17.8)	0.35	0.30
Respondents with allergic rhinitis and hoarseness	621 (33.2)	338 (32.3)	58 (35.2)	62 (33.3)	54 (27.8)	59 (32.4)	0.59	
Respondents with hoarseness, no rhinitis	1248 (25.3)	709 (28.7)	107 (20.7)	124 (28.6)	140 (35.0)	123 (30.4)	0.001	
Common cold, no hoarseness	2964 (71.6)	623 (75.1)	316 (69.1)	219 (70.0)	227 (77.5)	193 (65.4)	0.001	0.001
Common cold and hoarseness	1365 (82.7)	334 (84.6)	114 (78.1)	115 (82.7)	141 (82.5)	121 (78.1)	0.30	
Hoarseness with no common cold	286 (19.6)	61 (22.8)	32 (18.5)	24 (20.3)	30 (31.3)	34 (25.0)	0.05	
Acute sinusitis, no hoarseness	810 (18.3)	183 (20.8)	76 (15.6)	68 (20.1)	53 (17.0)	50 (15.6)	0.14	0.003
Acute sinusitis and hoarseness	642 (37.6)	169 (42.7)	47 (30.9)	51 (36.2)	59 (32.4)	62 (40.0)	0.06	
Hoarseness, no sinusitis	1066 (22.8)	227 (24.6)	105 (20.4)	90 (25.0)	123 (32.3)	93 (25.6)	0.001	

working in the care sector belong to a trade union.<sup>22</sup> Cooperation with trade unions thus enables extensive contact with those working in the field nationwide and therefore a large comprehensive sample size. However, there was also a converse side to the co-operation; because of the privacy protection policy of the trade unions the true responding rate was not available to us. The study was also limited by the fact that only self-reported data, with no objective measurements were used. On the other hand, assessing a working environment by means of those working in that environment is the best method of evaluating it. It is possible that the participants overestimated or underestimated their personal symptoms and/or perceived environmental problems. However, based on earlier studies, in which the participants evaluated environmental factors and possible symptoms related to a perceived environment, the participants in those studies tended rather to underestimate than overestimate the environmental problems and/or symptoms.<sup>23,24</sup>

Moreover, since a considerable number of the units appeared to have problems with adequate ventilation, in addition to the environmental problems addressed in this study, there might be many other work-related exposures causing hoarseness which we did not consider; for example, various cleaning chemicals or drug aerosols, or airborne chemical substances during dental treatments which are also known to cause irritation or respiratory symptoms.<sup>25–27</sup> These above-mentioned risk factors should be investigated in a separate study, but to obtain reliable results, the ventilation system in the unit should also be deemed appropriate before assessment.

## CONCLUSIONS

In conclusion, the variation in prevalence of hoarseness between the different occupational subgroups was significant and the prevalence were in line with the perceived environmental problems; these were mainly due to ventilation-related problems. In addition, “sewer odor” and “smell of mold or cellar” were also found to be significant risk factors for hoarseness. Based on this study, the current indoor air problems in Finnish health care environments are actual and a risk to the voice of nurses. To ensure health and safety working conditions, repairs to ventilation systems are needed, and possible moisture damage and maintenance deficiencies should be repaired.

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