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# Prevalence of Voice Disorders in the General Population, Based on the Stockholm Public Health Cohort

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**Summary: Objective.** To investigate the prevalence of voice disorders in the general population.

**Study design.** Analysis of data from the Stockholm Public Health Cohort.

**Methods.** A public health survey was distributed to an open cohort of 114,538 adults >18 years of age in the area of Stockholm County, Sweden. The survey included one question about voice problems, estimating the extent of occurrence of voice problems, excluding voice problems during colds/upper airway infections. The question was tested for validity and reliability in n = 166 voice healthy individuals and n = 183 patients with benign voice lesions. The construct validity was tested against two established self-assessment questionnaires. The question was established to correspond to tiring, strain, and hoarseness. Prevalence of voice problems and correlations with age, gender, occupation, hearing, smoking, and socio-economic status were calculated.

**Results.** The overall prevalence of voice disorders in the entire group was estimated to 16.9%, where 15.5% voice problems were rated to occur to a small extent and 1.4% to a great extent. Women were significantly more prone to report voice problems than men. The highest ratings of a great extent of voice problems were found in both women and men >85 years of age. As for occupation, the highest prevalence of voice problems was found in teaching and service occupations.

**Conclusions.** The prevalence of voice problems was estimated to 16.9% in the entire group. Women reported significantly more voice problems than men and voice problems were significantly more common in ages >65. This study of self-reported voice problems in a general population is one of the largest of its kind.

**Key Words:** Dysphonia—Voice—Aging—Prevalence—Stockholm public health cohort.

## INTRODUCTION

During the last decades there has been a rising interest in occupational voice and voice ergonomics. This being so, several studies have explored the prevalence of voice disorders in specific voice dependent occupations.<sup>1–5</sup> There is also a number of papers exploring prevalence and causes of voice disorders in treatment seeking groups<sup>6–10</sup> and in specific diagnose-groups.<sup>11–13</sup> Only a small number of studies have investigated the self-reported prevalence of voice problems in general, non-treatment seeking populations.<sup>14–18</sup> Besides the possibility of comparing prevalence numbers of specific populations, the knowledge of the prevalence of voice disorders in the general, non-treatment seeking population is essential to estimate costs for health care interventions or sick leave. The prevalence reported in earlier studies varies from 3.1%<sup>17</sup> to 38.5%.<sup>18</sup> This variation might depend on differences as to methods and on how voice disorders/voice problems are phrased and presented to the respondent. Also the targeted time frame varies between

studies. Most cover point prevalence,<sup>15,18</sup> also cover life-time or career prevalence<sup>16,17</sup> and some are not specific as to which time frame is intended – these are commonly interpreted as describing point prevalence.<sup>18,19</sup> Moreover, the means of data collection varies between studies. Bhattacharyya<sup>17</sup> published a large study of face-to-face interviews generalized to the larger population in the United States. The prevalence rate (7.6%) was close to that of Roy et al<sup>15</sup> (6.6%), who in 2005 performed telephone interviews, also in the United States. Cultural and geographical differences might also be an explanation to the variety in prevalence. For example, Spantideas et al,<sup>18</sup> reported a prevalence rate of 38.5% of voice problems in a Greek population. Cohen et al,<sup>19</sup> suggested that data on prevalence of voice disorders is needed also on a national level to understand how specific demographic and geographic variables relate to and influence voice disorders. There is thus, a need of epidemiological studies to investigate the current prevalence of self-assessed voice problems in the general Swedish population to broaden the picture.

Public health surveys are regularly distributed to an open cohort of individuals to inform on determinants and consequences of important contributors to the current burden of disease<sup>20</sup>. Participants in *the Stockholm Public Health Cohort (SPHC)* are randomly selected individuals from the adult population of Stockholm County, Sweden. Available data collected from the cohort is extensive and include a wide array of health, lifestyle, perinatal, demographic, socio-economic, and familial factors. Baseline surveys took place in 2002, 2006, 2010, and later 2014 via self-administered questionnaires. Through actions of the late

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Phoniatrician, Dr Staffan Wilén, a question on voice problems was inserted in the cross sectional and cohort questionnaire 2010.

The purpose and aim of the present study were thus to (1) explore the prevalence of voice problems in the general population through a public health survey, distributed to an open cohort of adults in the area of Stockholm County, Sweden and (2) to correlate voice problems to aspects of gender, age, hearing, occupation, and socio-economic status.

## METHODS

### Procedure

#### *Development and testing of a question about voice problems*

Only one question about voice was possible to include in the survey: *The SPHC*. Thus, a procedure was undertaken to construct and test one single question prior to inclusion. To single out the important traits, two existing questionnaires were selected and completed by  $n = 183$  consecutive patients with benign voice disorders, referred to one voice clinic. The group consisted of 119 F/63 M/1 not indicated, with a mean age of 45.4 F/41.2M (standard deviation 15.7/17.0) and an age range of 16–78 years. The Swedish version of the voice handicapped index<sup>21,22</sup> and, a screening questionnaire constructed for Finnish teacher students<sup>23</sup> were used. Statistical analyses showed a strong correlation between the screening questionnaire and the voice handicapped index (Spearman's rho 0.65,  $P < 0.001$ ). Specifically, item #5 (“Does your voice tire, strain or get hoarse when you talk?”) showed a similarly strong correlation to the entire voice handicapped index (Spearman's Rho 0.61,  $P < 0.001$ ).<sup>24</sup> Hence, this question was chosen for inclusion in the SPHC. The final version of the question read “Does your voice tire, strain or get hoarse when you talk? Disregard symptoms that depend on current cold or upper-airway infection. The voice symptoms may vary but try to estimate an average” (Blir din röst trött, ansträngd eller hes när du talar? Bortse från besvär som beror på att du är förkyld/har en luftvägsinfektion. Besvären kan variera, men försök ange ett genomsnitt). The occurrence of the symptoms was assessed on a frequency based scale with three levels: 1 = no, 2 = yes, to a small extent, 3 = yes, to a great extent (1 = Nej, 2 = Ja, i liten utsträckning, 3 = Ja, i stor utsträckning). For testing of the question's construct validity, a group of voice healthy, moderately voice active controls (hospital clinicians and bank officers) was recruited through an open call for participation at their work places. This group consisted of  $n = 166$  (F136/M30) individuals with a mean age of 43.1F/45.0M (standard deviation 12.2/12.1) and an age range of 22–64. The control group was presented with a questionnaire, comprising questions on voice, voice use, hearing, reflux and smoking. Apart from the question from the SPHC also one more question on voice problems was included for comparison and to capture persons with voice problems: “I have problems with my voice”.<sup>4</sup> A Chi2 test confirmed the statistically

significant difference between the responses of the patients and controls to the SPHC question with large effect  $\chi^2$  (2,  $n = 349$ ) = .73,  $P < 0.000$ ,  $\phi = .046$ .

### Distribution of the survey

A self-administered questionnaire including one question on the occurrence of voice problems was sent out in 2010 to an open cohort of 114,538 adults in the County of Stockholm (SPHC). With 74,351 questionnaires returned (41,650F/32,701M) the response rate was 64.9%. The questionnaire was web-based but also simultaneously distributed as a pen-and-paper survey to e.g. individuals  $\geq 65$  years. With the reminder, a pen-and-paper version was distributed. The survey was also translated to Arabic, Finnish, Turkish, Farsi, English and Spanish.<sup>20</sup> The question on voice was answered by 74,351 responders (41,976F/32,170M). The demographics of the responders are presented in Table 1. For details regarding the SPHC and the questionnaire see.<sup>20,24</sup>

### Use of calibration weights and variance estimation for stratified random samples

The same number of individuals is drawn from every municipality and city district area ( $n = 39$ ). This means that the inclusion probability is very different between the areas due to the difference in population size (2010: 5777–99,334, aged 18–w years). In order to calculate correct variance estimates, statistical analysis system 9.4 survey procedures were used. One problem is that the response is skewed, i.e. the respondents do not represent the structure of the sample. Another problem is that the response rate is very different between areas. The way statistics Sweden handle this is to use calibration weights. The weights are calculated using auxiliary variables from different population registries and their co-variation with selected variables from survey data.<sup>25</sup> These registries include age, sex, country of birth,

**TABLE 1.**  
**Demographics of  $n = 74,351$  Responders**

Demographic Characteristics	
<b>Number of respondents</b>	74,351
<b>Age, mean/range years</b>	48 years/18–104
<b>Gender F/M</b>	41,650/32,701
<b>University education/postsecondary education, &lt; 3 years</b>	24%
<b>Middle and high level non-manual employees and self-employed (%)</b>	52%
<b>Born in Sweden (%)</b>	76%
<b>Overweight, (BMI25+)</b>	45%
<b>Current smoker (%)</b>	13%
<b>Poor or very poor self-rated health (%)</b>	5%
<b>Psychological distress, c (GHQ12) (%)</b>	21%
<b>Living alone (%)</b>	24%

BMI, body mass index; F, female; GHQ, general health questionnaires; M, male.

civic status, income, educational level, sickness allowance, and area of residence.<sup>26</sup>

### Ethical approval

The study was vetted and approved by the Regional Ethical Review Board, Stockholm Dnr 2010/1879–31/5; Dnr 2007/545–31).

## RESULTS

### Prevalence of voice problems

The distribution of the answers from the 73,146 responders to the voice question is shown in Table 2. The majority rated 1 = no voice problems.

### Overall prevalence

The overall prevalence of voice problems in the entire group was estimated to 16.9% where 15.5% rated 2 = yes to a small extent and 1.4% rated 3 = yes, to a great extent.

### Prevalence per gender and age

Men: Among 32,170 men (531 missing) the prevalence was estimated to 15.5% (2 = 14.4%; 3 = 1.1%). Women: Among 41,976 women (674 missing) the prevalence was estimated to 18.0% (2 = 16.3%; 3 = 1.7%). The difference between men and women is statistically significant at  $P < 0.01$ . The prevalence per gender and age group is shown in Table 3.

### Prevalence per socio-economic group and occupation

There was no social gradient to be found in the material. That is there was no statistically significant correlation found between socio economic index and voice problems as calculated with Spearman's rho. For occupation, the highest prevalence of voice disorders was found within teaching professions and service occupations (Table 4).

Further, a statistical significant positive correlation between hearing impairment and voice problems was found:  $r = 0.11$   $P < 0.0001$ . For details and distribution of responses to questions about hearing (Table 5).

Also, for smoking and voice problems a statistically significant, positive however, weak correlation was found, Spearman's rho = 0.014,  $P = 0.0005$ .

## DISCUSSION

The point-prevalence of voice disorders in the population of 74,351 individuals from the SPHC was estimated to 16.9%. Compared to findings by Roy et al,<sup>16</sup> of 6.2%, 16.9% may be considered both remarkably high but also lower than the 38.5% reported by Spantideas et al.<sup>18</sup> The differences between these percentages may partly be attributed to the difference in the demographics of the included subjects; in the present study, the highest prevalence (3.5%) was found among the subjects aged 65–84 and 85 years and over (8.3%). There are two studies that are methodologically comparable in that they are epidemiological surveys with self-reported data on voice problems. Roy et al<sup>27</sup> found a

**TABLE 2.**  
Distribution of Answers to the Question 'Does Your Voice Tire, Strain or Get Hoarse When You Talk?' in the SPHC n = 73,146 responders

Response Alternative	Frequency	Cumulative Frequency	%	Calibrated Population Weight	Conf interv, 95%
No	60771	60771	83.1	1,307,077	82,6–83,4
Yes, small extent	11318	72089	15.5	242,224	14,3–17,0
Yes, large extent	1057	73146	1.4	24,978	1,2–1,7
<b>Total</b>	<b>73146</b>	<b>73146</b>	<b>100</b>		

**TABLE 3.**  
Prevalence of Voice Symptoms in Men and Women in Different Age Bands for n = 73 146 Responders

N	Men 32,170			Women 40,976		
	No voice probl (%)	Small extent (%)	Great extent (%)	No voice probl (%)	Small extent (%)	Great extent (%)
<b>Total:</b>	84.5	14.4	1.1	82.0	16.3	1.7
<b>18–24 years</b>	92.06	7.5	0.4	87.6	11.4	1.0
<b>25–44 years</b>	90.2	9.3	0.5	85.9	12.8	1.2
<b>45–64 years</b>	85.4	13.4	1.2	81.9	16.4	1.7
<b>65–84 years</b>	78.3	20.2	1.5	78.3	19.7	2.0
<b>85–years</b>	65.0	31.5	3.6	64.3	31.0	4.7

**TABLE 4.**  
Prevalence of Voice Problems (Small and Great Extent). Distribution Per Occupational Group According to SSK2, Swedish Standard for Occupational Classification, 2-digit Level (Translation of Occupations by Swedish Central Bureau of Statistics SCBS)

	%	CL 95% lower	CL 95% Upper	N	Calibrated Pop Weight
Other crafts and related trades workers	23.9	15.7	32.2	174	5404
Teaching associate professionals	21.9	18.2	25.5	1173	20221
Teaching professionals	19.3	17.1	21.5	2202	40888
Sales and services elementary occupations	18.8	15.9	21.7	1116	39218
Personal and protective service-workers	18.4	17.1	19.8	5622	154518
Drivers and mobile-plant operators	17.8	15.1	20.6	1221	36349
Precision, handicraft, craft printing and related trades workers	17.2	8.0	26.4	150	4161
Legislators and senior professionals	17.1	4.5	29.7	47	797
Clercs	16.7	15.0	18.4	3270	78907
Customer service clercs	16.7	13.4	19.9	1025	30416
Machine operators and assemblers	16.0	12.3	19.6	612	17696
Elementary occupations	15.1	8.0	22.2	146	5113
Models, salespersons and demonstrators	14.5	12.0	17.0	1618	54222
Other associate professionals	13.9	12.7	15.1	6252	138843
Other professionals	13.7	12.5	14.9	5416	112621
Skilled agricultural and fishery workers	12.3	7.1	17.5	286	7806
Managers of small enterprises	12.0	9.3	14.7	917	21483
Life science and health associate professionals	11.8	9.7	13.8	1522	27721
Corporated managers	11.7	10.0	13.5	2389	41787
Metal, machinery and related trades workers	11.6	8.8	14.5	801	21969
Physical and engineering science associate professionals	11.6	9.7	13.5	2361	54126
Life science and health professionals	11.5	9.0	14.0	1230	20807
Physical, mathematical and engineering science professionals	10.9	9.6	12.2	3275	74124
Agricultural, fishery and related laborers	10.5	0.0	31.0	8	231
Extraction and building trades workers	9.9	8.0	11.9	1763	48375
stationary-plant and related operators	6.4	0.4	12.5	94	2037
Missing data	16.7	15.4	18.0	5427	208928

SCBS, swedish central bureau of statistics.

point prevalence of 29.1% in N = 117 individuals >65 years of age and. Ruy et al,<sup>28</sup> established the point prevalence of subjectively reported voice problems in a Korean population was 7.3% in N = 3,759 individuals. Despite the variation in prevalence we can conclude that self-perceived voice problems in the elderly is common. The reasons to elderly

being more prone to report voice problems might have several explanations. Some of those most likely pertain to the laryngeal changings that occur during aging and concomitants effects on voice acoustics<sup>29</sup> However, Ryu et al,<sup>28</sup> found that physiological age more than chronological age was a risk factor in voice disorders. There was also a

**TABLE 5.**  
Distribution of Responses to Questions About Hearing and Hearing Impairments in Comparison to Voice Problems. N, Mean % and Confidence Intervals in 70,405 Responders

Hearing Level*	Variable	Level	N	%	95% CL for Mean	
Do not hear	hoarse	Small	2143	22.6	21.4	23.8
		Great	259	2.9	2.4	3.4
		No	6990	74.5	73.2	75.7
Hearing aid	hoarse	Small	708	25.8	23.6	28.1
		Great	69	2.9	1.9	3.8
		No	2133	71.2	68.8	73.5
Normal hearing	hoarse	Small	8077	13.9	13.5	14.3
		Great	696	1.4	1.2	1.4
		No	49330	84.7	84.3	85.1

\* As phrased in the questionnaire.

correlation between the individual's perception of quality of life and voice problems. Hence, as elderly of today are more active later in life than before, vocal problems might be subjectively perceived as a limitation affecting the person's quality of life. The literature in the area of voice limitations in healthy ageing elderly is surprisingly limited and more research is warranted.

Discrepancies in prevalence may typically also be attributed to differences in methods. The wording of the prevalence question in the present paper largely aligns with the study of Roy et al.<sup>15</sup> and, might hence have been interpreted similarly by the respondents. The prevalence question in Spantideas et al.<sup>18</sup> however, also included hoarseness, and even though the link between self-reported voice problems and voice symptoms has been established<sup>2,3,5</sup> hoarseness *per se* may not necessarily be considered a problem by the speaker. The self-assessment of voice problems seems to be related to the perception of an actual and sustained limitation. e.g. Whitling et al.<sup>30</sup> found that women who perceived voice problems related to vocal strain only during work-time were less prone to report a general voice problem. Hence, when a limitation is perceived, the voice dysfunction becomes a problem for the speaker. The perception of limitations naturally differs between individuals and also between variations in vocal demands. In the present study, as in the study by Roy et al.,<sup>15</sup> a large variety of occupations were represented thus, including both occupations with and without vocal demands. Not surprisingly, voice intensive occupations such as educational professionals and service professions topped the list of prevalence of voice problems per occupation. These are occupations commonly investigated for both symptoms and prevalence of voice disorders<sup>1-6</sup> and, also described as the topmost voice-treatment seeking groups.<sup>31</sup> Further, and similar to other studies that have explored prevalence of voice problems, the present results showed a higher prevalence in females than in males both for the estimation of problems to smaller and larger extent. After retirement there was no difference between sexes.

The results in the present study show a statistically significant correlation between voice problems and hearing impairments, also identified through clinical experience. The relationship between hearing difficulties and voice disorders is scarcely studied. Results from a handful of papers however, indicate that individuals with hearing-loss also report voice disorders.<sup>32</sup> Moreover, Cantor Cutiva and Burdof<sup>33</sup> showed that voice-related quality of life was statistically significant lower among teachers who reported hearing problems compared with those who did not report that condition. Further, Ramos et al.,<sup>34</sup> found that women with functional voice problems showed poorer auditory processing capacity than voice healthy women. Hearing impairment or auditory processing disorders might thus be established as factors adding to the individual's vocal load and maintaining of voice problems. A more thorough exploration is needed to fully understand the co-play between these aspects.

The results in the present study indicate a high prevalence of voice problems in the general population. An unofficial definition of an endemic disease is a prevalence of >1%.<sup>35</sup> According to this definition, voice problems should be considered endemic. However, from a single question included in the public health questionnaire and with a broad based assessment scale, it is hard to comment on what kind of problems build under the prevalence rates, even though we have tried to exclude voice problems occurring during temporary colds. The included occupations give an indication of the self-assessed voice problems to a part being functional and vocally loading induced, depending on their large vocal demands in these occupations.

The rating scale used was an ordinal scale with three levels. Extensive use of frequency based rating scales from a number of studies in Finland gives support to this.<sup>36,37</sup> In these studies, symptoms occurring twice a week or more often were considered to indicate a voice disorder, equaling "yes, to a great extent" in the present study. The broadness of the rating scale gives an estimation of the prevalence of voice problems frequently occurring in the general population but does not give possibility to a more detailed analysis. However, the study by Roy et al.<sup>1</sup> that has been the key reference establishing the prevalence of voice disorders in the general population (6%) used a very broad definition of voice disorders: '...to be any time the voice does not work, perform, or sound as it normally should, so that it interferes with communication.' (page 283) where the respondents were to give an initial answer of yes/no. Further, the geographical basis might be considered limited. It may however, be noted that the Stockholm County includes city, village, and rural areas and the studied cohort may thus be well suited for generalization also to larger populations. Moreover, it should be noted that the response in this kind of investigations commonly is skewed, i.e. the respondents do not represent the structure of the sample with regard to e.g. younger individuals, individuals with severe illness or immigrants. To take care of this and to increase the generality, information from national registers are used to calculate calibration weights (for details, see methods section). These registries include age, sex, country of birth, civic status, income, educational level, sickness allowance, and area of residence.<sup>26</sup>

These reservations notwithstanding, we can conclude that voice problems in the general population, and above all, in the older ages, constitutes a problem for the individual. Questions about voice and communication problems should be included in health examinations, especially with consideration to the close connection to quality of life. The strength of the present study is the number of informants. With answers from 75,000 individuals, this is one of the largest surveys of its kind.

## CONCLUSION

The overall prevalence of self-assessed voice problems in the cohort of 75,000 individuals was estimated to 16.9% where

15.5% of voice problems were rated to occur to a small extent and 1.4% to a great extent. Women were more prone to report voice problems than men. The highest ratings of a great extent of voice problems were found in both women and men >65 years of age. This finding increases the need of proactive information and treatment from voice clinics and general health, targeting older age groups. As for occupation, the highest prevalence of voice problems was found in teaching and service occupations. The awareness of the prevalence of voice disorders in a general population may have implications for both society and for the involvement of the individual.

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## SUPPLEMENTARY MATERIALS

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jvoice.2018.07.007](https://doi.org/10.1016/j.jvoice.2018.07.007).

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