

ORIGINAL ARTICLE

Prevalence of occupational voice disorders in teachers

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Key words

Voice disorders • Prevalence • Teachers

Summary

Introduction. In Italy the number of teachers among private and public schools is around one million. Voice disorders are thought to be one of the major occupational hazards of school teaching; in fact the teachers often use their voice with high-intensity, in noisy classes, for a long time and without suitable breaks. The aim of the study was to assess the prevalence of voice problems in teachers of Naples district, identifying risk factors for developing voice pathology.

Methods. In this study we evaluated 504 teachers (322 F - 182 M) with an age ranging between 24 and 62 years, randomly choiced in 28 schools of the district of Naples submitted to a questionnaire to determine the prevalence of voice disorders. In our study we have also introduced a comparison group of not-teachers workers of 402 subjects (244 F - 158 M); they were in the same age range as the teacher sample (range: 22-65 years). The control group was also submitted to a questionnaire regarding sociodemographic characteristics, smoking and alcohol use, a self-report of voice problems, voice symptoms, frequency of acute and chronic voice problems, absenteeism due to voice problems.

Results. The prevalence of reporting a current voice problem was significantly greater in teachers compared with not-teachers

(8.7% vs 2.9%), as the prevalence of voice disorders during their lifetime too (51.4% vs 25.9%), $\chi^2 = 86.672$, $p < 0.001$. Women, compared with men had a higher lifetime prevalence of voice disorders. An other important data evidenced, is that 116 workers of the teachers group (23.01%) have been forced, during their professional activity, to miss job for problems related to voice; only 22 subjects of control group (5.47%) instead, missed job for voice troubles.

Discussion and Conclusions. This study confirms that teachers have a higher rate of self-reported voice problems than subjects working in other occupations. Teachers, compared with not-teachers, were significantly more likely to have experienced multiple voice symptoms including hoarseness, discomfort while using their voice, difficulty projecting their voice and tiring or change in voice quality after short use. Large proportion of these problems may be preventable and prevention programs need to be developed and evaluated. Italian teachers do not receive any preventive voice training; that, in combination with poor hygienic work conditions, could increase health problems. Thus, voice training of teachers and teacher college students in some cases should be considered as a useful tool to prevent voice disorders.

Introduction

Approximately around one third of the workers in industrialized societies uses its own voice as the principal tool of work [1]. The group of heavy occupational voice users includes members of clergy, telemarketers, lawyers, consuelors, singers, tour guides, stage actors, call-center operators and teachers.

Different studies have shown an association between voice troubles and working activities requiring its use.

Long and others [2] in Alabama administered a questionnaire to 54 aerobic trainers (50 F and 4 M) of middle age 34.1 y and with a mean activity of 4.9 years.

In this study 44% of the subjects reported episodes of loss of voice and 42.6% reported loss of partial voice during lessons or immediately later.

Jones et al. [3] have underlined as among telemarketers there was a great prevalence of problems of voice in comparison to general population.

Lehto et al. [4] have shown as call-center operators get voice problems during their working days. The same group of workers, once submitted to a course of vocal

hygiene organized by speech and language therapist, registered a meaningful reduction of vocal symptoms.

Teachers represent the largest group of professionals who use their voice as primary job tool; they are around 3.3 million in the United States, employed in primary and secondary school [5].

In Italy the number of teachers among private and public schools is approximately one million [6].

They often use their voice with high-intensity, in noisy classrooms, for a long time and without suitable breaks.

Teachers are also exposed to infections (viruses associated with upper respiratory tract infections) that can contribute to determine laryngeal troubles in this group of workers [7-8].

In 1998 Smith et al. [9] conducted a study on 554 elementary and high school teachers and on 220 individuals employed in other occupations through administration of a questionnaire; when asked whether they had ever had a voice problem, 32% of teachers answered "yes" compared with only 1% in not-teachers group. About 20% of teachers but only 4% of not-teachers missed work for voice problems.

In the 2004 Roy et al. [5] organized a study on 2531 subjects (1243 teachers and 1288 not-teachers) interviewed on telephone using a voice disorder questionnaire. The prevalence of reporting a current voice problem was significantly greater in teachers compared with not-teachers (11.0% vs 6.2%), as the prevalence of voice disorders during their lifetime (57.7% for teachers vs 28.8% for not teachers). Teachers were also significantly more likely to have consulted a physician or speech-language pathologist regarding a voice disorder (14.3% vs 5.5%) in comparison to not-teachers. Fritzell [10] and Titze [11] have shown an increased risk ratio for developing voice disorders among teachers.

In the 2005 Preciado et al. [12] evaluated in 57% the prevalence of voice disorders on a group of 527 teachers.

In the 2006 Sliwinska-Kowalska et al. [13] analyzed a group of study constituted by 425 females full-time teachers (age ranging from 23 to 61 years) and 83 non-teachers group (control) whose jobs did not involve vocal effort, matched for age to the study group; the result was that the overall lifetime vocal symptoms were more frequent in teachers than in non-teachers (69% vs 36%) and in particular it related to permanent and recurrent hoarseness and throat dryness.

In 2006 a large-scale work was effected administering 2.117 questionnaires in Netherlands by de Jong et al. [14]; the group of study was constituted by 1,878 teachers and 239 controls and it underlined how more than half of teachers reported voice problems during their career and about one fifth had a history of absence from work due to voice problems. Moreover, more than 20% of teachers sought medical help or had been treated for voice problem.

Among teachers a group particularly at risk for vocal troubles is the one of the teachers of singing. In fact in a study on 125 teachers of singing [15] it has been underlined that the 64% of them reported voice problems.

Methods

In our study we evaluated 504 teachers (322 F – 182 M) with an age ranging between 24 and 62 years (mean 40.2) randomly choiced in 28 school of Neapolitan district. They were submitted to a questionnaire (appendix 1) to determine the prevalence of voice disorders. The questionnaire comprised questions about subject's age, duration of employment, current job, type of school, number of students in classroom, environmental work conditions. Further, questions were asked about the habit of speaking with loud voice and smoking.

The group of study included 116 teachers of maternal school, 118 teachers of elementary school, 128 of the junior high school, 142 of the senior high school.

In our study we also introduced a comparison group of not-teachers workers of 402 subjects (244 F – 158 M); they were in the same age range of the teacher sample (range: 22-65 years). Not-teachers were identified among a sample of people accompanying patients at

the Department of Audiology and Phoniatic of the II University of Naples; the subjects were excluded if they had an appointment at the above mentioned Department. People of the comparison group were not employed in teaching profession and included 44.27% clerical related worker, 32.33% professionals and administrator or managers, 9.45% craftsmen, 8.20% service workers, 2.98% farmers and 2.73% of other workers. The control group was submitted to the same questionnaire of the study group about sociodemographic characteristics, smoking and alcohol use, a self-report of voice problems, voice symptoms, frequency of acute and chronic voice problems, absenteeism due to voice problems.

Statistical analysis was performed using programs of automatic analysis (Sigmastat 3.1 for Windows).

The calculation of the odds ratio, through the use of a chart of contingency 2 x 2, was used to verify the greatest prevalence of dysphonia in teachers in comparison to the control group (dichotomic variable). Before declaring the existence of a relationship cause-effect between the exposure and the illness, to exclude that difference was casual, a test of χ square has been performed.

To determine the existence of a correlation between incidence of dysphonia and sex the test z has been applied.

Results

In 82 of 116 teachers of maternal school (70.7%), we registered problems to the voice: 12 of them (14.6%) presented voice troubles at the moment of the investigation and 70 (85.4%) had suffered from it in past; 47 of these 82 teachers (57.3%) had a job seniority superior to 15 years with a minimum of 18 working hours for week.

On 118 teachers of the elementary schools, 77 (65.2%) reported problems of voice: 11 (14.3%) interviewed subjects had current voice problems and 66 (85.7%) had suffered from it in past; 46 (59.7%) of these 77 teachers, had a job seniority superior to 15 years with a minimum of 18 working hours for week

On 128 teachers of the junior high schools 11 (15.3%) had dysphonia at the moment of the interview, and 61 (84.7%) had in past suffered from this problem. Of these 72 teachers, 44 (61.1%) had a job seniority superior to 15 years.

On 142 teachers of the senior high schools, 72 had voice problem. Ten of them had current dysphonia (13.9%), while 62 (86.1%) had suffered of it in past. In this group of 72 teachers reporting problems to the voice 46 subjects (63.9%) had a job seniority superior to 15 years.

Overall 44 teachers (8.7%) had dysphonia related symptoms at the moment of the interview and 31 of these were females while 13 were males; 259 teachers (51.4%) declared to have suffered from dysphonia (194 females vs 65 males).

Tab. I. Distribution of the teachers and controls on the basis of voice pathology.

Teachers 504 322 F - 182 M	Problems to the voice	Dysphonia at the moment of the interview	Past dysphonia	Job seniority superior to 15 years
Maternal school 116	n = 82 70.7%	n = 12 14.6%	n = 70 85.4%	47 57.3% a minimum of 18 working hours for week.
Elementary schools: 118	n = 77 65.2%	n = 11 14.3%	n = 66 85.7%	n = 46 59.7% a minimum of 18 working hours for week.
Yunior high schools: 128	n = 72 56.2%	n = 11 15.3%	n = 61 84.7%	n = 44 61.1%
Senior high schools 142	n = 72 50.7%	n = 10 13.9%	n = 62 86.1%	n = 46 63.9%
Total	n = 303 60.1%	n = 44 14.5% 31 F - 13 M	n = 259 85.5% 194 F - 65 M	n = 183 60.4%

Workers Not Teachers	Problems to the voice	Dysphonia at the moment of the interview	Past dysphonia
402	116 (28.8%)	12 - 8 F - 4 M (10.3%)	104 - 73 F - 31 M (89.7%)

An other important datum is that 116 teachers (23.01%) had been forced, during their professional activity to miss the job for problems related to the voice.

Only 131 teachers (43.2% of the total number of teachers that presented voice troubles at the moment of the investigation) were addressed to phoniatic or otorhinolaryngeal specialist to resolve their voice problems. Moreover we considered 402 workers that didn't work as teacher (244 F - 158 M with an age ranging between 22-65 years). In this control group 116 presented problems to the voice. Twelve of them (10.3%) had current dysphonic symptoms on the interview (8 females and 4 males) while 104 (89.7%) had suffered of it in past (73 F - 31 M).

Only 22 subjects of the control group (5.4%) have been forced to stay home because of the voice.

Results are shown in Table I.

In our study we evidenced a prevalence of dysphonia clearly superior in teachers in comparison to the control group (Tab. II).

Through the use of a chart of contingency 2x2 (Tab. III) we have calculated that the odds ratio (probability that teachers result dysphonic in comparison to controls) is 3.72.

This value shows that there is a positive association between teaching activity and dysphonia.

The test of the χ^2 square (correct Yates) gave as result 86.672 with 1 degree of liberty ($p < 0.001$).

This datum testifies that the two characteristics defined in the chart of contingency are meaningfully correlated.

In our study emerges that within the category of the teachers, women result to be more at risk of dysphonia in comparison to men. In the group of the teachers, (322 F - 182 M) women presented dysphonia in 70% of cases versus 42% of men.

Using z test it resulted that there is a meaningful difference between women and men $Z = 6.066$; standard error = 0.0455 confidence interval 95%; $p < 0.001$.

We also noticed that on 303 teachers with dysphonia, 183 (60.3%) had a seniority of service superior to 15 years with at least 18 working hours a week.

Tab. II. Distribution of teachers and controls by presence or absence of dysphonia (Chart of contingency 2 x 2).

	Dysphonic (sick)	Not dysphonic (healthy)
Teachers (exposed)	a. 303 (60,1%)	b. 201
Not Teachers (not exposed)	c. 116 (28,8%)	d. 286

Tab. III. Assessment of relative risk associated with teaching.

Odds cases $a/c = 303/116 = 2.6$
Odds controls $b/d = 201/286 = 0.7$
Odds ratio $a/c = a \times d = 3.72$ $b/d \quad c \times b$

Discussion and conclusions

This study confirms that teachers have a higher rate of self-reported voice problems than those working in other occupations. Teachers, compared with not-teachers, were significantly more likely to have experienced multiple voice symptoms including hoarseness, discomfort while using their voice, difficulty projecting their voice and tiring or change in voice quality after short use. The inclusion of a comparison group of individuals working in other occupations provides a contrast of the prevalence and types of voice problems experienced by the working population in the same relative geographic area of the teacher population. Without this group it is difficult to determine whether the results found among teachers are similar to (or different from) those experienced by the overall working population.

All works examined by our group put in evidence the greatest prevalence of dysphonia in voice professional workers compared to control group despite of the notably differences obtained in values in previous studies.

In fact the prevalence of voice problems in teachers spaces from 32% revealed by Smith [9] in 1988 to 69% evidenced by Sliwinska-Kowalska and oth. in 2006 [13].

This notable difference of data can be partially explained by some considerations.

In the 1998 Smith's study valued through a questionnaire approximately an equal number of male ($n = 274$) and female ($n = 280$) and 290 of 554 teachers (52.4%) had less than 21 years of working seniority.

The study group of Sliwinska-Kowalska comprised 425 females full-time teachers with an average job seniority of 15 years.

It's known that women are more exposed to voice problems due to various factors. In different studies it has been underlined that female teachers report more frequently voice complaints and absence from work due to voice problems despite of their male colleagues [5, 14, 15].

It has been hypothesized that women are more vulnerable to voice problems because of structural differences in their laryngeal anatomy. Women have shorter vocal folds and produce voice at a higher fundamental frequency; therefore, there is less tissue mass to dampen a larger amount of vibratory force [5]. At the molecular level, female subjects showed relatively less hyaluronic acid in the most superficial layer of the lamina propria [16]; relatively less hyaluronic acid in the most superficial area implies less protection from vibratory trauma and overuse; in fact hyaluronic acid is most concentrates in areas of high shock absorption and it plays an important role in wound repair [17].

Also our study has evidenced the greatest prevalence of voice troubles in females in comparison to males. In fact in the group of the teachers (322 F – 182 M) 225 women (70%) presented dysphonia, but only 78 males (42%) presented voice problems.

In our study we also evidenced a category at high risk of problems of voice: the teachers of the maternal and elementary schools belong to this risk category.

Our study has underlined the negative effect of the troubles of the voice on the working activity of the teachers too. In fact in 23% of the teachers have been forced, across career, to miss the job because of the vocal troubles; on the contrary only 5% of not-teachers in the current study had missed any work days due to their voice. Teachers, compared with not-teachers, reported that they were more likely to reduce activities or interactions because of voice related problems. Because the teachers typically use their voice as the primary tool of instruction, these voice symptoms and the need to restrict or adjust teaching activities, as result, presumably have large implications for both the quality of teaching and students' learning experience.

It was disturbing to note that, despite of the high frequency of reported voice problems, only a small percentage of teachers had sought medical care.

A large proportion of these problems may be preventable and prevention programs need to be developed and evaluated. Bitritsky and Frank [18] and Chan [19] studied the effectiveness of prevention and education workshops. Bitritsky and Frank carried out retrospective study comparing 40 teachers who had received no instruction on voice to 37 teachers who had received an hour of instruction per week for one year during teacher training. Evaluation was based on questionnaires, self-evaluation, and perceptual ratings of voice recordings. Rating of voice recordings showed that teachers who did no receive instruction had a greater incidence of severe hoarseness, low pitch and weak voice; these teachers also reported a great number and severity of vocal symptoms. It was concluded that the group who had received instruction had a greater awareness of vocal function and provided a more realistic evaluation of their voices.

Chan carried out a prospective, experimental design with two groups of kindergarten teachers. The experimental group of 12 female teachers received a 90-minute workshop aimed at developing an understanding and knowledge of vocal abuse and vocal hygiene, followed by daily practice of vocal hygiene for 2 months. The control group of 13 female teachers received no intervention. Chan demonstrated that the kindergarten teachers were able to improve their voices through the vocal hygiene program and that the control group experienced significantly more vocal fatigue. Timmermans et al. [20] have recently put in evidence the importance of voice training of professional voice users.

Italian teachers do not receive any preventive voice training; that, in combination with poor hygienic work conditions, could increase health problems. However, voice training of teachers and teacher college students in some cases should be considered as a useful tool in prevention of voice disorders.

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Questionnaire (appendix 1)

First and last name (optional) _____ Age _____ Sex _____

School type _____

School subject _____

Years of employment _____

Pupils, number in attendance _____

Vocal effort, h/week _____

Work and life hygiene:

Dustiness _____

Exposure to chemical substances _____

Air conditioning _____

Buzzing _____

Phonation habitus:

- Speaking in a low voice
 Speaking in a raised voice
 Speaking at the top of one's voice

Tobacco use:

Cigarettes per day _____ Years _____

Family history of voice problems _____

Lifetime vocal symptoms:

- Hoarseness
 Voice tiredness
 Difficulty projecting the voice
 Voice related discomfort
 Increased effort to talk
 Chronic throat dryness or soreness
 Trouble speaking or singing

Other: _____

Did this problem last for 4 weeks or more?

- No
 Yes

Has your voice disorder been continuous or off and on? _____

Do you currently have a voice disorder?

- Hoarseness
 Voice tiredness
 Difficulty projecting the voice
 Voice related discomfort
 Increased effort to talk
 Chronic throat dryness or soreness
 Trouble speaking or singing

Other: _____

Have you consulted a physician or other health care professional for your voice problem?

- Yes
 No

For your voice problem, have you received voice therapy ?

- Yes
 No

Number of work days missed due to voice disorder (in the past year): _____

Do you suffer from respiratory allergy?

- Yes
 No

Asthma

- Yes
 No

Did you suffer in the past two years from:

Cold

- Never
- Sometimes
- Frequently

Sinusitis

- Never
- Sometimes
- Frequently

Laryngitis

- Never
- Sometimes
- Frequently

Do you suffer from:

- gastritis
- thyroid diseases
- gastroesophageal reflux
- hearing impairment