THE VOICE OF THE TEACHER

A multidimensional and dynamic process

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A multidimensional and dynamic process

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voor Riet,

“alleen” zo minuscuul klein, “samen” zo onmetelijk groot”

in liefdevolle en dankbare herinnering

CONTENTS

Chapter 1

The Voice of the Teacher
General Introduction

THE VOICE AND OCCUPATIONS

Voice disorders are a growing health problem in society, and it has been estimated that around a third of occupations are voice dependent.[1] Professional voice users have been described as those individuals whose voice is the “primary tool” for the practice of their profession, and if insufficient would result in absence from work leading to personal, economic and social disadvantages.[2-7] Professional voice users have been associated with a high risk for developing voice disorders.[8-12]
Koufman et al.[6] classified professional voice users with different degree of voice dependence for the performance of their jobs into four categories; elite vocal perfomers, professional voice users, non-vocal professionals and non-vocal non-professionals(Table 1).

Occupational safety and health and professional voice users
It is said that “every workman takes care of his tools”, however, the care of the professional voice has often found to be lacking.[13] Despite the growing reports of voice problems in teachers[14,15] and other voice professionals[13], occupational safety and health is poor in The Netherlands[16], and the majority of other countries. In a way teachers are locked out of the benefits of occupational safety and health, and are locked in a vicious circle of voice problems and maintaining factors[17].

Table 1.

Level	Description	
I	The Elite Vocal Performer,	A person for who even a slight aberration of voice may have dire consequences. Most singers and actors are in this group; the opera singer is the quintessential level I performer.
II	The Professional Voice User,	A person for whom a moderate vocal problem might prevent adequate job performance. This group includes most clergy, teachers, lecturers, receptionists, etc.
III	The Non-Vocal Professional,	A person for whom a severe vocal problem would prevent adequate job performance. This group includes lawyers, physicians, businessmen, business women, etc.
IV	The Non-Vocal Non-Professional,	A person for whom vocal quality is not a prerequisite for adequate job performance. This group includes clerks, labourers, and so forth. Although persons in this group may suffer very significant social liability from a voice disorder, they are not prevented from doing their work.

Consequences of voice problems

The voice has been acknowledged to be the primary tool for communication, which is used to express emotions and meanings.[2,18-20] Communication has been described as the most existential act of man.[2,18-20] Therefore, a voice problem can result in significant psychological, social, physical, and occupational consequences for an individual.[3,7,21-23] Patients with chronic voice problems were observed to have a greater handicap on social functioning than other chronic diseases such as sciatica and cardiac angina.[24]

TEACHERS

Teachers are a striking example of professional voice users[3,12-14], and voice problems have been reported to be a common problem among teachers.[2,3,5,8,12,16] Teachers are often handicapped due to their voice problems[16,21,25], which often results in severe occupational, economic, personal, and social penalties.[3,21,26]

Teachers have been observed to experience voice problems more frequently and to a greater degree than other professional voice users.[13,17,21,26,27] Furthermore, voice related absenteeism has been reported to be up to five times greater compared with other professional voice users.[5,12,16] Teachers are reported to be the most common professional voice users who seek medical help and voice therapy for voice disorders.[3,12,21,28-32] Voice problems in teachers have therefore resulted in great costs personally, for education and the health sectors.[3,5,16,26]

Teachers have also appeared to be more vulnerable to voice problems when compared to other professional voice users.[4,8,12,26,27,29,33]
Voice screening before teacher training has been found to be lacking.[15,34,35] Furthermore, teacher training has been reported to be inadequate to meet the rigorous vocal demands of teaching.[3,15,16,34,36]

RISKS TO THE TEACHING VOICE

The professional voice has been found to be influenced by and exposed to various risk factors[14,15,26,37,38], which may be broadly classified for the sake of description into four domains, namely vocal loading, physical risk factors, psycho-emotional risk factors and environmental risk factors.[15,16,38]

VOCAL LOAD

Teachers appear to have a greater cumulative voice use in the practice of their profession when compared to other professional voice users.[3,16] There is often less recovery time for the voice after teaching, and it is not always practical or possible to reduce the use of the voice when a teacher has a voice problem, due to the professional demand.[15] In addition, surveillance and care of the voice of teachers during the career has been found to be often lacking.[3,12,16]

Primary school teachers often have to use their voice intensively and extensively[39-41], due to the primarily vocal teaching methods for primary school children who are often lingually immature. Moreover, due to mild hearing loss secondary to otitis media[42-45], which is common among primary school children, teachers often are forced to talk loudly. This is often in the presence of loud background classroom noise.[46-48] These various factors constitute a challenge for the voice. Furthermore, in The Netherlands primary school teachers often have to teach several subjects in the course of the day, which requires prolonged voice use.

Vocal loading has been acknowledged to be a risk factor for developing voice problems.[3,14,46,49-51] Increased vocal intensity has been considered to be an important causative factor for vocal load.[37,47,48] Additionally, prolonged voice use, speaking outside the normal pitch range, speaking with strong intonations or with an abnormal resonance has been found to increase the load on the vocal apparatus.[37,46] Prolonged voice use can also lead to laryngeal adjustments leading to acoustic changes in the voice.[52] Despite intensive and prolonged vocal use, teachers often do not make adequate use of voice amplifiers during teaching[25,48], despite the fact that voice amplification has been demonstrated to reduce the vocal load and to increase the vocal endurance.[25,48] Vocal abuse and misuse has been reported to increase the risk of developing vocal pathologies.[53,54]

There are also background factors, which could contribute to vocal load. Teaching under the influence of stress and/or emotions has been observed to cause a rise in the fundamental frequency of the voice[13] and increased tension of the laryngeal muscles[55,56], which increases the load on the vocal apparatus.[14,37,55] The number of pupils taught has been also observed to be a significant risk factor for voice problems[27,36,46,57], which increases the speaking distance and the background noise.

PHYSICAL RISK FACTORS

It has been stated that the whole body and not only the vocal folds take part in a vocal performance.[58] The respiratory bellows provide the breath support for voicing, the vocal folds vibrate producing the voice and the voice is further modulated by resonance in the pharynx and articulation, which involves the tongue, lips and palate.[59]

Physical factors like increased muscular tension in the head, larynx, neck and shoulder regions have been observed to lead to voice problems.[2,50,58,60-65]
Lower back, neck and shoulder problems and poor posture can result in inadequate breath support[2], and an altered laryngeal position causing voice strain.[55,56] Increased tension of the laryngeal muscles during speaking is observed to gradually change the resting tone of the muscles resulting in persistently tense laryngeal muscles and a strained voice.[55,56,60-62]

Voice problems have been linked with problems with the upper respiratory mucosa.[9,34,66] Inadequate hydration of the mucosa [2; 10; 26], dry environmental conditions[67], allergy, laryngitis[9] and hypersensitivity[68] can result in mucosal edema and inflammation.
Habitual throat clearing has been observed to be a common[69,70], and often ignored form of vocal abuse. Habitual throat clearing may be secondary to globus sensation due to gastro-esophageal reflux[71,72] or a response to stress.[2] Throat clearing may present as a symptom of vocal fatigue after prolonged and intensive speaking[73], or due to postnasal drip secondary to allergy, which is found to be common in teachers.[9] Habitual throat clearing appears to be a common presenting symptom of various mechanisms, and has been found to be harmful to the vocal folds due to collisions forces.[59,74]

Hearing loss has been reported by teachers and student teachers to have a negative influence on their voice, which was interpreted as a possible increase in hearing threshold in the presence of poor acoustics and high background noise.[15]
All the same even a mild hearing loss is associated with reduced acoustic feedback, and this could cause a teacher to speak loudly and strain the voice.[75]

PSYCHO-EMOTIONAL RISK FACTORS

Teachers have been reported to experience a great degree of stress during teaching[3,12,17,41,76], and the professional voice requires a great mental effort.[17,34] Psychosocial factors such as emotions and stress can contribute to psychosomatic problems such as increased muscular tension.[77-79] These mechanisms have also been observed to affect the voice.[2,58] The large majority of non-organic voice disorders have been demonstrated to have increased and inappropriate muscle tension in the neck, shoulders and postural muscles.[56,58] Increased muscle tension in the laryngeal and neck muscles leads to vocal strain[60,62], resulting in a vicious circle of voice problems, psycho-emotional and muscular problems. Apart from causality psycho-emotional factors can also contribute to maintenance of vocal problems.[17] The mechanisms of psycho-emotional factors in relation to the voice problems has been likened to repetitive strain injury syndrome in which an organic pathology is not always demonstrable[17], which constitutes a problem when defining a voice problem.

The World Health Organization defined health not only as a physical entity but also as having mental and social domains.[80] It therefore can be gathered that vocal health could be influenced by both physical and psychosocial factors, and it would be worthwhile to estimate the physical and psychosocial parameters of the voice of teachers to have a greater understanding of the multidimensional nature of their vocal status.

ENVIRONMENTAL RISK FACTORS

An unregulated classroom environment could pose a risk to the voice of teachers.[68,81] Environmental irritants[7,41] cross infection from children with frequent upper respiratory tract infections[7,9-11], dryness[26,67,82] and unregulated temperature of the classroom are voice-straining factors.[15,36,37,50,67]
Acoustic conditions of classrooms are often found to be poor.[46,48,81]
Coupled with a usually high background noise[46], it would be a challenge for teachers to communicate with students effectively without straining their voices in the absence of voice amplification. A speaker has been observed to raise the voice, about 3 dB increase for each 10 dB increase in ambient noise starting from 40 dB and this has been termed the Lombard effect.[41,83,84] In the Netherlands there is a unique situation in which acoustic damping materials are not permitted in

the construction of classrooms due to fire hazards. Therefore, teachers are forced to teach in acoustically poor classrooms, often without basic voice amplification. With regard to the listeners, even low background noise has been observed to adversely affect speech intelligibility.[46]

Voice problems have been observed to have a multi-factorial genesis.[10,14,17,26,37,50] Studies have shown that the risk factors for voice problems are mutually independent, however, they also appear to be linked.[15,26,36,85,86]

Aims and Objectives

1. The estimate the prevalence and magnitude of voice problems in teachers.
2. The examine associations between risk factors for voice problems and voice problems.
3. To evaluate the psychosocial impact of voice problems.
4. To investigate whether voice problems in teachers have a history during the training period and / or before.
5. To examine whether there is a difference in perception of risk factors and voice problems when student teachers begin professional teaching and during the entire teaching career.
6. To assess whether gender of teachers plays a role in voice problems.
7. To examine the role of muscle tension in voice production in teachers.
8. To examine whether the psychological cascade model alsohas a role in voice problems of teachers.

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Chapter 2

Epidemiology of Voice Problems in Dutch Teachers

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ABSTRACT

In order to assess voice complaints and absence from work due to voice problems among teachers of primary and secondary education, as well as among a control group, 2117 questionnaires were analysed. The total group consisted of 1878 teachers and 239 controls. Female teachers reported more frequently voice complaints and more absence from work due to voice problems than their male colleagues. No unequivocal relationship between age on the one-hand and voice complaints and absence from work due to voice problems on the other hand were observed. Therefore, the percent of cases was corrected for gender but not for age. More than half of the teachers reported voice problems during their career and about one-fifth had a history of absence from work due to voice problems. These numbers are relatively high compared to those of the controls with as well as to those without a vocally demanding profession. More than 20 percent of the teachers sought medical help or had been treated for a voice problem. Remarkably, more than 12 percent of the teachers had experienced voice problems during their training and this group reported significantly more voice complaints and absence from work due to voice problems in their career than the colleagues without voice problems during the training. The results of the Voice Handicap Index scores followed these trends. These findings point at voice problems during education as a risk factor for getting voice problems during the career. The results of this study clearly demonstrate that teaching is a high-risk profession for the development of voice problems, which is in accordance with other studies and support the contention that voice is a worldwide problem in the teaching profession. Furthermore, this study indicates the importance of voice care not only during training for the profession but also during the career.

INTRODUCTION

Evidently, in our modern society there is an increasing need for oral communication and the number of professions with high vocal demands is growing rapidly. Vilkman stated: "One third of the labour force is working in professions in which voice is the primary tool."[1] Professional voice users depend on their voice for practicing their profession and voice problems may lead to inability to work.[2] In recent years, the care of occupational voice and the diagnosis, treatment and prevention of occupational voice disorders is gaining importance.[3-8] In the Netherlands, however, there is no classification of professional voice disorders,

nor are they recognized as occupational disease. This severely hampers the assessment of the occurrence and the implications of professional voice disorders. For most professions an average vocal capacity is sufficient. However, there are some professions, for example teaching, singing and dramatic art, that require sustained and extensive use of the voice, above and beyond the demands of everyday speaking. As a consequence, these professions require a high degree of vocal capacity. Professional voice use can be characterized as a top sport, representing a great mental and physical effort. Remarkably, insufficient attention is paid to voice training in various educations for professions with high vocal demands[9] and the prediction of voice problems is still a diagnostic challenge.[10-12] Voice problems are common among teachers.[5,13-20] These problems are most likely due to the heavy vocal load of their profession.[11,21] Moreover, voice problems occur more frequently and to a larger extent in teachers than in many other vocally demanding professions. Teachers appear to be more vulnerable to voice strain.[2,7,16,22-29] Additionally, teachers have comparatively more sick leave due to voice problems than members of other professions.[16,27] Age and gender have been reported as related to voice capacity. Females report voice problems more frequently than males and voice capacity diminishes with increasing age.[11,26,30]

The aim of this study was to analyse the occurrence of voice problems and absence from work due to voice problems in Dutch teachers, and to investigate whether voice problems have their roots already in the education for the teaching profession. In addition, the subjective impact of the voice on the teaching career and the need for voice training were assessed.

METHODS

Questionnaires

Questionnaires were distributed among teachers of primary (PE) and secondary (SE) education (n = 6,000), as well as among a control group (n = 500). The directors of schools of primary and secondary education were approached by the telephone. The aim of the study was explained and the directors were asked to distribute the questionnaires among the teachers at their school. The directors determined the number of questionnaires that were required for the school. The persons for the control group were recruited as a sample of convenience, i.e. quasi-randomly. In this way, the control group was composed at random. The

questionnaires were accompanied by a description of the background and aim of the study, and instructions for the filling out of the form (Appendix A 1). The questionnaires were individually and anonymously returned in a post-paid envelope. The questionnaire was designed in such a way that personal, voice load, physical, psycho-emotional and environmental aspects of voice and voice problems were included. It consisted of 35 questions (Appendix B). The questions that pertained specifically to the teaching profession were modified for the control group (Appendix C).

The Dutch version of the Voice Handicap Index (VHI) according to Jacobson et al. was sent along with the questionnaire.[31,32] The VHI (Appendix G) was designed for rating the subjective psychosocial consequences caused by voice problems.[31,32] It consists of 30 questions in total. The questions regard emotional (10), physical (10) and functional (10) aspects. The questions were rated according to a five-point scale: never (0), almost never (1), sometimes (2), almost always (3) and always (4). The total score is between 0 and 120.

The control group was divided into a group of subjects with a profession with low vocal demands (negative answer to question 3 in the questionnaire; indicated with "Con") and a group of subjects with a profession with high vocal demands (positive answer to question 3; indicated with "ConVL").

Statistical analysis

The data was analysed using the statistical program SPSS 10.0. One-Sample, two-tailed Kolmogorov-Smirnov Test was applied in order to determine if continuous outcome variables were distributed normally. For continuous outcome variables that were not normally distributed, Mann-Whitney U (MW-U) tests and Kruskal-Wallis tests were used. For discrete outcome variables Chi-square tests were used. The significance level was set at $p \leq 0.05$. Odds Ratios were used to quantify the dependency in 2 x 2 tables. Weighting by the statistical program was applied for the correction for gender of the percent of cases within the different groups. The weight factor for the females was 1. The weight factor for the males was the ratio of the number of females and males in the various groups [n(females)/n(males)]. For further explanation see section “Results”.

RESULTS

From the 6,500 questionnaires 2,228 (34.3%) were returned in total. Sixty-one were excluded because they were filled out incorrectly (e.g. a positive score for

absence from work due to voice problems, without any reported voice complaints). The subjects younger than 21 years and older than 64 years (n = 50) were excluded from the control group in order to match the range of age of the PE and SE groups, which was 21-64 and 21-63 respectively. Finally, 1,878 teachers (31.3% of the distributed questionnaires) and 239 (47.8% of the distributed questionnaire) controls were included.

Groups

The number, age and gender of the participants in each group are listed in table 1. The questions 6-8 (see appendix B) pertain to voice complaints in different periods of the teaching career. If one or more of questions 6-8 were answered positively, the subject was classified as having complaints anytime during the teaching career (indicated with "COMPL").

Table 1. Number of persons, gender and age of the groups (Con = controls without voice load, ConVL = controls with voice load, PE = teachers in primary education, SE = teachers in Secondary Education).

Groups	N	Males (%)	Females (%)	Median age (range)
Con	156	30	70	41 (21-64)
ConVL	83	42	58	38 (21-62)
PE	636	25	75	44 (21-64)
SE	1241	59	41	48 (21-63)

Correction of the number of cases for gender and age

In the literature, effects of gender and age on voice have been reported.[16,26] Therefore, the correlation between gender and age on the one hand and voice complaints and absence from work due to voice complaints on the other hand was investigated initially. In this way, it was determined whether correction of the number of cases for these parameters was required.

Voice complaints during the teaching career (COMPL), were reported by 46.1% of the male teachers and 61.0 % of the female teachers. This difference was significant (Chi-square: $p < 0.001$; Odds Ratio = 2.00). Moreover, male teachers also reported significantly less absence from work due to voice complaints (ABS) compared to female teachers: 14.7 % versus 24.1 % (Chi-square: $p < 0.001$; Odds Ratio = 1.84).

Subjects without voice complaints, i.e. those who answered all of questions 6-8 negatively, were slightly older than those with voice complaints: median (inter-

quartile range) = 47 (37-53) and 45 (35-52) years respectively (MW-U: p = 0.001). There was only a very small difference of age between persons with and without absence from work due to voice complaints: median (inter-quartile range) = 46 (35-52) and 47 (40-52) years respectively (MW-U: p = 0.014). Therefore, for the following analysis the number of cases was corrected for gender and not for age.

Voice complaints and absence from work due to voice complaints

The results of the questions about the occurrence of voice complaints and absence from work due to voice complaints are summarized in Table 2. Generally, there is an increasing trend from controls with no vocally demanding profession, through controls with a vocally demanding profession into teachers. This trend was found for both voice complaints and voice-related absence.

Table 2A - F. Voice complaints and absence from work due to voice problems. Left column: the different groups (Con = controls without voice load, ConVL = controls with voice load, PE = teachers in Primary Education, SE = teachers in Secondary Education; VC = voice complaints. Second column to the left: percent of voice complaints/voice related absence. Third column to the left: the comparison of ConVL, PE and SE with Con. Fourth column to the left: the comparison of PE and SE with ConVL. The percent of cases is corrected for gender.

A

Group	Percent of subjects with voice complaints at this moment	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	6.5	0.249	
ConVL	10.6	1.71	
PE	17.4	< 0.001 3.03	0.111 1.77
SE	17.8	< 0.001 3.12	0.86 1.82

B

Group	Percent of subjects with voice complaints during the past year	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	16.4	0.0400	
ConVL	27.2	1.91	
PE	31.6	< 0.001 2.36	0.411 1.24
SE	35.8	< 0.001 2.86	0.110 1.49

C

Group	Percent of subjects with voice complaints earlier during the career	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	5.2	< 0.001	
ConVL	32.3	8.66	
PE	47.5	< 0.001	0.006
		16.39	1.90
SE	51.3	< 0.001	< 0.001
		19.23	2.21

D

Group	Percent of subjects with voice complaints anytime during the career	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	19.1	< 0.001	
ConVL	40.2	2.86	
PE	54.8	< 0.001	0.008
		5.15	1.80
SE	59.2	< 0.001	0.001
		6.17	2.16

E

Group	Percent of subjects with voice complaints during training	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	2.4	0.050	
ConVL	7.8	3.40	
PE	16.6	< 0.001	0.033
		8.00	2.36
SE	12.0	< 0.001	0.301
		5.46	1.62

F

Group	Percent of subjects with voice related absence	p (Chi-sq) Odds Ratio (Compared with Con)	p (Chi-sq) Odds Ratio (Compared with ConVL)
Con	1.9	0.002	
ConVL	10.5	6.03	
PE	16.8	< 0.001	0.143
		10.31	1.72
SE	24.3	< 0.001	0.002
		16.39	2.73

Table 3 shows the median frequency, the median duration of the voice problems and the median total absence due to voice problems in the different groups. There was a tendency for higher scores in the teachers compared with the controls for these parameters. The Kruskall-Wallis test indicates that there was a difference between the PE, SE and control groups, i.e. that they did not all belong to one population ($p \leq 0.001$). The difference between the two extreme values, i.e. between the Con and SE group, is significant (MW-U: $p \leq 0.002$).

Table 3. Quantification of voice complaints of the groups (Con = controls without voice load; ConVL = controls with voice load; PE = teachers in "Primary Education"; SE = teachers in "Secondary Education", Mean.inc = Mean times of voice complaints per year in the group; Dur = Mean duration of the periods of complaints (days) in the group; Tot.abs = Total voice related absence (weeks) during the career in the group). IQR = inter quartile range. The percent of cases is corrected for gender.

Group distribution	Median IQR	Mean.inc	Dur	Tot.abs
CON	median	1	0	0
	IQR	0.0-2.0	0.0-3.0	0.0-0.0
ConVL	median	1	2	0
	IQR	0.0-3.0	0.0-4.0	0.0-0.6
PE	median	2	3	0
	IQR	1.0-4.0	2.0-5.0	0.0-1.0
SE	median	2	3	0
	IQR	1.0-3.0	1.0-5.0	0.0-1.0

Voice Handicap Index

The psychosocial consequences of the voice problems were subjectively rated using the VHI (Table 4a). The Kruskal-Wallis test indicates that there was a difference between the PE, SE and control groups, and that they did not belong all to one population ($p < 0.001$). The teachers scored significantly higher than the controls without a vocally demanding profession. The controls with a vocally demanding profession scored not significantly higher than the controls without a vocally demanding profession [$p = 0.015$ (PE) and < 0.001 (SE)]. The VHI was also calculated for the subjects with a history of voice complaints and absence from work due to voice complaints. In the control groups, PE and SE group the VHI of the subjects with a history of voice complaints is significantly higher, compared to those without such a history (Table 4b). Because the numbers of subjects in the control groups were very low for the parameter absence from work

due to voice complaints (Con: n = 3; ConVL: n = 10), the VHI scores of only the PE and SE groups were considered. In the PE and SE group the VHI of the subjects with a history of absence from work due to voice complaints was significantly higher, compared to those without such a history ($p < 0.001$) (Table 4c).

Table 4a. Voice Handicap Index of the groups (Con = controls without voice load, ConVL = controls with voice load, PE = teachers in Primary Education, SE = teachers in Secondary Education). IQR = inter quartile range. The percent of cases is corrected for gender.

Group	Voice Handicap Index		
	Median	IQR	p (M-WU) (Compared with Con)
Con	5.0	2-10	
ConVL	6.5	2-13	0.086
PE	6.0	2-15	0.015
SE	8.0	3-15	< 0.001

Table 4b. Voice Handicap Index of the teachers with and without voice complaints (COMPL- = subjects without voice complaints during career; COMPL+ = subjects with voice complaints during career; PE = teachers in Primary Education, SE = teachers in Secondary Education). IQR = inter quartile range. The percent of cases is corrected for gender.

Group	Voice complaints	Voice Handicap Index		p (M-WU)
		Median	IQR	
CON	COMPL-	5	1-5	
	COMPL+	9	4-16	0.004
ConVL	COMPL-	4	2-8	
	COMPL+	13	6-21	< 0.001
PE	COMPL-	3	0-7	
	COMPL+	11	4-22	< 0.001
SE	COMPL-	4	1-8.5	
	COMPL+	11	5-20	< 0.001

Table 4c. Voice Handicap Index of the teachers with and without absence from work due to voice problems. ABS- = subjects *without* a history of absence due to voice problems; ABS+ = subjects *with* a history of absence from work due to voice problems; PE = teachers in Primary Education, SE = teachers in Secondary Education). The percent of cases is corrected for gender.

Group	Absence from work	Voice Handicap Index		p (M-WU)
		Median	IQR	
PE	ABS-	5	2-13	< 0.001
	ABS+	14	6-27	
SE	ABS-	6	2-13	< 0.001
	ABS+	12	5-23	

Implications for health care

Table 5 shows the results of the questions pertaining to seeking (para)medical help, having been examined and having been treated for a voice problem. For all these parameters the scores show an increase from controls without a vocally demanding profession, controls with a vocally demanding profession, teachers in secondary education to teachers in primary education.

Table 5. The percentage of those who sought examination and treatment. Param = (para)medical help, Exam = previous examination, Treat = earlier treatment; Con = controls without voice load, ConVL = controls with voice load, PE = teachers in Primary Education, SE = teachers in Secondary Education). The percent of cases is corrected for gender.

Group	Param	Exam	Treat
Con	5.7	5.2	3.3
ConVL	12.5	11.5	10.4
PE	23.6	17.6	18.7
SE	20.0	15.7	13.4

Voice related to training and career

The relation of voice complaints during training and the career, the subjective impact of the voice on the teaching career, and the desire for voice training were analyzed (Table 2, 6). From the group of teachers (PE and SE), who experienced voice problems during training, 90% experienced voice problems during their career; from the group of teachers (PE and SE), who experienced no voice problems during training, 49.2% experienced voice problems during their later career (Chi-square: $p < 0.001$, Odds Ratio: 9.32). From the group of teachers (PE

and SE), who experienced voice problems during training, 31.3% have been absent from work due to voice complaints; from the group of teachers (PE and SE), who experienced no voice problems during training, 18.0% have been absent from work due to voice complaints (Chi-square: $p < 0.001$, Odds Ratio: 2.07). Approximately 4 out of 10 teachers reported that teaching has a negative influence on the voice, and 1 out of 5 expected to develop a voice problem due to the profession. The minority of the controls and teachers judged the attention paid to the voice during their training as sufficient. In particular the controls with a voice demanding profession and the teachers had the opinion that a course for efficient voice use would be useful.

Table 6. The percent of the subjective impact of the voice on the teaching career and the need for voice training (Voice pr fut = occurrence of voice problem due to teaching in the future; Teach neg = teaching has a negative influence on the voice; Educ suff = is the attention for the voice sufficient during training; Course = is a course for efficient voice use desirable; Con = controls without voice load, ConVL = controls with voice load, PE = teachers in Primary Education, SE = teachers in Secondary Education). The percent of cases is corrected for gender.

Group	Voice pr fut	Teach neg	Educ suff	Course
Con	0.5	3.4	26.0	20.3
ConVL	10.4	23.5	30.4	44.6
PE	18.3	35.4	40.8	42.2
SE	21.9	44.6	28.6	46.9

DISCUSSION

More than one-third of the questionnaires were returned. This allowed the analysis of the large number of 2,228 cases.

Russell et al.[26] found that female teachers were twice as likely as male teachers to report voice problems. Smith et al.[16] found that female teachers reported voice problems more frequently than male teachers, 38% versus 26%, i.e. a ratio of 1.46. With a female to male ratio in the total group of 1.37 for voice complaints and 1.64 for absence from work due to voice complaints, the observations of the present study are in accordance with the data of Russell et al.[26] and Smith[16]. This supports the contention that voice is a worldwide problem in the teaching profession.

The Dutch Central Bureau for Statistics (CBS) reports that 67.7% of the teachers in the Netherlands in 1999 are between 35 and 54 years.[33] The age ranges of the teacher and control groups in this study are consistent with this range, whereas

the age of the controls with high professional vocal demands is lower. It is generally accepted that voice capacity decreases when age increases.[11] This is, however, not entirely in accordance with the findings of this study. Subjects without voice complaints were slightly older than those with voice complaints. On the other hand, subjects reporting no absence from work due to voice problems were found to be slightly younger than those who did report voice-related absence. In the clinical experience of the authors, teachers suffer frequently from voice problems but only a small number have to leave the profession due to voice problems. Therefore, the reason for the nearly equal occurrence of voice problems in younger and older teachers may rather be that teachers acquire coping strategies for their voice problems.

As in the study by Russell et al.[26] of 1,168 state school teachers (preschool- to Grade 12), questions about voice problems during the teaching career were included in the present study. In the present study, one question regarding voice complaints during training for the teaching profession was additionally included. Russell et al.[26] found 16% of the teachers reporting voice problems on the day of the survey, 20% reporting problems during the current teaching year and 19% reporting problems at some other point during their career. This study shows similar results with respect to voice problems on the day of the survey, but considerably higher figures with respect to voice complaints during the previous school year and earlier during the teaching career (31.6% and 47.5% respectively).

There is a trend which shows that teachers report more frequently voice complaints than controls who are in vocally demanding professions. Controls who are in vocally demanding professions, in turn, reported more frequently voice complaints than controls without a vocally demanding profession. This underlines the opinion that teachers are more at risk for voice problems than other vocally demanding professions.

About one-fifth of the teachers had sought (para)medical help. Compared to the control groups, teachers seek more (para)medical help and are more frequently treated for a voice problem. Morton and Watson[34] found that teachers are reluctant to seek medical help. This may mean that the number of subjects that report examination or treatment will be even higher if the subjects are more willing to seek medical help.

Teachers were found to be absent from work due to voice problems about twice as often compared to controls with a vocally demanding profession. This figure is even tenfold when compared to controls who are in professions with low vocal demands. This highlights a major impact of voice problems within the teaching

profession: teachers are more at risk of having to take time off work because of their voice problem than members of other professional groups. The aforementioned trend regarding the reporting of voice complaints was reflected in the VHI scores, with teachers scoring higher than controls with vocally demanding professions, who in turn score higher than controls with lower professional vocal demands. Within the teacher-groups, the VHI scores of the subjects with voice complaints and subjects with absence due to voice complaints were higher than those of subjects without voice complaints or absence due to voice complaints. Roy et al.[14], De Bodt et al.[32], and Murry and Rosen stated that the VHI is a useful tool to appraise the self-perceived psychosocial consequences of voice disorders.[14,32,35] The results of this study are in accordance with this statement.

A considerable proportion of student teachers suffer from voice problems during their training for the teaching profession: 16.6% (PE) and 12.0% (SE). In their study on the prevalence of voice disorders among student teachers, Simberg et al.[9] found that even 20% reported two or more vocal symptoms during the previous year and 19% had an organic voice disorder. In the present study, teachers who reported voice problems during training experienced significantly more frequently voice complaints and reported significantly more voice-related absence during their further career compared to teachers who did not report voice problems during their training. The question may be how long people remember their symptoms or problems. This time factor probably underestimates the prevalence of voice complaints during training, resulting in a number of false negatives in the teacher group. This rather strengthens the significance of the observed difference. These findings point at voice problems during education as a risk factor for getting voice problems during the career. This underlines the importance of voice screening before the start of the education for the profession and coaching during education in an adequate way. Consequently, this can play a key role in the prevention of voice problems during the career. The minority of the controls and teachers judged the attention paid to the voice during their training as sufficient. In particular the controls with a vocally demanding profession and the teachers had the opinion that a course for efficient voice use would be useful. Together with the high prevalence of voice problems in teachers these findings are in favour of the necessity of care of the voice, not only during education, but also throughout the individual's professional career.

About 4 out of 10 teachers reported that teaching has a negative influence on the voice and 1 out of 5 expected to develop a voice problem due to the profession. Smith et al.[27] reported similar findings. These numbers were more pronounced in

the teachers' group than in the control groups. Also these observations demonstrate a relatively high vulnerability of the voice in the teaching profession.

CONCLUSIONS

In the present study voice problems occur more frequently and to a larger degree in teachers than in controls with and without a vocally demanding profession. This confirms that teaching is a high-risk profession for voice problems. Female teachers reported more frequently voice complaints and absence from work due to voice problems than their male colleagues. In this study, an obvious effect of age could not be detected. Remarkably, about 1 out of 7 teachers has experienced voice problems during the training and reported more frequently voice complaints and absence from work due to voice problems compared to the colleagues without voice problems during their training. These findings point at voice problems during education as a risk factor for getting voice problems during the career. The results of the VHI scores, reflecting the self-perceived psychosocial consequences of voice disorders, followed these trends. Voice screening at the beginning of the training for a vocally demanding profession and vocal care, not only during the training but also during the career, may play a key role in diminishing occupational voice disorders. The results of this study are in accordance with other studies and support the contention that voice is a worldwide problem in the teaching profession. International initiatives for consent and standardization of occupational voice disorders would promote the recognition of voice problems as an occupational disease in countries where this is not the case (like in the Netherlands) and establishment or improvement of occupational safety and health arrangements, as supported by Vilkman.[36]

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Chapter 3

A Comparative Study of the Epidemiology of Voice Complaints of Female StudentS Teachers and Practicing Teachers early in their Career

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ABSTRACT

A cross-sectional questionnaire survey was performed to compare female student teachers (454 subjects; 1st to 4th year of training) and practicing teachers (82 female teachers; 1st to 4th year of teaching career) of primary education early in their career, with regard to risk factors perceived to be a negative influence on the voice, and the relative risk of the given risk factors for voice complaints. This enables the observation whether there is a sudden increase or difference in the perceived risk factors after starting the professional teaching career. Additionally, history of voice problems during training was enquired among teachers. Teachers with voice complaints compared to teachers without voice complaints reported a history of voice complaints during their training ($p = 0.013$). Teachers compared to student teachers reported more voice complaints at the moment and / or during the past year ($p = 0.002$). The following data was obtained from student teachers and teachers reporting voice complaints. Only around a third of the subjects of both groups sought voice care ($p = 0.286$-0.893). Risk factors were estimated in relation to voice complaints. Student teachers reported less frequently than teachers that stress ($p = 0.014$), work pressure ($p = 0.003$), and the composition of the class ($p = 0.013$) have a negative influence on their voice. Student teachers reported less frequently than teachers that the number of people they communicate with ($p < 0.001$), and the deterioration of their general physical condition ($p = 0.010$) have a negative influence on their voice. Student teachers reported more frequently than teachers that environmental irritants ($p < 0.001$) and humidity ($p = 0.020$) of the classroom have a negative influence on their voice. Student teachers more than teachers were of the opinion that the attention paid to the voice during their training was sufficient ($p < 0.001$). To test whether professional status (student teacher versus teacher) is an effect modifier for the risk factors, Odds Ratios were compared between the group of teachers and student teachers (total group with and without voice complaints) to search for interactions between the risk factors and professional status. There is a significant difference in the pattern of risk factors for student teachers and teachers ($p = 0.010$). There is an indication that vocal loading factors and environmental factors are more influential in student teachers and a trend of psycho-emotional factors being more influential for teachers early in their career.

INTRODUCTION

The term “professional voice user” has been defined as applying to those who depend on a consistent, special or appealing voice quality as a primary tool of trade, and those who are afflicted with dysphonia or aphonia would generally be discouraged in their jobs and seek alternative employment.[1] There are occupational risks for voice problems[2] and teachers are thought to be at a higher risk of voice problems than the general population.[3,4] Since the voice is such an essential part of the educational process, those in the teaching profession are described as professional voice users, and various studies have reported that voice problems are common among teachers.[4-12] An association between type of employment and development of voice disorders has been demonstrated and teachers are considered among those at greatest risk for vocal disability.[5]

It has been generally assumed that voice problems in teachers start after several years of work.[13] However, in certain studies the frequency of voice disorders has shown little correlation with the length of teaching experience.[9,14,15] Vocal dysfunction may lead to extensive periods of sick leave and vocal rehabilitation through speech pathology management, surgical intervention or both which involves great financial costs.[16] Additionally, a voice disorder may occasionally lead to the end of a professional teaching career.[7,16] Voice complaints apart from being a problem for teachers can also reduce their professional effectiveness.[9,17] In a study investigating the effect of the teachers voice quality on the pupils ability to process spoken language it was observed that children performed better when recalling the words presented by a female teacher with a normal voice, as opposed to a female teacher with a dysphonic voice.[17] Voice problems are therefore not only detrimental to the teacher concerned but also to their pupils and employers.

The purpose of the present study is to compare female student teachers and practicing teachers of primary education early in their career, with regard to risk factors perceived to be a negative influence on the voice, and the relative risk of the given risk factors for voice complaints. This enables the observation whether there is a sudden increase or difference in the perceived risk factors after starting the professional teaching career. This will provide data for planning for voice care and for the prevention of voice problems in student teachers and teachers. This may prevent and reduce voice problems in teachers during their professional teaching careers.

METHODS

The pertinent study is part of a larger cross sectional epidemiological study among teachers and student teachers. Questionnaires were distributed among teachers of primary and secondary education in the schools and to student teachers at teacher training institutes. The present study pertains to female student teachers for primary education and female teachers for primary education early in their professional teaching careers. The survey was conducted in the year 2003. The study population consisted of 454 female teachers in training for primary education (1st to 4th year of training; age range 16- 48 years, mean age 20 years) and 82 teachers in primary education (1st to 4th year of teaching career; age range 21- 49 years, mean age 29 years).

A questionnaire was used as a survey tool and the questionnaire was designed with information from literature,[2,16] suggestions of teachers and the clinical experience of the voice team of the department of ORL, Radboud University Medical Centre. A self-report system was used to collect data. The questionnaire was designed in such a way, that various aspects of voice and voice problems were included. It addresses voice complaints in relation to vocal load, physical, environmental and psycho-emotional risk factors. A covering letter was attached to the questionnaire, explaining the aims and objectives of the study. The questionnaires were accompanied by instructions on how to fill out the questionnaire (Appendix A1). The questionnaire consists of 37 questions (Appendix D). The questions that pertain specifically to the teaching profession were modified for the teachers (Appendix F). The various questions were categorized into four groups. With regard to vocal loading risk factors (hours of vocal use per week in the context of study / work, number of people the subjects communicate with), physical risk factors (neck or shoulder complaints, lower back complaints, deterioration of the general physical condition, mucosal problems, decrease of hearing), psycho-emotional risk factors (stress, emotions, work pressure, composition of the group) and environmental risk factors (acoustics, humidity, irritants and temperature changes). These factors are considered as risk factors for voice complaints and absence from work due to voice problems.

The directors of schools and teacher training centres were approached. The aim of the study was explained and the directors were asked to distribute the questionnaires. The questionnaires were then anonymously collected and returned.

The responses to the questions were dichotomised. One question pertaining to vocal load (question A 5) addresses the number of hours of vocal use per week in

the context of study / profession. The results were dichotomised into less than 20 hours of voice use per week and 20 or more hours of voice use per week in the context of study or work. Questions B 6-7 addresses voice complaints at the present moment (point prevalence) and voice complaints during the past year (period prevalence). The term “voice complaints” is used in reference to voice complaints at the moment and / or during the past year. Question B 9 for teachers (Appendix F) addresses whether a teacher had a history of voice complaints during training. Questions C 12-15 address the impact of voice problems. Question C15 [Been unable to perform activities?] refers to disability in relation to a voice problem.

Questions D 17-25 address opinions of the subjects with regard to vocal load, psycho-emotional risk factors, opinions regarding teaching and voice training. The results were dichotomised as well. The response 0 was classified as negative (score=0) and the response 1 as positive (score=1).

Questions E 26-37 address the physical, psycho-emotional and environmental risk factors and the results were dichotomised as well. The response 0 and 1 were classified as negative (score 0) and the responses 2, 3 and 4 as positive (score 1). The questionnaire refers to whether the risk factors have a negative influence on the voice. Whether voice complaints are present or not depends on the response to question B 6 [Have you experienced voice complaints at this moment?] and / or question B 7 [Have you experienced voice complaints during the past year?]. The risk factors are described and examined in association to “voice complaints” [positive response to question B 6 and / or question B 7].

Statistical analysis: The data was analysed using the statistical program SPSS 11.0. For discrete outcome variables the Pearson Chi-Square test was used. The significance level was set at $p \leq 0.05$ and Odds Ratios were used to quantify the dependency in 2 x 2 tables. The Odds Ratios are expressed with a 95% Confidence Interval. One-Sample 2-tailed Kolmogorov-Smirnov test was applied in order to determine if continuous outcome variables were distributed normally. For continuous outcome variables that were not normally distributed, the Mann-Whitney U test was used.

To test whether professional status (student teacher versus early career teacher) is an effect modifier for the risk factors, Odds Ratios were compared to search for interactions between the risk factors and professional status. The two-sided Fisher exact test was used to rate the significance (the significance level was set at $p \leq 0.05$). Since the Breslow-Day test or Tarone’s test have low power especially when the risk factors are rare, the results were combined over all risk factors. The Odds Ratios for voice complaints were rated for the student teachers and teachers

in relation to the risk factors (subjects with voice complaints versus subjects without voice complaints). Ratio of Odds ratios reveals the difference between the groups. When one Odds Ratio is 30% higher than the other Odds Ratio, the Odds Ratios are rated as different and the group in which the Odds Ratio is higher is given a score of 1. When the difference is smaller an equal score was given to both groups. In this manner it was possible to assess whether the risk factors for voice complaints were more profound for either the student teachers or the early career teachers. This method also opened the opportunity to compare the pattern of effect modification for all risk factors (vocal load, physical, psycho-emotional, and environmental).

RESULTS

For this study only female student teachers and female teachers of primary education in the first four years of their professional career were included, as voice complaints are known to be more common in females.[3,4,18] The questionnaires were distributed to teachers of primary education, secondary education, of both sexes and of different years of teaching experience. Post hoc it was not possible to determine the return rate of teachers based on gender, whether they were teachers early in their career or whether they were in primary education or secondary education. Among the teachers 35% questionnaires of the total group of teachers were returned. Among the students teachers 72% questionnaires of the total group of student teachers was returned. Response bias regards more the prevalence, and with regard to the difference in the response rate, the question is whether these groups are representative. The difference in the response rate does not essentially affect the results of this study as the prevalence of voice complaints in student teachers and teachers in the present study is in accordance with other studies and is representative.[3-6,8,9,13] Odds Ratios quantified the dependency in 2 x 2 tables, and the Odds Ratios were assessed within the groups of student teachers and teachers (with and without voice complaints) and then compared to search for interactions between the risk factors and professional status.

It was observed that teachers with voice complaints (41.3%) more than teachers without voice complaints (15.2%) reported a history of voice complaints during their training ($p = 0.013$). The Odds Ratio was 3.94.

Table 1 summarises the prevalence of voice complaints in the student teachers and teachers. Significantly more teachers reported voice complaints than the

student teachers. The various risk factor parameters (vocal load, physical factors, psycho-emotional factors and environmental factors) were analysed in the individuals who reported voice complaints at the moment and / or during the past year.

Table 1. The prevalence of voice complaints (positive response to question B6 and / or B7), point prevalence of voice complaints (positive response to question B6), and period prevalence of voice complaints (positive response to question B7) have been analyzed. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper.

Voice complaints	Groups	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(B6 and/or B7) Voice complaints	Student teachers	39.7	0.002	0.46	0.28	0.75
	Teachers	58.8				
(B6) Point prevalence (at this moment)	Student teachers	17.3	< 0.001	0.36	0.21	0.60
	Teachers	36.6				
(B7) Period prevalence (during the past year)	Student teachers	36.9	0.005	0.50	0.31	0.81
	Teachers	53.8				

Table 2. The association between vocal loading risk factors and voice complaints was analyzed. Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper. Vocal loading risk factors (A5: the number of hours of voice use per week in context of study / profession in the current year, D19: does the number of people you communicate with have a negative influence on your voice?) Voice complaints (positive response to question B6 and / or B7)

Voice load	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(A5) Vocal use of 20 hrs or more per week in the context of study / work	Student teachers	71.1	0.384	0.67	0.28	1.63
	Teachers	78.4				
(D19) The number of people you communicate with has a negative influence on the voice?	Student teachers	18.6	< 0.001	0.27	0.13	0.58
	Teachers	45.2				

The voice loading parameters in students and teachers who reported voice complaints are summarized in Table 2. Student teachers with voice complaints

less than teachers with voice complaints were of the opinion that the number of people they communicate with has a negative influence on their voice. The difference was found to be significant.

The parameters regarding the physical condition in students and teachers who reported voice complaints are summarized in Table 3. Student teachers with voice complaints less than teachers with voice complaints felt that the deterioration of their general physical condition has a negative influence on their voice. The difference was found to be significant.

The parameters regarding environmental conditions for students and teachers who reported voice complaints are summarized in Table 4. Student teachers with voice complaints more than teachers with voice complaints, felt that humidity and environmental irritants in the classroom have a negative influence on their voice. The difference was significant.

Table 3. The association between physical risk factors and voice complaints was analyzed. Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper. Physical risk factors (E26: decrease of hearing, E27: problems with neck or shoulders, E28: problems with lower back, E29: problems with mucosa). Voice complaints (positive response to question B6 and / or B7)

Physical risk factors	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(E26) Decrease in hearing	Student teachers	32.3	0.957	1.01	0.50	2.04
	Teachers	31.9				
(E27) Neck or shoulders complaints	Student teachers	5.0	0.435	0.57	0.14	2.34
	Teachers	8.3				
(E28) Lower back complaints	Student teachers	9.5	0.833	1.13	0.35	3.56
	Teachers	8.5				
(E29) Mucosal complaints	Student teachers	62.3	0.261	1.45	0.75	2.79
	Teachers	53.2				
(E30) Deterioration of general physical condition	Student teachers	36.5	0.010	0.42	0.22	0.82
	Teachers	57.4				

Table 4. The association between environmental risk factors and voice complaints was analyzed. Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper. Environmental risk factors (E34: bad room acoustics, E35: room humidity, E36: changes in room temperature, E 37: environmental irritants)
Voice complaints (positive response to question B6 and / or B7)

Environmental risk factors	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(E34) Acoustics	Student teachers	48.8	0.312	1.40	0.72	2.71
	Teachers	40.4				
(E35) Humidity	Student teachers	65.5	0.020	2.15	1.11	4.15
	Teachers	46.8				
(E36) Temperature	Student teachers	40.1	0.063	0.54	0.28	1.04
	Teachers	55.3				
(E37) Irritants	Student teachers	64.5	< 0.001	4.75	2.33	9.68
	Teachers	27.7				

Table 5. The association between psycho-emotional risk factors and voice complaints was analysed. Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper. Psycho-emotional risk factors (E31: stress, E32: emotions, D21: composition of the group, D24: work pressure)
Voice complaints (positive response to question B6 and / or B7)

Psycho-emotional risk factors	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(E31) Stress	Student teachers	36.5	0.014	0.44	0.22	0.85
	Teachers	56.5				
(E32) Emotion	Student teachers	65.9	0.992	0.99	0.50	1.97
	Teachers	66.0				
(D21) Group Composition	Student teachers	47.3	0.013	0.40	0.19	0.83
	Teachers	69.0				
(D24) Work pressure	Student teachers	44.7	0.003	0.31	0.14	0.69
	Teachers	71.8				

The parameters regarding psycho-emotional factors in students and teachers who reported voice complaints are summarized in Table 5. The student teachers with

voice complaints less than teachers with voice complaints felt that work pressure, stress and the composition of the group they communicate with have a negative influence on their voice. The difference was observed to be significant. The impact of voice complaints, search for paramedical help, clinical examination, treatment and voice related disability (limitation of activity) are summarised in table 6.

Table 6. The impact of voice problems: paramedical help (C12), clinical examination (C13), treatment (C14) and disability (C15). Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper

Impact of voice problems	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(C12) Paramedical help	Student teachers	34.1	0.286	0.69	0.36	1.35
	Teachers	42.6				
(C13) Examined for a voice problem	Student teachers	35.9	0.893	0.95	0.48	1.87
	Teachers	37.0				
(C14) Treatment	Student teachers	32.7	0.418	0.75	0.38	1.48
	Teachers	39.1				
(C15) Disability	Student teachers	16.6	0.085	2.84	0.82	9.82
	Teachers	6.5				

Table 7 summarizes the opinion of the student teachers and teachers about voice training and the influence the teaching profession has on their voice. Student teachers with voice complaints (46.4%) less than teachers with voice complaints (73.2%), were of the opinion that teaching will have a negative influence on their voice. The difference was significant.

Student teachers (31.1%) less than teachers with voice complaints (51.7%) were of the opinion that they will develop a voice problem due to teaching. The difference was significant.

Odds Ratios of risk factors for voice complaints in teachers and student teachers (Table 8). The student teacher group scored for the following variables: temperature, humidity, acoustics, mucosal problems, voice use for 20 hours or more in the context of study and the number of people communicated with. The teachers scored for the following variables: work pressure, stress, emotions, and environmental irritants.

Table 7. Opinions: (D17) Opinion whether you will develop a voice problem due to your profession. Opinion whether your profession will have a negative influence on the condition of your voice? (D18). Pearson Chi Square (p-value) indicates the difference between the groups and Odds Ratios indicate the relative risks. 95% Confidence Interval of Odds Ratio expressed as C.I lower and C.I upper.

Opinions: Influence of teaching	Groups with voice complaints	% Yes	Chi-Square p-value	Odds Ratio	C.I lower	C.I upper
(D17) You will develop a voice problem due to teaching?	Student teachers	31.1	0.037	0.42	0.18	0.96
	Teachers	51.7				
(D18) Teaching will have a negative influence on your voice?	Student teachers	46.4	0.003	0.31	0.14	0.68
	Teachers	73.2				
Opinions: Voice training						
(D22) Attention paid to your voice during training has been sufficient?	Student teachers	74.6	< 0.001	5.88	2.84	12.19
	Teachers	33.3				
(D23) Refresher course for efficient voice use is advisable?	Student teachers	60.1	0.126	0.55	0.25	1.18
	Teachers	73.2				

It is interesting to note that regarding environmental irritants, among the subjects with voice complaints, the student teachers more than the teachers, were of the opinion that environmental irritants had a negative influence on their voice ($p < 0.001$). However, on comparing the Odds Ratios in all the subjects with and without voice complaints (total groups) the teachers (Odds Ratio 3.82) scored over the student teachers (Odds Ratio 1.90). This finding was observed because apart from the student teachers with voice complaints, around 50% of student teachers without voice complaints were also of the opinion that environmental irritants had a negative influence on their voice. Therefore when observing the total groups (with and without voice complaints) the Odds Ratio was less for the student teachers than the teachers.

Table 8. Odds Ratios of risk factors for voice complaints in teachers and student teachers. Ratio of Odds ratios reveals the difference of the groups. When one Odds Ratio is 30% higher than the other Odds Ratio, the Odds Ratios are rated as different and the group in which the Odds Ratio is higher is given a score of 1. When the difference is smaller an equal score was given to both groups. The abbreviation O.R (C.I) is used to express Odds Ratio (95% Confidence Interval)

Risk factors	Teachers O.R (C.I) for voice complaints	Students O.R (C.I) for voice complaints	Ratio of Odds Ratios	Teacher score	Equal score	Student score
Voice use for 20 hours or more per week	1.26 (0.39-4.06)	2.10 (1.27-3.46)	1.65	0	0	1
Number of pupils	1.57 (0.59-4.17)	2.93 (1.53-5.63)	1.87	0	0	1
Group composition	1.63 (0.59-4.52)	1.61 (1.05-2.46)	1.01	0	1	0
Work pressure	3.52 (1.30-9.55)	1.94 (1.22-3.08)	1.81	1	0	0
Stress	3.46 (1.32-9.07)	2.52 (1.62-3.92)	1.37	1	0	0
Emotions	2.32 (0.93-5.79)	1.18 (0.78-1.77)	1.96	1	0	0
Neck, shoulder	0.52 (0.41-0.66)	0.52 (0.34-0.80)	1.00	0	1	0
Lower back	1.44 (0.24-8.37)	1.84 (0.87-3.88)	1.27	0	1	0
Mucosa	1.46 (0.59-3.60)	2.11 (1.41-3.14)	1.44	0	0	1
General physical condition	3.10 (1.21-7.95)	3.05 (1.93-4.82)	1.01	0	1	0
Decrease in Hearing	1.19 (0.44-3.20)	1.47 (0.95-2.26)	1.22	0	1	0
Acoustics	2.12 (0.79-5.68)	2.96 (1.95-4.50)	1.39	0	0	1
Humidity	1.35 (0.54-3.34)	3.21 (2.14-4.82)	2.37	0	0	1
Temperature	1.59 (0.64-3.93)	2.64 (1.71-4.07)	1.65	0	0	1
Irritants	3.82 (0.99-14.71)	1.90 (1.27-2.83)	2.00	1	0	0

Total scores of the groups of risk factors for voice complaints in teachers and student teachers and equal scores (Table 9). Four risk factors appear to be more profound for the early career teachers and six appear to be more profound for the student teachers. There is no proof for an overall difference in profoundness of risk factors. However, there is a significant difference in the pattern of risk factors for student teachers and teachers ($p = 0.010$). The findings suggest that there is an

indication that vocal loading factors and environmental factors seem to be more influential in student teachers, and it suggests a trend of increased influence of psycho-emotional factors in teachers early in their career.

Table 9. Total scores of the groups of risk factors for voice complaints in teachers and student teachers and equal scores. There is a significant difference in the pattern of predictive risk factors for student teachers and teachers (Fisher exact test, p = 0.010, two sided). The results in the table show there is an indication that vocal loading factors and environmental factors seem to be more influential in student teachers and it suggests a trend of more psycho-emotional factors in teachers early in their career.

Risk factors	Teachers	Equal	Student Teachers	Total
Vocal loading factors	0	0	2	2
Psycho-emotional factors	3	1	0	4
Physical risk factors	0	4	1	5
Environmental risk factors	1	0	3	4
Total score	4	5	6	15

(Fishers exact 2-sided test p = 0.010)

DISCUSSION

Only female student teachers and female teachers were assessed for this study. Studies have revealed that occupational voice disorders are more common among women, and women are known to be more susceptible to voice disorders than men.[3,4,18]

In the Netherlands, the curriculum of the education for student teachers in primary education is four years. During their education the student teachers have training for 5 days a week. They have supervised practical teaching sessions in batches, starting from the first year. Question A5 in the questionnaire is in order to ascertain how many hours of vocal use they have per week in the course of their study. The response may be purely subjective, however, self-report in questionnaires is a useful method to estimate the extent to which teachers suffer from vocal dysfunction.[3,6,9,14]

For teachers in primary education “early in their career” was defined to the first four years of teaching which mirrors the training period of student teachers. In this study it was investigated whether there is an increase in voice problems among

teachers and whether there is a change of factors that influence the voice when student teachers begin their career. Questionnaires were used to assess the individual's perception of voice problems and risk factors and this contributes to the understanding of the risk of voice problems and the consequences of voice problems in these groups.
Because of the relative shortage of teachers in the Netherlands "late" students are often recruited for teacher training. This explains the relative older age of a few of the student teachers and early-career teachers. However, the mean age of the student teachers was 20 years and of the teachers 29 years. Studies among teachers reported no association between the age of the teacher, years in the profession and voice problems.[3,9] It may be assumed that voice capacity is similar in this range of age.

The present study revealed that more teachers with voice complaints (41.3%) compared to teachers without voice complaints (15.2%) reported a history of voice complaints during their training ($p = 0.013$). The difference was significant. This was reflected in the Odds Ratio (Odds Ratio=3.94). Timmermans et al.[19] reported that future professional voice users often had vocal problems and they did not take sufficient precaution for the care of their voice. Furthermore, it was suggested that vocal training and a course on vocal hygiene were worthwhile to prevent future occupational voice problems.[19] The teaching profession is known to have high vocal demands requiring a high vocal endurance.[2,8,13] Therefore, student teachers need to be prepared during the training period and supported when they start their teaching career. Estimating voice complaints and associated risk factors in student teachers and teachers early in their career provides data to plan a preventive approach to voice problems in teachers. This may prevent future voice problems during the teaching career.

The results of the study revealed that more teachers (58.8%) than student teachers (39.7%) reported voice complaints at the moment and / or during the past year ($p = 0.002$). This was reflected in the point prevalence, and the period prevalence (during the past one year) of voice complaints. Studies have reported the prevalence of voice problems in teachers[3,4,6,13] and it has been reported that one-year prevalence is a more reliable measure than the two-year prevalence.[6] The prevalence value may give an estimate of the extent of the problem in the population concerned.[3,16] The results of the pertinent study show that voice disorders are a frequent problem among teachers and student teachers. Apparently with the onset of the professional teaching career there is an increase

in voice complaints, which is a major risk to their careers. In a study among prospective teachers and practicing teachers it was reported that practicing teachers perceived their voice to be significantly worse, and that they faced significantly more difficulties in daily communication than the prospective teachers.[20] The increase in voice problems in teachers early in their career is probably due to the fact that when teachers start their careers they are exposed more or to other risk factors. This points to the need to assess the various risk factors of voice problems in teachers and student teachers, as the teaching voice is known to be at risk for voice problems.[2,3,5,8,21]

Vocal loading is a known risk factor for developing voice problems[6,22,23] and it has been observed that the tendency to raise the voice level and to use a strained voice is more common for females.[22,24] Additionally, it has been reported that teachers place heavy demands on their voice by speaking loudly over background classroom noise for long periods.[10,14,25,26] In the present study around three quarters of both student teachers and teachers with voice complaints reported voice use for 20 hours or more per week in the context of their study or work. Though there was no difference between the groups the figures are remarkable. The type of voice use in student teachers and in teachers may not be similar. Nevertheless, these figures suggest that both student teachers and teachers have intensive voice use and they probably do not have sufficient voice rest or vocal hygiene. Studies have revealed that attention paid to voice training is insufficient during the education of teachers.[13,16] In the present study more student teachers with voice complaints (74.6%) compared to teachers with voice complaints (33.3%) were of the opinion that the attention paid to their voice during training was sufficient. The difference was significant. The finding may indicate that student teachers are not fully aware of the vocal demands of teaching, while teachers in the face of voice problems probably are more aware of the need for voice training. Various studies have suggested an impetus on vocal hygiene during voice training.[5,15,19] The principles of vocal hygiene and voice preservation should be given priority during the training of teachers and may prevent future voice problems among teachers. Refresher courses on effective voice use and vocal hygiene may be also worthwhile for teachers after starting their professional careers.

More teachers with voice complaints compared with student teachers with voice complaints opined that the number of people they communicated with had a negative influence on their voice. The difference was seen to be significant ($p <$

0.001). Morton and Watson,[21] in a study comparing the cause of voice problems in teachers and non-teachers found that the size of the audience, prolonged voice use and a raised voice level were significant risk factors for voice problems. Apart from reducing the load, smaller groups of pupils may also aid the professional output of teachers.[26] At present there are guidelines, but no official limits to the number of children per class in the Netherlands. The optimal number of pupils per class needs to be evaluated to prevent voice strain and to aid in teaching.

Non-organic or often termed “functional” dysphonia has been frequently found to be due to muscle misuse and is associated with increased tension around the larynx.[27,28,29] Stress has been reported to contribute to somatic problems and is associated with increased muscle tension.[12,29] Furthermore, stress is known to be a major cause of voice problems and articulation disorders.[8,12,29] Gotaas and Starr reported that apart from vocal load, psycho-emotional factors played a role in the development of vocal fatigue.[8] The composition of the group of pupils is known to have an effect on the voice load of the teacher.[26] Additionally the composition of the class may also contribute to the stress and work pressure of the teacher. In the pertinent study teachers with voice complaints more than student teachers with voice complaints were of the opinion that stress ($p = 0.014$), group composition ($p = 0.013$) and work pressure ($p = 0.003$) have a negative influence on their voice. The difference was seen to be significant. In The Netherlands the opportunities for special education are decreasing for economic reasons. Therefore, pupils that often need specific attention are sent to mainstream primary schools. Moreover, the group of pupils have increasingly a multicultural composition. Though student teachers are undergoing voice training they may not be prepared for the work pressure they will be exposed to when they start professional teaching.

More teachers with voice complaints than student teachers with voice complaints were of the opinion that teaching will have a negative influence on their voice ($p = 0.003$), and that they will develop a voice problem in the future due to teaching ($p = 0.037$). This opinion is probably because teachers who have started their professional teaching career are more aware than student teachers of the potential risks teaching has on their voice. This may also reveal a possible anxiety regarding teaching and the teachers are therefore more likely to be tensed when facing a group of students. The findings suggest that teachers require attention and support when they start their careers. It may be worthwhile to impart stress management techniques and coping strategies as a preventive measure and this may help to prevent persistence of voice problems in teachers.[29] Additionally

student teachers should be educated about the potential risks of teaching on their voice and the possible preventive measures.

Various studies have revealed that environmental irritants like dust, smoke, dry air, and temperature changes irritate the mucosa and negatively influence the quality of the voice.[19,21,22,30] In the classroom book dust and chalk dust may be responsible for producing a hypersensitive reaction.[21] By substituting chalk and blackboards with white boards and markers the dust load in classrooms may be reduced. In the pertinent study the student teachers with voice complaints more than teachers with voice complaints, opined that environmental irritants ($p < 0.001$) and humidity ($p = 0.020$) of the classroom have a negative influence on their voice. However, on comparing the Odds Ratios in all the subjects with and without voice complaints (total groups), the teachers (Odds Ratio 3.82) scored over the student teachers (Odds Ratio 1.90) with regard to environmental irritant risk factors. This finding was observed because apart from the student teachers with voice complaints, around 50% of student teachers without voice complaints were also of the opinion that environmental irritants had a negative influence on their voice. Therefore when observing the total groups (with and without voice complaints) the Odds Ratio was less for the student teachers than the teachers. These findings support the need to monitor and control the classroom environment, which is shared by both the teacher and the pupils.

In the present study not even half of student teachers and teachers with voice complaints, underwent clinical examination, paramedical intervention, and treatment for their voice problems. These figures suggest that the majority of teachers and student teachers do not readily seek voice care despite reporting voice complaints. This is in accordance with observations made in previous studies among teachers and other professional voice users.[3,4,9] The apparent reluctance to seek help may be interpreted as an unawareness of voice care available or due to the view that voice problems are an occupational hazard.[3] Further research for reasons for this low level of help seeking behaviour in teachers has been suggested.[4] It is important to motivate student teachers and teachers to report voice problems early and to seek voice care.

In accordance with other studies,[9,22,23,29] this study suggests that voice complaints have a multi-factorial genesis. It is interesting to note that among subjects with voice complaints, more teachers than student teachers felt that the deterioration of their general physical condition has a negative influence on their voice ($p = 0.010$).

Probably psycho-emotional, environmental and other physical factors may also have a negative influence on the general physical condition of the subject.

The increase in voice problems in teachers early in their career apparently seems to be due to a varied influence of the risk factors, which differ from those of the student teachers. The findings suggest that apart from vocal load and environmental risk factors, psycho-emotional risk factors are common and are a major risk factor as student teachers start their professional teaching careers.

CONCLUSIONS

Voice complaints were more prevalent in teachers than in student teachers. Voice complaints in teachers apparently have a history during the training period. Voice complaints appear to have a multi-factorial genesis. A significant difference in the pattern of risk factors for voice complaints was observed for student teachers and teachers. There is an indication that vocal loading factors and environmental factors are more influential in student teachers with voice complaints, and a trend of more psycho-emotional factors in teachers with voice complaints early in their career. Student teachers need to be educated about the risk factors for voice complaints and the potential risk of teaching on their voice. Impetus should be given to vocal hygiene, coping strategies for psycho-emotional problems during voice training, and postural training to meet the physical demands of teaching. Additionally, periodic refresher workshops on vocal care and efficient voice use during the teaching career may reduce voice complaints in teachers. The classroom environment needs to be monitored. As only a minority of student teachers and teachers with voice complaints sought voice care, they should be motivated and encouraged to report voice complaints early and to seek voice care.

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Chapter 4

Psychosocial Impact of Voice Problems throughout the Teaching Career

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ABSTRACT

It is generally accepted that vocal performance decreases with age. This can be expected more pronounced in voice loading professions, which may lead to occupational dysphonia. The aim of this study was to investigate the course of voice complaints, experienced handicap and absenteeism of work due to the voice problems throughout the teaching years. Questionnaires were distributed among teachers of primary and secondary education and 1875 were analyzed. The questionnaire was designed in such a way that personal aspects and questions about periods with symptoms and absence from work were included. The Voice Handicap Index (VHI) according to Jacobson et al. was sent along with the questionnaire.

In contradiction to the expectation a significant decrease of voice complaints during the career of the teachers was observed. The expectation that the percentage of teachers with a history of voice problems should experience more psychosocial impact, measured with the VHI, along their professional career could not be confirmed by this study.

These results indicate that serious attention has to be paid to teachers with voice complaints. The fact that teachers in the beginning of their career complain more than in the end of their career emphasize the importance of adequate aimed prevention programs for future teachers and accompanying for starting teachers with regard to their voice.

INTRODUCTION

It is generally accepted that the voice capacity decreases with age[1,2,3]. Baker and Hodge demonstrated that the intensity of the voice decreases in elderly speakers as a result of alterations in airway pressure, peak airflow and open quotient of the vocal fold vibratory cycle[4,5]. Many changes in the voice at old age can be ascribed to degeneration of connective tissue in the larynx as well as to polypoid degeneration of the vocal folds[2]. Linville and Rens found a significant lowering of the first three peaks in long-term average spectra across the adult lifespan in women and a similar tendency in males[2]. This phenomenon has been ascribed to the lengthening of the vocal tract, caused by a relatively lower position of the larynx at old age. In general, the voice becomes weaker and higher pitched in males and more husky and lower in females with increasing age[6]. To the knowledge of the authors, only Pahn and Pahn have reported on the course of

voice complaints during the career of teachers[7]. They described three peaks of prevalence of voice problems in teachers: after 2, 10 and 20 years of teaching. It may be expected that an increase of teaching years be related to age. Hence, an increase of teaching years is supposed to result in a greater development of voice problems.
The aim of this cross-sectional study was to investigate the course of prevalence of voice complaints and the psychosocial impact of the voice along the teaching career.

SUBJECTS AND METHODS

This investigation is part of a larger study that addresses voice problems in teachers.

Description of sample

Questionnaires (Appendix I) were distributed among teachers of primary and secondary education (n = 6000). The author approached directors of schools of primary and secondary education by the telephone. The aim of the study was explained and the directors were asked to distribute these questionnaires among the teachers. The questionnaires were accompanied by a description of the background and aim of the study, and instructions for the filling out of the form (Appendix I). They were anonymously and individually returned in a post-paid envelope. The questionnaire consisted of 35 questions. The questionnaire was designed in such a way that questions regarding personal aspects, as well as the prevalence of voice complaints and voice-related absenteeism were included (Appendix II).
In the design of the questionnaire, data from the literature[8;9] and clinical experiences were taken into consideration. Additionally, comments from workers in the teaching profession were used.

Description of questionnaires

The questions are composed in a simple and straightforward style. There is no restriction with respect to the nature of the complaints.
Questions 6-8 address voice complaints in different periods of the professional career. If one or more of questions 6-8 was answered positively, the subject was classified in the group ‘having complaints during the professional career’.

The Dutch version of the Voice Handicap Index (VHI) according to Jacobson et al.[10] was sent along with the questionnaire. The VHI is designed for rating the subjective psychosocial consequences caused by voice problems[10,11]. It consists of a set of 30 questions. The questions apply to emotional (10), physical (10) and functional (10) aspects. The questions are rated according to a five point scale: never (0), almost never (1), sometimes (2), almost always (3) and always (4). The total score is between 0 and 120.

Career periods

The teachers were classified into eight subsequent periods of teaching: period 1: 0-4 years; period 2: 5-9 years; and so on. The median score of the VHI in each period was calculated in order to assess if there was an increase of the VHI during the teaching career. The same procedure was used for the subdivision E (emotional), F (functional), and P (physical) of the VHI. While there was no significant difference between the periods with regard to the scores on the VHI a calculation was made of the 75 percentile of the VHI to investigate if higher scores should occur in longer periods along the teaching career.

Statistical analysis

The data was analysed using the statistical program SPSS 12.0. One-Sample, 2-tailed Kolmogorov-Smirnov tests (K-S) were applied in order to determine if continuous outcome variables were normally distributed. For continuous outcome variables that were not normally distributed, Mann-Whitney U (MW-U) tests and Kruskall-Wallis (K-W) tests were used. For discrete outcome variables Chi-square tests were used. The significance level was set at $p < .05$.

RESULTS

About one third (1,775) of the questionnaires was returned and had been correctly filled out. The numbers of the teachers (males and females), the mean age of the teachers and the age of the teachers with complaints at the moment of investigation and last year, are shown in Table 1.

The teaching period breakdown in 5 years is shown in Figure 1.

Of the total teacher group 58.6 % reported voice complaints during the professional career; 17.5 % voice complaints at the moment and 34.4 % voice complaints during the last year. The prevalence of voice complaints in the various

teaching periods is shown in figure 2. The graph shows a decreasing tendency of voice complaints with increasing teaching years (Pearson Chi-square: $p \leq .001$).

Table 1. number, mean age and the range of the age of total group teachers and of the males and females; and of the total group teachers and of the males and females with complaints at the moment of investigation and last year.

Total group teachers						
	total		males		females	
number	1775		865		910	
	mean	range	mean	range	mean	range
total group teachers	44.73	21 - 64	48.08	22 - 64	41.55	21 - 63
teachers with complaints at moment and last year	42	21 - 62	47	23 - 62	40	21 - 59

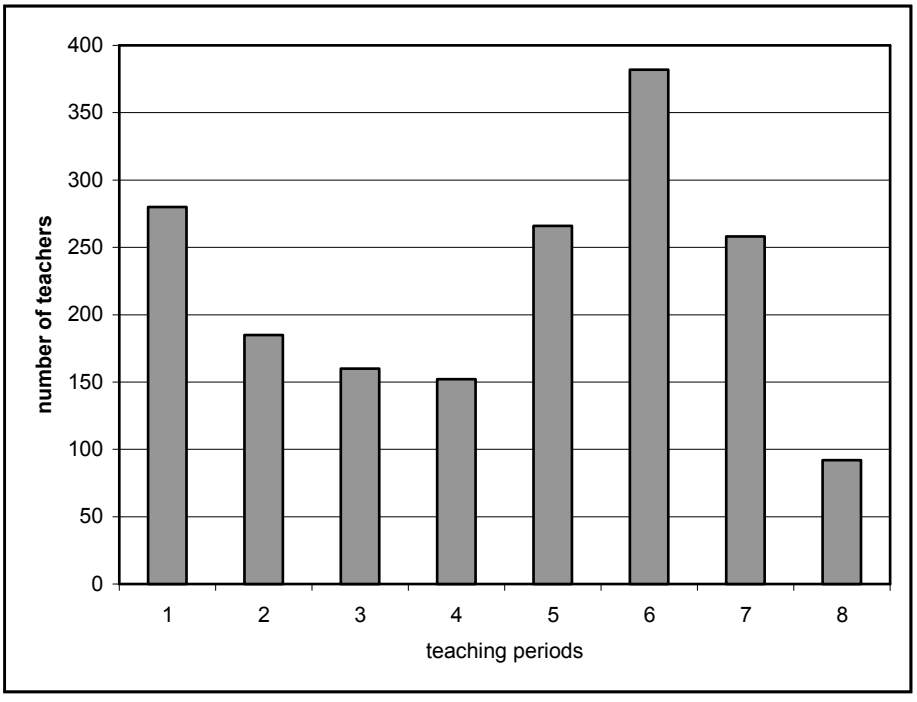

Figure 1. Teaching periods with numbers of teachers in the separated periods. Period 1: 1-4 years teaching, period 2: 5-9 years teaching, period 3: 10-14 years teaching, period 4: 15-19 years teaching, period 5: 20-24 years teaching, period 6: 25-29 years teaching, period 7: 30-39 years teaching, period 8: 35-40 years teaching.

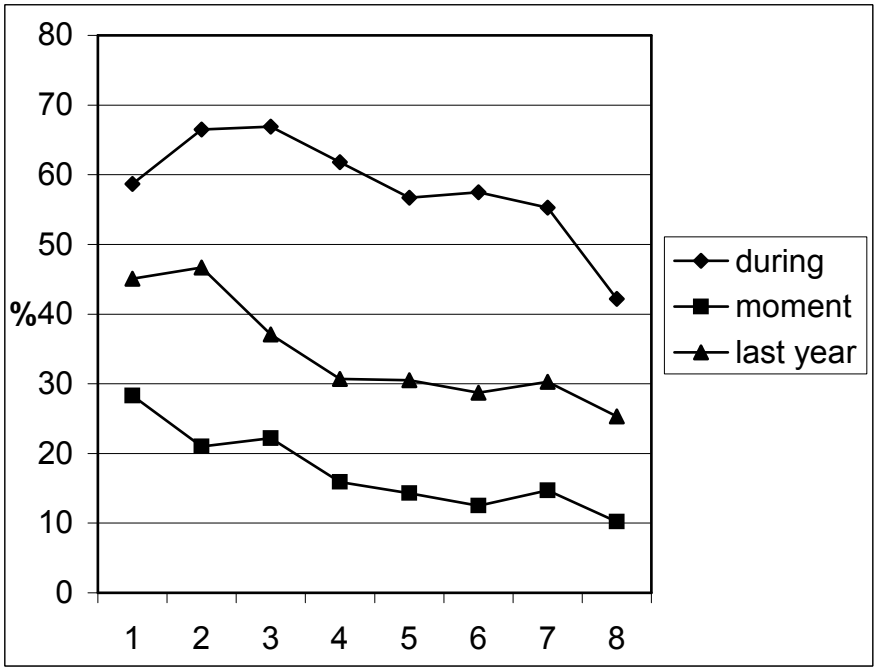

Figure 2. Percentages of experienced voice complaints during the career, at the moment of the investigation and during last year divided over the different periods. (during: complaints during the career; moment: complaints at the moment of investigation; last year: complaints during last year).

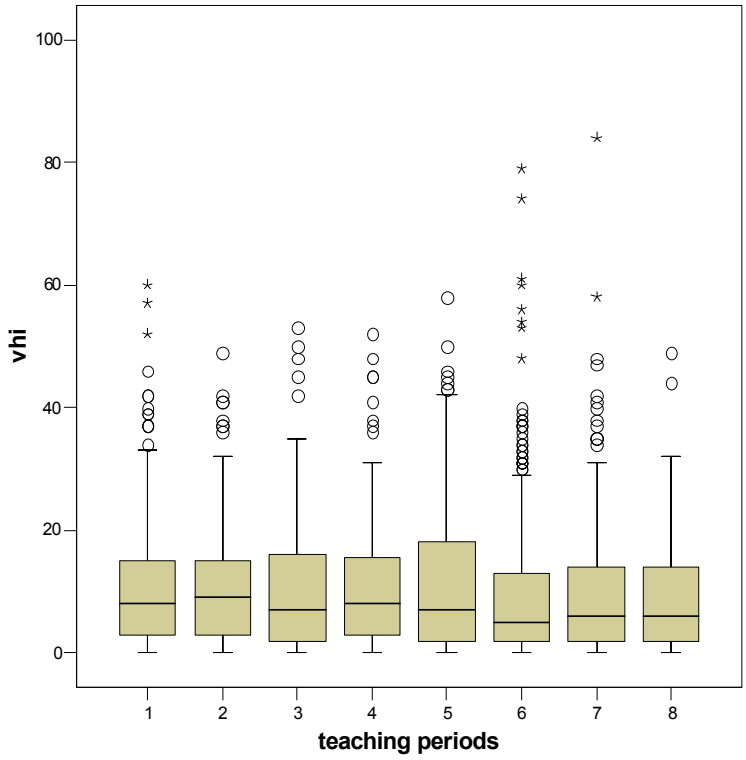

Figure 3. Median score of the VHI of all the teachers, divided over the teaching periods. (Kruskal Wallis: p = .006).

The total VHI scores and VHI sub scores (F: functional; E: emotional; P: physical) of the total teachers group were not normally distributed (Kolmogorov-Smirnov test: $p \leq .001$). Therefore, Kruskall-Wallis median test was used. The total VHI rating of the teachers in the various teaching periods is represented in Figure 3. The graph does not show a clear tendency pattern, while the Kruskall-Wallis test shows a p-value of p = .006. For the VHI sub scores, the Kruskall-Wallis test reveals only for the VHI-P a significant value (p = .037).

In order to assess the difference of psychosocial impact of the voice complaints in the various teaching periods, the total VHI scores and VHI sub-scores of the teachers with voice complaints at the moment and/or last year were assessed. The total VHI rating of the teachers with voice complaints at the moment and/or last year in the various teaching periods is represented in Figure 4. A specific pattern cannot be recognized (Kruskall-Wallis tests = .587). This was also found for the VHI sub scores (Kruskall-Wallis tests $\leq .05$).

The results of the total VHI scores and sub scores of all the teachers and the teachers with and without voice complaints are shown in Table 2. The p-values indicate the difference of psychosocial impact of the voice complaints in the various teaching periods measured with Kruskall-Wallis.

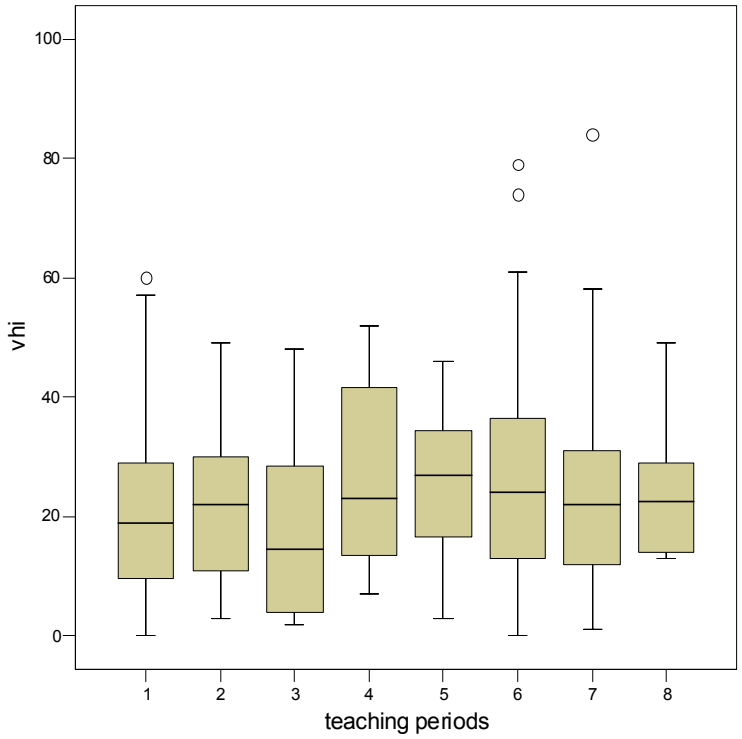

Figure 4. Median score of the VHI of the teachers with complaints at the moment of investigation and during last year, divided over the teaching periods (Kruskal Wallis: p = .587).

Table 2. Median scores of the VHI and the significant/not significant differences along the career of the VHI scores in the different teacher groups. In the rows the scores of all the teachers, the teachers without complaints (without compl.), the teachers with complaints (with compl.) are represented. In the columns the median scores and the p-values of K-W tests are showed.

		total VHI		F		E		P	
		median	p	median	p	median	p	median	p
VHI	all teachers	7	.006	3	.620	0	.293	4	.037
	without compl.	4	.058	2	.459	0	.442	1	.032
	with compl.	20	.664	5	.596	4	.643	12	.322

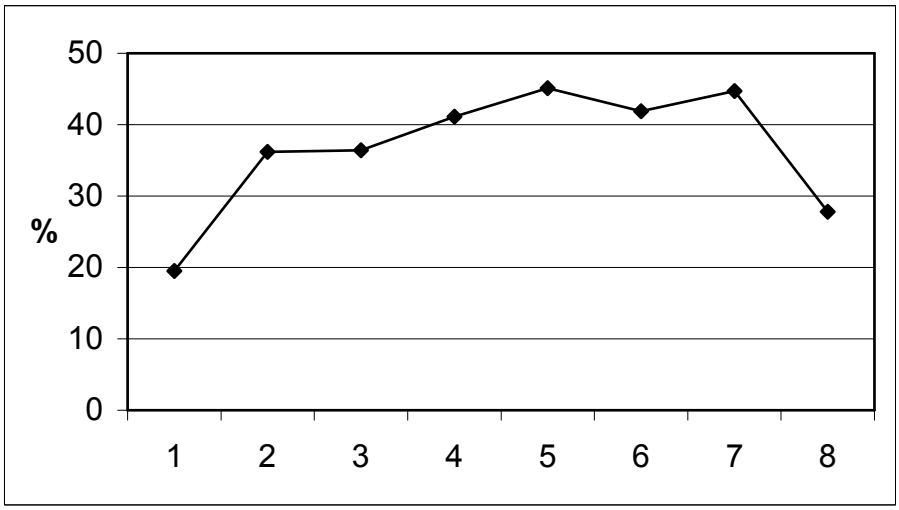

Figure 5. Percentages of teachers with absence from work due to voice problems during the career divided over the different periods.

The absence from work due to the voice problem of the teachers with complaints in the teaching period breakdown is shown in Figure 5. The absence in Figure 5 shows an ascending curve until the 7th period of teaching and a remarkable down sloping configuration for period of teaching 8. The Kruskall-Wallis test is significant ($p \leq .001$).

To compare the findings of the study of Pahn and Pahn about the course of voice complaints over the teaching years[7] with the results of the present study, the teachers with voice complaints were categorized in periods of one teaching year (see Figure 6).

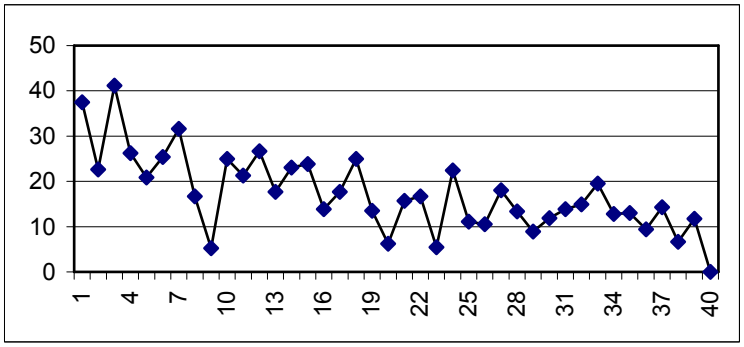

Figure 6. Percentages of teachers with voice complaints during their career, categorized in periods of one teaching year.

DISCUSSION

In order to determine voice complaints and the psychosocial impact in teachers, a questionnaire and the VHI inventory were used. The use of questionnaires enables the acquisition of a large amount of information in a practical way. The eventually derived 1,775 useful responses provided a large sample.

The non-response rate of the questionnaire may have biased the prevalence of the voice complaints. The direction of the bias is unclear, because subjects with voice complaints may be more apt to respond. On the other hand, subjects with voice problems may be more reluctant to react, because of fear and uncertainty.

Cross-sectional studies are valuable for providing descriptive information about disease prevalence and factors that are related, but the results are not informative about the causality of the investigated items[12]. The questions are constructed in a simple and straightforward style.

The mean age (range) of the teachers was 44 years (21-63 years) in the primary education group and 45 years (22-64 years) in the secondary education group. This age correspondents with the findings of Roy, who found that in his study participants ranged in age from 20 – 66, with a mean of 44.2 years[13]. The Dutch Central Bureau for Statistics (CBS) reports that the mean age of the teachers in the Netherlands in 2002 was 43[14]. The population of the present study can be considered as quite representative for this profession.

In order to approach the actual situation, a correction of the number of males and females is not made. The CBS describes predominance of females in primary education and of males in secondary education[14]. A correction of the number of teachers in primary and secondary education is not made, because no significant differences in reported voice complaints were found between these groups.

Voice complaints during the teaching career were reported by 58.6 % of the teachers. This is in accordance with the figure of Roy who reported 57.7 % of the teachers with voice disorders during their lifetime[13]. In the present study, however, the number of teachers, complaining of a current voice problem is greater than in the study of Roy: 17.4 % versus 11.0 %. Russell found 16% of teachers reporting voice problems on the day of the survey and 20% reporting problems during the current teaching year[15]. The results of the present study agree well with these findings. This suggests that the relative high number of non-respondents do not have a significant influence.

The first teaching period (0-4 teaching years) showed high percentages of complaints in comparison with the later periods. This is the most pronounced when compared with period 7 and 8 (30-34 and 35-39 teaching years): 58.7 % versus 55.3 % and 42.2 % (voice complaints during the career); 28.3 % versus 10.2 % and 17.5 % (voice complaints at the moment); 45.1 % versus 25.3 % and 34.4 % (voice complaints during the last year). The pertaining graphs indicate a decrease of voice complaints with an increase of teaching years. This decreasing tendency consequently indicates that the teachers that are working in a later period of their career have experienced fewer complaints in the beginning of their career than the teachers working in the beginning of their career. The reason for this may be that our modern society causes an increase of voice complaints. This may be enhanced by a change of pedagogical methods and demands, increase of stress and more adverse environmental situations. Another explanation may be that teachers develop coping strategies during their career with regard to voice loading factors and psycho emotional stressors. Additionally, teachers may not remember the complaints in the beginning of their career.

Roy et al[13]. found an increase of current voice disorders with increasing age, from 7.2 % up to 14.4 % at the ages 50-59. In correspondence to the present study, they found a decrease in the last age period of teaching (60 and older), down to 11.1 %. The figures of the present study are higher than those of Roy et al and are more in line of those of Russell et al[15].

The results of this study are the more remarkable compared to the findings of Baker et al.[5]. They found that voice intensity of elderly speakers was lower in all tasks they had to perform. This was confirmed by Hodge et al.[4]. Decreased voice capacity occurs in increasing age. The results of this study are not in accordance with this fact, and indicate that diminishing voice capacity not necessarily leads to voice complaints.

Pahn described three peaks of prevalence of voice complaints: after two teaching years and after 10 years and 20 years. The first peak may due to an insufficient

adaptation to professional requirements and the second one to the fact that teachers are more responsible because of their experience. Additionally, after 20 years of teaching voice problems may arise, due to hormonal changes, especially in females[7]. Ferrand indicated that hormonal changes might lead to a less efficient function of the laryngeal system, which will cause lowering of the F0, especially in elderly women, and a decrease of Harmonic Noise Ratios[16]. The results of this study agree with a high prevalence of voice complaints in the first years of the teacher's career (see Figure 6). The occurrence of the other two peaks of prevalence of voice complaints could not be confirmed.

In general, our results demonstrated a significant difference between the experienced psychosocial handicap between teachers with and without complaints. This is in accordance with the recent findings of Guimarães and Abberton who reported that subjects with voice complaints experience more psychosocial restrictions on functional, emotional and physical aspects than others[17]. Verdolini and Smith estimate that patients with voice disorders experience social, communicative, physical and psychological problems in the execution of their profession and even in their daily social life[18,19].

In this study, no significant differences throughout the career regarding the scores of the VHI in the group teachers with voice complaints were observed. This is supported by the findings of Guimarães and Abberton[17], who reported no significant effect of age on the VHI score.

Among the 3 sub scores of the VHI, the factor physical showed the highest scores. This indicates that physical aspects have the greatest impact on psychosocial functioning. This was reported too by Kooijman et al.[20] who found a significant relation between laryngeal muscular tension and high scores on the VHI. Guimarães and Abberton[17] found the same tendency of high scores on the factor 'physical' in the VHI scores.

The significant decrease of voice complaints along the career is a remarkable finding. This decreasing prevalence of symptoms may be ascribed to coping strategies, more teaching experience, or to a greater tolerance of the vocal problems, like Smith et al. found[21].

Absence from work due to a voice problem shows an increasing slope up to the 7th teaching period. The curve in the 8th teaching period shows an abrupt slope downwards. In the Netherlands teachers usually retire around 58-60 years. Probably only the fittest teacher's keep on working at the end of their career. This might explain the down slope in the absence from work as well as in the reporting of complaints.

CONCLUSION

Teachers along their professional career showed no more complaints than teachers in the beginning of their career. In contrast to the expectations even a decreasing level of complaints was found. Teachers in the first period (0-4 teaching years) were complaining the most compared to their colleagues in the other periods. This tendency was found in the three time categories: at the moment of investigation, during last year and earlier in their career. These results are remarkable compared to the data in the literature. Teachers along the professional career do not complain more, do not show a increasing score on the VHI, and high scores on the VHI are not concentrated in the later period of the career. And if there is a voice complain, it is not more severe in the later periods of the teaching career.

The results of this study suggest that special attention should be paid to teachers in the beginning of their career. The high prevalence of voice complaints in the beginning of the career supports the idea that more attention should be paid to preventive programs in the education of the student teachers.

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Chapter 5

Risk Factors for Voice Problems in Teachers

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ABSTRACT

In order to identify factors that are associated with voice problems and voice-related absenteeism in teachers, 1878 questionnaires were analysed. The questionnaires contained questions about personal data, voice complaints, voice-related absenteeism from work, and conditions that may lead to voice complaints and absenteeism. Different factors play a role in the development and consolidation of voice problems. Physical and psycho-emotional factors appear to be the most important risk factors. Remarkably, voice load and environment seem to be less important as risk factors in the development and consolidation of voice complaints. Teachers who experienced voice problems during their training reported more voice problems during their career. The results of this study stress the importance of a multifactorial approach in the diagnosis and treatment of voice problems, whereby physical and psycho-emotional aspects should be considered as sensitive to the risk of developing voice problems. Moreover, this study shows the crucial importance of adequate voice training during the teacher-training program.

INTRODUCTION

Professional voice disorders usually have a multifactorial pathogenesis[1-3] and there are different internal and external factors that may influence the ability of the voice in withstanding the demands of the profession. Longer classroom hours are related to the frequency of voice disorders.[4] Intensive voice use increases mechanical load on the mucous membranes.[5] Morrison and Rammage[6] describe four internal factors that may affect the phonation processes: deviant body posture and imbalanced use of muscles, behaviour towards the voice (e.g. smoking and shouting), emotional disturbances, and gastro-oesophageal reflux. The presence of one or more of these four conditions may lead to voice disorders. Deterioration of the general condition may lead to diminished fine-regulation, resulting in dysphonia and pathological fatigue of the voice.[7] Several authors have pointed out a number of external risk factors, for example lack of voice training,[8] and psychological factors like stress and fear.[9] The voice is an essential tool in the expression of meanings and emotions. As a result, emotions can negatively influence voice production, especially in sensitive persons. Increase in stress changes the phonation pattern with a subsequent increase in voice load.[10] An unsuitable acoustic working environment may play a role as well.[11,12] Other

unfavourable environmental conditions, for example, dry air, dust, smoke, air pollution, and temperature changes, may irritate the mucosa and negatively influence the voice.[13-16] Mucosal disorders affect voice production and reduce vocal capacity. Voice problems occur more frequently and to a larger extent in teachers, as compared to other occupational voice users.[17,18] The cost of voice problems in teachers of the United States (in terms of lost workdays and treatment) amounts to about $2.5 billion annually.[14] Teachers also appear to be relatively more susceptible to voice strain.[19] Moreover, voice problems in teachers may reach such a chronic stage, that a specific approach is required.[20]
The various conditions that lead to voice problems may have different impacts, and specific combinations may even be more harmful. Knowledge of these factors, and of the effect of combinations of factors, is a prerequisite for the assessment, treatment and prevention of occupational voice disorders. This investigation is part of a larger study that addresses voice problems in teachers. The aim of this study was to determine which factors teachers experience as riskfull for voice complaints and voice-related absenteeism. As an additional, but important item, this study addressed the question whether voice problems during the training for the teaching profession constituted a risk factor for getting voice problems and voice-related absenteeism during the later career.

METHODS AND MATERIALS

Description of sample

Six thousand questionnaires were distributed among teachers of primary (PE) and secondary (SE) education (see appendix I). The questionnaires were sent to directors of schools after they had been informed of the purpose of this study. They distributed the questionnaires to the teachers. The questionnaires were returned anonymously by means of a pre-paid envelope. The questionnaires were accompanied by a description of the background and aim of the study, and instructions for the filling out of the form (see appendix II). The questionnaire was designed in such a way that questions regarding personal, voice load, physical and psycho-emotional and environmental aspects, as well as the prevalence of voice complaints and voice-related absenteeism were included. It consisted of 35 questions. In the design of the questionnaire, data were obtained from the literature[14,22] and clinical experiences were considered. Additionally, comments from workers in the teaching profession were incorporated.

Description of questionnaires

The questions are constructed in a simple and direct style. There is no restriction in respect of the character of the complaints, experienced by the person. If there are complaints in the area, which are mentioned in the questionnaire, or if a person is convinced that the complaints are influenced by a factor, the question should be answered positively.

Questions 6-8 address voice complaints in different periods of the professional career. If one or more of questions 6-8 was answered positively, the subject was classified as having complaints during the professional career (indicated with "COMPL").

Questions 5, 19-20 address voice load aspects. Question 5 addresses the number of teaching hours per week. The results were dichotomised into less than 20 hours per week (half-time) and 20 or more hours per week (full-time). The results of question 19-20 were dichotomised as well. The answer 0 and 2 were classified as negative (score = 0) and the answer 1 as positive (score = 1).

Questions 25-28, and question 31 address physical aspects. The results were dichotomised as well. The answers 0 and 1 were classified as negative (score = 0) and the answers 2, 3 and 4 as positive (score = 1).

Questions 21, 24, 29-30 address psycho-emotional aspects. The results were dichotomised as well. From questions 21 and 24 the answer 0 was classified as negative (score = 0) and the answer 1 as positive (score = 1). Regarding the questions 29-30 the answers 0 and 1 were classified as negative (score = 0) and the answers 2, 3 and 4 as positive (score = 1).

Questions 32-35 address environmental aspects. The results were dichotomised. The answers 0 and 1 were classified as negative (score = 0) and the answers 2, 3 and 4 as positive (score = 1). Question 32 was classified as positive (score = 1) when the answer was "moderate" or "bad", and negative (score = 0) when the answer was "good". Question 33 was classified as positive (score = 1) when the answer was "dry" or "moist", and negative (score = 0) when the answer was "normal".

DS 16 personality list

The DS16 list, according to Denollet[23], was attached to the questionnaire. In this DS16 list, the personality traits 'negative affectivity' and 'social inhibition' are rated. Negative affectivity is defined as: "the tendency to experience negative emotions across time and situations". Social inhibition is defined as: "the tendency to inhibit self-expression in social interaction". In a study of Denollet a group of patients with cardiovascular disorders who had a combination of a high negative affectivity and

social inhibition score (type-D; set at 25 % of this population) appeared to have a poor prognosis compared to the other 75% (non-type-D).[23,24]

Statistic evaluation

The data was evaluated using the statistical program SPSS V 12.0. For discrete outcome variables, 2-sided Chi-square tests were used. The significance level was set at $p \leq 0.05$. Odds ratios were used to quantify the dependency in 2x2 tables.
The relation between voice complaints that occurred at any time during the professional career (questions 6-8) and various factors were assessed by the calculation of odds ratio, whereby an odds ratio of >2 and in reverse sense <0.5 was chosen as meaningful. The questions were arranged into four categories with regard to voice load and physical, psycho-emotional, and environmental aspects. A fifth category was added: the teacher-training period (see Table 1).

Table 1. Five categories with the risky factors belonging to the category.

Five categories of risky aspects with the factors, belonging to the category	
Categories	Factors
voice load	number of teaching years; full-time - half-time; number of pupils
physical aspects	neck and shoulders problems; low back problems; mucosal problems; general condition; hearing
psycho-emotional aspects	type D (DS-16); stress; emotions; composition of group; work load
environmental aspects	acoustics; humidity; temperature; irritants
training	voice problems during training

RESULTS

About 31% (1878) of the questionnaires were correctly filled out and returned. The PE (primary education) group consisted of 160 males and 476 females; the SE (secondary education) group of 730 males and 512 females. The median age (range) was 42 years (21-63 years) in the PE group and 50 years (22-64 years) in the SE group.

Voice complaints

The percentages of the complaints, divided over the sexes and the school types are shown in Table 2. The results of the relation between voice complaints that occurred at any time during the professional career (questions 6-8) and various factors are shown in Tables 3-7. Tables 3-7 should be read from left to right: the factor, the answer of the teacher as to whether there is a negative influence of that

factor on the voice or not, the absenteeism or presence of voice complaints during the career, the percentage of complaints, the Pearson Chi-Square (p) and at least the odds ratio. Odds ratio has been calculated by Cross-tabulation: [(A:C):(B:D)] (A, B, C, D: see Table 3,4,5, 6 and 7: column percent).

Table 2. Percentages of complaints of the total respondent teachers, differences in sexe and differences in schooltype.

Complaints		no	yes	p	odds ratio
Complaints total		41.36	58.64		
Sexe	females	32.40	67.60	<.001	.46
	males	51.30	48.70		
Schooltype	primary	39.30	60.70	.204	.88
	secondary	42.40	57.60		

Table 3. Cross-tabulation of the relation (odds ratio > 2) between factors belonging to voice load on the one hand and voice complaints occurring at any time during practising the teaching profession (COMPL, questions 6-7-8) and the occurrence of voice-related absence due to a voice problem at any time during practising the teaching profession (ABS, question 15) on the other hand. Pearson Chi-Square (p-value) indicates the difference between the groups; odds ratios indicate the relative risks. Odds ratio has been calculated by Cross-tabulation: [(A:C):(B:D)].

factor	neg. influence on voice	voice complaints during career	%	p	odds ratio
number of teaching years	no	.no	A 37.40	≤ .001	.73
		yes	B 62.60		
	yes	no	C 44.90		
		yes	D 55.10		
full-time / half-time	no	.no	A 40.20	.0450	.93
		yes	B 59.80		
	yes	no	C 42.00		
		yes	D 58.00		
number pupils	no	.no	A 55.50	≤ .001	3.24
		yes	B 44.50		
	yes	no	C 27.80		
		yes	D 72.20		
factor	neg. influence on voice	voice-related absence	%	p	odds ratio
number of teaching years	no	.no	A 80.40	.051	1.25
		yes	B 19.60		
	yes	no	C 52.60		
		yes	D 58.20		
full-time / half-time	no	.no	A 77.00	.375	.90
		yes	B 23.00		
	yes	no	C 78.80		
		yes	D 21.20		
number pupils	no	.no	A 85.40	≤ .001	2.30
		yes	B 14.60		
	yes	no	C 71.70		
		yes	D 28.30		

Table 4. Cross-tabulation of the relation (odds ratio >2) between factors belonging to physical aspects on the one hand, and voice complaints occurring at any time during practising the teaching profession (COMPL, questions 6-7-8) and the occurrence of voice-related absence due to a voice problem at any time during practising the teaching profession (ABS, question 15) on the other hand. Pearson Chi-Square (p-value) indicates the difference between the groups; odds ratios indicate the relative risks. Odds ratio has been calculated by Cross-tabulation: [(A:C):(B:D)].

factor	neg. influence on voice	voice complaints during career	%	p	odds ratio
neck shoulders problems	no	no	A 45.50	≤ .001	3.56
		yes	B 54.50		
	yes	no	C 19.00		
		yes	D 81.00		
low back problems	no	no	A 42.50	≤ .001	2. 01
		yes	B 57.50		
	yes	no	C 27.00		
		yes	D 73.00		
mucosal problems	no	no	A 55.00	≤ .001	3.48
		yes	B 45.00		
	yes	no	C 26.00		
		yes	D 74.00		
physical condition	no	no	A 54.50	≤ .001	4.04
		yes	B 45.50		
	yes	no	C 22.80		
		yes	D 77.20		
hearing	no	no	A 79.90	≤ .001	1.60
		yes	B 20.10		
	yes	no	C 74.70		
		yes	D 25.30		
factor	neg. influence on voice	voice related absence	%	p	odds ratio
neck shoulders problems	no	no	A 79.90	.021	1.34
		yes	B 20.10		
	yes	no	C 69.40		
		yes	D 30.60		
low back problems	no	no	A 78.70	.0340	1. 20
		yes	B 21.30		
	yes	no	C 75.30		
		yes	D 24.70		
mucosal problems	no	no	A 86.00	≤ .001	2.70
		yes	B 14.00		
	yes	no	C 69.50		
		yes	D 30.50		
physical condition	no	no	A 86.60	≤ .001	3.25
		yes	B 13.40		
	yes	no	C 66.40		
		yes	D 33.60		
hearing	no	no	A 81.90	.004	1.36
		yes	B 18.10		
	yes	no	C 77.00		
		Yes	D 23.00		

In the category 'voice load' (see Table 3) only the number of pupils in the classroom shows an odds ratio > 2 (odds ratio = 3.24). The number of teaching years and teaching hours per week do not show an odds ratio > 2 (.73 and .93 respectively).

Of the physical aspects (see Table 4), a meaningful odds ratio has been found for the factors 'neck and shoulders' (odds ratio = 3.56), 'low back' (odds ratio = 2.01) and 'mucosal problems' (odds ratio = 3.48), and for 'general physical condition' (odds ratio = 4.04). The factor 'hearing' did not show a meaningful odds ratio (odds ratio = 1.60).

Table 5 shows the results of the psycho-emotional category. Stress (odds ratio = 3.52), emotions (odds ratio = 2.70), composition of the group (odds ratio = 3.10) and workload (odds ratio = 3.83) are calculated as high risk factors. In this manuscript the type-D classification was assessed by selecting the cases that have a score higher than the median of both negative affectivity (score 6) and social inhibition (score 11). The scores of negative affectivity and social inhibition were dichotomised as follows: score $\leq$ median = 0 and score > median = 1. This resulted in 70.6 % non-type-D and 29.4% type-D. Type D subjects, calculated with the DS 16, do not show a meaningful odds ratio (odds ratio = 1.41).

Environment was not found to be a meaningful risk factor for the development of voice complaints (see Table 6). Among the parameters used in this study, humidity (odds ratio = 1.84) was the most important environmental factor in the development of voice complaints, followed by acoustic conditions (odds ratio = 1.80), temperature changes (odds ratio = 1.48) and irritants in the classroom (odds ratio = 1.45) in order of importance.

Table 7 shows that having voice problems during the training is a remarkably high risk factor (odds ratio = 8.81) for the development of voice complaints during the professional career.

Voice-related absenteeism

The relation between voice-related absenteeism (question 15) and the various factors was assessed. The questions were arranged into the same five categories as used for the assessment of voice complaints (see Table 1). In general, the relation between voice-related absenteeism and the various factors is similar to the relation between voice complaints and the various factors, but the results are less pronounced. The results are shown in Tables 2-6.

Table 5. Cross-tabulation of the relation (odds ratio > 2) between factors belonging to psycho-emotional on the one hand, and voice complaints occurring at any time during practising the teaching profession (COMPL, questions 6-7-8) and the occurrence of voice-related absence due to a voice problem at any time during practising the teaching profession (ABS, question 15) on the other hand. Type D has been constructed from the values 'negative affectivity' > 6, and 'social inhibition' > 11. Pearson Chi-Square (p-value) indicates the difference between the groups; odds ratios indicate the relative risks. Odds ratio was calculated by Cross-tabulation: [(A:C):(B:D)].

factor	neg. influence on voice	voice complaints during career	%	p	odds ratio
type D (DS16)	no	.no	A 43.50	.002	1.41
		yes	B 56.50		
	yes	no	C 35.30		
		yes	D 64.70		
stress	no	.no	A 54.40	≤ .001	3.52
		yes	B 45.60		
	yes	no	C 25.30		
		yes	D 74.70		
emotions	no	.no	A 54.40	≤ .001	2.70
		yes	B 45.60		
	yes	no	C 30.60		
		yes	D 69.40		
composition group	no	.no	A 56.80	≤ .001	3.10
		yes	B 43.20		
	yes	no	C 29.80		
		yes	D 70.20		
workload	no	.no	A 59.90	≤ .001	3.83
		yes	B 40.10		
	yes	no	C 28.00		
		yes	D 72.00		
factor	neg. influence on voice	voice-related absence	%	p	odds ratio
type D (DS16)	no	.no	A 78.90	.314	1.14
		yes	B 21.10		
	yes	no	C 76.70		
		yes	D 23.30		
stress	no	.no	A 84.50	≤ .001	2.26
		yes	B 15.50		
	yes	no	C 70.80		
		yes	D 29.30		
emotions	no	.no	A 83.90	≤ .001	1.85
		yes	B 16.10		
	yes	no	C 73.70		
		yes	D 26.30		
composition group	no	.no	A 84.50	≤ .001	1.95
		yes	B 15.50		
	yes	no	C 73.70		
		yes	D 26.30		
workload	no	.no	A 87.60	≤ .001	2.83
		yes	B 12.40		
	yes	no	C 71.40		
		yes	D 28.60		

Table 6. Cross-tabulation of the relation (odds ratio >2) between factors belonging to environmental aspects on the one hand, and voice complaints occurring at any time during practising the teaching profession (COMPL, questions 6-7-8) and the occurrence of voice-related absence due to a voice problem at any time during practising the teaching profession (ABS, question 15) on the other hand. Pearson Chi-Square (p-value) indicates the difference between the groups; odds ratios indicate the relative risks. Odds ratio has been calculated by Cross-tabulation: [(A:C):(B:D)].

factor	neg. influence on voice	voice complaints during career	%	p	odds ratio
acoustics	no	.no	A 48.70	≤ .001	1.80
		yes	B 51.30		
	yes	no	C 34.60		
		yes	D 65.40		
humidity	no	.no	A 47.30	≤ .001	1.84
		yes	B 52.70		
	yes	no	C 32.70		
		yes	D 67.30		
temperature	no	.no	A 46.60	≤ .001	1.48
		yes	B 53.40		
	yes	no	C 37.10		
		yes	D 62.90		
irritants	no	.no	A 43.60	.001	1.45
		yes	B 56.40		
	yes	no	C 34.70		
		yes	D 65.30		
factor	neg. influence on voice	voice-related absence	%	p	odds ratio
acoustics	no	.no	A 81.90	≤ .001	1.53
		yes	B 18.10		
	yes	no	C 74.80		
		yes	D 25.20		
humidity	no	.no	A 81.30	≤ .001	1.55
		yes	B 18.70		
	yes	no	C 73.70		
		yes	D 26.30		
temperature	no	.no	A 82.60	≤ .001	1.60
		yes	B 17.40		
	yes	no	C 74.80		
		yes	D 25.20		
irritants	no	.no	A 79.50	.019	1.35
		yes	B 20.50		
	yes	no	C 74.20		
		yes	D 25.80		

Table 7. Cross-tabulation of the relation (odds ratio > 2) between factors belonging to voice problems during training (VPE) on the one hand and voice complaints occurring at any time during practising the teaching profession (COMPL, questions 6-7-8) and the occurrence of voice-related absence due to a voice problem at any time during practising the teaching profession (ABS, question 15) on the other hand. Pearson Chi-Square (p-value) indicates the difference between the groups; odds ratios indicate the relative risks. Odds ratio was calculated by Cross-tabulation: [(A:C):(B:D)].

factor	neg. influence on voice	voice complaints during career	%	p	odds ratio
VPE	no	no	A 49.20	≤ .001	8.81
		yes	B 50.80		
	yes	no	C 09.90		
		yes	D 90.10		
factor	neg. influence on voice	voice-related absence	%	p	odds ratio
VPE	no	no	A 81.40	≤ .001	2.17
		yes	B 18.60		
	yes	no	C 66.80		
		yes	D 33.20		

DISCUSSION

Methodological aspects

In order to determine which factors play a role in voice problems in teachers[25], a questionnaire was chosen as the method of investigation. This means that the data were obtained from self-reporting by the teachers. As addressed by Russel et al.[26], this study design may introduce subjective elements, inherent in this type of investigation. However, this approach enables the collection, in a practical way, of a large amount of information. About one-third of the questionnaires was returned, which is an average response for a not personal addressed questionnaire by mail. The absolute number of 1878 useful responses is high and gives a large sample of information about the topic of self-experienced risk factors. Questionnaires are very cost effective when compared to face-to-face interviews. This is especially true for studies involving large sample sizes and large geographic areas. Questionnaires reduce bias.[27] There is a uniform question presentation and no middle-man bias. The question if the non-response rate of the questionnaire

influence the overestimation or underestimation of the prevalence of the voice complaints, is difficult to answer. It may be said that people with voice complaints are more interested in answering than others. On the other hand it is also plausible that people with voice problems are more reluctant than others, because of private fear and uncertainty.

By reason of the statistic calculation, over- or underestimation is not a problem in this research. There is no calculation of correlation, but a 2x2 cross-sectional calculation. Cross-sectional studies are valuable for providing descriptive information about disease prevalence and factors that are related, but the results are not informative about the causality of the investigated items.[27] The questions are constructed in a simple and direct style. There is no explanation of the character of the complaints. If there are complaints in the area, which are mentioned in the questionnaire, or if the teacher thinks that a factor influences his/her voice, the question should be answered positively.

It should be stated that this research investigated the subjective problem perception of the teachers. It is possible that the subjective perception does not correspond to the physical correlate of the item we want to investigate. Acoustical environment for example includes a lot of aspects that can be included in the answer of the teacher. However, it is still very important to know what kind of influences the teachers with voice problems experience to be able to investigate the whole spectrum in a later 'cohort' or 'experimental'study.

In order to approach the actual situation no correction of the number of males and females is made, although there is a significant difference in reporting voice complaints. The Central Institute of Statistics (Centraal Bureau van de Statistiek (CBS)) reported also more females in de primary education and more males in the secondary education.[28] No correction of the number of teachers in primary and secondary education is made, because no significant difference in reporting voice complaints was found.

Voice load

It has been reported that longer classroom hours are related to the incidence of voice disorders and voice-related absenteeism.[4] This could not be confirmed by the results of this study. Remarkably, the factor teaching hours did not show a meaningful odds ratio, which means that, in this study, more or less teaching hours cannot be considered as a risk factor in the development of voice problems and voice-related absenteeism. The same conclusion has to be drawn from the results regarding the number of teaching years. In the literature, it has been written that vocal fatigue increases with the number of teaching years.[17] This is not

supported by this study, neither regarding voice complaints nor voice-related absenteeism.

In contrast to the above-mentioned factors of voice load, the number of pupils in the classroom appeared to be important in the development of voice problems. Teaching a larger number of pupils also correlates with more voice-related absenteeism. This is in accordance with the assumption that teaching a larger group requires more vocal effort. In a study of voice load in different professions, Buekers et al.[19] found that teaching involves a greater voice load compared to other professions. Voice intensity has been considered one of the important factors in voice load.[9,29,30] Voice intensity usually increases in noisy conditions.[27,28] This is in accordance with the findings of Preciado[4], who confirms that a larger number of pupils and poor acoustic properties of the classroom lead to increased vocal intensities with consequent voice problems.

Environmental aspects

In this study, environmental aspects appear not to be very important in the development of voice complaints and voice-related absenteeism. This is in contrast with previous studies.[13-16,33] In literature, unfavourable acoustic conditions in the classroom are also considered as cause for voice problems.[4,11,12]

Physical condition

Physical aspects appear to play a prominent role in the development of voice complaints, whereas a less pronounced relation has been found between physical aspects and voice-related absenteeism from work. Increase in vocal pitch during the course of the day is very common in teachers, especially in teachers with voice complaints.[34] Intensive voice use forms an increased mechanical load on the mucous membranes. Conversely, mucosal disorders affect voice production and reduce vocal performance. The maintenance of fine-tuning of the voice, needed for adequate pitch and intensity changes, is an energy consuming process. Gotaas and Starr[7] provide a definition for vocal fatigue, and attribute it to "vocalisations that occur over long periods of time, at high loudness levels, at unusual pitch levels, with excessive or inappropriate tension, in the presence of unhealthy vocal fold tissue, or with some combination of these factors". In our study deterioration of general condition is found to be the most important physical factor, followed by problems with mucosa, neck or shoulders, lower back and hearing, in order of importance. Impaired hearing hampers adequate feedback and may lead to voice problems.[7] This finding cannot be confirmed by our study, where

among the physical aspects that have been investigated, hearing is the only one without a meaningful Odds ratio.

Psycho-emotional aspects

The results show that psycho-emotional aspects play a major role in the development of voice complaints. Their influence is less pronounced in voice-related absenteeism from work. High workload and stress, followed by emotions and composition of the group of pupils, represent a high relative risk of voice complaints. This is in accordance with the literature.[9,10] The voice is an essential tool in the expression of meanings and emotions. Being a type-D subject was found to be a relatively unimportant psycho-emotional factor in the development of voice problems. In this respect, there is no parallel with the findings in research on chronic heart disease, as described by Denollet.[23] It is questionable whether these individuals have some particular personality, whether there is a specific occupational stress and whether there are specific occupational demands. This means that the voice can be considered not only as an anatomophysiological event, but also as an intense psychomotoric expression and an existential tool.[21,35] As a result, emotions can influence voice production negatively, especially in sensitive persons. Increase in stress changes the phonation pattern, with a subsequent increase in voice load.[10,36] These ideas can be confirmed by the results of this manuscript, where psycho-emotional factors show a high odds ratio for both voice handicap and voice-related absenteeism.

Voice training

The findings of this study confirm that voice complaints during training for the teaching profession are a very high risk factor for the development of voice complaints during the career and to a lesser degree for voice-related absenteeism from work. This is in accordance with Buekers, who stated that lack of voice training is one of the most important factors leading to inappropriate voice use.[9] This stresses the utmost importance of adequate attention to the voice during the teacher-training program. A problem to motivate student teachers to participate in the training will be the fact that students do not complain more than others about voice problems [Thomas et al., unpubl. data]. Thomas et al. also found that only about a third of the student teachers with voice complaints were of the view that they would develop a voice complaint due to their profession. Less than half of the student teachers with voice complaints were aware of the potential risks of their profession on their voice [Thomas: unpubl. data]. The apparent lack of awareness in student teachers may be considered a risk factor for voice complaints.

CONCLUSIONS

The different conditions that give rise to voice problems are of varying importance. Specific combinations of factors appear to be harmful. Based on this questionnaire study it can be concluded that the factors from the category "voice load" play a minor role compared to factors from other categories, although the literature emphasizes voice load as a major risk factor. Furthermore, factors concerning physical and psycho-emotional condition appear to be the most important risk factors. In this study, the environmental aspects were not found to be risk factors for the development of voice complaints. The results of this study underline the multifactorial complexity of aspects related to voice complaints and voice-related absenteeism. Knowledge of the factors and the effects of their combinations are relevant for the diagnosis, therapy and prevention of occupational voice problems, and for avoiding personal and economical detriment. The findings of this study indicate the importance of the involvement of all the aspects in assessing voice problems, rather than the use of single parameters. Teachers, already having voice problems during their education, seem to be more susceptible to voice problems during their career. It can be expected that if, during the training, factors investigated in this research should already be present, the prediction of the development of voice problems would be more likely. It may be concluded that the crucial importance of comprehensive multifactorial assessment and adequate voice training during the education of the teaching profession is demonstrated. The results of this study confirm that teaching is a high-risk profession for voice problems and indicate that attention should be drawn to voice care during the training. This study has focused on the risk factors, i.e. hazards for voice problems in the teaching profession. These findings may be used in further investigations on risk analyses, where we have to specify which specific items will be a real risk for each individual teacher.

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Chapter 6

Muscular Tension and Body Posture in relation to Voice Handicap and Voice Quality in Teachers with Persistent Voice Complaints

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ABSTRACT

The aim of this study was to investigate the relationship between extrinsic laryngeal muscular hypertonicity and deviant body posture on the one hand and voice handicap and voice quality on the other hand in teachers with persistent voice complaints and a history of voice related absenteeism. The study group consisted of 25 female teachers. A voice therapist assessed extrinsic laryngeal muscular tension and a physical therapist assessed body posture, according to the method of Lieberman. The assessed parameters were clustered in categories, which represent the same function. Further a tension/posture index has been created, which is the summation of the different parameters. The different parameters and the index were compared with the Voice Handicap Index (VHI) and the Dysphonia Severity Index (DSI). The scores of the VHI and the individual parameters differ significantly except for the posterior weight bearing and tension of the sternocleidomastoid muscle. There was also a significant difference between the individual parameters and the DSI, except for tension of the cricothyroid muscle and posterior weight bearing.
The score of the tension/posture index correlates significantly with both the VHI and the DSI. In a linear regression analysis, the combination of hypertonicity of the sternocleidomastoid and the geniohyoid muscles, and a posterior weight bearing is the most important predictor for a high voice handicap. The combination of hypertonicity of the geniohyoid muscle, the posterior weight bearing, high position of the hyoid bone, hypertonicity of the cricothyroid muscle and anteroposition of the head is the most important predictor for a low DSI-score. The results of this study showed that a higher score on the index correlates with more voice complaints and a worse voice quality. Moreover the results are indicative for the importance of assessment of muscular tension and body posture in the diagnosis of voice disorders.

INTRODUCTION

Occupational voice disorders usually have a multifactorial pathogenesis and can be expressed by a large diversity of symptoms, for example muscular hypertonicity and abnormal body posture.[1] Chronic hypertonicity in the head and neck muscles and in the laryngeal muscles can be considered as a result of psycho-emotional stress in combination with intensive voice use, comparable to the Repetitive Strain Injury Syndrome.[2] A high position of the larynx has been observed in many

patients with voice disorders.[3] Morrison and Rammage indicates four internal factors that affect the phonation process: deviant body posture and misuse of muscles, personal behaviour with respect to the voice (e.g. smoking and shouting), emotional factors, and gastro-oesophageal reflux.[1] Morrison and Rammage also indicates that an asymmetric tension in the neck or shoulders can cause an increased cervical lordosis and may influence vocalisation. In voice therapy it is assumed that a straight position of the neck facilitates an economic control of the breathing process, whereas anteroposition of the head will lead to breathing problems.[4] Additionally, a deviant body posture, especially an increased lumbal lordosis with consequently a distorted elevation of the neck, reduces a flexible breathing pattern and results in a reduction and compression of the vocal tract.[6] Pitch problems in singers are explained as being caused among others by cervical abnormalities.[5] The position of the larynx, assumed to be important for phonation, can be affected by the inhalatory behaviour of the speaker [6]. Schneider et al. also considers that muscular hypertonicity and body posture can influence voice production.[7] In the authors' experience, abnormal body-posture is frequently observed in patients with voice problems. This is in accordance with the findings of other authors.[7-9] Correction of body posture and muscular hypertonicity frequently forms a part of voice therapy, particularly in the European countries.[20] Most of these publications investigate the occurrence of partial posture/tension aspects and voice changes. Utterances about causal relations are seldom. Hulse is one of a few who describe the causal relation between cervical problems and secondary tension in the laryngeal area with voice problems as consequence [30]. Although much attention has been paid to the role of posture and muscular tension on phonation, research on their quantitative contribution to voice quality and handicap does not exist to the knowledge of the authors.

The extrinsic laryngeal musculature as a whole can be considered as a chain of interconnected muscles and structures, which establishes equilibrium. A well-defined model for all the functions of the larynx is still under discussion. The reasons may be: not well-known functions of the different muscles, interfering action of the reflex mechanisms of the laryngeal structures and interindividual variations observed in the external functions.[29] A simplified model of extra laryngeal muscular functions can be described in forms of horizontal and vertical movement of the larynx (table 1). Isolated muscle functions are described in the model. In reality the larynx will be moved in a three-dimensional direction through the cooperation of the different muscles.

In this study the hypertonicity of the extra laryngeal muscles and various postural aspects are investigated by palpation and observation. It should be stated that

hyper functional patterns in the intrinsic laryngeal musculature are beyond the scope of this paper.
The aim of this study was to investigate the relationship between degree of extrinsic muscular hypertonicity and deviant body posture on the one hand, and voice handicap and voice quality on the other hand in teachers with persistent voice complaints and a history of voice related absenteeism.

Table 1. Simplified model of external laryngeal muscles and structures, involved in horizontal and vertical movement of the larynx.

position	direction	involved muscles
horizontal	ventral	cricothyroid muscle geniohyoid muscle
	dorsal	cricopharyngeal muscles stylohyoid muscle inferior / middle pharyngeal constrictors
vertical	cranial	geniohyoid muscle cricopharyngeal muscles stylohyoid muscle
	caudal	strap muscles tracheal pull

METHODS AND MATERIALS

This study was carried out as part of a larger multidisciplinary study, which investigates the process of persistent voice problems in teachers. By way of advertisement in professional journals, teachers were invited to participate in this study. The inclusion criteria were that the subjects are teachers with a history of persistent voice problems and have a history of absence from work due to the voice problem. The group consisted mainly of females and because voice problems differ in males and females, only females were included. The number of the female teachers was 25.

Laryngeal muscles, position of the larynx and body posture.
A voice therapist and a physical therapist judged various aspects of muscular tension and body posture (table 2). Body posture and head position were judged in an upright standing position in front of a horizontal and vertical grid with a perpendicular line (for examples of posture: see figure 1).

Table 2. The assessment of the various clusters expected to affect the phonation process, and their individual physiological and postural components.

categories/clusters	muscular and posture components	examiner
elevation larynx	geniohyoid muscle thyrohyoid muscle position hyoid bone position thyroid cartilage	voice therapist
laryngeal tensor	cricothyroid muscle	voice therapist
head and neck muscles	trapezius muscle sternocleidomastoid muscle	voice therapist
body posture	posterior weight bearing anterior weight bearing anteroposition head	physical herapist

Figure 1. Examples of successively: anteroposition of head, upright posture, anterior and posterior weight bearing

Tension of the laryngeal muscles was judged by palpation at rest, i.e. without phonation, by a voice therapist. The procedures of this palpation were done according to the method described by Lieberman[9] and Angsuwarangsee and Morrison.[16] Palpation is a clinical subjective tool, of which Angsuwarangsee and Morrison found a good inter- and intrarater reliability.[16] Table 3 describes the palpation method, used for this research.

The tension of the thyrohyoid and the cricothyroid muscles results into near/total approximation of the space between hyoid bone and thyroid cartilage, and cricoid and thyroid cartilage. Consequently narrow space between hyoid bone and thyroid cartilage, and cricoid and thyroid cartilage is considered as hypertonicity of the muscles involved. Palpation indicates the tonicity, represented by suppleness or stiffness of the muscles. In this study a qualitative judgement of stiffness was made and scored as: tensed or not.

Table 3. The method of palpation and judgment of posture and head position.

Physical aspects	Method of assessment
a. trapezius muscle b. sternocleidomastoid muscle	a. - palpation of the belly of the superior part of the trapezius muscle and feeling the stiffness / suppleness of the muscle - pushing the thumb in the belly of the muscle and feel stiffness / suppleness and observation of the reactions of patient (pain, resistance) b. palpation of the muscle at posterior and inferior part between thumb and fingers and observation of the reactions of patient
a. geniohyoid muscle b. thyrohyoid muscle c. pos. hyoid bone d. pos. thyroid cart.	a. palpation (pushing and gliding) in middle of floor of the mouth with middle finger b. palpation of frontal and lateral spaces between hyoid bone and thyroid cartilage with thumb and forefinger 1. at rest 2. at yawning and phonating /i/ at high pitch c. taking hyoid bone between thumb and forefinger/middle finger and feel position (high position/rotation/toppling) d. taking thyroid cartilage between thumb and forefinger/middle finger and feel position (high position/rotation/toppling)
cricothyroid muscle	palpation of frontal space between thyroid and cricoid cartilage with forefinger/middle finger 1. at rest 2. at yawning and phonating /i/ at high pitch
posture and head position	observation of upright standing position of the patient in front of a horizontal – vertical grid with a perpendicular line, used in physical therapist's practises

The assessed items were categorised into four equal clusters. The assessed items were categorised into four equal clusters. The cricothyroid muscle has a specific function in phonation.[10,33] Therefore this muscle has been considered as an individual cluster. Marks were assigned to each cluster in order to quantify the findings. For the tension/posture index, the clusters were considered of equal importance and each cluster was valued with maximally 4 marks. These scores were added up to form the resulting tension/posture index (see table 4). In this study the total score of the tension/posture index has been used for analyses.

Only new patients were included in this study to prevent possible bias from knowing the diagnosis. The voice therapist and physic therapist examined the patient before she/he saw the ENT-specialist.

Table 4. Tension/posture index resulting from the four clusters: elevation larynx, the visor (horizontal tensor), head and neck muscles, and posture and head position.

cluster	parameter	score	subtotal	total=index
elevation larynx	thyrhigh	1	0-4	0-16
	hyoidhigh	1		
	hthyper	1		
	ghhyper	1		
laryngeal	cthyper	4	0-4	
head and neck muscles	scmhyper	2	0-4	
	traphyper	2		
body posture	antepos. head	2	0-4	
	awb / pwb	2		

[The adjudication of the points to 'tensed' or 'disordered' items. Thyrhigh = high position of thyroid cartilage; hyoidhigh = high position of hyoid bone; hthyper = hypertonicity of thyrohyoid muscle; ghhyper = hypertonicity of geniohyoid muscle; cthyper = hypertonicity of cricothyroid muscle: scmhyper = hypertonicity of sternocleidomastoid muscle; traphyper = hypertonicity of trapezius muscle; antepos.head = anteroposition of the head; fwcarr/bwcarr = anterior weight bearing/posterior weight bearing].

Voice handicap and voice quality

The actual subjective psychosocial consequences of the voice problem were rated by the Dutch version of the Voice Handicap Index (VHI) of Jacobson et al.[11,12] Voice quality was objectively assessed using the Dysphonia Severity Index (DSI) according to Wuyts et al.[13]

Statistics

The statistical program SPSS V.11.0 evaluates the data. Most data is treated with non-parametric tests, such as the Mann-Whitney U test (MW-U) for comparison between groups.

Logistic regression and multiple linear regression methods are used to predict outcome based on a combination of multiple factors.

Spearman's Rho was calculated for the data at the interval level. The significance level was set at ≤ .05.

RESULTS

Muscular tension and body posture

The results of the laryngeal and postural assessments are shown in figure 2. The prevalence of hypertonicity, deviant position of the larynx, and an anteroposition of the head was for most of the parameters more than 50%, except for posterior or anterior weight bearing.

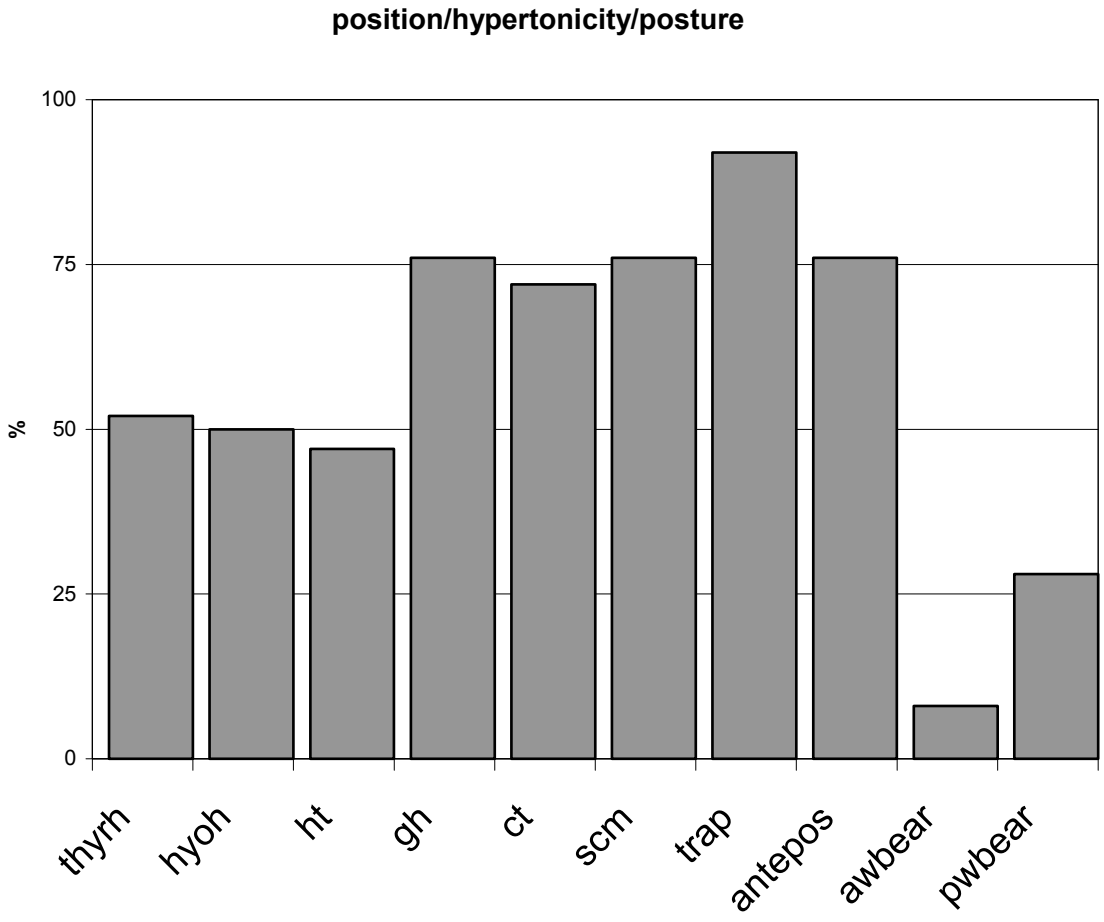

Figure 2. Prevalence in percentages of high position laryngeal structures, muscular hypertonicity and deviant body posture (thyrh = high position of thyroid cartilage; hyoh = high position of hyoid bone; h = hypertonicity of thyrohyoid muscle; gh = hypertonicity of geniohyoid muscle; ct = hypertonicity of cricothyroid muscle: scm = hypertonicity of sternocleidomastoid muscle; trap = hypertonicity of trapezius muscle; antepos = anteroposition of the head; awbea = anterior weight bearing; pwbear = posterior weight bearing). n = 25.

Voice Handicap Index and Dysphonia Severity Index

The median (interquartile range) of the VHI = 72 (48 - 82). The median (IQR) for the DSI = 4.92 (3.91 - 5.81).

Muscular tension and body posture related to voice complaints (VHI)

The MW-U was used to study the relationship between VHI-scores and the tensed or not-tensed laryngeal muscles as well as the normal or deviant body posture. The scores of the VHI and the individual parameters differ significantly (table 5) except for the posterior weight bearing (MW-U: p=0.034) and tension of the sternocleidomastoid muscle (MW-U: p=0.030).

Table 5. Differences of the VHI and DSI-scores with the different elements, calculated with MW-U

muscular tension / laryngeal position/ body posture	VHI	DSI
	p	p
thyroid high position	0.785	0.211
hyoid high position	0.848	0.661
thyrohyoid m.	0.861	0.268
geniohyoid m.	0.656	0.444
cricothyroid m.	0.079	0.046*
sternocl.mastoid m.	0.030*	0.162
trapezius m.	0.581	0.920
anteroposition head	0.702	0.799
anterior weight bearing	0.841	0.167
posterior weight bearing	0.034*	0.015*

* Significant (significance level set at $p \leq 0.05$

While most of the individual muscles or body posture aspects do not show a relation with the VHI, a significant correlation between the scores of the VHI and the scores of the tension/posture index was found. Spearman's r was 0.522, with a p-value of 0.007 (figure 3).

Muscle tension and body posture related to voice quality (DSI)

The MW-U was used to study the relationship between DSI-scores and the tensed or not-tensed laryngeal muscles as well as the normal or deviant body posture. There was also a significant difference between the individual parameters and the DSI (table 5) except for tension of the cricothyroid muscle (MW-U: p=0.046) and posterior weight bearing (MW-U: p=0.015).

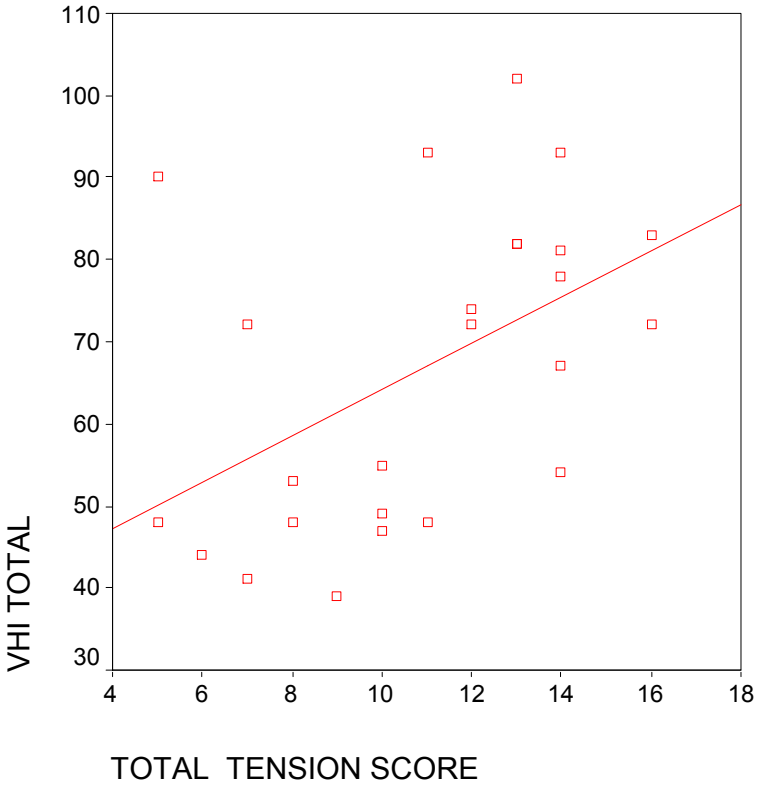

Figure 3. Scatter plot of the score of total tension score (x-axis) and VHI score (y-axis) (Spearman's r: 0.522; p= 0.007).

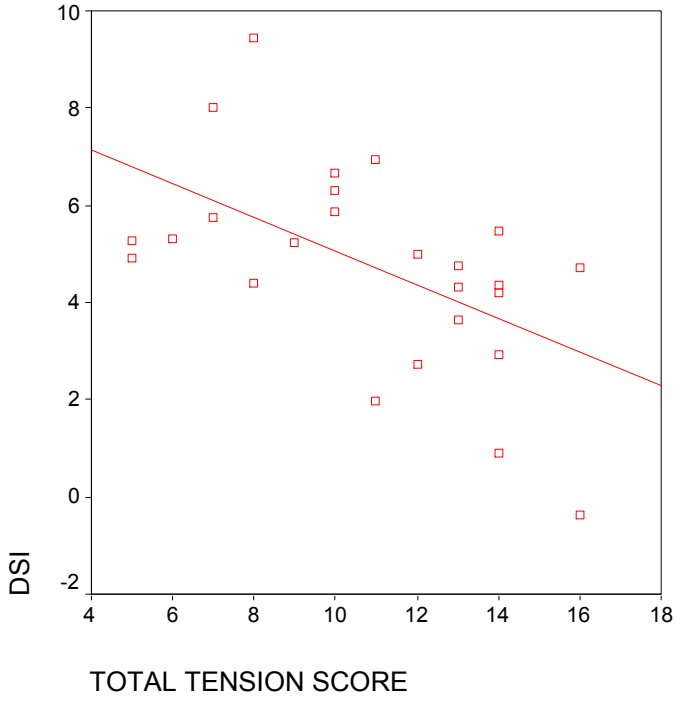

Figure 4. Scatter plot of the total tension score (x-axis) and DSI score (y-axis) (Spearman's r: -0,601; p=0.001).

Although almost none of the individual muscles and body posture aspects show significantly relation with the scores of the DSI, a significant correlation has been found between the scores of the DSI and the total scores of the index. The Spearman's r was -0.601, with a p-value of 0.001 (figure 4)

Combination of factors related to voice handicap (VHI)

In a stepwise regression model, including the parameters shown in figure 1, the combination of hypertonicity in the geniohyoid muscle (p=0.072), the posterior weight bearing (p=0.027) and a hypertonic sternocleidomastoid muscle (p=0.009) appeared to be the most important factor related to a high voice handicap (VHI). However, the p value for hypertonicity in the geniohyoid muscle was > 0.05 (table 6).

Table 6. Components used in ANOVA stepwise backwards regression analyses, and the results of the last step of the analysis to predict outcome of the VHI based on a combination of multiple factors.

Components, used in the analyses			
Thyroid high			
Hyoid high			
Hyo-thyroid muscle			
Geniohyoid muscle			
Cricothyroid muscle			
Sternocleidomastoid muscle			
Trapezius muscle			
Anteroposition head			
Anterior weight bearing			
Posterior weight bearing			
Model	**B-value**	**St.Error**	**Significance**
Geniohyoid muscle	14.105	7.439	0.072
Sternocleidomastoid muscle	21.590	7.498	0.009
Posterior weight bearing	16.086	6.783	0.027

Dependent variable: VHI total

Combination of factors related to voice quality (DSI)

In a stepwise regression, including the parameters shown in figure 1, the combination of hypertonicity in the geniohyoid muscle (p=0.075), the posterior weight bearing (p=0.004), high position of the hyoid bone (p=0.083), hypertonicity

in the cricothyroid muscle (p=0.015) and anteroposition of the head (p=0.052) appeared to be the most important predictor. However, only for posterior weight bearing and cricothyroid muscle was the p-value < 0.05 (table 7).

Table 7. Components, used in ANOVA stepwise backwards regression analyses, and the results of the last step of the analysis to predict outcome of the VHI based on a combination of multiple factors.

Components, used in the analyses			
Thyroid high			
Hyoid high			
Hyo-thyroid muscle			
Geniohyoid muscle			
Cricothyroid muscle			
Sternocleidomastoid muscle			
Trapezius muscle			
Anteroposition head			
Anterior weight bearing			
Posterior weight bearing			
Model	**B-value**	**St.Error**	**Significance**
Hyoid high	1.496	0.816	0.083
Geniohyoid muscle	-1.667	0.886	0.075
Cricothyroid muscle	-2.089	0.785	0.015
Anteroposition head	1.936	0.932	0.052
Posterior weight bearing	-2.781	0.849	0.004
Dependent variable: VHI total			

DISCUSSION

De Bodt et al.[12], Roy et al.[14] and Murry and Rosen[15] stated that the VHI is a useful tool to appraise the self-perceived psychosocial consequences of voice disorders. The VHI is based on a validated questionnaire and can be used as a clinical diagnostic tool for the individual patient. The scores of the VHI however cannot distinguish between specific voice disorders and is therefore not diagnosis related. The VHI was used in this study, because the subjects can be considered as a homogeneous group, where the assessed items do have a similar impact on handicaps and restrictions. A (voice) complaint is per definition subjective, but by

using a validated questionnaire the complaints of individuals of a homogeneous group can be compared.

The DSI is an objective measurement and reflects the multidimensional nature of the voice.[13] The DSI-score is the result of a formula composed out of 4 objective measurements: maximum frequency, minimum intensity, maximum phonation time and jitter. Therefore, the DSI was chosen as a suitable objective tool to correlate with the findings of muscular tension and posture. The Spearman's r is negative, because the score of the DSI is running from -5 for a seriously disturbed voice to average +5 for a clear and good voice. The expectation in such a case is that the higher the score of the muscular tension/posture index, the lower the score of the DSI.

Palpation and judgment of muscular tension and body posture are subjective physical diagnostic procedures, but they are clinical usual tools of many (para)medical professionals. Palpation and observation are daily used clinical instruments for diagnosis.

In research some measurements have been practiced[20,21,28] to obtain objective information about the role of different muscles towards phonation or to get insight in the influence of some alterations in posture at the function or tension of certain muscles, involved in phonation. These objective measurements are still such invasive and inconvenient for patients that they are not yet available for clinical practice. However, an experienced examiner can make reliable and reproducible assessments. The procedures of this palpation are clearly described by Lieberman[9] and Angsuwarangsee and Morrison.[16] Angsuwarangsee and Morrison found also a good inter- and intrarater reliability in the palpation skills, except for the laryngopharyngeal muscles.[16] In this study the laryngopharyngeal muscles were not included.

The creation of the Nijmegen Muscular Tension Index was composed of four categories: extra laryngeal elevators, the cricothyroid muscle (visor), head and neck muscles / head position, and body posture aspects. All these categories refer to extralaryngeal functions. Angsuwarangsee and Morrison[16] made a comparison between these extralaryngeal components and the intrinsic configurations diagnosed as muscle misuse dysphonia type 1 – 4. The interpretation, however, about the intrinsic tension configurations is still subject to discussion. Stager et al.[31] found the same false vocal fold activity and the same anterior – posterior compression in patients with voice disorders as in a control group. Behrman et al.[32] also concluded that median compression of the ventricular folds could be considered as a normal laryngeal posture. The anterior-posterior compression was seen that much in ‘normals’ that the utility as a diagnostic sign of phonatory

dysfunction is questionable. Therefore, the relation of the intrinsic configurations and the extralaryngeal tension is not taken in account in this study.

Phonation is not only a result of activity inside the larynx. Muscle activity in the whole body is also responsible for the appropriate functioning of the larynx. One of the muscles involved in this process is the sternocleidomastoid muscle that undoubtedly reflects postural problems and that, although indirectly, influences the phonation process. Many authors describe or have investigated the role of body posture in relation to muscular tension in the neck and the laryngeal region. A deviant posture, such as posterior or anterior weight bearing, excessive lordosis, kyphosis and/or a deviant head position, will be compensated for in the neck and the laryngeal area.[9,19] The efficiency of the dorsal neck muscles, including the trapezius muscle, seems to be influenced by the head position.[18] “Displacement of gravity”, among other things by changes of posture, has been found to be a discriminating factor in the development of voice problems.[19] This supports our finding that, within the investigated aspects, posterior weight bearing is the only discrete aspect that correlates with both VHI and DSI, and is found in both regression analyses as an important predictor for a high score on the VHI and a low score on the DSI.
A 'normal' cervical lordosis may be used as a tool to move the larynx i.e. the cricoid cartilage for producing low pitches.[21] An anteroposition of the head facilitates an increased cervical lordosis. In this study more than 70% of the subjects (figure 2) had an anteroposition of the head. The deviant cervical lordosis may be influence negatively the control of pitch regulation and fine-tuning of the phonation process.[5,10,21,30] The speaker or singer needs an increased muscle tension, or at least a compensation mechanism, for reaching the same aim.
Hypertonicity of the cricothyroid muscles influences the mobility of the visor function of cricoid and thyroid cartilages.[10] This results in an ergonomic disadvantageous start of the phonation. The start of phonation is tensed and the speaker has to compensate to reach the same quality of voice. This will lead to a hyper tensed phonation and probably to vocal fatigue. Tension of the cricothyroid muscle will also influence the fine-tuning for F0. This tuning differs in the transition from voiceless or voiced consonants to vocals.[33] This means that during speech a very quick and flexible change of tension should be possible and this is restricted in case of a tensed cricothyroid muscle.

All subjects in this study showed deviances in one or more aspects of extrinsic laryngeal muscular tension and body posture (figure 2). Angsuwarangsee and

Morrison[16] found a significant correlation between hypertonicity of the thyrohyoid muscles and specific voice disorders in a group of 465 patients, namely patients with an anteroposterior constriction of the supraglottal area during voicing due to gastroesophageal reflux. In this study the thyrohyoid muscle did not show a significant correlation with voice handicap or voice quality. This could be caused by the fact that we didn't divide our subjects into different groups of disorders. Furthermore, it is possible that we had just a few subjects with gastroesophageal reflux. Probably a third aspect is that we didn't want to find a correlation between the tension and categories of voice disorders, but tried to correlate tension with complaints and voice quality. Only the tonicity of the sternocleidomastoid and the cricothyroid muscles showed a significant correlation with the VHI and the DSI respectively. Apparently, hypertonicity of the neck muscles has a great impact on the complaints and handicaps of a patient.
In the literature several authors have discussed the relation between body posture and breathing. Iwarsson[6] describes that he way of breathing induces typical changes of body posture that in turn affect the position of the larynx. Respiration of the costal type for example results in a higher activity in the sternocleidomastoid muscle.[20] Most of the findings in the literature pertain to relations of one physical aspect with another. In this study we have correlated the discrete aspects to voice handicaps and voice quality. As shown in table 3, only three aspects show a significant relation. Apparently, no single aspect of muscular hypertonicity or deviant body posture influences the complaints or the voice quality. Posterior weight bearing, however, is the only postural aspect to show such influence.

It is remarkable that in the final results of the regression analysis, aspects from all categories were found to be significant, especially with regard to the voice quality (DSI). This favors the concept that phonation is an integrative result of a wide range of postural and perilaryngeal muscular activity.
During palpation of the floor of the mouth, a tensed geniohyoid muscle was frequently found (figure 2). This is supposed to lead to elevation of the larynx. Milidonis et al.[22] found an increased tension in the geniohyoid muscle by changing the head position from normal to anteroposition. Our study underlies the findings of Milidonis et al., because the combination of hypertonicity of the geniohyoid muscle and anteroposition of the head, amongst other aspects, were found to be important factors related to a high score of the VHI and a low score on the DSI.
This study demonstrated that particularly posterior weight bearing and hypertonicity of the sternocleidomastoid muscles have a remarkable correlation with the subjective handicaps of the patients. Furthermore, one of the elevators,

that is the geniohyoid muscle, modify the pattern of complaints. A high position of the larynx and a high tonus of perilaryngeal muscles are considered a part of functional voice disorders.[1,10,17] This explanation is based on the idea that some voice disorders are brought about by this muscular hypertonicity. A high position of the thyroid cartilage and hyoid bone, and high muscular tension in the head and neck region are considered to be part of hypertonic voice use, as mentioned by several authors.[1,6,16,17] However, others explain the perilaryngeal muscle hypertonicity as a result, partially, of psycho-emotional stress, as is the case in the Repetitive Strain Injury Syndrome.[2,23-26] Physical stressors, like noise, environmental vibrations, as well as mental stressors force an individual to use higher levels of muscular stiffness to achieve a same level of precision of activity. This leads to suboptimal movements in which more muscular energy is needed. Blood circulation and neural innervations will be hindered or blocked.[2] Stress is a normal biological and mental excitement occurring in everyday life. A physiological increase in stress is needed to perform well. A pathological increase in stress (dis-stress) may result in an increase in muscular tension.[26] This increase in tension tends to focus on the shoulders and neck region. Teachers experience increased stress in their profession and complaints of pain in the neck and shoulders are very common in the field of education.[27]

CONCLUSIONS

The results of this study demonstrate that the more muscular hypertonicity and deviant body posture, or combinations of these aspects, a patient has, the more complaints about voice handicap she/he will have. It is demonstrated that hypertonicity of more than one group of muscles in combination with posture problems will cause these complaints, because the individual muscles or body posture aspects do not show significant relations, except for the sternocleidomastoid muscles and posterior weight bearing. The same results have been found regarding the correlation of hypertonicity and/or posture problems, and the quality of the voice. Here too, no significant relation has been found for individual muscles, except for the cricothyroid muscle and, again, posterior weight bearing. The results show that specific combinations of hypertonicity and posture problems are related to high scores on the VHI and low scores on the DSI. This confirms the importance of a meticulous observation of body posture and palpation of the larynx in the assessment of voice disorders, to inventory those aspects that should be corrected in in therapy. It is recognized that movements in a pre-tensed

system may lead to complaints, for example RSI. Perhaps muscular tension in teachers is an early sign of the development of complaints. It also suggests that, in voice therapy, attention should be paid to correction of deviant body posture and precise relaxation of the muscles mentioned in this study. No judgments can be pronounced about present tension and the specific voice disorder that exists. Further investigation on palpatoire findings and objective measurements with EMG are recommended.

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Chapter 7

Risk Factors for Voice Complaints throughout the Teaching Career

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ABSTRACT

Several risk factors are known to be associated with voice problems, especially in voice-loaded professions. The aim of this study was to identify risk factors in teachers throughout their career. Primary and secondary school teachers were invited to complete a questionnaire; 1775 sets of responses were suitable for analysis. The questionnaire addressed personal, voice loading, physical, psycho-emotional and environmental aspects of the voice and voice problems. Voice complaints were reported by a large percentage of the teachers with a decreasing tendency with increasing stages. Throughout the teaching career, teachers with voice symptoms scored the prevalence of ten out of sixteen risk factors at a level of fifty percent or more. In general no distinct tendency could be observed in the course of percentages teachers with voice complaints. The odds ratios indicated a high relative risk in almost all categories of the risk factors and showed an increasing tendency throughout the career. Only the environmental category showed a low relative risk and no distinct tendency could be observed. These findings indicated that teachers with voice complaints were more susceptible to several risk factors, especially in the vocal load, physical and the psycho-emotional domains, but there was no increase in determinants as their career progressed. However, an increasing relative risk was found. Obviously, teachers develop coping strategies for voice risks to some extend that are reflected in the decrease of voice complaints throughout the teaching career. Further research is needed to specify adequate coping strategies. Bringing adequate coping strategies into action during training or in an early stage of the career may prevent voice problems throughout the teaching career.

Keywords: teachers, teaching years, voice complaints, risk factors, relative risk

INTRODUCTION

Several authors[1,2,3] described the multifactorial pathogenesis of professional voice disorders. In the literature different internal and external factors are mentioned that may influence the ability of the voice to withstand the demands of the teaching profession.[4,5] Morrison and Rammage described various factors that can influence the voice: deviant body posture and imbalanced use of muscles, behavioural habits, such as smoking and shouting, emotional disturbances and gastro-esophageal reflux. The presence of one or more of these conditions may lead to

voice disorders.[4] Several authors described a number of risk factors, for example lack of voice training, background noise, acoustics, air quality, voice constitution.[5,6,7,8,9] Most of these factors can be clustered into four categories of determinants: voice load, psycho-emotional aspects, physical aspects and environmental aspects. Many authors emphasized the importance of the voice load category. Preciado found that longer classroom hours were related to a higher prevalence of voice disorders[10]. Speaking loudly for a long time is one of the heaviest loading factors in the teaching profession and will ultimately lead to vocal fatigue.[11,12] Intensive voice use was found to increases the mechanical load on the mucous membranes.[12] The voice par excellence is the instrument to express opinions and emotions. However, emotions can have a negative influence on voice production, especially in sensitive persons. Increased levels of stress changed the phonation pattern with a subsequent increase in voice load.[13] An increase in external muscular tension, inconsistencies and deterioration in general health may lead to the development of voice symptoms[14] and to diminished fine-regulation that results in dysphonia and pathological voice fatigue.[9] An unsuitable acoustic employment environment and other unfavorable environmental conditions, such as dry air, dust, smoke, air pollution and temperature changes, may irritate the mucosa and have detrimental effects on the voice.[8,15,16,17] Mucosal disorders affect voice production and reduce vocal capacity.

In teachers, voice problems occur more frequently and more severely than in other professions.[17,18,19,20] The societal cost of voice problems in teachers (in terms of lost employment days and treatment) is tremendous (for example in the United States about $2.5 billion annually[21]). Moreover, voice problems in teachers may become so chronic that long-term specific therapeutic approaches are required[20]. There is still a lack of knowledge about the role of risk determinants throughout the teaching career.[23] Therefore, it seems worthwhile to obtain detailed information on risk factors and their course during the teaching career.

Very few studies have been conducted on the course of voice complaints during the career of teachers. Pahn detected a pattern in the prevalence of voice problems in teachers: after two years of teaching due to inadequate adaptation to the professional requirements, after 10 years due to taking on tasks with more responsibility and after 20 years, especially in the women, due to hormonal changes.[22] The length of the teaching career is related to age. It is generally accepted that voice capacity decreases with age.[2,3,10,12] Thus, a longer teaching career may form a risk for the development of voice problems due to physical changes.

The aim of this cross-sectional study was to gain insight into the prevalence of risk factors during the teaching career and to evaluate whether there were differences between the teachers with voice complaints and those without.

MATERIALS AND METHODS

This investigation is part of a more extensive study that addresses voice problems in teachers.

Description of the study sample

The first author approached the directors of primary and secondary schools by telephone to invite the teachers (n = 6000) to take part in a questionnaire survey. The aim and background of the study were explained in the questionnaires and instructions were given for their completion (Appendix A1). Data were treated anonymously and each individual could return the questionnaire in a stamped addressed envelope. Our specially designed questionnaire comprised 35 questions that included items on personal aspects, the prevalence of voice complaints and voice-related absenteeism, as well as voice loading, physical, psycho-emotional and environmental aspects (Appendix B). The four categories of risk and their determinants are shown in table 1.

Table 1. Four risk categories with the relevant determinants

categories	determinants
voice load	full-time - part-time; number of pupils; number of teaching years
physical aspects	neck and shoulder problems; lower back problems; mucosal problems; general condition; diminished hearing
psycho-emotional aspects	stress; emotions; composition of group; work load
environmental aspects	acoustics; humidity; temperature; irritants

Description of the new questionnaire

A new questionnaire was designed on the basis of data from the literature[21,23] and clinical experience. Additionally, comments were used from workers in the teaching profession.

The questions had a simple and straightforward style, without any restrictions about the nature of the voice complaints and the perceived risk factors.

Questions 6-8 addressed voice complaints or symptoms in different stages of the teaching career. If one or more of these questions were answered positively, the subject was classified in the group 'voice complaints or symptoms present during the teaching career'.

Questions 5, 19-20 addressed voice load aspects; questions 25-28 and question 31 addressed physical aspects; questions 21, 24, 29-30 addressed psycho-emotional aspects; questions 32-35 addressed environmental aspects. Questions answered with yes or no, or multiple choice, were dichotomised into 0 (no or not present) and 1 (yes or present). Answers of 0 and 1 were classified as negative (score=0), while answers of 2, 3 and 4 were classified as positive (score=1).

Career stages

The teaching career was divided into eight consecutive stages: t1: 0-4 years of teaching; t2: 5-9 years of teaching; and so on.

Statistical analysis

The data were analysed using the statistical programme SPSS 12.0 and presented in a descriptive way. Discrete outcome variables were analysed with Chi-square tests. The significance level was set at $p < .05$. The relation between voice symptoms that occurred at any time during the professional career (questions 6-8) and various factors were assessed by the calculation of odds ratios to quantify the dependency in 2x2 tables: [(A:C):(B:D); e.g. A = percentage without symptoms; C= percentage with symptoms; B= percentage without symptoms but with perceived risk factor full-time vs part-time; D= percentage with symptoms and with perceived risk factor full-time vs. part-time)]. An odds ratio of >2 or <0.5 was considered to be meaningful.

RESULTS

More than one third (1775) of the questionnaires were filled out correctly and returned.

The mean age (range) of the teachers was 44 years (21-64 years), in the men 48 years (22-64 years) and in the women 42 years (21-63 years).
The numbers of teachers in the 8 teaching stages are shown in figure 1.

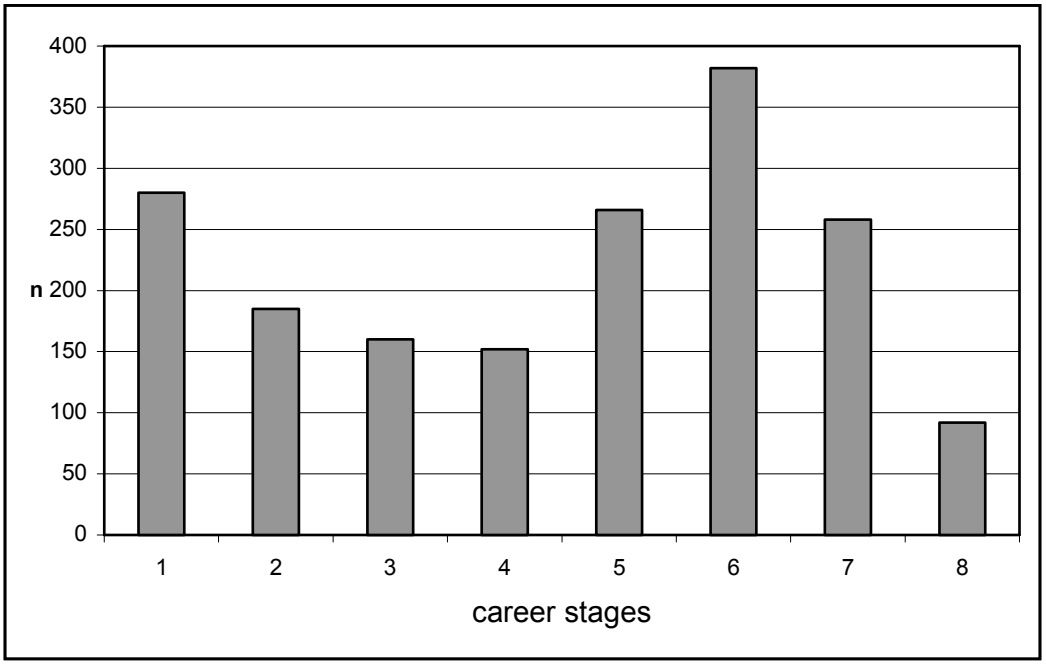

Figure 1. Teaching career divided into 8 5-year stages (t) and the number of teachers in each stage: t1: 1-4 years, t2: 5-9 years, t3: 10-14 years, t4: 15-19 years, t5: 20-24 years, t6: 25-29 years, t7: 30-39 years, t8: 35-40 years

Symptoms and professional career

Voice complaints were reported by 17.2% of the teachers at the time of the investigation, 33.9% during the past year and 35.9% of the teachers reported voice complaints during the time of the investigation and/or the past year. The course of the reported voice complaints during the time of the investigation and/or the past year throughout the career is shown in figure 2. A decreasing tendency is observed with increasing stages. However, the percentage remains more than 20%.

Perceived risk factors

In the individuals with voice complaints, the percentages of perceived risk factors were assessed. Subsequently, the course of perceived risk factors during the career was investigated. The odds ratios indicate the relative risk of the various perceived risk factors for the development of voice problems. The course of the perceived risk factors and their relative risk for the development of voice problems during the career was reflected in the various teaching stages.

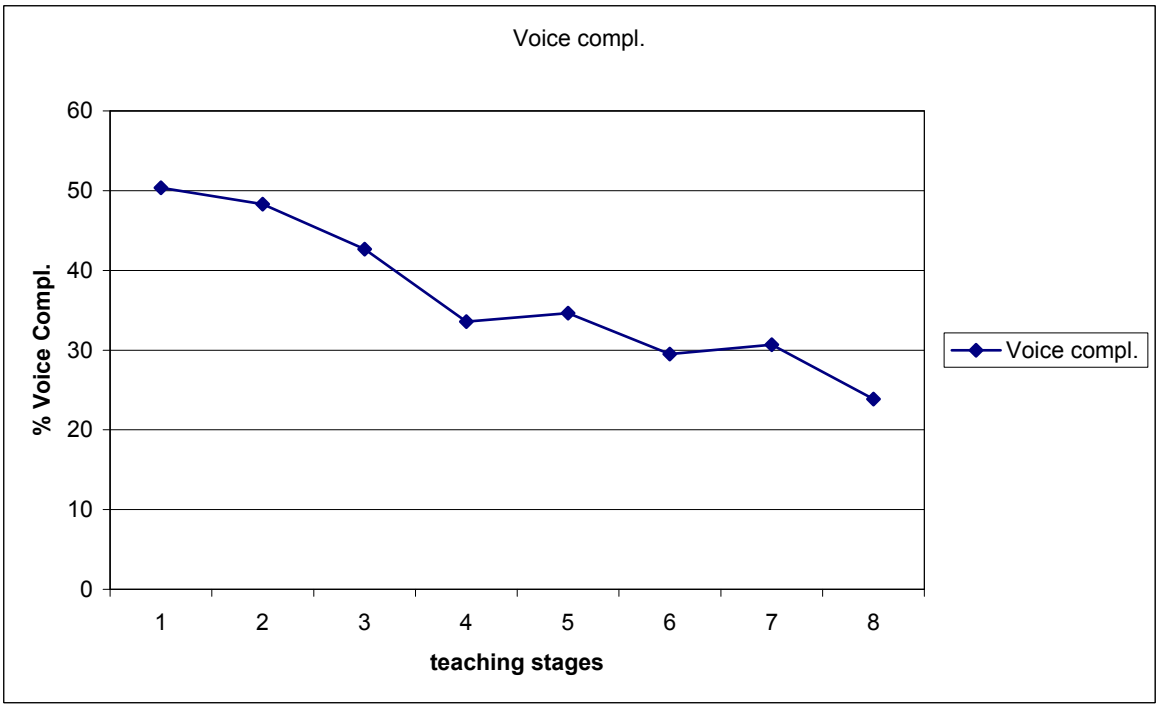

Figure 2. the percentage of teachers that reported voice problems at the moment and/or the last year in the various teaching stages.

Voice Load

The percentages of teachers (with voice complaints in the 8 teaching stages) who reported the factors 'full-time vs. part-time employment', 'number of pupils' and 'number of teaching years' as 'voice load' risk factors, are shown in figure 3. The factors 'full-time – part-time employment' and 'number of pupils' were reported to a high degree, in contrast to the factor 'number of teaching years'. A distinct tendency was not observed.

The course of the relative risk of the various perceived risk factors regarding voice load is represented in figure 4. The factor 'full-time – part-time employment' was not a relative risk for voice problems, and showed no distinct pattern. The factors 'number of pupils' and 'number of teaching years' were a relative high risk after the first stage and showed an increasing tendency throughout the teaching stages.

Physical factors

The percentages of teachers (with voice complaints in the 8 teaching stages) who reported the factors 'neck and shoulder problems', 'lower back problems', 'mucosal problems', 'general condition' and 'diminished hearing' as physical risk factors, are shown in figure 5. The factors 'mucosal problems' and 'general condition' were reported to a high degree in comparison with 'neck and shoulder problems', 'lower back problems' and 'diminished hearing'. A distinct tendency was not observed.

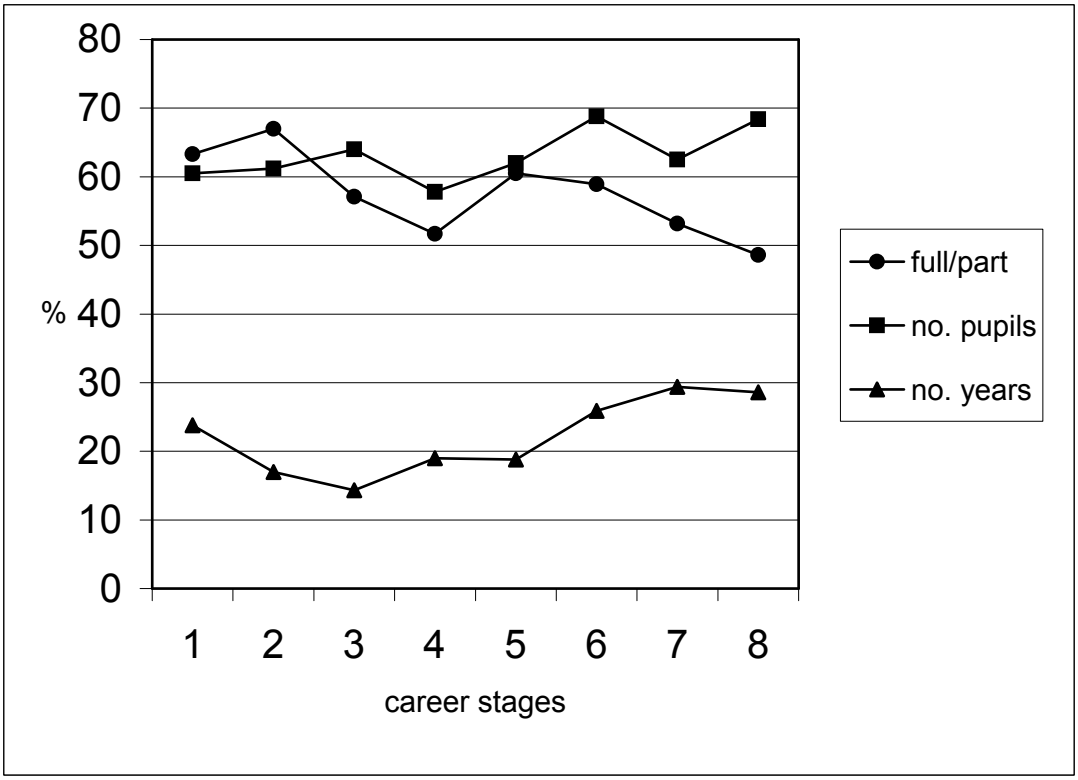

Figure 3. Percentages of teachers (with voice complaints and divided into 8 5-year stages) who reported the factors 'full-time – part-time employment', 'number of pupils' and 'number of teaching years' as voice load risk factors (full-part: 'full-time – part-time employment'; no. pupils: 'number of pupils'; no. years: 'number of teaching years)

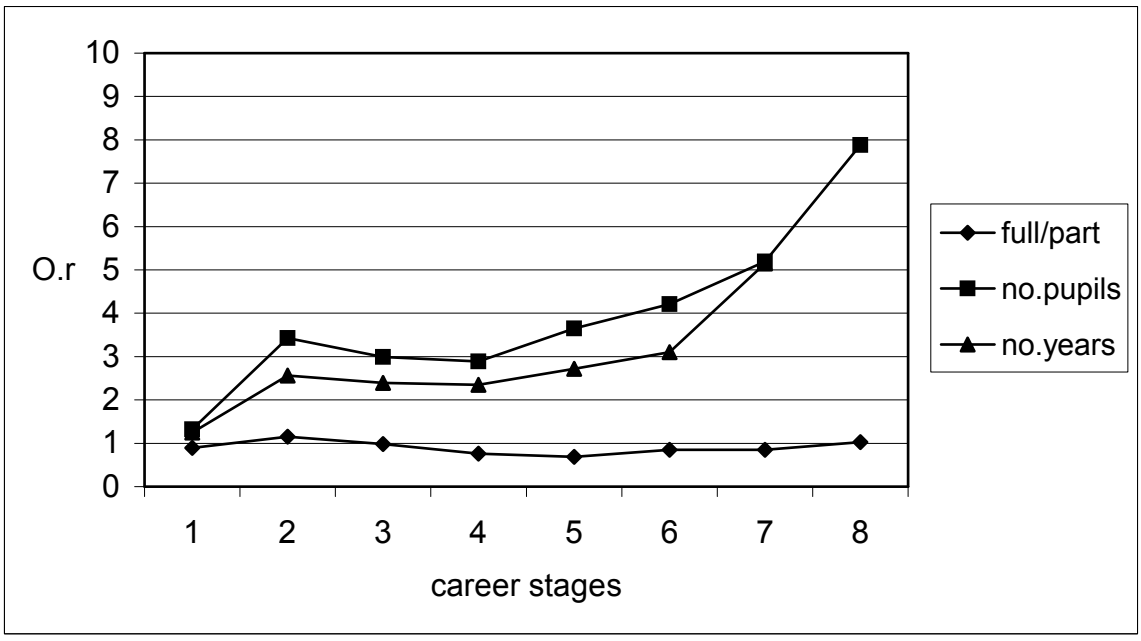

Figure 4. The Odds ratios, indicating the relative risk to develop voice complaints if a teacher perceived a voice load factor as a risk for voice problems. (O.r: Odds ratio; full/part: 'full-time – part-time employment'; no. pupils: 'number of pupils'; no. years: 'number of years')

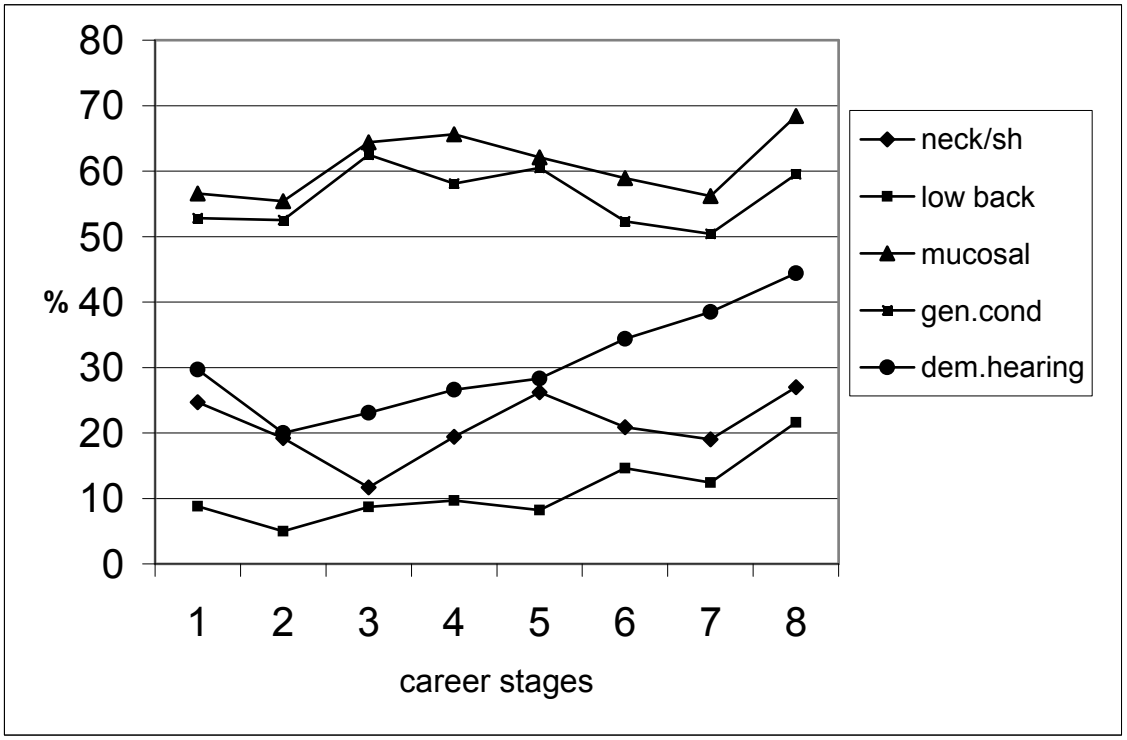

Figure 5. Percentages of teachers (with voice complaints and divided into 8 5-year stages) who reported the factors factors 'neck and shoulder', 'lower back problems', 'mucosal problems', 'general condition' and 'diminished hearing' as physical risk factors. (neck/sh: neck and shoulders; gen.cond: general condition)

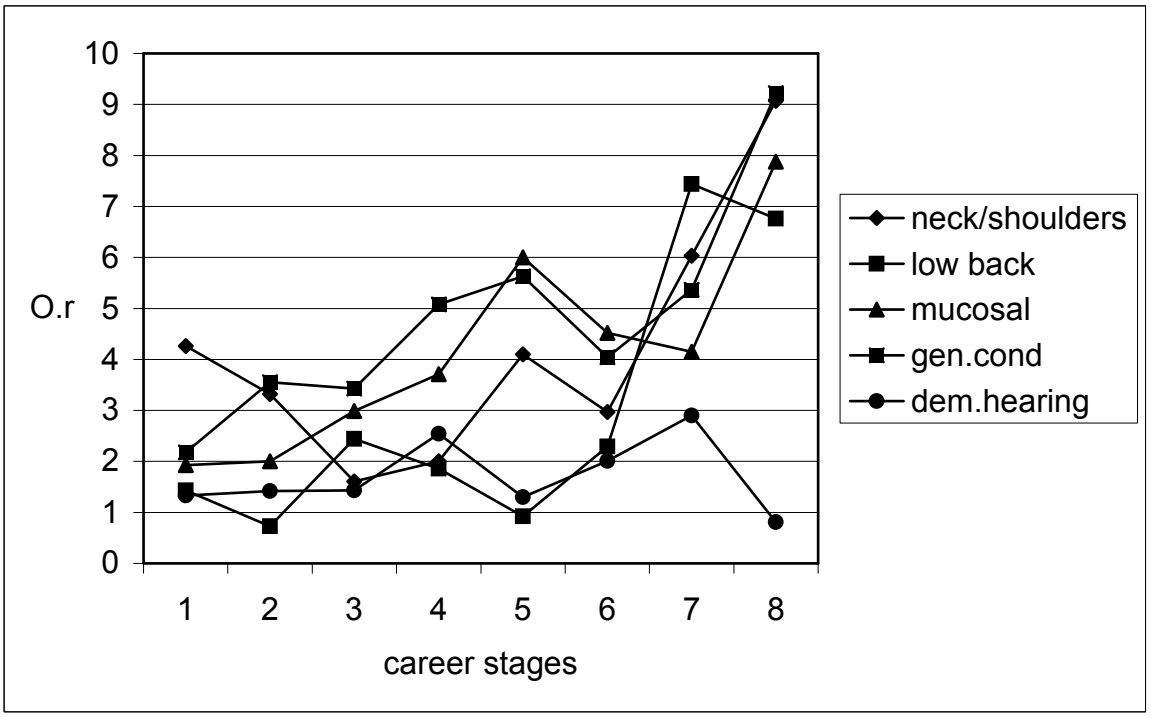

Figure 6. The Odds ratios, indicating the relative risk to develop voice complaints if a teacher perceived a physical factor as a risk for voice problems. (O.r: Odds ratio; neck/sh: neck and shoulders; gen.cond: general condition)

The course of the relative risk of the various perceived risk factors regarding physical factors is represented in figure 6. All the factors, except ‘diminished hearing’, showed, indeed in various degrees, an increased relative risk and an increasing tendency throughout the teaching stages.

Psycho-emotional factors

The percentages teachers (with voice complaints in the 8 teaching stages) who reported the factors ‘stress’, ‘emotions’, ‘composition of the group’ and ‘work load‘ as psycho-emotional risk factors are shown in figure 7. The teachers reported all factors equal to or more than fifty percent. No distinct pattern could be observed.

The course of the relative risk of the various perceived risk factors regarding psycho-emotional factors is represented in figure 8. All the factors showed an increased relative risk and an increasing tendency throughout the teaching stages. There is a remarkable peak of the relative risk ‘stress’ in stage four.

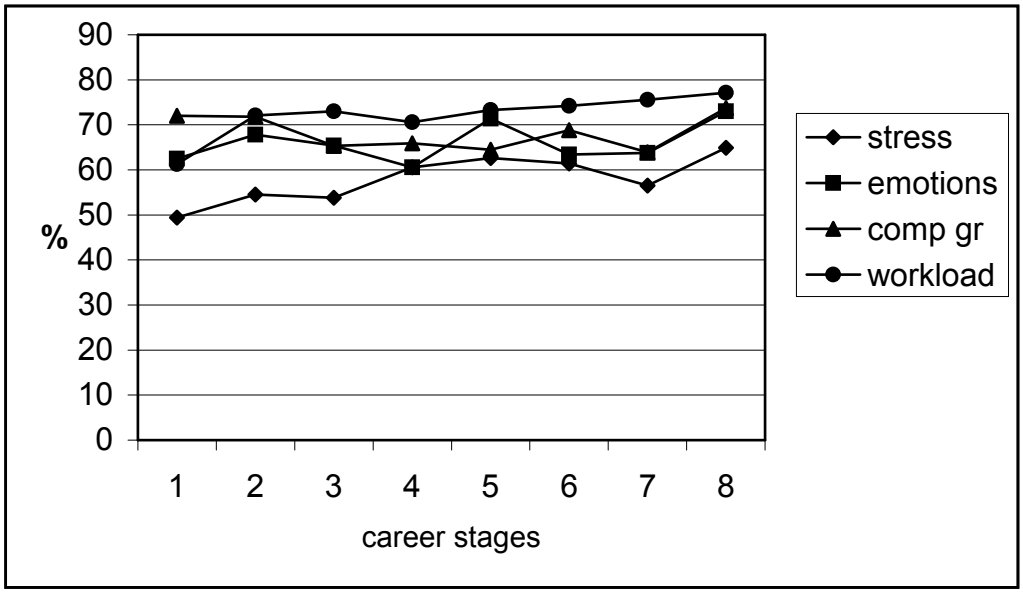

Figure 7. Percentages of teachers (with voice complaints and divided into 8 5-year stages) who reported the factors ‘stress’, ‘emotions’, ‘composition group’ and ‘workload’ as psycho-emotional risk factors. (comp.gr: composition group)

Environmental factors

The percentages teachers (with voice complaints in the 8 teaching stages) who reported the factors ‘acoustics’, ‘humidity’, ‘temperature’ and ‘irritants’ as risk factors, are shown in figure 9. The frequencies differed between the factors, ranging from 20 to 71 percent. No distinct pattern could be observed.The course of the relative risk of the various perceived risk factors regarding environmental

factors is represented in figure 10. Most of the factors showed a relative risk of less than two times and did not show a distinct tendency throughout the teaching stages.

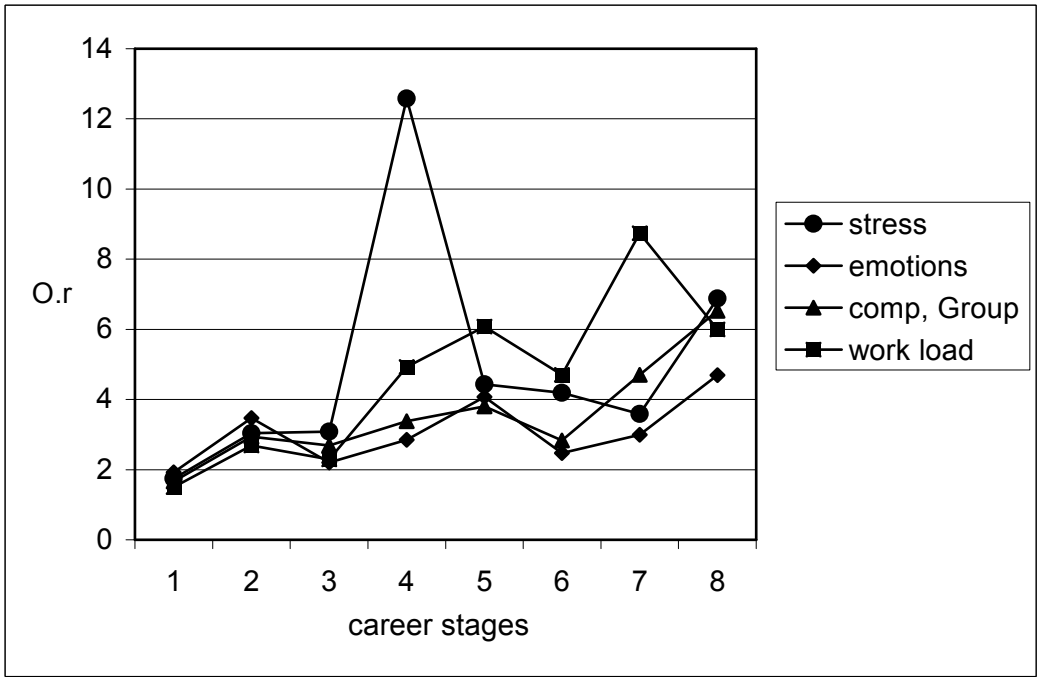

Figure 8. The Odds ratios, indicating the relative risk to develop voice complaints if a teacher perceived a psycho-emotional factor as a risk for voice problems. (O.r: Odds ratio; comp.gr: composition group)

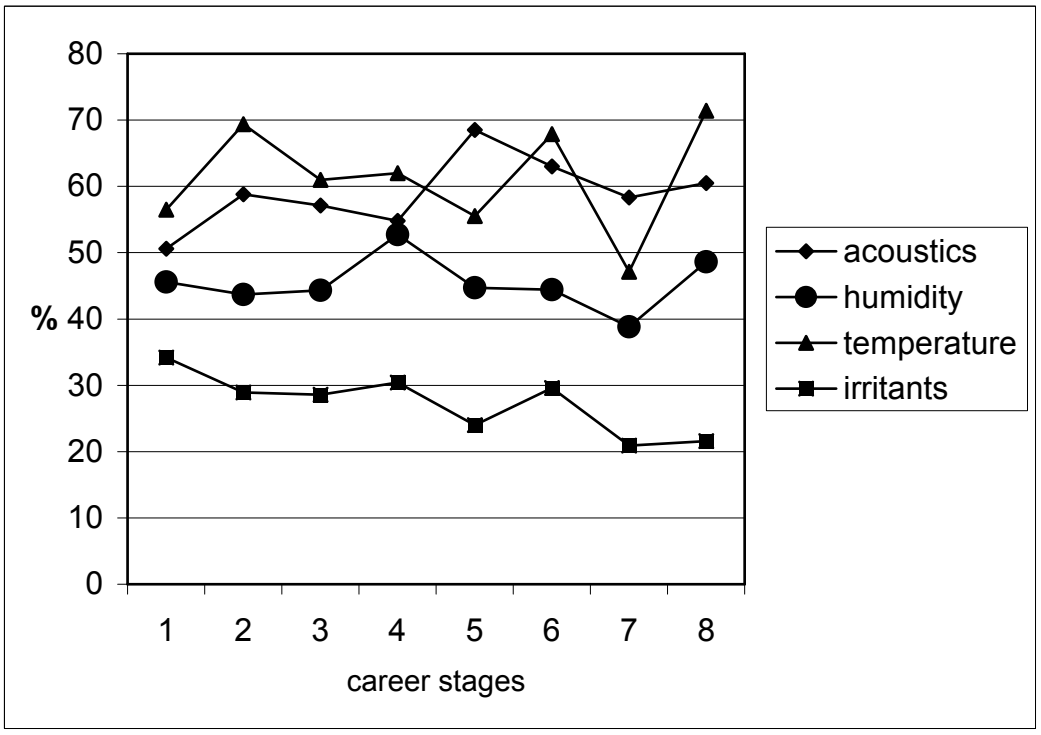

Figure 9. Percentages of teachers (with voice complaints and divided into 8 5-year stages) who reported the factors: 'acoustics', 'humidity', 'temperature' and 'irritants' as environmental risk factors

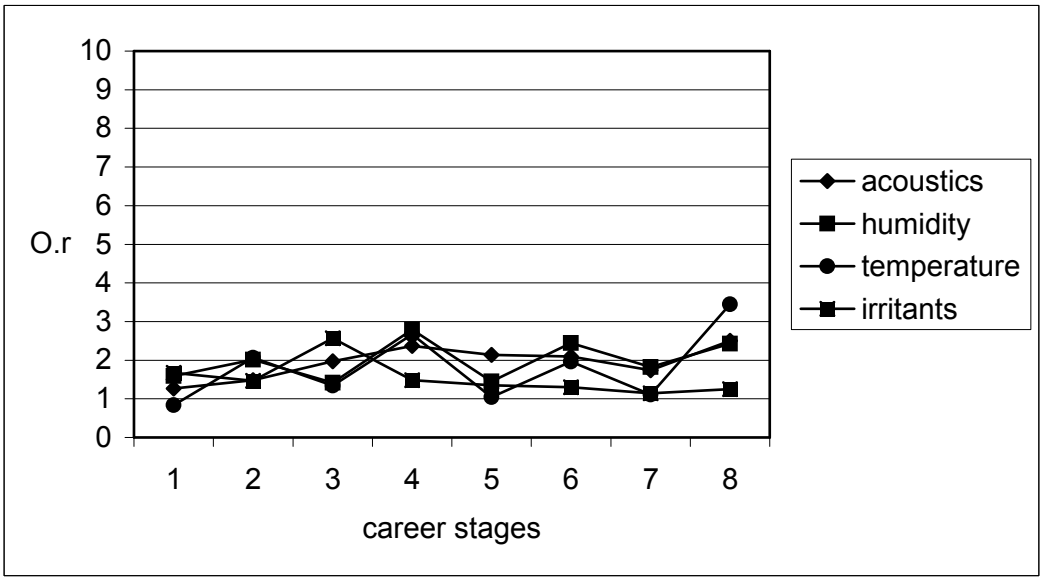

Figure 10: The Odds ratios, indicating the relative risk to develop voice complaints if a teacher perceived a environmental factor as a risk for voice problems. (O.r: Odds ratio)

DISCUSSION

General aspects

A specially designed questionnaire was used to evaluate voice complaints in teachers and to determine which factors played a role. This self-report inventory consisted of questions on factors considered to be risk factors for voice problems and absenteeism from work due to voice problems.[37,38] The risk factors for voice problems were categorized into four groups: voice loading risk factors, physical risk factors, psycho-emotional risk factors and environmental risk factors. The questions were formulated in a simple and straightforward style.

The questionnaire may have introduced subjective elements inherent to this type of investigation[24], but they collected a vast amount of data in a practical way. The ultimate total of 1775 useful responses provided a large sample for analysis. Written instructions have been observed to reduce biases from interaction with an interviewer and anonymity has been reported to encourage candid and honest responses to sensitive questions.[25]

The questions uniformly are presented and there is no middleman bias. The non-response rate may have biased the prevalence of voice complaints, but the direction of the bias was unclear. We do not know whether the subjects with voice complaints were more apt to respond, or whether they were more reluctant because of fear and uncertainty. Possibly, the not personal distribution of the

questionnaire is one of the reasons for the non-respons rate. The negative influences of the non-response rate can be compensated by a large initial random sample. The more homogeneous the group respondents and non-respondents is, the fewer the negative influences of the non-response rate.[25] The weakness of the cross sectional design has been reported to be the difficulty in establishing a causal relationship from the data collected in a cross sectional time frame.[12, 25] Nevertheless, cross sectional studies have been found to be convenient for examining networks of causal links and are useful as the first step in a cohort study at little cost.[25] The results help to define the demographic and clinical characteristics of the study group at baseline and can sometimes reveal cross sectional associations of interest.[25] Data on prevalence and risk factors are important to elucidate the causes of voice disorders, the frequency with which new disease develops in a population, the characteristics that increase the risk and to develop early screening or disease prevention programmes that aim to protect against further deterioration of the larynx or related structures[17]. Before embarking on field studies to study risk factors for voice problems, it would be valuable to have information on which risk factors subjects experience or perceive to be a negative influence on their voice. This would be a valuable guide to plan further research and to improve vocal health care in teaching professionals.

The mean age (range) of the teachers was 44 years (21-64 years). In 2003, the mean age of the school teachers in the Netherlands was 43 years according to the Dutch Central Bureau for Statistics (CBS).[26] This also corresponded with the study by Roy et al., whose participants ranged from 20 to 66 years, with a mean age of 44.2 years.[19] Thus, the age of the population surveyed in the present study was fairly representative of the total teaching profession.

Voice symptoms were reported by 58.6% of the teachers during their teaching career. This high percentage was also reported by Roy et al., who found that 57.7% of the teachers complained about voice problems during their lifetime[19]. However, in the present study more teachers reported current voice problems than in the study by Roy et al.: 17.4% versus 11.0%. Russell et al. found that 16% of the teachers reported voice problems on the day of the survey, while 20% reported problems during the past year.[24] The results of the present study agree closely with these findings.[19,24] This suggests that the relatively large number of non-responders did not have a significant bias.

In this study no correction was made for the distribution of men and women in the survey sample. According to the CBS, there is a predominance of women in primary education and of men in secondary education.[26] This corresponds with the situation in our population of teachers.
Furthermore, it was likewise not necessary to apply weighting regarding school type, because there were no significant differences in voice complaints between the primary and secondary school teachers.

Risk factors and methodological choices
The aim of this cross-sectional study was to gain insight in the course of the prevalence of risk factors and their relative risk for voice problems in teachers during their career. The proper method for such an investigation is a longitudinal study. However, this would imply a forty-year duration of the study. Therefore, a cross sectional study was applied. This may introduce bias because the data are based on subjective rating of the teachers that may differ with socio-cultural context in the course of time. Furthermore, the risk factors may change in the course of time. The direction of the possible bias is difficult to indicate and may differ for the various factors. Furthermore, it should be mentioned that this research investigated the subjective problem perception of the teachers. It is possible that the subjective perception does not correspond to the physical correlate of the item that was investigated. Acoustical environment, for example, includes a lot of aspects that can be involved in the answer of the teacher. However, it is still very important to know what kind of influences the teachers with voice problems experience to be able to investigate the whole spectrum in a later cohort or experimental study.

The prevalence of risk factors and their relative risk for voice problems in teachers during their career are presented in a descriptive manner. This is a simple but clear way to present the results, based upon statistical calculations. The emphasis was put on tendencies, rather than on details.

The observation that voice complaints were reported by 17.2% of the teachers at the time of the investigation, 33.9% during the past year and 35.9% of the teachers reported voice complaints during the time of the investigation and/or the past year indicates that voice problems in the teaching profession should be taken seriously. It confirms that teaching is a high-risk profession for voice problems.[17,21]
It is remarkable that teachers throughout the career stages show a decreasing tendency in reporting voice complaints during the time of the investigation and/or

the past year. On the other hand, the observation was made that most of the relative risks for voice problems show an increasing tendency throughout the career stages. Thus, it may be concluded that teachers without voice problems may have developed coping strategies one way or another and that teachers with voice problems may have difficulties with coping. Making the teachers more aware of the role of the various risk factors and supporting care probably reduces the high percentage of voice complaints. This should be part of an occupational safety and health program.

Perceived risk factors

Ten out of sixteen factors were reported to be a risk factor for voice problems at equal or more than 50 percent of the teachers. They are located in all main categories: voice load, physical aspects, psycho-emotional aspects and environmental aspects. The risk factors in the psycho-emotional domain are dominantly present. These observations support the idea that voice problems have a multicausal etiology. [5,9,19,23,39] In the diagnosis treatment and prevention of voice problems in teachers a holistic approach appears to be appropriate. Besides physical issues, psycho-emotional and environmental aspects should be taken into account.

Throughout the teaching career, no distinct patterns of changes could be found in the percentages of teachers with voice complaints who perceived voice load, physical aspects, psycho-emotional aspects and environmental aspects as a risk factor for voice complaints, except for the items diminished hearing and low back problems.

Previous studies discussed possible causes for voice complaints in teachers. [5,9,19,23,39,41] It was observed that teachers load their voice by speaking loudly for long periods.[30,39,40] Furthermore, it has been reported that vocal fatigue increases with the number of teaching years, due to the increase in voice load.[9] Baker et al.[27] found that the intensity of the voice in older people was lower on all the tasks. In general, a decrease of voice capacity is observed as age advances, among others because of ossification of soft tissues, degeneration of connective tissue, and decreased pulmonary and neuroregulatory function.[17] Therefore, it may be expected that such degeneration would influence the capacity and robustness of the voice of teachers in the later teaching stages. Any decrease in voice capacity might influence the load of teaching hours, teaching years and others on the occurrence of voice problems. This study, however, did not confirm that teachers with voice problems experience increasing voice load as negative for their voice

throughout their career. The factor ‘full-time – part-time employment’ was not a relative risk for voice problems, and showed no distinct pattern. The factors ‘number of pupils’ and ‘number of teaching years’ were a relative high risk after the first stage and showed an increasing tendency throughout the teaching stages. The fact that these differences are caused by a decrease of experienced risk by the teachers without complaints supports the idea that usually teachers are able to cope with these risk factors.

Gotaas and Starr reported high scores on the risk factor ‘mucosal problems’ and suggested that mucosal disorders may affect voice production and reduce vocal capacity.[9] They confirmed that mucosal problems form part of the development of vocal fatigue. Jones et al. describes that in a group of telemarketers with voice problems, factors such as mucosal disorders, sinus disorders and frequent colds, played significant roles.[31] The high percentages of teachers with voice complaints who reported mucosal problems as a risk factor indicates a need for further research into this area. The present study did not investigate whether the mucosal problems were caused by mechanical load, environmental influences or other factors. Therefore, it may be worthwhile to investigate possible influences of environmental irritants, individual susceptibility to irritants and tobacco and alcohol consumptions of teachers. A careful approach to change such influences seems to be indicated.

Many of the teachers with voice complaints regarded deterioration in general physical condition as a high risk for voice complaints. A distinct pattern throughout the teaching stages was not observed. This is in accordance to Ramig and Ringel, who found that the subjects in good physical condition performed much better in different vocal tasks.[32] This applied both to their young and elderly subjects. The Roman proverb ‘Mens sana in corpore sano’ may be transformed into ‘Vox sana in corpere sano”. This emphasizes the key role of good general health in phonation and the high number of teachers who perceived deterioration in general physical condition as a negative factor on voice performance supports the idea that fitness training should form part of the education of teachers and that assessments of general health should be incorporated into the coaching of teachers with voice problems.

The teachers with voice complaints perceived the determinant ‘diminished hearing’ as an increasing risk for voice problems throughout the career. This is in accordance with the findings of Gotaas and Starr who found that teachers with vocal fatigue had more hearing problems than others.[9] Poor hearing may

influence the feedback system that controls the function of phonation and result in louder phonation, i.e. increased tension may lead to more voice complaints. Standard screening tests for hearing should form part of health care in teachers, especially in those with voice problems, to prevent deterioration.
The factors regarding physical aspects, except 'diminished hearing', showed, indeed in various degrees, a tendency of increasing relative risk. However, the trend is caused by a decrease of experienced risk by the teachers without complaints

In a considerable percentage, teachers with voice complaints reported poor environmental conditions to have a negative influence on the voice, however, without a distinct tendency throughout the teaching stages. Most of the environmental factors showed a relative risk of less than two times and also did not show a distinct tendency throughout the teaching stages. Several authors underlined the influence of environmental risk factors on the voice.[5,15,34,35,36] Especially the background noise is considered to play an important role.[39,40] Teaching with high levels of background noise increases the risk of the "Lombard effect"[46] and voice load will also increase. Södersten et al. gave a guideline that classroom noise levels should be monitored and maintained within limits of less than 50-55 dB-A to prevent the potentially harmful effect of background noise on the voice.[39] Morton et al. found that central heating was associated with vocal dysfunction.[47] These findings indicate that phonation will benefit if the temperature in classrooms is monitored, optimized and maintained. In the present study, acoustic and temperature factors were score at levels of about 50% by the group teachers with voice complaints. Mucosal problems may arise when environmental irritants are present. Unfavourable conditions, for example dry air, dust, smoke, air pollution and temperature changes, can irritate the mucosa and have negative effects on the voice.[8,21,34] The results of this study brings to our attention the potentially harmful effects of environmental factors on the voice and underline the need to inform teachers about how the voice is affected by humidity, temperature, hydration, allergy, cigarette smoking and upper airway infections. Further research as field studies is necessary to estimate ambient classroom noise, classroom acoustics, temperature, humidity and quality of the air to bring about legislation for occupational safety for the vocal health of teaching professionals.

Since increasing age is accompanied with a decrease of general physical capacity, the overall absence of an increasing trend of experienced risk regarding voice load, physical and environmental factors is remarkable. This, again, is an

indication of more or less effective coping during the teaching career. This is also reflected in the decrease of voice complaints throughout the teaching career; however, the percentage remains more than 20 percent.

If these coping strategies can be improved and trained in an earlier stage, this could prevent and diminish voice problems among teachers. Further research on specific coping strategies would be useful.

The teachers with voice complaints had the highest scores of all in the psycho-emotional category. Increased stress was found to change the phonation pattern, with a subsequent increase in voice load.[13,33] Teaching is considered to be a stressful profession and psycho-emotional factors can be expected to have a negative influence on the voice of teachers.[5,9,20] These notions were confirmed by the results of this study, in which there were high scores of psycho-emotional factors by the teachers with voice problems. A pathological increase in stress (dis-stress) may result in increased muscular tension, particularly focused on the shoulders and neck regions.[13] Kooijman et al. found a high percentage of hypertonicity in the shoulder and neck muscles of female teachers with persistent voice problems.[14] This hypertonicity showed a positive correlation with the gravity of the complaints and handicaps of teachers. Not only stress factors that influence tension in the neck, but also deviant body posture, such as posterior weight bearing, excessive lumbar lordosis and deviant head position, will be compensated for in the neck and the laryngeal areas.[42,43] Posterior weight bearing and anteropositioning of the head were also found to be significant problems in female teachers by Kooijman et al.[14]. Assessments and correction of posture problems should be incorporated into the coaching of teachers with voice problems. This could be combined with assessment and training of the general health. The course of the relative risk of the various perceived risk factors regarding psycho-emotional factors showed an increasing tendency throughout the teaching stages. However, the trend is caused by a decrease of experienced risk by the teachers without complaints. There is a remarkable peak of the relative risk of ‘stress’ in stage four. The author’s do not have an explanation for this phenomenon.

It seems that throughout their career teachers without voice complaints have found a coping strategy for the psycho-emotional aspects of their profession, whereas teachers with voice complaints have been unable to handle this issue. Increasing age is accompanied with a change of psycho-emotional coping strategies. On the one hand flexibility may decrease, on the other hand coping strategies may be more effectively designed.[44] The observed high scores in the psycho-emotional category underlines the importance of paying attention to psycho-emotional

aspects in teachers with voice complaints. In teaching, work pressure can be expected to start at the beginning of the career, so coping strategies should be incorporated into the training of student teachers.[45]

CONCLUSION

High percentages of reporting various risk factors to have a negative influence on the voice were found. Very few distinct tendencies in the prevalence of perceived risk factors were found in the group teachers with complaints throughout their career. The only exceptions were some physical aspects. This suggests that care for teachers with voice complaints should be concerned with more than just the reduction of occupational voice load. Other risk factors such as physical, psycho-emotional and environmental factors should also be addressed. Therefore, it is suggested to pay attention to these factors more extensively. The increase of the relative risk for having voice problems along with the teaching stages is largely due to the decrease of experienced risk by the teachers without complaints. This indicates that the teachers without voice complaints are getting more resistant to vocal risks by improving their coping strategies. Teachers with voice complaints may have specific vulnerability to certain risk factors and as a consequence, need specific interventions. Continuously high levels of voice complaints throughout the teaching career require early intervention and an appropriate attention during training. If coping strategies can be improved and brought into action in an earlier stage, this could prevent and diminish voice problems among teachers. Further research is needed into desensitization to risk factors.

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Chapter 8

Comparative Study of Voice complaints, Voice Handicap and Risk Factors for Voice Complaints of Male and Female Teachers

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ABSTRACT

Questionnaires were used to investigate the influence of gender on the occurrence of voice complaints, the perceived risk factors for voice problems and the impact of voice problems in teachers. Primary and secondary school teachers were invited to complete two questionnaires; 1,775 sets of responses were suitable for analysis. One questionnaire addressed personal, voice loading, physical, psycho-emotional and environmental aspects of the voice and voice problems. Questions were included about absenteeism from work due to voice problems and the rate of help seeking and therapy. The second questionnaire comprised the Voice Handicap Index (VHI) according to Jacobson et al. Almost 50 per cent of the male teachers and almost 70 per cent of the female teachers reported voice complaints during their career. More of the female teachers reported voice problems and voice related absenteeism, had sought help and undergone examinations and treatment for their voice complaints than the male teachers (Pearson Chi-square: $p < .001$).

Male and female teachers with voice complaints showed different relative risks for various (five out of sixteen) perceived risk factors. These factors mainly concerned voice load and more men reported that they had a negative influence of voice load factors on their voice. This indicates that the male teachers were more vulnerable to vocal load than their female colleagues. The perceived risk factors for voice complaints ‘full-time vs. part-time work’, ‘number of pupils’, ‘number of teaching years’, ‘lower back complaints’ and “diminished hearing” were found to be more profound in the men. The perceived risk factors for voice complaints ‘physical health’ and ‘irritants’ were found to be more profound in the women. This indicates difference in the perception of various risk factors between the sexes. No significant differences were observed in the VHI functional, emotional and physical subscale scores between the male and female teachers with recent voice problems (Mann–Whitney U Test: $p > .100$). These findings should be taken into consideration in the design of diagnosis, treatment and prevention programmes for voice problems in male and female teachers. Furthermore, voice coaching can be expected to have important advantages.

INTRODUCTION

Teachers seem to be more vulnerable to voice problems and they have been found to complain more frequently about voice problems than other professional

voice users.[1-7] These voice problems can be explained on the basis of multi-factorial genesis.[8-10] In the literature different risk factors are reported to play a role in the development of voice problems. One of the most important factors is 'voice load'.[11-13] Speaking at high intensities, for a long duration, at a pitch outside the normal range and with strong intonation or resonance increased voice load[12,13] Psycho-emotional factors also increased vocal load and led to specific physical complaints, such as neck and shoulder problems.[14] Deviant body posture, laryngeal muscular strain, deviant laryngeal position[15,16] and impaired hearing[17] have been reported to cause and aggravate voice disorders. Environmental factors in the classroom, such as dust, dryness, moisture and temperature, may affect the condition of the mucosal layers of the vocal apparatus and increase susceptibility to vocal load.[18,19] Several authors described the importance of good acoustics and low background noise to avoid the need for teachers to raise their voice or speak at a deviant pitch,[20-22] that may otherwise lead to increased vocal load.

Women appeared to complain more than men about voice problems.[4,23] The presence of physical symptoms did not discriminate between men and women with regard to clinic consultation behavior.[24] Psychosocial problems and distress, however, predicted help-seeking consultation in women. In a group of Australian adolescents, 'female sex' itself was found to be a predictor for help seeking.[25]
The aim of this study was to investigate whether there were differences in the occurrence, perceived risk and implications of voice problems between male and female teachers.

MATERIALS AND METHODS

This investigation formed part of a larger study on voice problems in teachers.

Recruitment of the study sample

The first author approached the directors of primary and secondary schools by telephone to invite the teachers (n = 6000) to take part in a questionnaire survey (Appendix B). The aim and background of the study were explained in the questionnaires and instructions were given for their completion (Appendix A1). Data were treated anonymously and each individual could return the questionnaire in a stamped addressed envelope.

Description of the new questionnaire

A new questionnaire was designed on the basis of data from the literature,[21,23] clinical experience and comments from workers in the teaching profession.

The questions had a simple and straightforward style, without any restrictions about the nature of the voice complaints and the perceived risk factors. It comprised 35 questions that included items on personal aspects, the prevalence of voice complaints and voice-related absenteeism, as well as voice loading, physical, psycho-emotional and environmental aspects (Appendix B). The four categories of risk and their determinants are shown in table 2.

Questions 6-8 addressed voice complaints in different stages of the teaching career. If one or more of these questions were answered positively, the subject was classified in the group 'voice complaints present during the teaching career'.

Questions 5, 19-20 addressed voice load aspects; questions 25-28 and question 31 addressed physical aspects; questions 21, 24, 29-30 addressed psycho-emotional aspects; questions 32-35 addressed environmental aspects. Questions answered with yes or no, or multiple choice, were dichotomized into 0 (no or not present) and 1 (yes or present). Answers of 0 and 1 were classified as negative (score=0), while answers of 2, 3 and 4 were classified as positive (score=1).

The Dutch version of the Voice Handicap Index (VHI) according to Jacobson et al.[26] was also enclosed with the questionnaire. It is designed to rate the subjective psychosocial consequences of voice problems[26,27] and consists of 30 questions in total. The questions cover emotional (10), physical (10) and functional (10) aspects that respondents can rate on a five point scale: never (0), almost never (1), sometimes (2), almost always (3) and always (4). Scores can lie between 0 and 120.

Statistical analysis

The data were analysed using the statistical program SPSS 12.0. Chi-square tests were used to analyse discrete outcome variables. The significance level was set at $p < .05$. Odds ratios were used to quantify dependency in 2x2 tables. One-sample, 2-tailed Kolmogorov-Smirnov tests were applied to determine if continuous outcome variables were normally distributed. If continuous outcome variables were not normally distributed, Mann–Whitney U Test (MW-U) was used.

To test whether gender (male versus female) was an effect modifier of a risk factor, odds ratios were compared to search for interactions between the risk

factors and gender. The odds ratios for voice complaints were rated in the men and the women in relation to the risk factors (subjects with voice complaints versus those without). Ratio of odds ratios reveals the difference between the groups. When one odds ratio was 30% higher than the other, the ratio was rated as being different and a score of 1 was given to the group (male or female) with the highest score. At a difference smaller than 30%, an equal score was given to the two groups. This procedure enabled us to assess whether specific risk factors for voice complaints were more profound in the men or women.

RESULTS

About one third (1775) of the questionnaires were correctly filled out and returned: 599 from primary education (Pe) and 1176 from secondary (Se) education. The mean age (range) of the total group was 44 years (21-64 years), in the men 48 years (22-64 years) and in the women 42 years (21-63 years).

Table 1 shows the percentages of voice complaints in the various stages of the teaching career and absenteeism from work due to voice problems. The women reported significantly more voice complaints in the various stages of teaching and more absenteeism from work due to voice problems than their male colleagues (Pearson Chi-square: $p < .001$).

Table 1. Percentages of complaints throughout the career, at the time of the investigation and during the past year and absenteeism from work due to voice complaints (total group, men and women). Pearson Chi Square (p value) indicates the differences in voice complaints between men and women.

percentages of complaints	total	men	women	p
at present	17.2	12.4	22.4	≤0.001
in the past year	34.4	28.1	40.5	≤0.001
earlier during the career	51.7	43.6	59.3	≤0.001
absenteeism	22.4	16.5	28.0	≤0.001

The perceived risk factors were categorized into voice load, physical, psycho-emotional and environmental aspects (table 2).

Table 2. Four risk categories with the relevant determinants.

categories	factors
voice load	number of teaching years; full-time - part-time; number of pupils
physical aspects	head and neck problems; lower back problems; mucosal problems; general health; diminished hearing
psycho-emotional aspects	stress; emotions; composition of class; work load
environmental aspects	acoustics; moisture; irritants; temperature

In the group of teachers with voice complaints throughout their career, the perceived risk factors appeared to be associated with gender (table 3). Significantly more men reported that the vocal load determinants 'full-time vs. part-time work', 'number of pupils' and 'number of teaching years' and the physical determinants 'lower back problems' and 'diminished hearing' had negative effects on their voice (Pearson Chi-square: $p < .001$, respectively $p = 0.024$). Significantly more women reported that 'general health' and 'moisture in the classroom' had negative effects on their voice (Pearson Chi-square: $p = 0.021$, respectively $p < .001$). No significant differences were found in the other factors between men and women (Pearson Chi-square: $p > 0.05$). Odds ratios showed that 'male sex' held more than twice the perceived risk with regard to the number of teaching years (table 3).

The ratio's of odds ratios revealed that the number of pupils, lower back problems and diminished hearing were more profound risks for voice complaints in the men (Table 4). The reverse was found for general health and environmental irritants. No clear patterns could be detected.

The Voice Handicap Index (VHI) scores and the percentages of teachers with voice complaints throughout their career who had sought help and undergone examinations and treatment, indicated the impact of the voice problems.
Table 5 shows the scores on the VHI and the sub-scores: F (functional), E (emotional) and P (physical). No differences were observed in any of the VHI scores between the women and men (MW-U: $p > 0.100$).

Table 3. The association between risk factors and voice complaints at the time of the investigation and/or in the past year. Pearson Chi Square (p value) indicates the difference in voice complaints between the male and female teachers. Odds ratios indicate the relative risks.

risk factors	teachers with voice complaints	% yes	p-value	odds ratio
1. voice load				
full – part time	men	66.1	≤0.001	1.68
	women	53.7		
no. of pupils	men	67.4	0.024	1.36
	women	60.3		
teaching years	men	72.0	≤0.001	3.86
	women	40.0		
2. physical				
head/shoulders	men	22.1	0.464	1.12
	women	20.2		
lower back	men	13.3	0.017	1.63
	women	8.6		
mucosal	men	57.9	0.308	0.88
	women	61.1		
general health	men	50.9	0.021	0.74
	women	58.2		
diminished hearing	men	38.2	≤0.001	1.88
	women	24.7		
3. psych-emotional				
stress	men	56.5	0.619	0.94
	women	58.1		
emotion	men	62.7	0.157	0.83
	women	67.0		
comp. class	men	67.5	0.843	0.97
	women	68.1		
work load	men	73.0	0.484	1.11
	women	70.9		
4. environmental				
acoustics	men	60.9	0.374	1.12
	women	58.1		
moisture	men	37.9	≤0.001	0.63
	women	49.3		
temperature	men	60.8	0.868	1.02
	women	60.3		
irritants	men	26.7	0.477	0.90
	women	27.9		

Table 4. Odds ratios of risk factors for voice complaints in the male and female teachers with voice complaints at the time of the investigation and in the past year. Ratio of odds ratios reveals the differences between the sexes. When one odds ratio was 30% higher than the other odds ratio, it was rated as being different and a score of 1 was given to the group with the higher odds ratio. When the difference was smaller, equal scores were given to two groups.

risk factors	odds ratios men for voice complains	odds ratios women for voice complains	ratio of odds ratios	scores		
				men	equal	women
1. voice load						
full – part time	0.98	0.99	1.01		1	
no. of pupils	4.03	2.91	1.38	1		
teaching years	0.99	0.90	1.01		1	
2. physical						
head / shoulders	3.77	3.32	1.14		1	
lower back	2.48	1.56	1.58	1		
mucosal	3.62	3.49	1.04		1	
general health	3.48	4.63	1.33			1
diminished hearing	2. 71	1.51	1.79	1		
3. psycho-emotional						
stress	3.28	4.18	1.27		1	
emotion	2.55	2.94	1.15		1	
comp class	3.08	3.14	1.01		1	
work load	3.99	4.24	1.06		1	
4. environmental						
acoustics	1.80	1.98	1.10		1	
moisture	1.65	1.89	1.15		1	
temperature	1.44	1.55	1.08		1	
irritants	1.23	1.83	1.48			1

The percentages of teachers with voice complaints throughout their career who had sought help and undergone examinations and treatment are listed in Table 6. Pearson Chi-square test showed that the women reported these three items significantly more frequently than the men ($p < .001$).

DISCUSSION

Methodology

In order to examine whether there were differences in the prevalence of voice complaints, risk factors and implications of voice problems between male and female teachers, a self-report questionnaire survey was chosen as the method of investigation.

Table 5. Scores on the VHI and the sub-scores: F (functional), E (emotional) and P (physical) from the teachers with voice complaints at the time of the investigation and/or in the past year. Mann Whitney – U Test (p value) indicates the differences in scores between the men and women.

VHI scores		percentiles	VHI tot	F	E	P
teachers with complaints at the present and/or in the past year	men	25	12	3	1	8
		50	**23**	**5**	**5**	**12**
		75	37	9	11	18
	women	25	11	2	1	7
		50	**20**	**5**	**4**	**12**
		75	31	8	9	18
	p		0.184	0.553	0.285	0.902
	total	25	11	2	1	8
		50	**20**	**5**	**4**	**12**
		75	33	8	10	18

Table 6. Percentages of teachers (total group, men and women) with voice complaints throughout their career who had sought help, undergone examinations and treatment. Pearson Chi Square (p value) indicates the differences in rates between the group men and women.

percentages of teachers with complaints	total	men	women	p
sought help	36.0	27.8	41.3	≤0.001
assessment	27.1	21.4	30.8	≤0.001
treatment	25.8	17.5	31.1	≤0.001

Russel reported that subjective elements are inherent to this type of study design.[4] However, this approach enabled the collection of a large amount of information in a practical way. About one third of the questionnaires were returned, which is a normal response to a non-personal survey sent by mail. The absolute number of 1775 useful responses was high and provided a large body of data on the prevalence of voice complaints, perceived risk factors and the impact of voice problems. Self-report questionnaires are very cost-effective compared to face-to-face interviews. This applies particularly to studies with large sample sizes and large geographic areas. Questionnaires reduce bias;[28] question presentation is a uniform and there is no middle-man bias. However, it is not clear whether the non-response rate led to overestimation or underestimation of the prevalence of voice complaints. It might be argued that people with voice complaints will be more interested in responding than others. On the other hand, people with voice problems might be more ashamed than others, and tend not to respond. They may

be afraid of being identified as having problems by their superiors and afraid of losing their job as a result.

Owing to the statistical calculations, over- or underestimation was not an issue in this study. Instead of correlation calculation, we used but a 2x2 cross-sectional calculation. Cross-sectional studies provide descriptive information about disease prevalence and related factors, but the results do not give much information about the causality of the items under investigation.[28] The questions were formulated in a simple and direct way. No explanation was required of the nature of the complaints. If complaints were present in the area mentioned in the questionnaire, or if the teacher thought that a factor influenced his/her voice, the question was answered positively.

It should be emphasized that this research investigated the subjective perception of voice problems in the teachers. The subjective perception may not necessarily correspond with the physical status on the item in question. For example, the acoustic environment involved a great many aspects that could be included in the answers of individual teachers. In this we we gained further insight into the types of influence that the teachers with voice problems perceived. This will enable us to investigate the whole spectrum in a later cohort or experimental study.

Occurrence of voice complaints

Russell found that women reported twice as many voice problems as men.[4] Smith found that more female teachers reported voice problems than male teachers, 38% versus 26%.[20] In this study the number of teachers who complained of a current voice problem was higher than the rate reported by of Roy:[23] 17.7% (12.5% men; 22.5% women) versus 11.0% (8.6% men; 12.0% women). However, the results were in line with those of Russell and Roy.[4,23] A remarkably high percentage of women and men reported voice problems and voice-related absenteeism. These findings suggest that care and cure of voice problems in teachers could be useful.

Perceived risk factors of voice problems

There is evidence that women report more voice problems than men, but it is unclear whether there are differences in the etiopathogenesis of voice problems between men and women and whether women are more sensitive to certain factors than men. Surprisingly, significantly more men than women perceived all the determinants in the category ‘vocal load’ as risk factors for voice complaints. This indicates increased vulnerability of male teachers to vocal load, compared to their female colleagues. Significantly more of the women reported that ‘physical

health' and 'moisture in the classroom' had negative effects on their voice. These findings suggest that in the care of voice problems in women, physical health should be taken into account.

To test whether gender (male versus female) is an effect modifier of specific risk factors, odds ratios were compared. When one odds ratio was 30% higher than the other, we rated the perceived risk factors as different. In the men with voice problems, the 'number of pupils', 'lower back complaints' and 'diminished hearing' were perceived more profoundly. In the women with voice complaints, 'physical health' and 'irritants' were perceived more profoundly. This indicates that gender was affecting the various risk factors.

These findings must be interpreted within the context of subjective problem perception by teachers, while keeping in mind that the subjective perceptions may not correspond entirely with the physical status. Within this context, evidence was found in favour of differences in the etiopathogenesis of voice problems between men and women and of differences in sensitivity to certain risk factors.

Implications of voice problems

Another question that has to be answered is: Do voice problems have different impacts on men and women.

Measurement of voice handicap should not only take physical aspects into account, but also emotional and functional consequences of a voice problem.[26,27,30,31] The physical subscale represents the self-perceptions of laryngeal discomfort and voice output. The emotional subscale of the VHI reflects the affective responses to a voice disorder, while the functional subscale of the VHI includes statements that describe the impact of a person's voice disorder on daily activities.[2] No significant differences were observed in the VHI functional, emotional and physical subscale scores between the male and female teachers with recent voice problems. This suggests that the male and female teachers experienced equal handicap from the voice problems.

The scores on the physical subscale were higher than those on the functional and emotional subscales. Physical handicap appeared to be the most prominent. Therefore, physical aspects should receive special attention in voice training.

The scores on the physical subscale were equal in the men and women. This is remarkable, because gender was an effect modifier in the voice load risk factors. This confirms that the VHI is a valuable tool in combination with other questionnaires.

More women had sought help and undergone examinations and treatment for their voice problems than their male colleagues. This difference in help-seeking behaviour was also found by Corney.[32] He found that equal proportions of men and women sought help for physical problems, but that more women sought help for psychosocial problems, distress and related consequences and also at an earlier stage than the men. This indicates that men and women have coping attitude towards their voice problems. Morton and Watson found that teachers were reluctant to seek medical help.[28] Thus, the number of subjects who had been examined or treated would have been higher than reported in our questionnaires, especially if the men had been more willing to seek medical help.
Special attention should be paid to the relatively low percentages of teachers with voice problems who sought medical help. It seems that teachers, especially the men, need to be made more aware of their voice problems, the risks and opportunities for care and cure.

CONCLUSIONS

The results of this study indicate that voice complaints are common among male and female teachers. More female teachers reported voice problems, had sought help and undergone examinations and treatment for their voice complaints than their male counterparts. In the male teachers voice load factors received particular emphasis. These findings can be incorporated into the design of diagnostic, treatment and prevention programmes of voice problems in men and women. Furthermore, voice coaching would seem useful and advisable in teachers.

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Chapter 9

A Psychological Cascade Model for Persisting Voice Problems in Teachers

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ABSTRACT

In 76 teachers with persisting voice problems, the maintaining factors and coping strategies were examined. Physical, functional, psychological and socioeconomic factors were assessed. A parallel was drawn to the psychological cascade model, which have been described by Anderson in patients with chronic spinal pain. The majority of the patients were found to be in a deadlocked situation (phase 1 of the cascade model), for which the combination of externalisation and unawareness for the situation is the main risk-factor. Subjective rating of the voice problem was assessed by the Voice Handicap Index (VHI) and a Visual Analogous Scale (VAS). Patients in phase 1 of the cascade model showed higher VHI and VAS scores compared with the other patients. For a high VHI score, the combination of socioeconomic factors and been assessed in phase 1 was the most important risk-factor. Social economic factors were the most important risk-factors for a high VAS score. We introduce the term "chronicity", which means that the problems are maintained and the patient finds himself in a deadlocked situation, and is sliding down into a chronic disease. "Chronicity" is essentially different from "chronic", which refers only to the duration of the disease. We consider maintaining factors and (inadequate) coping factors, which consist of emotional / psychological, physical and socioeconomic aspects, as indicators for chronicity.

INTRODUCTION

The care of occupational voice and cure of occupational voice disorders is gaining importance and attention.[1-14] Occupational voice disorders usually have a multifactorial etiology and can become manifest in a large diversity of symptoms.[15-18] Internal factors such as general condition, psychological factors and personality traits may influence the ability of the voice to withstand the demands of the profession.[19-21] A constitutional weak voice is a predisposition for the development of occupational voice disorders, and should be assessed before starting a voice demanding profession.[1] External factors such as demands on the voice, psychological demands and environmental factors may play an important role in the etiology of occupational voice disorders.[18,20-26]

Occupational voice problems may be refractory to the applied therapy. This may be due to an improper evaluation or an inefficient treatment. Moreover, recovery may be beyond the bounds of the possible. Recognition of the factors that cause the voice problem may be difficult and detection, judgement and treatment of the

factors that maintain the voice problem and the way in which the person copes with his problem may turn out to be of crucial importance. Factors that maintain or hamper adequate coping of the voice problem may vary, e.g. physical, functional, psychological and environmental factors may be involved.

Psychological cascade model

Anderson described a model of psychological cascade in patients with chronic back pain.[27] This cascade model entails the demanding influence of psychological factors on the patient, and encompasses an inexorable loss of some aspects of the patient's pre-injury identity and way of life, and consists of three phases (figure 1). In the *first phase*, the patient experiences the disorder as a threat. This phase is characterized by anxiety, fear and terror of loss, struggle against the loss, searching for help, exhaustion and isolation, and depression. The various characteristics may be present simultaneously and to a different degree. The patient might leave the first phase to enter the *second phase* of the cascade model if the influence of the maintaining factors is not too high and coping is adequate.

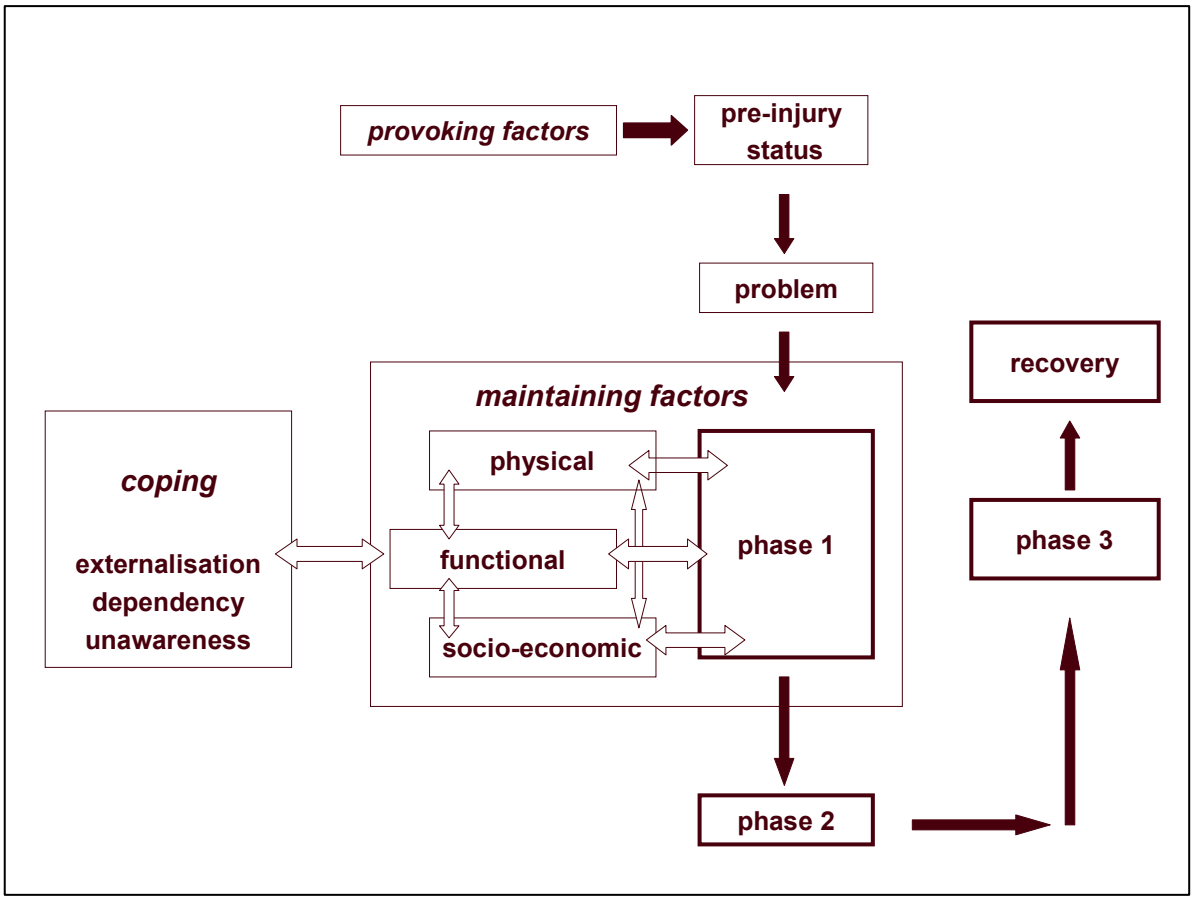

Figure 1. The psychological cascade model after Anderson (black arrows). The maintaining and coping factors are put in relation to each other and to the cascade model (dotted arrows).

The second phase is called “the pit” and is characterised by surrender to the loss and giving in without giving up, which is followed by clarity and acceptance of the disorder. Reaching “the pit” enables the patient to proceed into the *third phase* of renewal, which is characterized by hope. This phase finally may lead to recovery.

Coping and maintaining factors

Essentially, the psychological cascade model is gone through in every health problem. If coping is adequate and the maintaining factors are not too strong, the cascade path may be followed through rapidly without problems. If a disorder or problem persists, the patient may have turned himself in the deadlocked situation of phase 1. This situation may be supported by inadequate coping strategies and the presence of maintaining factors. The way of coping depends of personal factors, such as flexibility, tenacity, and acting on one’s own or in a cooperative style. Adequate coping of problems requires a balance between these three conditions.[28-32] Maintaining factors may consist of unfavourable physical, functional and socioeconomic factors.

Voice problems occur more frequently and to a larger degree in teachers than in other voice demanding professions.[33-38] Moreover, teachers appear to be relatively more vulnerable to voice strain.[6,11,34,37,39-44] This group of professional voice users is of great interest, because they often reach a chronic stage with respect to their voice problem.

Aim of the study

The aim of this study is to describe the factors that maintain the voice problem and the way in which teachers with chronic voice complaints cope with their voice problem. This requires the assessment of physical, functional, psychological and socioeconomic factors. This study also addresses the question whether a parallel can be drawn to the psychological cascade model, as described by Anderson. We will focus special attention on the presence of deadlocking in phase 1 and the relevant causative mechanisms.

PATIENTS AND METHODS

This study was carried out in a group of 76 teachers with persisting voice problems and a history of absence of work due to voice problems. By advertisement in professional journals, teachers were invited to apply for participation in this study.

The inclusion criteria were: a history of persisting voice problems and a previous or present period of absence from work due to voice problems.
The patients were examined in a multidisciplinary set-up, involving two ORL-phoniatricians, two voice therapists, and one psychologist-haptonomist. The study was carried out in the institute for rehabilitation and reintegration “De Gezonde Zaak” in Uden - the Netherlands, in close collaboration with the Department of ORL-Voice of the University Medical Centre Nijmegen, the Groningen Voice Research Laboratory (both in the Netherlands) and the Department of ORL of the University of Antwerp (Belgium).

Methods
Prior to the examination a questionnaire on personal data and medical history was filled out by the patients. The actual handicap was rated in a Visual Analogous Scale of 10 centimetres and by the Voice Handicap Index (VHI).[45] The VHI questionnaires were sent to the patients shortly after the examination, in a Dutch version after translation by the “European Study Group of Voice Disorders”.[46]
The database of VHI of teachers without voice problems of the department of ORL-Voice of the University Medical Centre of Nijmegen, the Netherlands, served as control, containing 835 cases.

Evaluation procedure of the factors mentioned in figure 1.
In the analysis, the factors were considered to be of equal importance. For quantification of the factors marks were attributed (table 1). The factors were measured at a nominal level (0 or 4 marks), except the functional factors regarding voice technique, which were measured at an interval level (0-4 marks).

Maintaining factors
Physical factors. The presence or absence of vocal fold lesions and the degree of glottal closure were assessed by the ORL-phoniatrician by means of videolaryngostroboscopy (Atmos Medizintechnik, Lenzkirch-Germany). A distinct mucosal lesion and/or a glottal closure insufficiency of more than the cartilaginous glottis in men, or in women reaching more than 25% of the membranous glottis were considered to be abnormal and 4 marks were given (table 1).

Factors regarding voice technique.
The following parameters regarding voice technique were assessed by palpation without voicing, and were carried out by voice therapists, which have a large experience in this type of examination (table 1):

- High position of the thyroid cartilage (1 mark) and hyoid bone (1 mark), short distance between the cricoid and thyroid cartilages representing hypertension of the cricothyroid muscle (2 marks), hypertension of the thyrohyoid (1 mark), geniohyoid (1 mark), sternocleidomastoid (1 mark) and trapezius (1 mark) muscles. In this group of items a total score of 8 marks is maximum. For the definite score of functional factors, the score 0 is finally awarded with 0 marks, the scores 1-4 with 1 mark, and the scores 5-8 with 2 marks.
- Articulation by visual and perceptual judgement (if inadequate: 2 marks).

Table 1. The scores of the various maintaining and coping factors. The functional parameters are represented by an interval scale (0 - 4), while the other parameters are represented by a nominal scale (0 or 4).

		Score
Maintaining Factors	Physical	0 or 4
	Functional	0 - 4
	Socio-economic	0 or 4
	Phase I	0 or 4
Coping Factors	Externalisation	0 or 4
	Dependence	0 or 4
	Awareness	0 or 4

Socioeconomic factors. Socioeconomic factors were assessed by a psychologist-haptonomist. These factors entail a demanding influence of the environment on the patient, e.g. voice and/or other problems at work, assignment of a different task by the employer, frustration by lack of efficient care, financial loss, pressure by the health assurance company and doctor to return to work, both might turn away from the patient, followed by the patient's consultation of other doctors or even a lawyer. If was judged that such demanding influences of the environment on the patient were present, the socioeconomic factors were given 4 marks (table 1).

Psychological factors. The psychologist-haptonomist also judged whether the patient can be staged in the first phase of the psychological cascade model. Here, the items of anxiety, fear and terror of loss, struggle against the loss and search for help, exhaustion and isolation, and depression were taken into account. When the patient is in the first phase, 4 marks were given (table 1). Additionally, also on

clinical grounds, it was judged whether the patient was in the second phase (pit) or in the third phase (renewal) of the psychological cascade model.

Coping strategies

The coping strategies were assessed by the psychologist-haptonomist.

Dependence. The balance between flexibility, tenacity, acting on one's own or acting in a cooperative style was judged. If there was an adequate balance between the three items, the patient is considered to be "non-dependent". If there was an excess of tenacity and acting on it's own, the patient is considered to be "dependent" and dependence was classified with 4 marks (table 1).

Externalisation. It was judged whether the patient experiences that the causes and solutions of problems are out of his own control. If this was the case, 4 marks were given for externalisation (table 1).

Awareness of the three phases of the psychological cascade model. If the patient was not aware that in his/her case mechanisms of phase 1 of the psychological cascade model, such as anxiety, fear and terror of loss, struggle against the loss and search for help, exhaustion and isolation, and depression, play a role, and that they actually are in phase 1 of the psychological cascade model, the factor awareness was given 4 marks (table 1).

Statistics

The data is evaluated by the statistical program SPSS V.10. Most data is treated with non-parametric tests, such as the Mann-Whitney U test for comparison between groups. Chi square test is used to investigate association between groups, for the occurrence of one or more characteristics. Logistic regression and multiple linear regression methods are used to predict outcome based on a combination of multiple factors.

RESULTS

Patients

The group consisted of 76 patients, 21 males and 55 females. The mean age was 45 years (range: 23-59). There were 43 teachers of primary and 24 of secondary education, and 9 teachers of other educational institutions.

Duration of the complaints and previous treatment

In 56 patients (74%) the voice complaints were present for two or more years. Seventy two patients (95%) had undergone treatment in the past. In 51 patients (67%) more than one treatment modality (e.g. voice therapy, physical therapy, voice rest, medication, microlaryngeal surgery) had been applied. The median score on the VAS was 68 mm, range 4-100 mm. The median VHI-score was 70, range 35 - 102 (n = 40). The median VHI-score of the control group was 3, range 0 - 69 (n = 835). The median VHI score is significantly higher compared with control group ($p < 0.001$; Mann-Whitney U test).

Maintaining factors

Physical factors. In 15 patients (20%) a distinct lesion of the vocal fold(s) was observed: polyp (2), local edema (1), sulcus (1), vergeture (1); in 10 patients a sulcus (7) and cyst (3) were suspected, due to a diminished vibratory pattern of the mucosa. In five cases (7%) there were only minor changes of the mucosa like slight hyperaemia or vascular injection. The last five cases were not included in the score. In 61 patients (80%) no abnormalities of the vocal folds were observed.

Factors regarding voice technique. All patients had one or more functional factors regarding voice technique. The cumulative scores of high position of the thyroid cartilage and hyoid bone, short distance between the cricoid and thyroid cartilages (hypertension of the cricothyroid muscle); hypertension of the thyrohyoid, geniohyoid, sternocleidomastoid and trapezius muscles; and inadequate articulation are as follows: 0 (0%), 1 (21%), 2 (38%), 3 (7%) and 4 (34%).

Socioeconomic factors. Relevant socioeconomic factors were found in 29 patients (38%).

Psychological factors. Fifty-four patients (71%) were assessed to be in phase 1 of the psychological cascade model. Twelve patients (16%) were found to be in phase 2 of the psychological cascade model. The third phase was reached by 11 patients (14%).

Coping strategies

Unawareness. In 30 patients (39%) there was no awareness that they actually are in phase 1 of the psychological cascade model.

Externalisation. Externalisation is present in 57 patients (75%).

Dependence. In 51 patients (67%) there was imbalance between flexibility, tenacity, acting on one's own and acting in a cooperative style.

Correlations

The prevalence of maintaining and coping factors for the patients in phase 1 and for those not in phase 1 are shown in table 2. The medians of the functional factors for both the patients in phase 1 and not in phase 1 were 2 (Mann-Whitney U: p = 0.187). There was no significant difference with respect to the prevalence of physical and functional factors, while the prevalence of socioeconomic factors, unawareness, externalisation and dependence differ significantly for the patients in phase 1 and patients not in phase 1. Of these factors, externalization and unawareness were most correlated with phase 1.

Table 2. Cross table of the prevalence of the various factors in the group positive of phase 1 and negative of phase 1. (phys = physical; SEF = socioeconomic factors; unaw = unawareness; ext = externalisation; dep = dependence; NP = absent; P = present). Significance calculated by Pearson Chi-square test. Spearman's rho and Odds ratio. indicate the risk.

	phys		SEF		Unaw		Ext		dep	
	NP	P	NP	P	NP	P	NP	P	NP	P
not phase 1	19	3	19	3	20	2	13	9	12	10
phase 1	42	12	28	26	26	28	6	48	13	41
p - Chi sq	0.532		0.008		0.001		≤ 0.001		0.015	
Spearman's rho	0.98		0.322		0.397		0.503		0.294	
Odds ratio	1.810		5.881		10.769		11.556		3.785	

The medians of the sum of scores of the maintaining factors (other maintaining factors than phase 1), of the coping factors and of the total maintaining (other maintaining factors than phase 1) and total coping factors are also calculated for the patients in phase 1 and not in phase 1 (table 3). There is a significant difference between the patients in phase 1 and patients not in phase 1 with respect to all of these three parameters.

The median of the VHI and VAS scores are calculated separately for the patients in phase 1 and not in phase 1 (table 3). There is a significant difference between the patients in phase I and patients not in phase 1 with respect to both parameters.

Table 3. The medians and the ranges of the sum of various factors, VAS and VHI in the group positive of phase 1. (Tot maint-ph1 = physical + functional + social economic factors; TOTmanag = unawareness + externalisation + dependence; TOTAL = Tot maint-ph1 + TOTmanag; VAS = visual analogous scale; VHI = voice handicap index). Significance calculated by Mann-Whitney U test.

	phase 1	Not phase 1	p
Tot maint-ph1	6.00 (1-12)	3.00 (1-8)	0.009
TOTmanag	8.00 (0-12)	2.00 (0-12)	≤ 0.001
TOTAL	14.00 (1-24)	5.50 (1-16)	≤ 0.001
VAS	70.00 (4-100)	54.00 (41-88)	0.039
VHI	78.00 (35-102)	52.00 (22-94)	0.006

To determine which maintaining and coping factors are the most important for the classification of a patient in phase I or not in phase 1, a logistic regression model was applied. The stepwise regression method resulted in the selection of the following variables as appropriate for correct classification of cases in either the phase 1 group or not belonging to this group: physical, functional, unawareness and externalisation. With a specific linear combination of these variables, a correct identification of subjects in the phase 1 group was 83.3 % and a correct classification of subject not belonging to the phase 1 group was 72.7 %. However, only for unawareness and externalization the p-value was < 0.05 (0.033 and 0.009 respectively).”

To determine the way the voice complaints are influenced by the maintaining and coping factors, a multiple linear regression model was applied. In a stepwise regression the VHI and VAS score are related to physical factors, functional factors, socioeconomic factors, phase 1, unawareness, externalisation and dependence. For the VHI (n = 40), the socioeconomic factors (p = 0.023) and phase 1 (p = 0.058) appeared to be the most important factors. For the VAS (n = 76), the socioeconomic factors, phase 1 and externalisation were the most important factors (in sequence of importance). However in the model for the VAS of only socioeconomic factors the p-value is < .05 (0.023).

DISCUSSION

In only 20% of the patients a lesion of the vocal folds may be hold responsible for the maintenance of the voice problem. This indicates that other mechanisms are involved in the continuation of the voice problem and this underlines the difference between dysphonia and voice problem. In contrast to physical factors, in all patients one or more functional factors were observed. The findings of a high position of the thyroid cartilage and hyoid bone and high muscular tension of the head and neck region are considered to be associated with “hypertonic” voice use. This may be caused by psychoemotional stressors, as is the case in the Repetitive Strain Injury Syndrome.[47-52]

Thirty-eight percent of the patients scored positively on socioeconomic factors. This relatively low figure may be due to the fact that the Netherlands are short of teachers, and the job is relatively sure. Additionally, the facilities of part-time working are ample, and supported by the Dutch law.

Most patients (71%) have been found to be in phase 1 of the psychological cascade model. The second phase has been reached by only 12 patients (16%), and the third phase was reached by only 11 patients (14%). These findings indicate that most of the patients apparently are in the deadlocked situation, corresponding with the first phase of the psychological cascade model of Anderson. Only the minority of the patients had reached the phase of surrender to the problem (pit) with insight into the voice problem and acceptance. This corresponds with the low figure of renewal, which is a condition for recovery. This is probably the mechanism that hinders the recovery of the patient. The question urges: Why is the patient not able to manage this mechanism in order to overcome this situation? The next three ways of coping are thought to play a role. Most patients show a pattern of externalisation. If the patient considers the causes and solutions of problems are to be sought outside him/herself, the recovery is hampered. Basically, the individual must be able to manage the problem by himself to obtain a durable effect. In 39% of the patients there was no awareness about being in the actual phase of the psychological cascade model. The condition of unawareness hampers recovery because the patient does not recognise the factors that play a role in the course of the problem. In 67% of the patients there was imbalance between flexibility, tenacity, acting on one’s own and acting in a cooperative style. This results into an inadequate coping style. These mechanisms may be summarised in stating that in many patients the coping strategies are not aimed in the proper direction.

The positive correlation between the maintaining and coping factors and the severity of voice complaints contributes to the validity of the concept that these factors play a role in keeping up the voice problem.

The psychological cascade model, which is described by Anderson in patients with chronic back pain, is a dynamic approach in persisting disease. This cascade model pertains to the psychological challenges, which are imposed on the patient by the problem. The mechanisms of this psychological cascade model are especially based on psychological aspects with great emphasis on the role of self-experience. In our study, a resemblance appeared to exist between the mechanism that maintains voice problems compared with recovery in patients with chronic disabling lumbar spine pain. In our study, the patients in phase 1 of the cascade model have more maintaining factors, more inadequate coping strategies for their problem and more serious voice complaints compared with the patients evaluated not to be in phase 1. These findings fit well in the concept of the cascade model, i.e. the patients in phase 1 do not effectively overcome problems and are more at risk. The minority of our group did not reach the phase of surrender to the problem (pit), nor there is an adequate awareness and acceptance of the problem. This corresponds with the low figure of renewal and lack of awareness, also with respect to this aspect.

It is important to detect the various parameters that contribute to the genesis and continuation of the complaints. However, a mere description of the parameters does not lead to an understanding of the mutual influence of the various parameters and their cumulative effect. The results of this study indicate that the combination of externalisation and unawareness about being in the actual phase of the psychological cascade model is a high risk for being in the deadlocked phase 1. This finding may have consequences for the diagnose and therapy. With respect to the seriousness of the complaints, the combination of socioeconomic factors and externalisation and phase 1 plays an important role. These results may contribute to a better understanding of the complaints of the patient, and indicate the direction of realising relief of the patient’s complaints.

It should be realised that recovery to the level before the onset of the voice problems may be impossible. In such a case, new opportunities must be created, based on the remaining possibilities in a realistic way. This requires a new attitude and behavior, which in itself is not aimed to reverse the causes of the problem. Anderson calls the second phase of surrender, clarity and acceptance “the pit”.

This phase may be accompanied by a pervasive passivity and dependency by the patient. Nevertheless, we prefer the term “turning point” because there is an about-turn into a different direction, i.e. the phase of renewal. The term “turning point” reflects more the dynamic aspects of the way to recovery.

We consider maintaining factors and (inadequate) coping factors as indicators of chronicity. Chronicity means that the problems are maintained and the patient is likely to find himself in a deadlocked situation, and is likely to slide down into a chronic disease. It must be emphasised that the term “chronicity” is essentially different from “chronic”. “Chronic” refers only to the duration of the disease and not to the involved mechanisms. In the concept of chronicity, emotional/ psychological, physical and socioeconomical aspects, regarding both the load of the problem and the capability to carry the load of the problem play a role. From this study follows if the threat and the maintaining problems are great and coping is inadequate, the struggle against the problem will be increased and the patient remains stuck in phase 1 of the cascade model.

CONCLUSIONS

Apparently, a different approach has to be adopted in order to solve a persisting voice problem, if previous treatment has failed, especially if the treatment was merely based on trying to eliminate the causes of the problem. The mechanisms that are involved in the continuation of the voice problem should be clear to both the person who treats the patient and the patient himself. The etiologic moments themselves may not be changed, terminated, or reversed in every case. In these cases the useless struggle against these mechanisms must stop and make way for understanding and acceptance. From this situation renewal and recovery can start. This pathway may not be successful at one time and must be passed through for more times. The results of this study support the idea that a similar mechanism of the psychological cascade model according to Anderson plays a role in the dynamics of the problems in teachers with a history of persisting voice problems and absence of work due to voice problems. The recognition of such a cascade model may contribute to a more adequate diagnosis and therapy of patients with persisting voice problems, and should take place in an early stage. Further research is needed to develop specific and efficient instruments to identify the different phases of the psychological cascade model and to bring about early recognition of symptoms of chronicity in patients with voice problems, that are

refractory and persisting. A study on early detection of chronicity is ongoing in our department.

In treating voice problems the first aim should be to correct the physical and functional aspects of the voice problem. When this approach has failed and the problems persist, the mechanisms of the psychological cascade model should be recognized and taken into account in the treatment strategy. Intervention should be aimed on all aspects of threat, other maintaining factors and inadequate coping strategies. This may lead to an adequate solution of the problem.

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Chapter 10

General Discussion and considerations

GENERAL DISCUSSION

MATERIALS AND METHODS

This thesis was part of a research project on occupational voice disorders of the Department of Otorhinolaryngology, University Medical Centre St Radboud Nijmegen - the Netherlands. The data used in this thesis were collected from two sources. The first source was a multidisciplinary investigation on the causes of persisting voice problems in teachers by order of and sponsored by the 'Diensten Vf/Pf' of the 'Algemeen Burgerlijk Pensioenfonds' (ABP), a Dutch company for retirement insurance (chapter 6). The second source consisted of questionnaires that were sent to student teachers (chapter 3), teachers in primary and secondary education (chapter 2; 4; 5; 7-9) and controls (chapter 2). The research was instigated by the clinical experience with the numerous teachers, who seek advice about their voice problems.
The assessment of the prevalence of voice problems, the associated/perceived risk factors for voice complaints, the psychosocial impact of voice problems in teachers, the effect of starting the teaching profession, the influence of all these aspects throughout the teaching career and the different influences on persisting voice problems are the overall objectives of this thesis.

The investigation on the causes of persisting voice problems in teachers was a prospective study. After recruitment, the candidates were examined by a multidisciplinary team consisting of an ENT specialist / phoniatrician, a voice therapist, a physic therapist and a psychologist / haptonomist according to the protocol.[1] With this multifaceted team a multidimensional view of voice problems could be obtained.
In order to assess voice problems with regard to the prevalence, the perceived influences and the impact, questionnaires were chosen as the tools for investigation. The design was fed by information that was obtained by clinical practice, literature and suggestions by teachers. As addressed by Russell et al.[2], this study design may introduce subjective elements, inherent in this type of investigation. However, this approach enables the collection of large amounts of information in a practical way. Questionnaires have been found to be very cost effective when compared to face-to-face interviews. [2] This particularly holds true for studies involving large sample sizes and large geographic areas. Questionnaires reduce bias[3], by a uniform presentation of the questions that eliminates middle-mean bias. Cummings et al.[4] reported that questionnaires with

closed-ended questions sometimes do not include answers, which may be the most appropriate for the particular respondent. However, the disadvantages were minimized in the present study by including information of practicing teachers into the design of the questionnaire. This also helped to expand the list of questions and the possible responses.

About one-third of the questionnaires was returned, which is a satisfactory response for a not personally addressed questionnaire by mail.[5] The question whether the non-response rate of the questionnaire resulted in an overestimation or underestimation of the prevalence of the voice complaints and risk factors is debatable.

The possible negative influences of the non-response rate can be compensated by a large initial random sample. The more homogeneous the group respondents and non-respondents is, the fewer the negative influences of the non-response rate.[6] In the present study all the respondents were teachers, except for chapter 3, where student teachers were involved. Response rate influences more the prevalence rates of the variables rather than the correlations. The non-response rate could have biased the prevalence of voice complaints.

The prevalence rates are likely to be representative as it was similar in other studies among teachers using different methods such as telephonic interview and direct examination.

It can be argued that subjects with voice problems may have been more interested in responding to the questionnaire than subjects without voice complaints. On the other hand subjects with voice problems may be more ashamed than those without, and may be afraid of being detected by their leading staff as having problems and afraid to lose their job for this reason. To minimize this aspect the questionnaires were filled out and returned anonymously.

The weakness of the cross sectional design has been the difficulty in establishing a causal relationship from the data collected in a cross sectional time frame. However, cross sectional self-report studies have been found to be valuable for providing descriptive information about prevalence of a health problem and its correlations.[2,7,8]

The questionnaire contains 35 questions regarding personal aspects, the prevalence of voice complaints and voice-related absenteeism, the impact of the voice problems, and including voice loading, physical, psycho-emotional and environmental aspects (Appendix C - F). The questions are constructed in a simple and direct style without any restrictions about the nature of the voice complaints and the perceived risk factors. There is no explanation of the character

of the complaints. This means that the data were obtained from self-reporting by the subjects and that the questionnaires generate information about the subjective problem perception of the teachers. It is possible that the subjective perception does not correspond to the physical correlate of the item to be investigated. Acoustical environment for example includes a lot of aspects that can be included in the answer of the teacher. However, it is still very important to know what kind of influences the teachers with voice problems experience to be able in a later cohort or experimental study to investigate the whole spectrum.

To the questionnaires the Voice Handicap Index questionnaire and The DS-16 questionnaire were added (Appendix G and H).

The VHI is a useful instrument to quantify the psychosocial consequences and handicaps due to voice problems. The VHI is known to be a statistically robust instrument and it has been psychometrically validated with strong internal consistency, reliability, and test-retest stability.[9-11] In the pertinent study, subjects with voice complaints showed significantly greater voice handicaps than those without voice complaints. This affirmed that subjects with voice complaints faced physical and psychosocial consequences because of their voice problems.[1,12] Subjects with voice problems who are apparently reluctant to report on a nominal scale (yes / no) of the general questionnaire can be detected by use of the VHI[13], which is a multidimensional, detailed questionnaire using an ordinal rating scale. Use of the VHI together with the general questionnaire provided an opportunity to identify these subjects, which may make up the occult false negative cases in the estimation of voice complaints. Further examination is required to assess whether these are false positive or negative cases, or whether they have few or much voice complaints with a higher or less degree of handicap.

In the DS16 list, the personality traits 'negative affectivity' and 'social inhibition' are rated. As personality has been considered to be a stable personality trait [14-16], the student teachers and practicing teachers early in their career (chapter 3), and the teachers during their whole career (chapter 5) were assessed as one group to study the possible effects of the Type-D personality trait with regard to the impact of voice problems and the coping with the problems. Subjects with a high score on both “negative affectivity” and “social inhibition” (>median) were classified as “Type-D”. Selection of the Type-D group depends on both the median of social inhibition and negative affectivity of the group concerned and classifying subjects as “Type-D personalities” is therefore relative, that provides an indication of which individuals of the group have a relative tendency towards psychosocial health problems. In the pertinent study type-D personalities” did not report more voice complaints than those with a non-type-D personality. In the more detailed 5-point

ordinal scale of the VHI questionnaire, however, subjects with a type-D personality scored significantly higher than those with a non-type D personality and significantly more type-D personalities scored into the 75th percentile of the VHI.[13] The prevalence of voice complaints in the type-D group may be underestimated if based only on reported voice complaints. This finding shows that subjects with a type-D personality were apparently more bothered by their voice than non-type-D subjects.

To correlate voice complaints, psychosocial impact of this complaints and voice quality the Dysphonia Severity Index (DSI) has been used. Wuyts et al.[17] defined the DSI from the parameters maximum F_0, minimum intensity, jitter and maximum phonation time (MPT). The DSI was found to correlate highly with the G (Grade) of the GRBAS scale (0.996, Spearman's rho) and also with the VHI (-0.79, Spearman's rho). It is intended as a measure for the description of vocal quality rather than a method for voice classification.[17]

PREVALENCE OF VOICE PROBLEMS IN TEACHERS

It may be stated that the prevalence of voice problems and voice related absence from work in teachers could be regarded to be considerable and confirm that teaching is a high-risk profession for voice problems. The similar findings in literature support the view that voice is a worldwide problem in the teaching profession.[18 – 20] Adequate diagnosis, care and cure of voice disorders in teachers are relevant and would benefit from international initiatives for consent and standardization of occupational voice disorders.[21,22]

Moreover, teachers who reported voice problems during their career, reported more frequently voice problems already during their training, compared to the teachers who did not report voice problems during their career.[12,13] In addition a distinct increase of voice problems was observed in the early period of the career, which indicates the occurrence of 'new' subjects with voice complaints. This supports the idea for more adequate voice training during the education.

The pertinent study indicates the importance of voice care not only during training for the profession but also during the career, with accent on the beginning of the career.

More than half of the teachers reported voice problems during their career and about one-fifth had a history of absence from work due to voice problems. These numbers are relatively high compared to those of the controls with as well as to

those without a vocally demanding profession. There is a remarkable increase in reporting voice problems after starting the career.[12,13] Teachers in the first four years of practising the profession reported more voice problems than the teacher students. More than 12 percent of the teachers had experienced voice problems during their training and this group reported significantly more voice complaints and absence from work due to voice problems in their career than the colleagues without voice problems during the training.[23] Remarkably, voice complaints were reported with a decreasing tendency with increasing number of teaching years.[24] Apparently, entering the teaching profession is a period of risk for getting voice problems. Some teachers may develop strategies during this period to cope with voice problems and may continue to do so during their career.

Simberg et al.[25] found that about twenty percent of student teachers had a voice disorder. Thomas et al. found that 39.6 percent of female student teachers reported voice complaints at the moment and / or during the past year.[26] Frequent vocal problems and insufficient care for their voice was reported by Timmermans et al. in future professional voice users.[27] Together with the observed considerable prevalence of voice problems and voice related absence from work in teachers,[41] it can be stated that adequate screening of student teachers and prevention of voice problems in teachers is necessary.

Screening student teachers for voice disorders, however, is not common practise on every teacher schools in the Netherlands. Furthermore, the lack of a valid protocol to predict voice problems hampers effective screening and more research about this subject is necessary.

Training for correct voice use and vocal hygiene are preventive measures and various studies have stressed their need during the formal education.[19,28-30] In essence, it is necessary to judge whether there is a good balance between voice capacity and voice load. Voice capacity not only depends on the physical condition of the voice apparatus but also on the use of the voice that must be adjusted individually. In-adequate voice capacity must be compensated by emergency measures on the site of the vocal load. This means that highly individual tuning of the balance in voice training is necessary. What is lacking on the one side must be compensated at the other side.

PERCEIVED RISK FACTORS FOR VOICE PROBLEMS IN TEACHERS

The different prevalence's of voice problems in the various stages (education, beginning of the career, during the career) urges the question of the causes and

risks. The genesis of voice problems is frequently multicausal.[31, 32] Based upon the literature the pertinent study divided the wide spectrum of causes and risks in 4 categories: vocal load, physical, environmental and psycho-emotional factors.[31, 33, 34]

The teachers reported that various factors in the domain of voice load, physical condition, psycho-emotional condition and environment are related to voice problems. Physical and psycho-emotional factors appear to be the most influential risk factors. Remarkably, voice load and environment seem to be less influential as risk factors in the development and consolidation of voice complaints. In education (if there is any training) students learn vocal skills concerning vocal load.[27] As demonstrated by the great number of teachers with voice problems in the beginning of their career, this training seems to be unsuccessful. Obviously training should address other skills of teaching and voicing than the used ones. A more multifactorial approach to diagnosis of voice problems and subsequent training appear to be necessary.

Tension and body posture are psychomotoric expressions of stress. High stress and emotion-level can contribute to psychosomatic problems such as increased muscular tension.[35-37] These mechanisms have consequently been observed to affect the voice.[1,38]

The cascade model can explain persisting complaints[39]. Most of the time inadequate coping strategies are the cause of staying in phase 1 of the model. In persisting voice problems not only the voice techniques but also the personal functioning has to be considered. Persisting voice complaints hardly are based upon organic disorders.[39]

PERCEPTION OF VOICE PROBLEMS (according to gender)

Female teachers reported more frequently voice complaints and absence from work due to voice problems than their male colleagues. This is in accordance with the data obtained by Russell et al., Smith et al. and Roy et al.[2,18,19,31,32] Gender was found to be a different effect modifier for the various risk factors.[40] Especially the psycho-emotional factors were found to be more frequent in female teachers than in the male teachers. Within this context, these findings suggest a different etiopathogenesis of voice problems between males and females, a different sensitivity to certain risk factors and a different coping between males and females. The question is whether there is a real difference? Or do females adopt a

more vulnerable attitude towards there problems? This should be subject for further research.

IMPACT OF VOICE PROBLEMS IN TEACHERS

A lack of objective physical and physiological abnormalities, while the person does have complaints, can be a diagnostic problem in occupational dysphonia. This raises the question whether the relationship between causal factors and voice complaints. One out of five teachers reported a history of absence from work due to voice problems and more than 20 percent of the teachers sought medical help or had been treated for a voice problem[41]. Teachers with voice problems reported a greater psychosocial impact (VHI score) compared to students and the general population, whereas voice problems did not have an increasing psychosocial impact in teachers in different stages of their career.[23,24] A high psychosocial impact may constitute a source of stress, generating a vicious circle. Therefore, the assessment of the impact of the voice problems is inextricably bound to a correct diagnosis.

The demonstration of a psychological cascade model for persisting voice problems in teachers indicates that not only the factors that cause the voice problem should be detected and eliminated, but also the factors that maintain the voice problem, e.g. physical, functional, psychological and environmental factors. Especially when physical and voice technical therapy have failed and the patient finds himself / herself in a deadlocked situation and is sliding down into a chronic disease, the dynamic mechanisms of the psychological cascade model should be recognized and taken into account in the treatment strategy.[39]

FINAL CONSIDERATIONS

The above-mentioned considerations make clear that prevention and care of voice problems is an actual necessity. Individual tuning has to be practiced in the assessment and therapy of professional speakers with voice problems. A personal profile has to be created for the prediction of the development of a occupational voice disorder. This is probably more important than the assessment of separate acoustic aspects of the voice. The assessment of occupational voice problems, therefore, has to be multidisciplinary and multidimensional. This means that medical, logopedical, psychological and physiotherapeutic professionals have to

be part of the screening / examination team. The team has to comply with the interaction and the dynamic processes of a occupational voice problem. In the care of occupational voice problems the first aim should be focused on all aspects of threat, maintaining factors and inadequate coping strategies. This may lead to an adequate solution of the problem. Hereby the mechanisms of the psychological cascade model should be recognized and taken into account in the treatment strategy.

However, a mere description of the parameters does not lead to an understanding of the mutual influence of the various parameters and their cumulative effect. The interaction differs during the whole career, for example psycho-emotional factors play more frequently a part in the beginning of the career, physical aspect more at the end. Also, there is a continuously changing dynamic process.

The mechanisms that are involved in the continuation of the voice problem should be clear to both the person who treats the patient and the patient himself. The etiologic moments themselves may not be changed, terminated, or reversed in every case.

The term "chronicity" was introduced, which means that the problems are maintained and the patient finds himself in a deadlocked situation, and is sliding down into a chronic disease. "Chronicity" is essentially different from "chronic", which refers only to the duration of the disease. We consider maintaining factors and (inadequate) coping factors, which consist of emotional / psychological, physical and socioeconomic aspects, as indicators for chronicity. Instruments to measure chronicity have to be developed.

It should be part of an adequate program in the field of occupational safety and health. In this light, international initiatives for consent and standardization of occupational voice disorders would promote the recognition of voice problems as an occupational disease in countries where this is not the case (like in the Netherlands). Furthermore, this would promote establishment or improvement of occupational safety and health arrangements like adequate risk analysis, as supported by Vilkman.[22]

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Chapter 11

Summary and Conclusions

SUMMARY AND CONCLUSIONS

Occupational voice problems constitute a challenge for challenge for medicine and Occupational Safety and Health. Occupational voice disorders are often complex with a multifactor genesis. In the Netherlands occupational voice disorders are not classified and recognized as an occupational disease like in Poland and Finland. Therefore, epidemiological data are lacking and systematic adequate diagnosis, treatment and prevention of occupational voice disorders are neglected. The teaching profession is an outstanding example of a voice demanding profession, and voice disorders are common among teachers.

The aims of this study in Dutch teachers are:

1. To estimate the prevalence and magnitude of voice problems.
2. To examine associations between risk factors for voice problems and voice problems.
3. To evaluate the psychosocial impact of voice problems.
4. To investigate whether voice problems in teachers have a history during the training period and / or before.
5. To examine whether there is a difference in perception of risk factors and voice problems when student teachers begin professional teaching and during the entire teaching career.
6. To assess whether gender of teachers plays a role in voice problems.
7. To examine the role of muscle tension in voice production and voice handicap in teachers.
8. To examine whether a psychological cascade model also plays a role in voice problems of teachers.

Epidemiology of Voice Problems in Dutch Teachers

Chapter 2 describes in a cross sectional study the analysis of the occurrence of voice problems and absence from work due to voice problems in 1878 Dutch Primary and secondary school teachers and 239 controls with the use of questionnaires. Besides, it was investigated whether voice problems have their roots already in the education for the teaching profession and the subjective impact of the voice on the teaching career and the need for voice training were assessed. The number of subjects was corrected for gender. Female teachers reported more voice complaints and more absence from work due to voice problems than their male colleagues. More than half of the teachers reported voice problems during their career and about one-fifth had a history of absence from work due to voice problems. These numbers are relatively high compared to those

of the controls with as well as to those without a vocally demanding profession. More than 20 percent of the teachers sought medical help or had been treated for a voice problem. Remarkably, more than 12 percent of the teachers had experienced voice problems during their training and this group reported significantly more voice complaints and absence from work due to voice problems in their career than the colleagues without voice problems during the training. The results of the Voice Handicap Index (VHI) scores followed these trends. These findings point at voice problems during education as a risk factor for getting voice problems during the career. The results of this study clearly demonstrate that teaching is a high-risk profession for the development of voice problems, which is in accordance with other studies and support the contention that voice is a worldwide problem in the teaching profession. Furthermore, this study indicates the importance of voice care not only during training for the profession but also during the career.

A Comparative Study of Voice Complaints and Risk Factors for Voice Complaints in Female Student Teachers and Practicing Teachers early in their Career

A cross-sectional questionnaire survey described in chapter 3 was performed to compare female student teachers (454 subjects; 1st to 4th year of training) and practicing teachers (82 female teachers; 1st to 4th year of teaching career) of primary education early in their career, with regard to risk factors perceived to be a negative influence on the voice, and the relative risk of the given risk factors for voice complaints. This enables the observation whether there is a sudden increase or difference in the perceived risk factors after starting the professional teaching career. Additionally, history of voice problems during training was enquired among teachers. Teachers with voice complaints compared to teachers without voice complaints reported a history of voice complaints during their training ($p=0.013$). Teachers compared to student teachers reported more voice complaints at the moment and / or during the past year ($p=0.002$). The following data is obtained from student teachers and teachers reporting voice complaints. Only around a third of the subjects of both groups sought voice care ($p=0.286$-0.893). Risk factors were estimated in relation to voice complaints. Student teachers reported less frequently than teachers that stress ($p=0.014$), work pressure ($p=0.003$), and the composition of the class ($p=0.013$) have a negative influence on their voice. Student teachers reported less frequently than teachers that the number of people they communicate with ($p<0.001$), and the deterioration of their general physical condition ($p=0.010$) have a negative influence on their voice. Student teachers

reported more frequently than teachers that environmental irritants ($p<0.001$) and humidity ($p=0.020$) of the classroom have a negative influence on their voice. Student teachers more than teachers were of the opinion that the attention paid to the voice during their training was sufficient ($p<0.001$). To test whether professional status (student teacher versus teacher) is an effect modifier for the risk factors, Odds Ratios were compared between the group of teachers and student teachers (total group with and without voice complaints) to search for interactions between the risk factors and professional status. There is a significant difference in the pattern of risk factors for student teachers and teachers ($p=0.010$). There is an indication that vocal loading factors and environmental factors are more influential in student teachers and a trend of psycho-emotional factors being more influential for teachers early in their career.

Psychosocial Impact of Voice Problems throughout the teaching Career

In chapter 4 the psychosocial impact of voice problems throughout the teaching career is assessed. It is generally agreed that voice capacity decreases with age. This is likely to be more pronounced in voice-loaded professions and may lead to occupational dysphonia. The aim of this cross-sectional study was to investigate the course of voice complaints, percieved handicap and absenteeism from work due to the voice problems in primary and secondary school teachers. Questionnaires were used to obtain data; 1775 were returned for analysis. The Voice Handicap Index (VHI) list according to Jacobson et al. was also enclosed with the questionnaire. Surprisingly, a significant decrease in voice complaints was observed during the teaching career. The expectation that voice problems would have an increasing psychosocial impact on teachers during the course of their career and in their daily lives, measured with the VHI, was not confirmed by this study. The results indicate that close attention must be paid to teachers with voice complaints. The fact that more voice complaints were reported at the beginning of the teaching career than at the end emphasizes the importance of adequate prevention programmes for future teachers and special care for those just starting the profession.

Risk Factors for Voice Problems in Teachers

Chapter 5 describes which factors are experienced by primary and secondary school teachers as a risk for voice complaints and voice-related absenteeism. As an additional, but important item, this study addressed the question whether voice problems during the training for the teaching profession constituted a risk factor for

getting voice problems and voice-related absenteeism during the later career. Questionnaires of 1878 teachers were analyzed. The questionnaires contained questions about personal data, voice complaints, voice-related absenteeism from work, and conditions that may lead to voice complaints and absenteeism. Different factors play a role in the development and consolidation of voice problems. Physical and psycho-emotional factors appear to be the most important risk factors. Remarkably, voice load and environment seem to be less important as risk factors in the development and consolidation of voice complaints. Teachers who experienced voice problems during their training reported more voice problems during their career. The results of this study stress the importance of a multifactor approach in the diagnosis and treatment of voice problems, whereby physical and psycho-emotional aspects should be considered as sensitive to the risk of developing voice problems. Moreover, this study shows the crucial importance of adequate voice training during the teacher-training program.

Muscular Tension and Body Posture in Relation to Voice Handicap and Voice Quality in Teachers with persistent Voice Complaints

In chapter 6 the relationship between extrinsic laryngeal muscular hyper tonicity and deviant body posture on the one hand and voice handicap and voice quality on the other hand in teachers with persistent voice complaints and a history of voice related absenteeism was assessed. The study group consisted of 25 female teachers. A voice therapist assessed extrinsic laryngeal muscular tension and a physical therapist assessed body posture. The assessed parameters were clustered in categories. The parameters within the same categories represent similar function. Furthermore, a tension/posture index was created, which is the summation of the different parameters. The different parameters and the index were related to the Voice Handicap Index (VHI) and the Dysphonia Severity Index (DSI). The scores of the VHI and the individual parameters differ significantly, except for the posterior weight bearing and tension of the sternocleidomastoid muscle. There was also a significant difference between the individual parameters and the DSI, except for tension of the cricothyroid muscle and posterior weight bearing. The score of the tension/posture index correlates significantly with both the VHI and the DSI. In a linear regression analysis, the combination of hypertonicity of the sternocleidomastoid and the geniohyoid muscles and posterior weight bearing is the most important predictor for a high voice handicap. The combination of hypertonicity of the geniohyoid muscle, posterior weight bearing, high position of the hyoid bone, hypertonicity of the cricothyroid muscle and anteroposition of the head is the most important predictor for a low DSI-score. The

results of this study show the higher the score of the index, the higher the score of the voice handicap and the worse the voice quality. Moreover, the results are indicative for the importance of assessment of muscular tension and body posture in the diagnosis of voice disorders.

Risk Factors for Voice Complaints throughout the Teaching Career

The aim of chapter 7 was to identify risk factors in teachers throughout their career and to evaluate whether there were differences between the teachers with voice complaints and those without. From primary and secondary school teachers 1775 questionnaires were suitable for analysis. The questionnaire addressed personal, voice loading, physical, psycho-emotional and environmental aspects of the voice and voice problems. Voice complaints were reported by a large percentage of the teachers with a decreasing tendency with increasing stages. Throughout the teaching career, teachers with voice symptoms scored the prevalence of ten out of sixteen risk factors at a level of fifty percent or more. In general no distinct tendency could be observed in the course of percentages teachers with voice complaints. The odds ratios, representing the relative risk for the development of voice complaints, indicated a high relative risk in the voice load, physical and psycho-emotional categories throughout almost all teaching stages and showed an increasing tendency throughout the career. In the environmental category most of the factors showed a low relative risk and no distinct tendency could be observed. These findings indicate that teachers with voice complaints are more susceptible to several risk factors, especially in the vocal load, physical and the psycho-emotional domains, but there was no increase in determinants as their career progressed. However, an increasing relative risk was found. Obviously, teachers develop coping strategies for voice risks to some extend that are reflected in the decrease of voice complaints throughout the teaching career. Further research is needed to specify adequate coping strategies. Bringing adequate coping strategies into action during training or in an early stage of the career may prevent voice problems throughout the teaching career.

Comparative Study on Voice Complaints, Voice Handicap and Risk Factors for Voice Complaints in Male and Female Teachers

In chapter 8 it was investigated whether there were differences in the occurrence, perceived risk and implications of voice problems between male and female primary and secondary school teachers. Questionnaires were used, of which 1775 were suitable for analysis. The questionnaire addressed personal, voice loading, physical, psycho-emotional and environmental aspects of the voice and voice

problems. Questions were included about absenteeism from work due to voice problems and the rate of help seeking and therapy. The Voice Handicap Index (VHI) questionnaire according to Jacobson et al. was added. Almost 50 per cent of the male teachers and almost 70 per cent of the female teachers reported voice complaints during their career. More of the female teachers reported voice problems and voice related absenteeism, had sought help and undergone examinations and treatment for their voice complaints than the male teachers. Male and female teachers with voice complaints showed different relative risks of voice problems for various (five out of sixteen) perceived risk factors. These factors mainly concerned voice load and more males than females reported that they had a negative influence of voice load factors on their voice. This indicates that the male teachers were more vulnerable to vocal load than their female colleagues. The perceived risk factors for voice complaints 'full-time vs. part-time work', 'number of pupils', 'number of teaching years', 'lower back complaints' and "diminished hearing" were found to be more profound in the males. The perceived risk factors for voice complaints 'physical health' and 'irritants' were found to be more profound in the females. This indicates difference in the perception of various risk factors between the sexes. No significant differences were observed in the VHI functional, emotional and physical subscale scores between the male and female teachers with recent voice problems. These findings should be taken into consideration in the design of diagnosis, treatment and prevention programs for voice problems in male and female teachers. Furthermore, voice coaching can be expected to have important advantages.

A Psychological Cascade Model for Persisting Voice Problems in Teachers

This study (chapter 9) describes the factors that maintain the voice problem and the way in which teachers with chronic voice complaints cope with their voice problem in 76 teachers with persisting voice problems. Physical, functional, psychological and socioeconomic factors were assessed. This study also addressed the question whether a parallel can be drawn to the psychological cascade model, as described by Anderson. The majority of the patients were found to be in a deadlocked situation (phase 1 of the cascade model), for which the combination of externalization and unawareness for the situation is the main risk-factor. Subjective rating of the psychosocial consequences of the voice problem was assessed by the Voice Handicap Index (VHI) and the severity of the voice problem by a Visual Analogous Scale (VAS). Teachers in phase 1 of the cascade model showed higher VHI and VAS scores compared with the other teachers. For a high VHI score, the combination of socioeconomic factors and been assessed in

phase 1 was the most important risk factor. Social economic factors alone were the most important risk factors for a high VAS score. The term "chronicity" was introduced, which means that the problems are maintained and the subject finds himself in a deadlocked situation, and is sliding down into a chronic disease. "Chronicity" is essentially different from "chronic", which refers only to the duration of the disease. Maintaining factors and (inadequate) coping factors, which consist of emotional / psychological, physical and socioeconomic aspects, were considered as indicators for chronicity.

CONCLUSIONS

In conclusion it may stated that voice problems occur frequently in Dutch teachers. The genesis is multifactor, while voice loading factors seem not to constitute the most important factor. In teachers with persisting voice problems a positive correlation was found between the amount of muscular tension and abnormal body posture on the one hand and voice handicap and voice quality on the other hand. Female teachers reported more frequently voice problems than their male colleagues. The pattern of perceived risk factors was different between females and males. Remarkably, teachers at the beginning of their career reported more voice complaints than student teachers, with a different pattern of perceived risk factors. Emotional risk factors gained importance. The observation of a decrease and stabilisation of reporting voice problems in the course of the teacher’s career is just as remarkable. Apparently teachers develop certain coping strategies. Besides causative factors of the occurrence of voice problems, factors that cause a continuing of the voice problems are of importance. In teachers with persisting voice problems a psychological cascade seems to play a role, in which the subject sticks in the first phase of the healing process. Coping strategies play a crucial part in this mechanism. The findings of this study indicate the necessity of a multidisciplinary approach of the diagnosis, treatment and prevention of voice problems in teachers. The scope must be broader than that exists at the moment. Training of voice use and coping with voice problems should start already during education.

SAMENVATTING EN CONCLUSIES

Stemproblemen bij beroepssprekers vormen een uitdaging voor de medische wetenschappen en een risico voor de veiligheid en gezondheid van deze sprekers. Stemstoornissen binnen een spreekberoep zijn vaak complex en multifactorieel van oorsprong. In Nederland worden stemstoornissen niet geclassificeerd en als beroepsziekte erkend, terwijl dit wel het geval is in bijvoorbeeld Polen en Finland. Epidemiologische gegevens ontbreken derhalve en adequate diagnosestelling, therapie en preventie van stemstoornissen binnen het spreekberoep worden dientengevolge veronachtzaamd. Het beroep van leerkracht is een uitermate kenmerkend voorbeeld van een stembelastend beroep, en stemproblemen komen frequent voor bij leerkrachten.

De doelstellingen van deze studie bij Nederlandse leerkrachten zijn:

1. inzicht krijgen omtrent het vóórkomen van stemstoornissen en de ernst daarvan;
2. te onderzoeken welke relaties er bestaan tussen risicofactoren voor stemproblemen en stemproblemen;
3. te evalueren wat de psychosociale impact van stemproblemen is;
4. te onderzoeken of stemproblemen bij leerkrachten een oorsprong hebben in de periode van opleiding of daarvoor;
5. te onderzoeken of beginnende leerkrachten risicofactoren voor stemproblemen anders ervaren dan leerkrachten in de verdere loop van hun carrière;
6. te beoordelen of de sekse van leerkrachten een rol speelt bij stemproblemen;
7. te onderzoeken of spierspanning bij leerkrachten een rol speelt in stemkwaliteit en de subjectief ervaren stemhandicap;
8. na te gaan of een psychologisch cascade model toepasbaar is en een rol speelt bij leerkrachten met stemproblemen.

Epidemiologie van Stemproblemen bij Nederlandse Leerkrachten

In hoofdstuk 2 wordt een cross-sectional studie beschreven betreffende de aanwezigheid van stemproblemen en het ziekteverzuim vanwege stemproblemen bij 1878 Nederlandse leerkrachten in basis- en vervolgonderwijs en 239 controlepersonen. Daarnaast werd onderzocht of de oorsprong van de stemproblemen al in de opleiding te vinden was, wat de subjectief ervaren impact van de stemproblemen op de carrière was en of leerkrachten behoefte hadden aan

stemtraining. Het aantal proefpersonen werd gecorrigeerd voor geslacht. Vrouwelijke leerkrachten rapporteerden meer stemklachten en ziekteverzuim vanwege stemproblemen dan de mannelijke collega's. Meer dan 50% van de leerkrachten rapporteerden stemklachten gedurende hun carrière en ongeveer 20% had ziekteverzuim vanwege de stemklachten. Deze aantallen zijn relatief hoog in vergelijking met de controlepersonen, zowel met als zonder stembelastend beroep. Meer dan 20% van de leerkrachten zocht medische hulp of onderging stemtherapie. Opvallend was dat 12% van de leerkrachten met stemproblemen deze ook tijdens hun opleiding ervaren hadden. Deze groep rapporteerde significant meer stemproblemen en ziekteverzuim vanwege stemproblemen dan de leerkrachten die geen stemproblemen hadden tijdens de opleiding. Ook de scores op de Voice Handicap Index (VHI) volgden deze trend. Het hebben van stemproblemen tijdens de opleiding mag dus als een risico factor gezien worden voor het krijgen van stemklachten tijdens de uitoefening van het beroep.
De resultaten van deze studie tonen duidelijk aan dat het beroep van leerkracht een zeer riskant beroep is voor het krijgen van stemproblemen en bevestigen de gedachte dat de stem binnen het onderwijs een wereldwijd probleem is. Zorg voor de stem is niet alleen noodzakelijk tijdens de opleiding, maar ook tijdens de uitoefening van het beroep van leerkracht.

Een vergelijkende studie naar stemklachten en risicofactoren voor het krijgen van stemproblemen bij vrouwelijke studenten en beginnende leerkrachten
In hoofdstuk 3 wordt een studie beschreven waarbij 454 vrouwelijke Pabo-studenten en 82 vrouwelijke basisschoolleerkrachten in de eerste 4 jaar van hun carrière werd gevraagd naar de subjectief ervaren risicofactoren voor het krijgen van stemklachten en het relatieve risico van deze factoren voor het krijgen van stemproblemen. Dit maakte het mogelijk te onderzoeken of er een verschil in subjectief beleven van de risicofactoren bestond na start van de carrière. Leerkrachten met stemproblemen hadden significant meer stemproblemen ($p=0.013$) tijdens de opleiding dan de leerkrachten zonder stemproblemen. Beginnende leerkrachten rapporteerden meer stemklachten op het moment van onderzoek en in het voorbijgaande jaar dan de Pabo-studenten ($p=0,002$). Van de leerkrachten en Pabo-studenten met stemklachten zocht ongeveer 30% hulp. Pabo-studenten beschreven stress ($p=0.014$), werkdruk ($p=0.003$), de samenstelling van de groep ($p=0.013$), aantal leerlingen ($p=0.001$) en verminderde algemene conditie ($p=0.010$) minder frequent als risicovol voor de stem dan de beginnende leerkrachten. Meer Pabo-studenten dan beginnende leerkrachten

waren van mening dat prikkelende stoffen ($p<0.001$) en luchtvochtigheid ($p<0.001$) negatief werken op de stem. Pabo-studenten, meer dan de beginnende leerkrachten, vonden de aandacht die er aan de stem werd geschonken op de opleiding voldoende ($p<0.001$). Om te bepalen of de professionele status (student versus leerkracht) een 'effekt-modifier' was met betrekking tot de risicofactoren, werden odds ratios berekend tussen de groep leerkrachten en de groep studenten (totale groep met en zonder stemklachten) om te bepalen of er interacties waren tussen de risicofactoren en de professionele status. Er blijkt een significant verschil te zijn tussen de Pabo-studenten en de beginnende leerkrachten in de ervaren risico factoren. Factoren betreffende stembelasting en omgevingsfactoren worden door studenten meer als risicovol gezien, terwijl beginnende leerkrachten meer risico ervaren van psycho-emotionele factoren.

Psychosociale Impact van stemproblemen gedurende de carrière

In hoofdstuk 4 werd de psychosociale impact van stemproblemen gedurende de carrière onderzocht. Over het algemeen wordt aangenomen dat stemcapaciteit bij het ouder worden afneemt. Dit zal meer voorkomen bij stembelastende beroepen en kan leiden tot beroepsheesheid. Het doel van deze 'cross-sectional' studie was het verloop van stemklachten subjectief ervaren handicap en ziekteverzuim vanwege stemproblemen bij leerkrachten in het basis- en voortgezet onderwijs te onderzoeken. Naast een nieuw ontworpen vragenlijst werd ook de Voice Handicap Index (VHI) volgens Jacobson et al. gebruikt. In totaal waren 1775 vragenlijsten geschikt voor analyse. Tegen de verwachting in werd een significante afname van stemklachten gevonden gedurende de onderwijscarrière. De verwachting dat stemproblemen een toenemende psychosociale impact zouden hebben op leerkrachten gedurende het verloop van hun carrière en op hun dagelijks leven, kon door deze studie niet worden bevestigd. De resultaten geven wel aan dat gerichte aandacht moet worden besteed aan leerkrachten met stemproblemen. Dat leerkrachten aan het begin van hun carrière meer stemproblemen rapporteerden dan aan het eind geeft het belang aan van adequate preventieprogramma's voor toekomstige leerkrachten en speciale aandacht voor leerkrachten aan het begin van hun loopbaan.

Risicofactoren voor stemproblemen bij leerkrachten

De factoren die door leerkrachten uit het basis- en voortgezet onderwijs worden ervaren als risicofactoren voor stemproblemen en ziekteverzuim vanwege stemproblemen, worden in hoofdstuk 5 beschreven. Of stemproblemen gedurende de opleiding tot leerkracht een risico factor vormde voor het krijgen van stem-

problemen en ziekteverzuim gedurende de professionele carrière was een bijkomende vraagstelling bij deze studie. Vragenlijsten van 1878 leerkrachten werden geanalyseerd. Deze vragenlijsten bevatten vragen betreffende persoonsgegevens, stemklachten, stemgerelateerd ziekteverzuim en condities die zouden kunnen leiden tot stemproblemen en hun ziekteverzuim. Verschillende factoren spelen een rol in de ontwikkeling en instandhouding van stemproblemen. Fysieke en psycho-emotionele factoren werden in deze studie als belangrijkste risico factoren gevonden. Tegen de verwachting in, bleken stembelasting en omgeving minder belangrijk te zijn voor het ontwikkelen en in standhouden van stemproblemen. Leerkrachten, die tijdens de opleiding tot leerkracht stemproblemen hadden ervaren, rapporteerden meer stemproblemen tijdens hun carrière dan de collega's die geen stemproblemen hadden tijdens de opleiding. De resultaten van deze studie benadrukken het belang van een multifactoriële benadering in de diagnose en de behandeling van stemproblemen, waarbij fysieke en psycho-emotionele aspecten beschouwd moeten worden als risicovol voor het ontwikkelen van stemproblemen. Bovendien blijkt uit deze studie het grote belang van adequate stemtraining gedurende de opleiding tot leerkracht.

Spierspanning en lichaamshouding in relatie tot Voice Handicap en stemkwaliteit bij leerkrachten met persisterende stemklachten

Hoofdstuk 6 beschrijft de relatie tussen extrinsieke laryngeale spierspanning en afwijkende lichaamshouding enerzijds en stem handicap en kwaliteit anderzijds bij leerkrachten met stemklachten en ziekteverzuim vanwege de stemklachten. Bij 25 vrouwelijke leerkrachten werd de extrinsieke laryngeale spanning door een logopedist/stemtherapeut beoordeeld en de lichaamshouding door een fysiotherapeut/manueel therapeut. De onderzochte parameters werden in vier categorieën ingedeeld, die een gelijke functie representeerden. Vervolgens werd een index ontworpen die een optelsom van de gevonden parameters weergaf. De verschillende parameters en de totaalsom van de index werd gecorreleerd met de Voice Handicap Index (VHI) en de Dysphonia Severity Index (DSI). De scores van de individuele parameters lieten significante verschillen zien, behalve voor de posterieure lichaamshouding en spanning van de m. sternocleidomastoideus. Ook in vergelijking met de DSI werden significante verschillen gevonden, behalve voor de m. cricothyroideus en de posterieure lichaamshouding. De score van de spanning- en houdingindex echter liet een significante correlatie met de VHI en de DSI zien. Via een lineaire regressie analyse bleek de gecombineerde aanwezigheid van hypertonie van de m. sternocleidomastoideus en de m. geniohyoideus, en de posterieure lichaamshouding de belangrijkste predictor te zijn

voor een hoge score op de VHI. De combinatie van hypertonie van de m. geniohyoideus en de m. cricothyroideus, posterieure lichaamshouding, hoge stand van het os hyoideum en vooruitgeschoven stand van het hoofd bleek de belangrijkste predictor voor een lage score op de DSI. Deze studie toont aan dat hoe hoger de score van de index is, des te hoger de score op de VHI en hoe lager de score op de DSI. Het gebruik van een index bij deze beoordelingen heeft een grote meerwaarde boven de beoordeling van spanning en positie van individuele spieren, structuren en houdingsaspecten. Het beoordelen van spierspanning en lichaamshouding, blijkt uit deze studie, is van groot belang binnen de diagnose van stemstoornissen.

Risicofactoren voor stemklachten in de loop van de carrière van leerkrachten
In hoofdstuk 7 wordt beschreven hoe leerkrachten in de verschillende stadia van de carrière risicofactoren ervaren en de verschillen daarin tussen leerkrachten met en zonder stemklachten. De risicofactoren werden onderverdeeld in 4 categorieën: stembelastende, fysieke, psycho-emotionele en omgevingsfactoren. Stemklachten werden door een hoog percentage van de leerkrachten gerapporteerd met een afname gedurende de toename van dienstjaren.
50% of meer van de leerkrachten met stemproblemen scoorden 10 van de 16 aangegeven factoren als risicovol. In de loop van de carrière werd geen verandering in de tendens van de gescoorde factoren waargenomen. De odds ratio's, die het relatieve risico aangeven voor de ontwikkeling van stemproblemen, geven een hoog relatief risico aan voor de categorieën 'stembelasting', 'fysieke' en 'psycho-emotionele' factoren in vrijwel alle stadia van de loopbaan, met een toename in de latere periode van de carrière. In de categorie omgevingsfactoren toonden vrijwel alle factoren een laag relatief risico zonder een specifieke tendens in de gescoorde factoren. De bevindingen geven aan dat leerkrachten met stemklachten meer ontvankelijk zijn voor bepaalde risicofactoren dan hun collega's zonder stemklachten, met name in de gebieden stembelasting, fysieke en psycho-emotionele factoren. Er werd geen toename in gescoorde factoren waargenomen in de loop van de carrière. Echter een toename in het relatieve risico werd wel gevonden. Blijkbaar ontwikkelen leerkrachten coping-strategieën voor stemklachten, hetgeen zich manifesteert in de afname van stemklachten. Verder onderzoek naar deze coping-strategieën en hun invloed op stemproblemen is noodzakelijk. Het aandacht besteden aan en eventueel aanleren van coping-strategieën in de opleiding tot leerkracht of in het begin van de carrière als leerkracht kan wellicht stemproblemen voorkomen.

Een vergelijkende studie naar stemproblemen, stemhandicap en risicofactoren voor stemproblemen bij mannelijke en vrouwelijke leerkrachten

Hoofdstuk 8 beschrijft het onderzoek naar verschillen in voorkomen, ervaren risicofactoren en de implicaties voor stemproblemen tussen mannelijke en vrouwelijke leerkrachten in het basis- en voorgezet onderwijs. De reeds eerder genoemde vragenlijsten werden gebruikt. Hierbij werd ook de vraag in hoeverre de leerkrachten hulp hadden gezocht voor de stemproblemen betrokken. Naast de algemene vragenlijst werd ook de Voice Handicap Index (VHI) meegestuurd. Bijna 50% van de mannelijke leerkrachten gaf aan stemklachten gedurende de carrière te hebben gekend, tegenover 70% van de vrouwelijke collega's. Meer vrouwen dan mannen rapporteerden stemproblemen, stemgerelateerd ziekteverzuim, zochten hulp en ondergingen onderzoeken en behandelingen voor hun stemproblemen. De mannelijke en vrouwelijke leerkrachten kenden verschillende relatieve risico's voor het krijgen van stemproblemen voor 5 van de 16 te scoren risicofactoren. Meer mannen dan vrouwen gaven aan dat factoren betreffende de stembelasting een negatieve invloed op hun stem hadden. De factoren 'fulltime vs. parttime', 'aantal leerlingen', 'aantal jaren onderwijs', 'lage rugklachten' en 'verminderd gehoor' waren meer uitgesproken bij mannelijke leerkrachten aanwezig; de factoren 'algemene gezondheid' en 'prikkelende stoffen' meer bij de vrouwelijke leerkrachten. Deze bevindingen wijzen op een verschil in perceptie van de risicofactoren tussen de seksen. In de VHI werd geen verschil gevonden tussen mannelijke en vrouwelijke leerkrachten met recente stemklachten betreffende de scores op de categorieën 'emotioneel', 'functioneel' en 'fysiek'. In de uitvoering van diagnostische en therapeutische procedures en bij de begeleiding van studenten moeten de bevindingen van deze studie in acht genomen worden.

Een psychologisch 'cascademodel' voor aanhoudende stemklachten bij leerkrachten

In hoofdstuk 9 wordt een studie beschreven naar de instandhoudende factoren van stemproblemen en het coping gedrag bij 76 leerkrachten met aanhoudende stemproblemen. Fysieke, functionele, psychologische en socio-economische factoren werden in het onderzoek betrokken. Ook werd de vraag of er een parallel te trekken was met het psychologische cascademodel, zoals beschreven door Anderson, in het onderzoek betrokken. Het merendeel van de leerkrachten bevond zich in een vastgelopen situatie (fase 1 van het cascademodel), waarbij de combinatie van externalisatie en onbewust zijn van de situatie waarin men verkeert de belangrijkste risicofactor vormt. De subjectieve inschatting van de

psychosociale consequenties van de stemproblemen werd onderzocht middels de Voice Handicap Index (VHI). De subjectief ervaren ernst van de stemproblemen werd onderzocht via een visueel-analoge schaal (VAS). Leerkrachten in fase 1 van het psychologische cascademodel vertoonden hogere VHI en VAS scores in vergelijking met de andere leerkrachten. Voor een hoge VHI score was de combinatie van 'socio-economische factoren' en 'verkeren in fase 1' het grootste risico. Socio-economische factoren alleen bleken de hoogste risicofactoren voor een hoge VAS-score te zijn. De term 'chroniciteit' werd in dit verband geïntroduceerd, hetgeen betekent dat de problemen zich voortzetten en het subject zich in een vastgelopen situatie bevind, waardoor hij/zij in een chronische stoornis afglijdt. 'Chroniciteit' verschilt wezenlijk van 'chronisch' hetgeen alleen refereert aan de tijdsduur van een probleem. Onderhoudende factoren en (inadequate) coping-strategieën, welke bestaan uit psycho-emotionele, fysieke en socio-economische aspecten, werden aangemerkt als indicatoren voor chroniciteit.

CONCLUSIES

Concluderend kan gesteld worden dat stemproblemen bij Nederlandse leerkrachtren in hoge mate bestaan. Het ontstaan van stemproblemen is multifactorieel, waarbij de stembelastende factoren tegen de verwachting in niet de belangrijkste factor blijkt te zijn. Bij leerkrachten met een stemprobleem werd een positieve correlatie gevonden tussen de aanwezigheid van (peri)laryngeale spierspanning en houdingsafwijkingen enerzijds en verhoogde stemhandicap en verminderde stemkwaliteit anderzijds. Vrouwelijke leerkrachten rapporteerden meer frequent stemproblemen dan hun mannelijke collega's. Het patroon van subjectief ervaren risicofactoren was verschillend tussen mannen en vrouwen. Door beginnende leerkrachten werden opvallend vaker dan door studenten in de opleiding tot leerkracht stemproblemen vermeld, waarbij ook de ervaren risicofactoren verschilden. Psycho-emotionele factoren bleken daarbij een grote rol te spelen. De bevinding dat stemproblemen in de loop van de carrière daalden of in ieder geval stabiliseerden is al even opmerkelijk. Blijkbaar ontwikkelen leerkrachten adequate coping-strategieën. Behalve de factoren die invloed uitoefenen op het ontstaan van stemproblemen zijn ook instandhoudende factoren van groot belang. Bij leerkrachten met persisterende stemproblemen lijkt een psychologische cascade van invloed te zijn, waarbij het subject in de eerste fase van het genezingsproces blijft steken. Coping-strategieën spelen een cruciale rol in dit mechanisme. De bevindingen van deze studie geven de noodzaak aan van

een multidisciplinaire benadering van de diagnostiek, de behandeling en de preventie van stemklachten bij leerkrachten. Meer dan nu het geval is zal er vanuit een bredere optiek gekeken moeten worden naar deze problematiek. Stemtraining en het leren omgaan met risicofactoren en eventuele stemproblemen moet al starten tijdens de opleiding tot leerkracht.

DANKWOORD

Promoveren betekent ‘naar voren bewegen’; soms getrokken, soms geduwd, soms op eigen kracht. In dit bewegingsproces zijn vele krachten actief. Enkele van deze stuwende krachten wil ik met name bedanken. Echter naast degenen die met naam genoemd worden, stonden velen die bewust of onbewust een belangrijke steun in de rug hebben betekend. In principe bedank ik alle mensen om mij heen die hiertoe hebben bijgedragen.

Felix de Jong: Allereerst Felix wend ik me tot jou. Jij bent degene geweest die mij over de drempel hebt geholpen om onderzoek te gaan doen. Met een niet aflatende duwkracht, waarbij nacht- en weekendwerk niet werd geschuwd, bracht jij me tot dit eindresultaat. Je staat in mijn hart gegrift als promotor, directe chef, collega en vriend. Jouw verdiensten zijn niet in woorden uit te drukken, maar toch dat ene woord: bedankt.

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Wendy en Rogier: Het terrein van de statistiek en de methodologie is een vak apart. Jullie hebben op de nodige woensdagavonden, nadat de kids naar bed waren gebracht, mij wegwijs gemaakt in die moeilijke materie. Stomme vragen per email of telefoon werden altijd als een zeer adequate vraag beantwoord. Hoewel het soms goochelen leek, kreeg ik toch inzicht in de manier waarop zaken dienden te worden geanalyseerd.

Collega’s, m.n. Monique, Mariette, Liesbeth, Rosemary, George, Hanneke, Bert, Janneke, Simone en alle gangbewoners
Jullie waren wellicht ongewild en misschien ongeweten een enorme steun. Trotse belangstelling en enthousiasme over het gebeuren, overtuigden mij ervan om door te zetten en het vak logopedie naar een ander niveau te tillen. Als een van jullie weer een artikel vond dat mogelijk met mijn onderwerp van doen had, kreeg ik dat terloops in mijn postvak. George, jij vooral, wees mij op relevante literatuur, corrigeerde waar nodig mijn Engels en bleek een goede co-promovendus. De collega’s van Neuro waren zeer geïnteresseerd en enthousiast en zeker niet te beroerd om mijn oncologie patiënten in de kliniek over te nemen, zodat ik meer tijd kreeg voor schrijfwerk. Jullie allemaal, bedankt.

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Judith Abma: Judith, ik dank je voor de zeer constructieve vertalingen naar en correcties van het Engels. Jouw manier van werken, je inhoudelijke commentaren of vragen scherpten mijn formuleringen.

Diny Helsper: De lay-out van dit proefschrift Diny komt geheel op jouw conto. Geweldig professioneel! Steeds zonder morren, als iets toch weer wat anders moest zijn, heb je dit werk uitgevoerd. Kleren maken de man, de lay-out maakt de thesis.

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Teun Diels: Uren van discussie, onorthodoxe raadgevingen en gedachtegangen, creatieve oplossingen. Hoewel niet altijd toepasbaar, zetten ze mij wel aan het denken. Als techneut zorgde je voor rechtlijnig denken en analyseren. We zullen de discussies wel over een ander onderwerp voortzetten.

Mark, Anke, Judith en Bas: In toenemende mate raakten jullie betrokken bij mijn werk. Jullie waren enthousiast, stimuleerden waar nodig en zetten mij weer op positieve gedachten als ik het even niet meer zag zitten. Trots waren jullie als er weer een artikel af was en dat werd bijna altijd gewaardeerd met een kaart of een bos bloemen. ‘Jongens’, het is af en we maken er ons feestje van.

Riet

Je staat helemaal aan het einde Riet, maar alles overstijgend was jouw steun en meeleven. Je was in het begin vaak sceptisch: eerst zien, dan geloven. Maar toen er vorm kwam in het proces stimuleerde en stuurde je me waar en zoveel als je kon. Helaas mag je juist deze kroon op het werk niet meemaken, maar ik ben ervan overtuigd en heb ervaren dat je ook de laatste maanden sturing en steun gaf. Hoewel het niet zo voelt, hoop ik toch dat je nu met mij dit resultaat kunt vieren.
Ik hou van je.

Petrus Gerardus Clemens Kooijman werd op 7 februari 1948 te Utrecht geboren. Na het met goed gevolg doorlopen van de kleuterschool en de lagere school ging hij in 1960 naar het gymnasium St. Alberti te Zenderen (Ov.). In 1966 werd het gymnasium A met een diploma afgesloten. Daarna volgde hij drie jaar de universitaire opleiding Filosofie en Theologie aan de Katholieke Universiteit te Nijmegen. Door het stoppen van deze opleiding moest hij in militaire dienst. Van 1971 tot 1974 volgde hij de Opleiding Logopedie te Nijmegen.

In 1974 werd hij de eerste logopedist in de gemeente Cuijk en St. Agatha, waar hij een begin maakte met de schoollogopedische dienst, die vervolgens uitmondde in de schoollogopedisch dienst Land van Cuijk. Bij het begin van deze baan werd hem al een baan aangeboden aan de afdeling Stem- en Spraakstoornissen van het Academisch Ziekenhuis te Nijmegen. Hier begon hij in 1975 zijn academische loopbaan; aanvankelijk als allround logopedist, maar al snel als specialist op het gebied van stemstoornissen en stotteren. Het volgen van vele cursussen op het gebied van stem en stotteren ging langzamerhand over in het geven van lezingen en cursussen.

In 1976 werd hem een kleine betrekking aangeboden als docent logopedie aan de Opleiding Logopedie te Nijmegen (1 uur per week); aanvankelijk als docent ‘articulatorische fonetiek’ maar al snel ook als praktijkdocent, scriptiebegeleider en docent ‘stem’. In 1989 werd de aanstelling aan de inmiddels zo geheten ‘Hogeschool Nijmegen’ uitgebreid tot een halftime baan met als taak coördinator van de Specialistische Opleiding tot Stemtherapeut’, een post-HBO opleiding. Door het geringe aantal aanmeldingen werd deze opleiding stopgezet en kwam hij in 1996 halftime in het onderwijs tot logopedist terecht.

Hoewel hij in het academisch circuit al menigmaal in uitvoerende zin had deelgenomen aan onderzoeksprojecten, werd zijn belangstelling tot het zelf uitvoeren van onderzoek gewekt door een samenwerkingsproject tussen het Academisch Ziekenhuis St. Radboud en de Hogeschool: het ‘Werkplaatsproject’, waar het uitvoeren van onderzoek door Hbo-studenten in de academische setting vorm gegeven diende te worden. Aan dit project heeft hij drie jaar gewerkt.

In 2000 werkte hij mee aan een project vanuit de ‘diensten Vf/Pf van het Algemeen Burgerlijk Pensioenfonds, waarbij in kaart gebracht moest worden of leerkrachten met stemproblemen pasten binnen een bepaald profiel. Dit project was het startpunt voor het promotieonderzoek.

In 2002 stapte hij weer bijna fulltime over naar het klinische werk aan de afd. KNO van het Universitair Medisch Centrum Nijmegen St. Radboud. Vanaf die tijd tot nu kwam het voor u liggende werk tot stand.

Appendix A1.

Instructions provided with the questionnaires

We would be grateful if you could fill in the attached four pages as soon as possible, preferably within two days. Depending on the type of question, you are asked to circle, cross, or fill in the answer. Your response is only valid if the space between boxes is left clear, and if only *one* box per question is filled in. Completing the questionnaire requires about ten minutes. The processing of the data is, of course, completely anonymous, and you are *not* required to put your name on the forms.

Appendix A2.

Instructions provided with the questionnaires for the general population

We would be grateful if you could fill in the attached four pages as soon as possible, preferably within two days. Depending on the type of question, you are asked to circle, cross, or fill in the answer. Your response is only valid if the space between boxes is left clear, and if only *one* box per question is filled in. Completing the questionnaire requires about ten minutes. The processing of the data is, of course, completely anonymous, and you are *not* required to put your name on the forms. Please return the questionnaires, without this cover letter, in the stamped envelopes provided in this package.

Appendix B. Questionnaire for the teachers

A	*General questions*					
1	Age	…. Years				
2	Gender	m / f				
3	Are you working as a teacher?	yes / no				
4	How many years are you working as a teacher?	…… Years				
5	How many hours are you teaching in the current year?	…… hours / week				
		no	yes	I don't know		
B	*Have you experienced voice complaints?*					
6	At this moment	0	1	2		
7	During the past year	0	1	2		
8	Earlier during your teaching career	0	1	2		
9	Earlier during training	0	1	2		
10	How often have you experienced voice complaints?	…. times / year				
11	Mean duration of the voice complaints?	…. days				
C	*Have you, in relation to a voice problem at present or in the past:*					
12	Sought (para) medical help?	0	1	2		
13	Undergone an examination?	0	1	2		
14	Undergone a treatment?	0	1	2		
15	Been unable to work? ; if yes, see also question 16	0	1	2		
16	Absence from work in total	…. weeks				
D	*Are you of the opinion that:*					
17	You will develop a voice problem, due to your profession?	0	1	2		
18	Teaching has a negative influence on the condition of your voice?	0	1	2		
19	The number of pupils in the classroom has a negative influence on your voice?	0	1	2		
20	The number of teaching years has a negative influence on your voice?	0	1	2		
21	The composition of the group of pupils has an influence on your voice?	0	1	2		
22	The attention paid to the voice during your training has been sufficient?	0	1	2		
23	A (refresher) course for efficient voice use is advisable?	0	1	2		
24	High work pressure has a negative influence on your voice?	0	1	2		
E	*Have the factors below a negative influence on your voice?*					
		never	almost never	Some-times	almost always	always
25	Problems with neck or shoulders	0	1	2	3	4
26	Problems with low back	0	1	2	3	4
27	Problems with mucosa	0	1	2	3	4
28	Deterioration of general condition	0	1	2	3	4
29	Stress	0	1	2	3	4
30	Emotions	0	1	2	3	4
31	Decrease of hearing	0	1	2	3	4
F	*How are your working conditions?*					
32	Acoustics of the classroom/place of work	good / moderate / bad				
33	Moisture in the classroom/place of work	dry / normal / moist				
34	Changes of temperature in the classroom/place of work	yes / no				
35	Irritants in the classroom/place of work	yes / no				

Appendix C. Modifications of the questionnaire for the control group

3	Do you have a vocally demanding profession? If yes, see also questions 4 and 5	yes / no		
4	How many years do you have a vocally demanding profession?	.... years		
5	How many hours do you have to load your voice during practicing your profession?	…. hours / week		
8	Earlier during practicing the profession	0	1	2
9	Earlier during training for the profession	0	1	2
18	Your profession has a negative influence on the condition of your voice?	0	1	2
19	The number of people you communicate with has a negative influence on your voice?	0	1	2
20	The number years you work has a negative influence on your voice?	0	1	2
21	The composition of the group of people you communicate with has an influence on your voice?	0	1	2
32	Acoustics of the place of work	good / moderate / bad		
33	Moisture in the place of work	dry / normal / moist		
34	Changes of temperature in the place of work	yes / no		
35	Irritants in the place of work	yes / no		

Appendix D. Questionnaire for the student teachers

A	*General questions*					
1	Age	…. Years				
2	Sex	m / f				
3	Do you use your voice intensively?	yes / no				
4	In which year of training are you?	….. years				
5	How many hours are you using your voice in the context of your study?	….. hours / week				
		no	yes	I don't know		
B	*Have you experienced voice complaints?*					
6	At this moment	0	1	2		
7	During the past year	0	1	2		
8	During puberty	0	1	2		
9	Before puberty	0	1	2		
10	How often have you experienced voice complaints?	…. times / year				
11	How long do your voice complaints last?	…. days				
C	*Have you, in relation to a voice problem at present or in the past:*					
12	Sought (para) medical help?	0	1	2		
13	Undergone an examination?	0	1	2		
14	Undergone a treatment?	0	1	2		
15	Been unable to perform activities? ; If yes, see also question 16	0	1	2		
16	Total duration	…. weeks				
D	*Are you of the opinion that:*					
17	You will develop a voice problem, due to your profession?	0	1	2		
18	Your profession will have a negative influence on the condition of your voice?	0	1	2		
19	Does the number of people you communicate with have a negative influence on your voice?	0	1	2		
20	Voice load has a negative influence on your voice?	0	1	2		
21	The composition of the group of people you communicate with has a negative influence on your voice?	0	1	2		
22	The attention paid to the voice during your training has been sufficient?	0	1	2		
23	A (refresher) course for efficient voice use is advisable?	0	1	2		
24	High work pressure has a negative influence on your voice?	0	1	2		
25	You have a tendency to clear your throat and cough?	0	1	2		
E	*Have the factors below a negative influence on your voice?*					
		never	almost never	sometimes	almost always	always
26	Decrease of hearing	0	1	2	3	4
27	Problems with neck or shoulders	0	1	2	3	4
28	Problems with lower back	0	1	2	3	4
29	Problems with mucosa	0	1	2	3	4
30	Deterioration of general physical condition	0	1	2	3	4
31	Stress	0	1	2	3	4
32	Emotions	0	1	2	3	4
33	Noise in the room you speak	0	1	2	3	4
34	Bad acoustics in the room you speak	0	1	2	3	4
35	Dry or moist air in the room you speak	0	1	2	3	4
36	Changes of temperature in the room you speak	0	1	2	3	4
37	Irritants in the room you speak	0	1	2	3	4
F	Do you have any comments or suggestions?					

Appendix E. Modifications of the questionnaire for the general population group

3	Do you have a vocally demanding profession? If yes, see also questions 4 and 5	yes / no		
4	How many years do you have a vocally demanding profession?	... years		
5	How many hours do you have to load your voice during practicing your profession?	… hours / week		
8	Earlier during practicing the profession	0	1	2
9	Earlier during training for the profession	0	1	2
18	Your profession has a negative influence on the condition of your voice?	0	1	2
19	The number of people you communicate with has a negative influence on your voice?	0	1	2
20	The number years you work has a negative influence on your voice?	0	1	2
21	The composition of the group of people you communicate with has an influence on your voice?	0	1	2
34	Acoustics of the place of work	good / moderate / bad		
35	Moisture in the place of work	dry / normal / moist		
36	Changes of temperature in the place of work	yes / no		
37	Irritants in the place of work	yes / no		

Appendix F. Modifications of the questionnaire for the teachers

3	Are you working as a teacher?	yes / no		
4	How many years are you working as a teacher?	... years		
5	How many hours are you teaching in the current year?	… hours / week		
8	Earlier during your teaching career	0	1	2
9	Earlier during your training	0	1	2
18	Teaching has a negative influence on the condition of your voice?	0	1	2
19	The number of pupils in the classroom has a negative influence on your voice?	0	1	2
20	The number of teaching years has a negative influence on your voice?	0	1	2
21	The composition of the group of pupils has an influence on your voice?	0	1	2
34	Acoustics of the classroom/place of work	good / moderate / bad		
35	Moisture in the classroom/place of work	dry / normal / moist		
36	Changes of temperature in the classroom/place of work	yes / no		
37	Irritants in the classroom/place of work	yes / no		

Appendix G. Voice Handicap Index

Instructions: These are statements that many people have used to describe their voices and the effects of their voices on their lives. Choose the response that indicates how frequently you have the same experience by placing a cross mark in one of the adjacent boxes.

		Never	Almost never	Some-times	Almost always	Always
F1	My voice makes it difficult for people to hear me					
P2	I run out of air when I talk					
F3	People have difficulty understanding me in a noisy room					
P4	The sound of my voice varies throughout the day					
F5	My family has difficulty hearing me when I call them throughout the house					
F6	I use the phone less often than I would like					
E7	I am tense when talking with others because of my voice					
F8	I tend to avoid groups of people because of my voice					
E9	People seem irritated with my voice					
P10	People ask, “What is wrong with your voice?”					
F11	I speak with friends, neighbours, or relatives less often because of my voice					
F12	People ask me to repeat myself when speaking face to face					
P13	My voice sounds creaky and dry					
P14	I feel as though I have to strain to produce voice					
E15	I find other people do not understand my voice problem					
F16	My voice difficulties restrict my personal and social life					
P17	The clarity of my voice is unpredictable					
P18	I try to change my voice to sound different					
F19	I feel left out of conversations because of my voice					
P20	I use a great deal of effort to speak					
P21	My voice is worse in the evening					
F22	My voice problem causes me to lose income					
E23	My voice problem upsets me					
E24	I am less outgoing because of my voice problem					
E25	My voice makes me feel handicapped					
P26	My voice “gives out” on me in the middle of speaking					
E27	I feel annoyed when people ask me to repeat					
E28	I feel embarrassed when people ask me to repeat					
E29	My voice makes me feel incompetent					
E30	I am ashamed of my voice problem					

Appendix H. DS16

Below are a number of statements that people often use to describe themselves. Read each statement and then circle the appropriate number next to that statement to indicate your answer. There are no right or wrong answers; the only thing that matters is how you generally feel

0 = False
1 = Rather false
2 = Neutral
3 = Rather true
4 = True

1	I am happy most of the time	0	1	2	3	4
2	I take a gloomy view of things	0	1	2	3	4
3	I often talk to strangers	0	1	2	3	4
4	I have little impact on other people	0	1	2	3	4
5	I find it hard to express my opinions to others	0	1	2	3	4
6	The future seems hopeful to me	0	1	2	3	4
7	I often find myself taking charge in group situations	0	1	2	3	4
8	I find it hard to make “small talk”	0	1	2	3	4
9	I am often in a bad mood	0	1	2	3	4
10	I often feel unhappy	0	1	2	3	4
11	I make contact easily when I meet people	0	1	2	3	4
12	I often find myself worrying about something	0	1	2	3	4
13	I like to be in charge of things	0	1	2	3	4
14	When socializing, I dont find the right things to talk about	0	1	2	3	4
15	I feel at ease most of the time	0	1	2	3	4
16	I am often down in the dumps	0	1	2	3	4