THE VOICE OF STUDENT TEACHERS AND TEACHERS

A challenge for teacher training, occupational safety and health care

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THE VOICE OF STUDENT TEACHERS AND TEACHERS

A challenge for teacher training, occupational safety and health care

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Chapter 1

GENERAL INTRODUCTION

Communication and voice problems

Communication is considered to be the most existential act of man.[1-4] The last two centuries were characterized by industrial and technical revolutions. The last decades were also marked by rapid strides of development in the field of communication, which can be best exemplified by the overwhelming use and reliance on mobile telephones. The voice is a primary tool for communication, which is used to express meanings and emotions.[1-4] With regard to voice problems, the concern has been whether the voice was effective for professional communication.[5-7] Voice disorders have been observed to cause a significant communication handicap for professionals who were dependent on their voice.[7,8]

Voice problems in teachers and other professional voice users

It has been estimated that one third of the labour force are working in professions in which voice is the primary tool.[5] Professional voice users are professionals who are dependent on their voice[4,8-12] and studies have associated them with a high risk for developing voice disorders.[13-17] Voice complaints have been reported to be a common problem in teachers[4,8,10,13-24] and teachers were observed to experience voice problems more frequently than other professional voice users.[17,25-28] The need for a high voice capacity, vocal endurance and effective communication has been found to be great in teachers[5,16,19,20,23,28,29] and they have appeared to be more vulnerable to voice problems compared with other professional voice users.[9,13,17,25-28,30]

Koufman and Isaacson[11] defined four categories of professional voice users with different degree of voice dependence for the performance of their jobs. (1) Elite vocal performers like singers and actors for whom even a slight vocal difficulty causes serious consequences, (2) Professional voice users for whom even a moderate vocal difficulty would hamper adequate job performance e.g. teachers, public speakers and telephone operators, (3) Non-vocal professionals who can perform their jobs with slight or moderate voice problems; where only severe dysphonia endangers adequate job performance e.g. TV and film directors and (4) Non-vocal non-professionals that are not impeded from performing work when they experience any degree of dysphonia.[11]
Recently Vilkman[7] presented a useful classification of voice and speech professions according to demands on voice quality and vocal loading from the

point of view of working ability (Table 1). In the high quality group (e.g. singers, actors), prior to education programmes, there are usually stringent voice fitness examinations and vocal training during the education is generally well organized.[6,7] Teachers have a high vocal load, however, pre-occupational vocal health examinations and continuing surveillance of their voices are observed to be lacking.[6,7] Furthermore, despite having a high vocal load, unlike singers they do not have adequate training in voicing and articulation, which makes them a high-risk group for developing voice problems.[4] This itself constitutes a risk for voice problems as the pre-occupational status of the voice has been found to be poor in student teachers.[20,31-33]

Table 1. Classification of voice and speech professions

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Voice quality	Voice loading	Profession
+ + +	+ +	Actors, singers
+ + +	+ +	Radio, TV journalists
+	+ + +	Teachers, telephone operators, telemarketers, military, clergy, cantors
+ +	+ +	Bank, business, insurance personnel, physicians, lawyers, nurses
+	+ + + +	Foremen, welders, platers
+ + + = high; + + = moderate; + = low.		

Studies among student teachers have reported a prevalence of voice complaints of around 20%.[20,31] Various investigators who have surveyed teachers have reported a higher prevalence of voice problems.[10,14,16,17,20,21,23,31] This raises questions as to why there is an increase in voice problems after student teachers begin the professional teaching career.

In an epidemiological study of voice problems in teachers, it was observed that one out of seven teachers had experienced voice problems during the training period.[24] This group had significantly more voice complaints and absence from work in comparison to teachers without a history of voice problems during training.[24] Among the teachers who had voice problems during training, 90% also experienced voice problems during their career.[24] The findings suggested that voice problems in teachers probably had their roots before the teaching career and this calls for research among student teachers during the training period before they embark on the professional teaching career.

Impact of voice problems

Estimates based on empirical data suggest that, considering lost workdays and treatment expenses, the societal cost of voice problems in teachers alone may be around $2.5 billion annually in the United States of America.[26] It is most likely that the impact of voice problems would be similar in other parts of the developed and developing world.

Voice problems are observed to have a significant psychological, social, physical, occupational and communicational impact on an individual.[8,12,27,34,37] Teachers can be handicapped due to their voice problems[23,24,27] and this could result in severe personal, social, vocational and economic penalties.[8,27] The World Health Organization defined a handicap as a social, economic or environmental disadvantage that results from an impairment or disability.[38,39] With regard to voice disorders, handicap has been interpreted as a reduction or avoidance of voice activities by the individual, which results in an occupational or economic consequence.[27] Benninger et al.[40] in a study assessing outcomes for dysphonic patients compared the degree of handicap for patients who had voice problems, with patients suffering from chronic diseases such as sciatica, and angina pectoris. Voice patients were observed to have a greater handicap than the chronic disease group on social functioning.

Table 2. The factors that determine the voice[1]

Internal	External
Morphology of the vocal apparatus	Voice demands
Functional capacity of voice apparatus	Mental stress
Vocal behaviour	Environmental conditions
Musicality	
Psycho-emotional factors	
Personality, character	
General physical condition	
Age	
Neuromuscular condition	

Teachers are reported to belong to the most common occupational groups who seek medical help and voice therapy for voice disorders.[8,17,18,27,30,41-43] Voice problems have been found to have an occupational impact[8,27,34,43] often leading to absenteeism and work related problems.[8-10,15,16,21,24,43] The voice is a multi-dimensional entity and the pre-occupational voice has been found to be influenced

and determined by multiple factors during practice of the occupation.[1] The factors that determine the voice and the parameters that characterize the voice are essentially different, but are observed to be mutually dependent (Table 3).[1]

Table 3. The parameters that characterize the voice[1]

Loudness	Variation
Pitch	Endurance
Quality	Intelligibility
Tempo	Interaction with expression and gestures

Questionnaires used in this study (the general questionnaire, the Voice Handicap Index, and the DS16 questionnaires) provide the opportunity to gather information of factors that determine and characterize the voice of student teachers and teachers.

Risk factors for voice problems

Voice complaints have been observed to have a multi-factorial genesis.[1,15,26,28,44,45] The voice is exposed and influenced by multiple risk factors[1,26,45-47], which may be broadly described as four groups, vocal loading, physical factors, psycho-emotional factors and environmental factors.[24,47]

Vocal loading

Voice loading is a known risk factor for developing voice problems.[1,8,21,44,48,49] It has been observed that the tendency to raise the voice level, to use a strained voice[5,44] and vocal fatigue[50] were more common for females. Voice intensity has been considered to be an important factor in vocal load.[45,51,52] Voice straining factors such as prolonged use of the voice, high intensity of the voice,[25,45,48,49] speaking at a pitch outside the normal range, and speaking with strong intonations and abnormal resonance have been found to increase the vocal load.[45,49] Vocal abuse was reported to increase the risk of vocal pathologies.[53,54] It has been observed that voice use for extended periods can result in acoustic changes and laryngeal adjustments.[55] Speaking while affected by psycho-emotional factors can also increase the vocal load.[28,45,56] Furthermore, the size of the audience was also observed to be a significant risk factor for voice problems.[25,57]

It has been reported that teachers place heavy demands on their voice by speaking loudly over background classroom noise for long periods.[13,49,51] Teachers for primary education are considered to be at risk for voice

problems[19,58,59] probably due to increased vocal teaching methods, which is required for younger pupils. Furthermore, among primary school children, otitis media with effusion (OME) is common and is associated with an average hearing loss of 25dB[60-64] and the teacher may be forced to speak loudly to communicate effectively. It can be expected that in the presence of loud background noise the teacher would have to raise the voice and voice intensity is considered to be an important factor in vocal load.[45,51,52]

Physical risk factors

Frequent throat clearing is probably one of the commonest voice abuses.[65,66] Throat clearing is also a symptom of vocal fatigue.[67] Analyses of high speed motion pictures of the larynx during throat clearing revealed vigorous changes in the larynx.[68] Habitual clearing of the throat has been found to be harmful to the vocal folds on account of sphincteric spasm against strong sub-glottic air pressure in order to dislodge mucous.[69,70] Habitual throat clearing may also be related to globus sensation secondary to gastro-esophageal reflux,[20,31,71-74] which may aggravate a voice disorder.

Smith et al.[10] in a study among teachers reported that female subjects were more likely to report physical discomfort when speaking. Phonasthenia is the term, which has been used for a musculoskeletal tension disorder, in which there is no demonstrable vocal pathology but laryngeal discomfort, hoarseness and vocal fatigue develop.[30] Muscle misuse dysphonia (MMD) has been reported to be probably the most common non-organic cause of voice disorders and may be the most common cause of chronic dysphonia.[71] Over two-thirds of patients in some voice clinics have been identified as having muscle misuse dysphonia.[75] Habitual misuse of laryngeal muscles during phonation may slowly change the resting tone of the laryngeal muscles so that they are persistently tense[71,76-79] eventually leading to distortion of the laryngeal framework, persistent closure of the thyrohyoid or cricothyroid spaces or anterior displacement of the cricoid cartilage relative to the thyroid cartilage.[71,80,81] The diagnosis of muscle misuse dysphonia is based on history of vocal misuse or abuse and the videostrobo-laryngoscopic finding of normal vocal fold mucosa and movement, usually with some specific abnormal laryngeal posture.[56,71,76] Videostrobo-laryngoscopy is essential in distinguishing muscle misuse dysphonia from vocal fold lesions such as sulcus vocalis and submucosal scarring.[71]

External laryngeal muscles in the neck are known to contribute significantly to voice production.[44,71,76,78,83,84] In untrained vocal performers there is usually a high

tension of the supra-hyoid muscles resulting in excessive elevation of the larynx.[71] Deviant laryngeal position due to muscle tension can cause and aggravate voice disorders.[44,71,77,83-86] Apart from laryngeal and extra-laryngeal muscles, musculature of the chest, abdomen, diaphragm and postural muscles also take part in vocal performance.[56,75,87-89] Physical factors like increased muscular tension in the head, larynx, neck and shoulder regions may result in voice discomfort and dysphonia.[4,28,44,46,76-78,80,87,89,-92] In female teachers, Kooijman et al.[89] observed a high percentage of subjects with hypertonicity in the neck and shoulders, which had an impact on voice complaints and the resulting voice handicap. Deviant body posture such as posterior weight bearing, excessive lumbar spine lordosis and deviant head position are compensated by adjustments in the neck and laryngeal regions.[88] Increased muscle tension may result in poor posture and breath support while phonating.[4] Deviant body posture can also negatively influence the breathing pattern[93] resulting in reduced voice capacity. Wilner and Sataloff[94] reported that voice problem in singers pertain to poor vocal hygiene including improper breathing techniques, increased skeletal muscle tension and poor resonance. Lung volume may affect laryngeal adjustment by causing tracheal pull.[95] Tracheal pull varies with lung volume, pulling the cricoid cartilage and consequently the larynx downwards during inhalation. Moreover, the tracheal pull has been found to be a force that potentially lowers the fundamental frequency Fo.[95] High muscular tension of the head and neck region is also observed to be associated with “hypertonic” voice use.[28] Psychosocial factors such as emotions and stress can contribute to somatic problems and increased muscle tension[4,96-98] and increased muscular tension in the head, larynx, back, neck and shoulder regions[4,28,46,97-99] can lead to voice discomfort and voice problems.[28,46,76,77]

Voice problems are seen to be associated with mucosal problems.[14,20,47,100] Intensive voice use has been reported to increase the mechanical load on the mucous membranes and conversely, mucosal disorders may affect voice production and reduce vocal capacity.[14] Allergy, rhinitis, sinusitis, laryngitis[14,20,101], hydration[26], humidity[102], dryness of the throat[15], and decrease of lubrication of the mouth and throat[4] can affect the condition of the mucosa.

Environmental risk factors

Environmental factors play an important role in the etiology of occupational voice disorders.[52,101-105] Mucosal problems may also arise due to environmental irritants.[12,103] Teachers are considered to be at high risk of developing voice

disorders due to their professional activities and frequent exposure to children who frequently develop upper respiratory infections.[12,14-16] Allergies and hypersensitivity have been observed among teachers and this could also contribute to mucosal problems.[25,101] An environment affected by dust, vapours, dryness, humidity and variations of temperature is a voice-straining factor, leading to an increase in vocal load.[26,44,45,102] Repeated exposure to airborne irritants can also complicate a voice problem.[12] The human voice has been found to be very sensitive to decreases of relative humidity of inhaled air[102,104] and in experimental conditions even after short provocation a significant increase in perturbation measures was reported.[102]

A study of noise levels in classrooms observed that the acoustic conditions in majority of the classrooms studied were unacceptable.[105] Teachers voice and background noise were recorded and analysis revealed that poor signal to noise ratios were associated with a high background noise level.[105] Classrooms with poor surrounding acoustics[15,26,44,57-59,105] and background noise have caused teachers to raise their voice[10,13,16,49,51,58,59,105,106] and to speak in a deviant pitch, thereby increasing the voice load.[45] Speaking in high background noise levels and extensive voice use, in combination with less voice rest are vocal loading factors, which can lead to changes in the voice.[49,107] Ambient noise is a common risk factor in the working environment of professional voice users, and it has been observed that the sound level of the speaking voice significantly increases in ambient noise levels starting from 40 dB A (about 3 dB increase for each 10 dB increase in ambient noise), due to the “Lombard effect”, the tendency to increase vocal intensity in response to increasing background noise.[108-110] It has been observed that gender may also be a factor in the ability to cope with background noise. A study among teachers made interesting observations that a male teacher did not have as much difficulty coping with background noise, as did female teachers.[111] This is probably due to the low fundamental frequency of the male voice, while the higher fundamental frequency of female teachers voices were close to the fundamental frequency of the pupils voices, making it harder to be heard.[111] High background noise levels may aggravate an existing voice problem in a teacher, and Duclos et al.[112] emphasized the importance of reducing ambient noise to prevent vocal strain. The W.H.O. recommendation of noise levels that is safe to avoid hearing loss is 75 dB for a period of 8 hours,[113] however, there is currently no legislation with regard to noise levels causing voice strain. Even low background noise is observed to affect speech intelligibility.[49] The background noise level recommended for an occupied classroom is 50 dB A, which provides 99% speech intelligibility.[114] In normal conditions, a noise level of 55 dB A gives

95% speech intelligibility for normal running speech at one meter.[115] Furthermore, it has been observed that children between 5 and 11 years old require a level upto 5 dB lower to hear 95% of the same speech as young adults, probably because children are not as linguistically mature as adults.[116] Therefore, Södersten et al. suggested that background noise levels in classrooms should ideally be less than 50-55 dB A, and put forward the need for legislation of classroom noise levels in relation to speech intelligibility.[49] Legislation is also required for noise levels with regard to its effect on the teachers` voice.

Psycho-emotional risk factors

Apart from physical effort, professional voice also requires great mental effort.[20,28] Psycho-emotional factors are considered to be a considerable risk for developing and persisting of voice problems.[1,4,14,15,20,24,45,47,59] In certain cases the psychological reaction to an organic problem causes a voice problem far in excess of the organic impairment.[117]

Teachers have been found to experience a considerable degree of stress during their work.[8,17,28,59,118,119] Psychological factors like stress and fear may also influence the voice load.[45] Emotions are also identified as a link in the stress chain.[4] Studies have demonstrated an association between vocal impairment and psychological stress.[4,14,25,28] The negative image projected by a dysphonic voice may in its turn contribute to stress[15], creating a vicious circle. Stress has been demonstrated to cause a rise in the fundamental frequency of the voice, change in sound level, spectral characteristics, increased muscle tension and may also affect the external framework of the larynx.[7] Stress was reported to contribute to somatic problems and has been associated with increased muscle tension.[4,28,98] High muscular tension of the head and neck region may be due to psycho-emotional stressors, as is the case in repetitive strain injury syndrome.[28,120] Non-organic or often inappropriately termed “functional” dysphonia has been frequently found to be due to muscle misuse and is associated with increased tension around the larynx.[28,56,71] Sapir et al.[15] suggested that individuals with a tendency for deviant moods may be at risk for vocal attrition, perhaps through psychosomatic responses to stress like elevated muscle tension, autonomic nervous system responses or reduced immune function. It has been reported that the composition of the group of pupils taught can also have an effect on the voice load.[49] The findings show the interdependence of various factors that influence the voice and the multi-factorial genesis of voice problems.

Personality

Research about personality in relation to voice problems in teachers is a new area of study. Personality is one of the factors that determine the voice of an individual[1,122] and various studies have linked vocal disorders and other disease to personality and psycho-emotional factors.[15,77,121-126] Furthermore, studies suggest that personality traits and psychological factors may influence the ability of the voice to withstand a voice demanding profession.[4,22,28,121] Personality refers to a complex organisation of trait dispositions and it is well established that these traits can be linked to important life outcomes.[127,128] This raises a question whether the impact of voice problems will be more severe in individuals with personalities with negative psychosocial traits.

The combination of the two basic personality traits “social inhibition” and “negative affectivity” define the Type-D personality.[128] Social inhibition and negative affectivity are considered to be stable and broad personality traits that are known to be relevant to mental and physical health.[128-130] Negative affectivity denotes the stable tendency to experience negative emotions[128,131] and has been found to be associated with emotional distress, anxiety and depression.[132,133] Social inhibition denotes the stable tendency to inhibit the expression of emotions and behaviours in social interaction[128,134] and refers to low self-expression, sub-assertiveness and withdrawal.[128,134] It has also been observed that social inhibition is also associated with a tendency to seek less social support.[135] Type-D personalities have a tendency to experience negative emotions, to inhibit the expression of these emotions in social interaction and are additionally at risk for social phobias and psycho-emotional problems.[128] Research has shown that patients with coronary heart disease who had a Type-D personality had more cardiac problems, deaths and incidence of cancer compared to other patients.[128,136] They had a four-fold mortality risk, when compared to non-type-D personalities.[128,136] This raises questions whether there is a difference in the voice handicap and behaviour in response to voice problems between Type-D subjects and non-Type-D subjects.

Occupational safety and health with regard to vocal health

It is remarkable that though there is data demonstrating risk factors, prevalence of voice problems and impact of voice problems among teachers,[9,13,17,24-27,30] even in various developed countries voice disorders of voice professionals are not currently accepted as an occupational disease.[5,7,19] Currently, in The Netherlands

there is no classification or registration of voice disorders in occupational medicine. Voice problems of teachers often become chronic[28] and occasionally if the voice problem is severe and the teacher cannot teach or communicate effectively, the teacher may be even forced to leave the teaching profession.[8,12,15,137] This suggests that teachers with severe voice problems may often be left in a desperate situation to face the consequences alone. The solution for those inflicted by occupational diseases is social security (occupational safety and health), which acknowledges a right rather than bestowing charity.[138] The impact of voice disorders in teachers is apparently underestimated and occupational safety and health of teachers is not given sufficient attention in developed countries,[6,7] and may be even neglected in developing countries. In developing countries the priority for health care has been for life threatening diseases. The paradox is that although education is the foundation for development, occupational safety and vocal health of teachers is not given priority. To develop occupational safety and health in voice professions it is essential to demonstrate the relationship between voice problems and risk factors.[1,7] The impact of a voice problem depends also on how an individual perceives the problem.[27,139] Therefore, it is extremely relevant to assess the degree of handicap and the risk factors that are perceived to exert a negative influence on the voice in subjects with voice complaints and those with a voice handicap.

Objectives of the study

The objectives of the thesis are explored in the following chapters.
Chapter 2. The epidemiology of voice problems in Dutch teachers in comparison to the general population is addressed in this chapter. Furthermore, the history of voice problems during the training period is investigated.
Chapter 3. The chapter deals with the question whether female student teachers experience vocal complaints and risk factors to a larger degree than females in the general population.
Chapter 4. The chapter deals with the risk factors that are perceived to be a negative influence on the voice in female student teachers with and without voice complaints and to ascertain whether voice complaints in student teachers have a history prior to their training.
Chapter 5. This chapter compares voice complaints and perceived risk factors for voice problems in female student teachers and female teachers of primary education early in their career. The chapter deals with the question whether there

is a sudden increase or different set of risk factors for voice problems across the threshold of teaching.

Chapter 6. In this chapter the voice handicap as perceived by female student teachers is assessed in comparison to student teachers without voice complaints. Additionally, a comparison is made with non-professional voice users in the general population. Furthermore, risk factors perceived to have a negative influence on the voice are explored in relation to the perceived voice handicap.

Chapter 7. The Voice Handicap Index and the Type-D scale-16 questionnaires are used concomitantly to assess the voice handicap of Type-D personality and non-Type-D subjects and whether they behave differently regarding seeking voice care. Additionally, Type-D and non-Type-D subjects who did not report a voice complaint are examined to assess whether they have a voice handicap despite not reporting voice complaints.

References

1. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia. myth or reality? in Dejonckere PH(ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 101-112.
2. Smith GA. Voice analysis for the measurements of anxiety. Br J Med Psychol 1977; 50: 367-373.
3. Schutte HK. The efficiency of voice production. Groningen, Kemper, 1980
4. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 81-100.
5. Vilkman E. Voice problems at work: a challenge for occupational safety and health arrangement. Folia Phoniatrica et Logopaedica 2000; 52: 120-125.
6. Vilkman E. A survey on the occupational safety and health arrangements for voice and speech professionals in Europe; in Dejonckere (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 129-137.
7. Vilkman E. Occupational safety and health aspects of voice and speech professions. Folia Phoniatrica et Logopaedica 2004; 56: 220-253.
8. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
9. Titze IR, Lemke JH, Montequin D. Populations in the U.S. workforce who rely on voice as a primary tool of trade: a preliminary report. Journal of Voice 1997; 11: 254-259.
10. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
11. Koufman JA, Isaacson G. Voice disorders. Philadelphia, WB Saunders, 1999.
12. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomised clinical trial. Journal of Speech Language and Hearing Research 2001; 44: 286-296.
13. Pekkarinen E, Himberg L, Pentti J. Prevalence of vocal symptoms among teachers compared with nurses: a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics1992; 17: 113-117.
14. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica 1993; 45: 120-129.
15. Sapir S. Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.

16. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
17. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-479.
18. Herrington-Hall BL, Lee L, Stemple JC, Niemi KR, McHone M. Description of laryngeal pathologies by age sex and occupation in a treatment seeking sample. J Speech Hear Disord 1988; 53: 57-64.
19. Rantala L, Vilkman E, Bloigu R. Voice changes during work: subjective complaints and objective measurements for female primary and secondary school teachers. Journal of Voice 2002; 16: 344-355.
20. Simberg S, Laine A, Sala E, Ronnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
21. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
22. Sataloff RT. Stress, anxiety, and psychogenic dysphonia; in Sataloff RT (ed): Professional Voice: the science and art of clinical care. New York, Raven Press, 1991, pp 195-200.
23. Roy N, Thibeault MRM, Gray SD, Smith EM. Voice disorders in teachers and the general population: effects of work performance, attendance and future career choices. J Speech Lang Hear Res 2004; 47: 542-551.
24. Jong FICRS de, Kooijman PGC, Thomas G, Huinck WJ, Graamans K, Schutte HK. Epidemiology of voice problems in Dutch teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
25. Morton V, Watson DR. The teaching voice: problems and perceptions. Logopedics Phoniatrics Vocology 1998; 23: 133-139.
26. Verdolini K, Ramig LO. Review: Occupational risks for voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
27. Yiu EM-L. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
28. Jong FICRS de, Cornelis BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A psychological cascade model for persisting voice problems in teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
29. Vilkman E, Lauri E-R, Alku P, Sala E, Sihvo M. Ergonomic conditions and voice. Logopedics Phoniatrics Vocology 1998; 23: 11-19.
30. Fritzell B. Voice disorders and occupations. Logopedics Phoniatrics Vocology 1996; 2: 7-12.
31. Simberg S, Sala E, Rönnemaa A-M. A comparison of the prevalence of vocal symptoms among teacher students and other university students. Journal of Voice 2004; 18: 363-368.
32. Schneider B, Cecon M, Hanke G, Wehner S, Bigenzahn W. Significance of voice constitution as a predisposition for occupational voice disorders. HNO 2004; 52: 461-470.
33. Schneider B, Bigenzahn W. How we do it: Voice therapy to improve vocal constitution and endurance in female student teachers. Clinical Otolaryngology 2005; 30: 66-71.
34. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): development and validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
35. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie. 2000; 13: 29-33.
36. Murry T, Rosen CA. Outcome measurements and quality of life in voice disorders. Otolaryngol Clin North Am 2000; 33: 905-916.
37. Rosen CA, Murry T, Zinn A, Zullo T, Sonbolian M. Voice Handicap Index change following treatment of voice disorders. Journal of Voice 2000; 14: 619-623.
38. World Health Organization. International Classification of Impairment, Disability and Handicap. Geneva, World Health Organization, 1980.
39. World Heath Organizaton. International classification of Impairment, Disability and Handicap-Beta 2: A manual of dimensions of disablement and participation. Geneva, World Health Organization, 1997.
40. Benninger MS, Ahuja AS, Gardner G, Grywalski C. Assessing outcomes for dysphonic patients. Journal of Voice 1998; 12: 540-550.
41. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.

42. Yiu EM-L, Ho PSP. Voice problems in Hong Kong: a preliminary report. Australian J Hum Commun Disord 1991; 19: 45-58.
43. Smith E, Verdolini K, Gray S, Nichols S, Lemke J, Barkmeier J, et al. Effect of voice disorders on quality of life. J Med Speech-Lang Pathol 1996; 4: 223-244.
44. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21: 137-141.
45. Buekers R. Voice Performances in Relation to Demands & Capacity (PhD thesis). University of Maastricht, The Netherlands, 1998.
46. Sundberg J. The Science of the Singing Voice. Dekalb, IL, Northern Illinois, University press, 1987.
47. Kooijman PGC, Jong FICRS de, Thomas G, Huinck WJ, Donders R, Graamans K, Schutte HK. Risk factors for voice problems in teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
48. Masuda T, Ikeda Y, Manako H, Komiyama S. Analysis of vocal abuse: fluctuations in phonation time and intensity in 4 groups of speakers. Acta Otolaryngol (Stockholm) 1993; 113: 547-552.
49. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
50. Solomon NP, Glaze LE, Arnold RR, Van Mersbergen M. Effects of vocally fatiguing task and systemic hydration on mens voices. Journal of Voice 2003; 17: 31-46.
51. Sapienza CM, Crandell CC, Curtis B. Effects of sound-field frequency modulation amplification on reducing teachers' sound pressure level in the classroom. Journal of Voice 1999; 13: 375-381.
52. Jonsdottir V, Rantala L, Laukkanen A-M, Vilkman E. Effects of sound amplification on teachers speech while teaching. Logopedics Phoniatrics Vocology 2001; 26: 118-123.
53. Sataloff RT. Common diagnosis and treatments in professional singers. Ear Nose Throat J 1987; 66: 278-288.
54. Zeine L, Waltar KL. The voice and its care: survey findings from actors perspectives. Journal of Voice 2002; 16: 229-243.
55. Stemple JC, Stanley J, Lee L. Objective measures of voice production in normal subjects following prolonged voice use. Journal of Voice 1995; 9: 127-133.
56. Morrison MD, Ramaje LA. Muscle misuse voice disorders: description and classification. Acta Otolaryngol 1993; 113: 428-434.
57. Preciado JA, Garcia TR, Infante JC. Estudio de la prevalencia de los trastornos de la voz en los profesionales de la enseñanza. Factores que intervienen en su aparición o en su mantenimiento (prevalence of voice disorders among educational professionals: factors contributing to their appearance or their persistence). Acta Otorrinolaringolo Esp 1998; 49: 137-142.
58. Sarfati J. Réadaptation vocale des enseignants (Vocal re-training of teachers). Rev Laryngol Otol Rhinol 1989; 110: 393-395.
59. Morton V, Watson DR. Voice in the classroom; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 53-69.
60. Gates GA, Klein JO, Lim DJ, Mogi G, Ogra PL, Pararella MM, Paradise JL, Tos M. Recent advances in otitis media: definitions, terminology and classification of otitis media. Ann Otol Rhinol Laryngol Suppl 2002; 188: 8-18.
61. Schilder AG, Zielhuis GA, Van den Broek P. The otological profile of Dutch 7.5 – 8 year olds. Clin Otolaryngol 1993; 18: 48-54.
62. Schilder AG, Snik AF, Straatman H, Van den Broek P. The effect of otitis media with effusion at preschool age on some aspects of auditory perception at school age. Ear Hear 1994; 15: 224-231.
63. Bluestone CD. Epidemiology and pathogenesis of chronic suppurative otitis media: implications for prevention and treatment. Int J Paediatr Otorhinolaryngol. 1998; 42: 207-223.
64. Moore DR, Hartley DE, Hogan SC. Effects of otitis media with effusion (OME) on central auditory function. Int J Paediatr Otorhinolaryngol 2003; 67Suppl1: S63-S67.
65. Wilson K. Voice Problems of Children, 3rd edition. Baltimore, Williams & Wilkins, 1987.
66. Comins R. Helping people to keep their voices healthy and to communicate effectively. International journal of language and communication disorders- Royal College of Speech and Language Therapists 1998; 33 Suppl: 310-315.

67. Kostyk BE, Rochet AP. Laryngeal airway resistance in teachers with vocal fatigue: a preliminary study. J Voice 1998; 12: 287-299.
68. Timcke R, von Leden H, Moore P. Laryngeal vibrations: measurements of the glottic wave. Part II. Physiological variations. Arch Otolaryngol 1959; 69: 438-444.
69. Greene MCL. The Voice and its disorders. London, Pitman Medical, Pitman publishing, 1978.
70. Brodnitz FS. Keep Your Voice Healthy. New York: Harper; 1953.
71. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscle tension in patients with voice disorders. Journal of Voice 2002; 16: 333-343.
72. Koufman JA. The otolaryngologic manifestations of gastro-esophageal reflux disease (GERD). Laryngoscope 1991; 101 (supp53): 1-78.
73. Koufman J, Sataloff RT, Toohill R. Laryngopharyngeal reflux: consensus conference report. J Voice 1996; 10: 215-216.
74. Morrison M, Rammage L, Emami AJ. The irritable larynx syndrome. Journal of Voice 1999; 13: 447-455.
75. Harris T, Harris S, Rubin JS, Howard DM. The voice clinic handbook. London, Whurr, 1998.
76. Morrison MD, Rammage LA, Beslisle GM, Pullan CB, Nichol H. Muscular tension dysphonia. Journal of Otolaryngology 1983; 12: 302-306.
77. Morrison MD, Nichol H, Rammage LA. Diagnostic criteria in functional dysphonia. Laryngoscope 1986; 96: 1-8.
78. Morrison M. Pattern recognition in muscle misuse voice disorders: how I do it. Journal of Voice 1997; 11: 108-114.
79. Morrison MD, Rammage LA, Nichol H. Management of the voice and its disorders. 2nd ed. San Diego: Singular; 2001: 28-35.
80. Beslisle GM, Morrison MD. Anatomic correlation for muscle tension dysphonia. Journal of Otolaryngology 1983; 12: 319-321.
81. Harris T, Lieberman J. The cricothyroid mechanism, its relation to vocal fatigue and vocal dysfunction. Voice Forum 1993; 2: 89-96.
82. Morrison MD, Rammage LA. Muscle misuse voice disorders: description and classification. Acta Otolaryngol 1993; 113. 428-434.
83. Roy N, Leeper HA. Effects of the manual laryngeal musculoskeletal tension reduction technique as a treatment for functional voice disorders: perceptual and acoustic measures. Journal of Voice 1993; 7: 242-249.
84. Vilkman E, Sonninen A, Hurme P, Körkkö P. External laryngeal frame function in voice production revisited: a review. Journal of Voice 1996; 10: 78-92.
85. Boltezar IH, Janko M, Zargi M. Role of surface EMG in diagnostics and treatment of muscle tension dysphonia. Acta Otolaryngol (Stockh) 1998; 118: 739-743.
86. Van Lierde KM, Ley SD, Clement G, De Bodt M, Cauwenberge PV. Outcome of laryngeal manual therapy in four Dutch adults with persistent moderate-to-severe vocal hyperfunction: a pilot study. Journal of Voice 2004; 18: 467-474.
87. Aronson. Clinical Voice Disorders. New York, Thieme, 1990, pp121-122.
88. Lieberman J. Principles and techniques of manual therapy: applications in the management of dysphonia; in Harris T, Harris, S, Rubin JS, Howard DM (eds): The Voice Clinic Handbook. London, Whurr, 1998, pp 91-138.
89. Kooijman PGC, Jong FICRS de, Oudes MJ, Huink W, Acht H van, Graamans K. Muscular tension and body posture in relation to voice handicap and voice quality in teachers with persistent voice complaints. Accepted for publication by Folia Phoniatrica et Logopaedica 2004.
90. Hulse M. Zervikale dysphonia [cervical dysphonia]. Folia Phoniatrica et Logopaedica 1991; 43: 181-196.
91. Holte KA, Westgaard RH. Daytime trapezius muscle activity and shoulder-neck pain of service workers with work stress and low biomechanical exposure. Am J Ind Med 2002; 41: 393-405.
92. Holte KA, Vasseljen O, Westgaard RH. Exploring perceived tension as a response to psychosocial work stress. Scand J Work Environ Health 2003; 29: 124-133.
93. Hoit JD. Influence of body position on breathing and its implications for the evaluation and treatment of speech and voice disorders. Journal of Voice 1995; 9:341-347
94. Wilner L, Sataloff RD. Speech language pathology and the professional voice. Ear Nose Throat J 1987; 66: 313-317.

95. Rantala L, Määtä T, Vilkman E. Measuring voice under teachers' working circumstances: Fo and perturbation features in maximally sustained phonation. Folia Phoniatrica et Logopaedica 1997; 49: 281-291.
96. Hazlett RL, MacLeod DR, Hoehn-Saric R. Muscle tension in generalized anxiety disorder: elevated muscle tonus or agitated movement? Psychophysiology 1994; 31: 189-195.
97. Lundberg U. Methods and applications of stress research. Technol Health care. 1995; 3: 3-9.
98. Vasseljen O Jr, Westgaard RH. Can stress related shoulder and neck pain develop independently of muscle activity. Pain 1996; 64: 221-230.
99. Hagen KB, Magnus P, Vetlesen K. Neck / shoulder and low-back disorders in the forestry industry: relationship to work tasks and perceived psychosocial job stress. Ergonomics 1998; 41: 1510-8.
100. Jones K, Sigmon J, Hock L, Nelson E, Sullivan M, Ogren F. Prevalence and risk factors for voice problems in telemarketers. Arch Otolaryng Head Neck Surg 2002; 128: 571-577.
101. Sala E, Hytönen M, Tupasela O, Estlander T. Occupational laryngitis with immediate allergy or immediate type specific chemical hypersensitivity. Clin Otolaryngol 1996; 21: 42-48.
102. Hemler RJ, Wieneke GH, Dejonckere PH.The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. Journal of Voice 1997; 11: 295-300.
103. Chavez RE, Bartelt C de. Air pollution and environmental factors: their importance in the aetiology of occupational voice disorders; in Dejonckere (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 71-79.
104. Hemler RJ, Wieneke GH, Lebacq J, Dejonckere PH. Laryngeal mucosa elasticity and viscosity in high and low relative air humidity. Eur-Arch-Otorhinolaryngol 2001; 258: 125-129.
105. Blake P, Busby S. Noise levels in New Zealand junior classrooms: Their impact on hearing and teaching. N Z Med J 1994; 107: 357-358.
106. Andersson K, Fagerlund I. The Indoor Climate in 82 schools in Stockholm-results of a Questionnaire survey. Department of Occupational and Environmental medicine, Örebro Medical Centre Hospital. Report MM 25/99, Örebro, Sweden; 1999.
107. Neils RL, Yairi E. Effects of speaking in noise and vocal fatigue and vocal recovery. Folia Phoniatrica et Logopaedica 1987; 39: 104-112.
108. Heusden Ev, Plomp R, Pols LCW. Effect of ambient noise on the vocal output and the preferred listening level of conversational speech. Applied Acoustics 1979; 12: 31-43.
109. Dejonckere PH, Pépin F. Study of the Lombard effect by measuring equivalent sound level. Folia Phoniatrica et Logopaedica 1983; 35: 310-315.
110. Pick HL, Siegel GM, Fox Pw, Garber SR, Kearney Jk. Inhibiting the Lombard Effect. J Acoust Coc Am 1989; 85: 894-900.
111. Hay B. A pilot survey of classroom noise levels and teachers reaction. British Voice Association. Voice 1995; 4: 127-134.
112. Duclos JC, Dubreuil C, Faure MA. Bruit et larynx (Noise and the larynx). J Franc Orl 1980; 29: 605-607.
113. World Health Organization: Noise. Environmental Health Criteria 12, Geneve: World Health Organization, 1980.
114. Pearsons K, Bennet L, Fidell S. Speech levels in various noise environments. Washington DC: office of health and ecological effects, office of research and development, U.S. environmental protection agency, 1977.
115. ISO/TR3352. Assessment of noise with respect to its effect on the intelligibility of speech. Geneve: International Organization for Standardization, 1974.
116. Marshall L, Brandt JF, Marston LE, Ruder K. Changes in numbers and type of errors on repetition of acoustically distorted sentences as a function of age in normal children. J Am Aud Soc 1979; 4: 218-225.
117. Brodnitz FS . Vocal Rehabilitation. Ed. 4 American Academy of Ophthalmology and Otolaryngology, Rochester, MN, 1971, p 50.
118. Malone J, Denny T, Dalton P, Addley K. Stress at work. Part 1: recognition, causes, outcomes and effects; in Addley K (ed): Occupational stress; a practical approach. Oxford, Butterworth-Heinemann, 1997.
119. Duffy OM, Hazlett DE. The impact of preventive voice care programs for training teachers: a longitudinal study. Journal of Voice 2004; 18: 63-70.
120. Sanders AF. Towards a model of stress and human performance. Acta Psychol 1983; 53: 61-97.
121. Rosen DC, Sataloff RT; Psychology of Voice Disorders. San Diego, Singular Publishing Group, 1995.

122. Roy N, Bless DM, Heisey D. Personality and voice disorders: a multi trait-multi disorder analysis. Journal of Voice 2000; 14: 521-548.
123. Butcher P, Elias A, Raven R, Yeatman J, Littlejohans D. Psychogenic voice disorder unresponsive to speech therapy: psychological characteristics and cognitive-behaviour therapy. Br J Disord Commun 1987; 22: 81-92.
124. House A, Andrews H. The psychiatric and social characteristics of patients with functional dysphonia. J Psychosom Res 1987; 31: 483-490.
125. Long G. The relationship of voice stress, anxiety, and depression to life events and personal style variables. J Soc Behav Person 1988; 16: 133-145.
126. Green G. Psycho-behavioural characteristics of children with vocal nodules. WPBIC ratings. J Speech Hear Disord 1989; 54: 306-312.
127. Watson D, Clark LA, Harkness AR. Structures of personality and their relevance to psychopathology. Journal of Abnormal Psychology 1994; 103: 18-31.
128. Denollet J. Personality and coronary heart disease: the Type-D scale-16 (DS16). Annals of Behavioral Medicine 1998; 20: 209-215.
129. Clark LA, Watson D, Mineka S. Temperament, personality, and the mood and anxiety disorders. Journal of Abnormal Psychology 1994; 103: 103-116.
130. Friedman HS, Tucker JS, Reise SP. Personality dimensions and measures potentially relevant to health: A focus on hostility. Annals of Behavioral Medicine 1995; 17: 245-253.
131. Watson D, Clark LA. Negative affectivity: the disposition to experience aversive emotional states. Psychological Bulletin 1984; 96: 465-490.
132. Watson D, Pennebaker JW. Health complaints, stress, and distress: Exploring the central role of negative affectivity. Psychological Review 1989; 96: 234-254.
133. Denollet J. Negative affectivity and repressive coping: Pervasive influence on self reported mood, health, and coronary prone behaviour. Psychosomatic Medicine 1991; 53: 538-556.
134. Asendorpf JB. Social Inhibition: A general-development perspective; in Traue HC, Pennebaker JW (eds): Emotion inhibition and health. Seattle WA: Hogrefe & Huber Publishers, 1993, pp 80-99.
135. Berry DS, Hansen JS. Positive effect negative effect and social interaction. Journal of Personality and Social Psychology 1996; 71: 796-809.
136. Denollet J, Sys SU, Stroobant N, et al. Personality as independent predictor of long- term mortality in patients with coronary heart disease. Lancet 1996; 347: 417-421.
137. Bistritsky Y, Frank Y. Efficacy of voice and speech training of prospective elementary school teachers. Israeli J Speech Hear 1981; 10: 16-32.
138. Ugeux J. The spirit of laws on occupational diseases: historical background and comparative overview of European legislations; in Dejonckere PH(ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 139-148.
139. Ma EP-M, Yiu EM-L. Voice activity and participation profile: assessing the impact of voice disorders on daily activities. J Speech Lang Hear Res 2001; 44: 511-524.

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 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 (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.

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 recognised 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 analyze 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 = 6000), 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) [32] according to Jacobson et al.[31] 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, 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, Mann-Whitney U (M-W 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 $p \leq 0.05$. 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 6500 questionnaires 2228 (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, 1878 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) pertain to voice complaints in different periods of the teaching career. If one or more of the 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 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 (M-W 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 (M-W 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 2A - 2F. 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 (M-W 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 (VHI)

The psychosocial consequences of the voice problems were subjectively rated using the Voice Handicap Index (Table 4a). The Kruskall-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, Table 6). From the group of teachers (PE & SE), who experienced voice problems during training, 90% experienced voice problems during their career; from the group of teachers (PE & 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 & SE), who experienced voice problems during training, 31.3% have been absent from work due to voice complaints; from the group of teachers (PE & 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 four out of ten teachers reported that teaching has a negative influence on the voice, and one out of five 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 2228 cases.

Russell and her colleagues found that female teachers were twice as likely as male teachers to report voice problems.[26] Smith and co-workers found that female teachers reported voice problems more frequently than male teachers, 38% versus 26%, i.e. a ratio of 1.46.[16] 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 and Smith. 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 percent of the teachers in the Netherlands in 1999 has the age 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 of Russell[26] and her colleagues of 1168 state school teachers (preschool-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 and her colleagues 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 voice complaints than controls who are in vocally demanding professions. Controls who are in vocally demanding professions, in turn, reported more 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 found that teachers are reluctant to seek medical help.[34] 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, De Bodt, and Murry 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 and co-workers found that even 20% reported two or more vocal symptoms during the previous year and 19% had an organic voice disorder.[9] 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 time 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 training 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 four out of ten teachers reported that teaching has a negative influence on the voice and one out of five expected to develop a voice problem due to the profession. Smith and co-workers reported similar findings.[27]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 voice complaints and more 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 one out of seven teachers has experienced voice problems during the training and reported more 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 psycho-social 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]

References

1. Vilkman E. Voice Problems at Work: A challenge for occupational safety and health arrangement. Folia Phoniatrica et Logopaedica 2000; 52: 120-125.
2. Titze IR, Lemke JH, Montequin D. Populations in the U.S. workforce who rely on voice as a primary tool of trade: a preliminary report. Journal of Voice 1997; 11: 254-259.
3. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21: 137-141.
4. Vilkman E. A survey on the occupational safety and health arrangements for voice and speech professionals in Europe; in Dejonckere PH (eds): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 129-138.
5. Sapir S, Keidar A, Mathers-Schmidt B. Vocal attrition in teachers: survey findings. European Journal of Disorders of Communication 1993; 28: 177-185.

6. Irving RM, Epstein R, Harries ML. Care of the professional voice. Clinical Otolaryngology (Oxford) 1997; 22: 202-205.
7. Fritzell B. Voice disorders and occupations. Logopedics Phoniatrics Vocology 1996; 21: 7-12.
8. Alexander DL. School employees: the forgotten municipal workers. Occup Med 2001; 16: 65-78.
9. Simberg S, Laine A, Sala E, Ronnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
10. Wendler, Jürgen and Seidner, Wolfram W. Lehrbuch der Phoniatrie. Thieme Verlag, Leipzig, 1987.
11. Buekers RA. Voice performances in relation to demands and capacity. Thesis University of Maastricht, 1998.
12. De Jong FICRS, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia. Myth or reality? in Dejonckere PH (eds): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 101-112.
13. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: a questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
14. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. Journal of Speech, Language, and Hearing Research 2001; 44: 286-296.
15. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica 1993; 45: 120-129.
16. Smith E, Lemke J, Taylor M, Kirchner HL, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
17. Rantala L, Määtä T, Vilkman E. Measuring Voice under Teachers' Working Circumstances: F0 and Perturbation Features in Maximally Sustained Phonation. Folia Phoniatrica et Logopaedica 1997; 49: 281-291.
18. Sataloff RT. Professional voice users: the evaluation of voice disorders. Occup Med 2001; 16: 633-647.
19. Dejonckere, Philippe H. Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001.
20. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (eds): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 81-100.
21. Jonsdottir V, Rantala L, Laukkanen A-M, Vilkman E. Effects of sound amplification on teachers' speech while teaching. Logopedics Phoniatrics Vocology 2001; 26: 118-123.
22. Gundermann H. Die Berufsdysphonie; Nosologie der Stimmstörungen in Sprechberufen unter besonderer Berücksichtigung der sogenannten Lehrerkrankheit. Georg Thieme Verlag, Leipzig, 1970.
23. Marks JB. A comparative study of voice problems among teachers and civil service workers. Thesis University of Minnesota, Minneapolis, 1985.
24. Pekkarinen E, et al. Prevalence of vocal symptoms among teachers compared with nurses - a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics 1992; 17: 113-117.
25. Morton V, Watson DR. The teaching Voice: Problems and Perceptions. Logopedics Phoniatrics Vocology 1998; 23: 133-139.
26. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-479.
27. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
28. Yiu EM. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
29. Verdolini K, Ramig LO. Review: Occupational Risks for Voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
30. Smith E, Kirchner HL, Taylor M, Hoffman H, Lemke JH. Voice problems among teachers: differences by gender and teaching characteristics. Journal of Voice 1998; 12: 328-334.
31. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): Development and Validation. American Journal of Speech Language Pathology 1997; 6: 66-70.

32. De Bodt MS, Jacobson BH, et al. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
33. Centraal bureau voor de Statistiek: Statistisch Jaarboek 2001. CBS, Voorburg, 2001.
34. Morton V, Watson DR. Voice in the classroom. A re-evaluation; in Dejonckere PH (eds): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 53-70.
35. Murry T, Rosen CA. Occupational voice disorders and the Voice Handicap Index; in Dejonckere PH (eds): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 113-128.
36. Vilkman E. Occupational Safety and Health Aspects of Voice and Speech Professions. Folia Phoniatrica et Logopaedica 2004; 56: 220-253.

Chapter 3

PREVALENCE OF VOICE COMPLAINTS, RISK FACTORS AND IMPACT OF VOICE PROBLEMS IN FEMALE STUDENT TEACHERS

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Abstract

A cross sectional questionnaire survey was done among 457 female student teachers and 144 females in the general population. The conclusions are based on the opinions of student teachers and the general population. The results of this study show that 39.6% of the student teachers and 32.6% of the general population reported voice complaints at the moment and/or over the past year ($p = 0.198$). The association between various risk factors (voice loading factors, physical factors, environmental factors and psycho-emotional factors) and voice complaints were examined. Vocal load was reported in both the student teachers and the general population ($p = 0.322$). Among the subjects with voice complaints, the student teachers were significantly more of the opinion than the general population that environmental irritants in the classroom ($p = 0.001$) and the composition of the group they communicate with ($p = 0.033$) have a negative influence on their voice. In the groups with voice complaints, the student teachers reported significantly less than the general population that stress ($p = 0.004$) and the deterioration of their general physical condition ($p = 0.003$) have a negative influence on their voice. Remarkably, over a third of the student teachers and one fifth of the general population with voice complaints were of the opinion that decrease of hearing has a negative influence on their voices ($p = 0.113$). There was no significant difference in Voice Handicap Index scores and impact of voice complaints among student teachers and the general population ($p > 0.05$). Over 15% of the student teachers and the general population with voice complaints reported being or having been disabled due to the voice problem, probably reflecting the severity of the voice problem ($p = 0.838$). The groups reporting voice complaints and disability in relation to their voice complaints have significantly higher VHI scores than those without voice complaints and disability, which indicates a higher psychosocial impact of voice complaints. Only around a third of the student teachers and the general population with voice complaints sought paramedical care ($p = 0.656$) / treatment ($p = 0.361$) for their voice complaint. Only a minority of student teachers (18.6%) and the general population (29.5%) with voice complaints were of the opinion that the number of people they communicate with has a negative influence on their voice ($p = 0.120$). Only around a third of the student teachers and less than a tenth of the general population with voice complaints were of the view that they would develop a voice complaint due to their profession ($p = 0.003$). Less than half of the student teachers and less than one fifth of the general population with voice complaints were aware of the potential risks of their profession on their voice ($p = 0.002$).

Voice complaints appear to have a multi-factorial genesis. The student teachers are not sufficiently aware of the impact of the various risk factors on their voice. Furthermore, they are not aware of the potential risk that future teaching may have on their voice. This apparent lack of awareness in student teachers may be considered a risk factor for voice complaints.

Introduction

Professional voice users are those who depend on their voice for practising their profession,[1-4] and they are often considered to be at risk for the development of voice problems.[5-8] Various studies have reported that voice problems are common among professional voice users, especially teachers.[3,4,6,7,9-14] Voice problems have been reported to occur more frequently in teachers than in other voice demanding professions and teachers appear to be relatively vulnerable to voice strain.[1,5,8,14-18] Voice problems may lead to an inability to work[1-4] and severe voice problems may force a teacher to leave the teaching profession permanently.[4]

Roy et al.[14] reported that teachers have significantly more voice complaints than the general population. Timmermans et al.[19], in a study of voice problems in future voice professionals reported that the subjects with voice complaints ignored the rules of vocal hygiene and were apparently unaware of the consequences to their voices and careers, despite knowing that they had a voice problem. In the teaching profession, it has been reported that the need for voice performance and endurance is exceedingly high.[20]These findings brought about the need to study the prevalence and epidemiological aspects of voice problems in student teachers before they start their professional teaching careers. Moreover, it has been suggested that voice disorders should be diagnosed and treated early preferably before or during their training for that profession.[20] It has been recommended that routine screening of prospective teachers for susceptibility to voice disorders could prevent vocal dysfunction.[2]

Voice disorders usually have a multi-factorial genesis.[21-23] Vocal load is an important factor in the development of voice problems.[2,23-25] Voice straining factors, such as speaking at high intensities (more than 70 dB), speaking for long durations, speaking at a pitch outside the normal range, and speaking with strong intonations and abnormal resonance, increases vocal load.[25,26] Speaking while affected by psycho-emotional factors may also increase the vocal load.[26-28] An environment affected by dust, vapours, dryness, humidity and variations of temperature is considered to be a voice-straining factor, and may also cause an increase of voice load.[17,22,26,29] Poor surrounding acoustics[17,22,29] and background

noise[3,30,31] may cause a teacher to raise the voice and to speak in a deviant pitch thereby increasing the voice load.[26] Physical factors like deviant body posture, straining of muscles,[27] deviant laryngeal position[32] and impaired hearing[6] may cause and aggravate voice disorders. Lack of proper voice training and vocal hygiene are considered as important risk factors for the development of voice problems.[2]

The aim of this study was to estimate the prevalence of voice complaints, risk factors and the impact of voice problems among female student teachers in comparison to females in the general population, to demonstrate whether student teachers experience vocal complaints and risk factors to a larger degree than the general population.

Methods

An epidemiological cross sectional survey study was done among student teachers and the general population. This was part of a larger study of voice problems among teachers. A questionnaire was used as a survey tool. A self-report system was used to collect data and the questionnaire was designed with information from literature, suggestions of teachers and the clinical experience of the voice team of the department of ORL of the Radboud University Medical Centre. The questionnaire was designed in such a way, that various aspects of voice and voice problems were included. It addresses voice not only in relation to vocal load, but also in relation to physical, environmental and psycho-emotional aspects. The questionnaire consists of 37 questions (Appendix D). The questions that pertain specifically to the teaching profession were modified for the general population group (Appendix E). The various questions were categorized into four groups with regard to vocal load (hours of vocal use per week, number of people the subjects communicate with), physical factors (neck or shoulder complaints, lower back complaints, deterioration of general physical condition, mucosal problems, decrease of hearing), psycho-emotional factors (stress, emotions, work pressure, composition of the group) and environmental 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.

Directors of teacher training schools for primary education were approached. The aim of the study was explained and the directors were asked to distribute the questionnaires among the student teachers. The directors estimated the number

of questionnaires that was required for the school, according to the number of student teachers. The persons for the reference group were recruited from the general population as a sample of convenience, i.e. quasi randomly. 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 A 1 for the student teachers, Appendix A 2 for the general population). The questionnaires were anonymously collected from the student teachers at the school and returned. The subjects of the general population returned the questionnaire by a pre-paid envelope. In this study only females were included.

The responses to the questions were dichotomised. One question (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.

Questions B 6-7 addresses voice complaints at the present moment (point prevalence) and voice complaints during the past year (period prevalence). We use the term “voice complaints” in reference to voice complaints at the moment and/or during the past year.

Questions C 12-15 address the impact of voice problems. Question C15 [Been unable to perform activities?] refers to disability[18] in relation to a voice problem.

Questions D 17-25 address opinions of the subjects.

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 B6 [Have you experienced voice complaints at this moment?] and / or question B7 [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 B6 and / or question B7].

Subjects filled out the Voice Handicap Index (VHI), which is designed to quantify the self-perceived psychosocial consequences of voice disorders.[33] In this study the Dutch version of the Voice Handicap Index was used.[34]

It consists of 30 questions in total (Appendix G). The questions regard 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.

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. One-Sample 2-tailed the 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.

Results

Seventy two percent of the student questionnaires and forty nine percent of the questionnaires from the general population were returned. This enabled the analysis of the questionnaires of 457 female student teachers and 144 females from the general population. The groups were matched for age (16 to 48 yrs). The mean age of the female student teachers was 20 years and the mean age of the females in the general population was 32 years.
The prevalence of voice complaints is represented in Table 1. The prevalence of "voice complaints" [at the moment and / or during the past year] was 39.6% for the student teachers and 32.6% for the general population. The prevalence of voice complaints at this moment (point prevalence) was 17.2% for the students and 12.0% for the general population. The prevalence of voice complaints during the past year (period prevalence) was 36.9% for the student teachers and 31.0% for the general population. There was no significant difference in the prevalence values between the student teachers and the general population.

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 analysed. (Abbreviations: Stud-teach = Student teachers; Gen-pop = General population)

Experienced voice complaints?	Groups	% Yes	p-value	Odds Ratio
(B6 and/or B7) "Voice complaints"	Stud-teach	39.6	0.136	1.35
	Gen-pop.	32.6		
(B6) Point prevalence (at this moment)	Stud-teach	17.2	0.139	1.52
	Gen-pop.	12.0		
(B7) Period prevalence (during the past year)	Stud-teach	36.9	0.198	1.30
	Gen-pop.	31.0		

Vocal loading factors are represented in Table 2, in relation to voice complaints. Among those with voice complaints, the student teachers (71.1%) and general population (60%) had vocal use of 20 hours or more per week. Of those with voice complaints, the general population (29.5%) and students (18.6%) felt that that the number of people they communicated with had a negative influence on their voice. The difference between the groups was not significant. This reveals that vocal loading is present in both the student teachers and the general population.

Table 2. The association between predictive vocal loading 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. Vocal loading risk factors (variable A3: do you use your voice intensively / do you have a voice demanding profession, variable A5: the number of hours of voice use per week in context of study / profession in the current year, variable 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).

Vocal load risk factors	Groups with voice complaints	% Yes	p-value	Odds Ratio
(A5)Vocal use of 20 hrs or more per week in context of study or work	Stud-teach	71.1	0.322	1.63
	Gen-pop.	60.0		
(D19)The number of people you communicate with has a negative influence on the voice?	Stud-teach	18.6	0.120	0.54
	Gen-pop.	29.5		

Physical risk factors (Table 3). Among the subjects with voice complaints, the student teachers (36.8%) reported significantly less than the general population (60.9%) that the deterioration of their general physical condition had a negative influence on their voice ($p = 0.003$, Odds Ratio 0.37). It was interesting to note that 32.1% of the students and 20.0% of the general population with voice complaints were of the opinion that decrease of hearing had a negative influence on their voice ($p = 0.113$). The majority of students (62.5%) and general population (69.6%) with voice complaints felt that mucosal problems had a negative influence on their voice ($p = 0.376$). Among those with voice complaints, 4.9% of the students and 10.8% of the general population reported that neck and shoulder problems had a negative influence on their voice ($p = 0.185$). Of those with voice complaints, the students (9.5%) and general population (2.2%) reported that problems with their lower back had a negative influence on their voice. This was

reflected in the Odds Ratio (4.60), however, the difference was found to be not significant (p = 0.110).

Table 3. The association between predictive physical 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. Physical risk factors (variable E26: decrease of hearing, variable E27: problems with neck or shoulders, variable E28: problems with lower back, variable E29: problems with mucosa, variable E30: deterioration of general physical condition). Voice complaints (positive response to question B6 and/or B7).

Physical risk factors	Groups with voice complaints	% Yes	p-value	Odds Ratio
(E26)Hearing decrease	Stud-teach	32.1	0.113	1.89
	Gen-pop.	20.0		
(E27)Neck or shoulder complaints	Stud-teach	4.9	0.185	0.42
	Gen-pop.	10.8		
(E28)Lower back complaints	Stud-teach	9.5	0.110	4.60
	Gen-pop.	2.2		
(E29)Mucosal problems	Stud-teach	62.5	0.376	0.72
	Gen-pop.	69.6		
(E30)Deterioration of general physical condition	Stud-teach	36.8	0.003	0.37
	Gen-pop.	60.9		

Environmental risk factors (Table 4). Among the subjects with voice complaints, the student teachers (64.7%) were significantly more of the opinion than the general population (22.2%) that environmental irritants in the room have a negative influence on their voice (p < 0.001; Odds Ratio = 6.41). Among those with voice complaints in the student teachers 40.5% and in the general population 53.5% reported that changes of the room temperature had a negative influence on their voice. In the groups with voice complaints, 65.7% of the students and 57.1% of the general population felt that humidity had a negative influence on the voice. Of the subjects with voice complaints, 49.1% of the student teachers and 46.5% of the general population felt that the acoustics of the room had a negative influence on their voice. The difference between the groups was not significant for the environmental factors, except for irritants.

The psycho-emotional factors were analysed in relation to voice complaints (Table 5). Significantly more student teachers with voice complaints (47.7%) than the general population with voice complaints (29.5%) felt that the composition of the group they communicated with had a negative influence on their voice (p = 0.033; Odds Ratio = 2.17). On the contrary it was observed that among the subjects with voice complaints, significantly less student teachers (36.3%), than the general population (60.0%) felt that stress had a negative influence on their voices (p =

0.004; Odds Ratio = 0.37). There was no significant difference between the groups, with regard to the opinion of the influence of emotions and work pressure on their voices.

Table 4. The association between predictive environmental 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. Environmental risk factors (variable E34: bad room acoustics, variable E35: room humidity, E36: changes in room temperature, E37: environmental irritants). Voice complaints (positive response to question B6 and/or B7).

Environmental risk factors	Groups with voice complaints	% Yes	p-value	Odds Ratio
(E34)Room Acoustics	Stud-teach	49.1	0.763	1.10
	Gen-pop.	46.5		
(E35)Humidity	Stud-teach	65.7	0.302	1.43
	Gen-pop.	57.1		
(E36)Temperature	Stud-teach	40.5	0.124	0.59
	Gen-pop.	53.5		
(E37)Irritants	Stud-teach	64.7	< 0.001	6.41
	Gen-pop.	22.2		

Table 5. The association between predictive 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. Predictive 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	p-value	Odds Ratio
(E31)Stress	Stud-teach	36.3	0.004	0.37
	Gen-pop.	60.0		
(E32)Emotion	Stud-teach	66.1	0.196	0.61
	Gen-pop.	76.1		
(D21)Group Composition	Stud-teach	47.7	0.033	2.17
	Gen-pop.	29.5		
(D24)Work pressure	Stud-teach	45.1	0.122	0.56
	Gen-pop.	59.5		

The impact of voice problems was analysed in the student teachers and the general population with voice complaints (Table 6). Of the student teachers with voice complaints 35.7% underwent clinical examination in comparison to the general population with voice complaints 26.1%, and 33.1% of students with voice complaints underwent treatment for voice problems in comparison to the general population: 26.1%. Among the student teachers with voice complaints, 33.9% underwent paramedical intervention compared to the general population: 30.4%.

Of the students with voice complaints 16.5% reported being disabled due to the voice problem, in comparison to 15.2 % of the general population. The difference in the impact of voice complaints between the groups with voice complaints was not seen to be significant for all examined impact parameters.

Opinions of subjects with voice complaints about whether they would develop a voice problem due to their profession and whether their profession would have a negative influence on the condition of their voice were inquired (Table 7). Among the subjects with voice complaints, the student teachers (46.8%) were significantly more of the opinion than the general population (19.5%) that their profession would have a negative influence on the voice ($p = 0.002$; Odds Ratio = 3.62). The student teachers (31.1%) were significantly more of the opinion than the general population (7.5%) that they would develop a future voice problem due to their profession ($p = 0.003$; Odds Ratio = 5.56).

Table 6. The impact of voice problems: paramedical help (variable C12), clinical examination (variable C13), treatment (variable C14) and disability (variable C15).

Impact of voice problems	Groups with voice complaints	% Yes	p-value	Odds Ratio
(C12) Paramedical help	Stud-teach	33.9	0.656	1.17
	Gen-pop.	30.4		
(C13)Clinical examination	Stud-teach	35.7	0.222	1.57
	Gen-pop.	26.1		
(C14)Treatment	Stud-teach	33.1	0.361	1.40
	Gen-pop.	26.1		
(C15)Disability (unable to perform activities)	Stud-teach	16.5	0.838	1.09
	Gen-pop.	15.2		

Table 7. Opinions: (variable D17) Opinion whether you will develop a voice problem due to your profession? & (variable D18) Opinion whether your profession will have a negative influence on the condition of your voice?

Opinions	Groups with voice complaints	% Yes	p-value	Odds Ratio
(D17)You will develop a voice problem due to your profession / teaching?	Stud-teach	31.1	0.003	5.56
	Gen-pop.	7.5		
(D18)Your profession will have a negative influence on your voice?	Stud-teach	46.8	0.002	3.62
	Gen-pop.	19.5		

Table 8a shows the Voice Handicap Index (VHI) scores in student teachers and the general population with and without voice complaints. In student teachers with voice complaints, the median VHI score (inter-quartile range) was significantly

higher than that of the student teachers without voice complaints: 14 (17.0) versus 6 (8.5) ($p < 0.001$). Similar findings were observed in the general population: the median VHI score (inter-quartile range) in the general population with voice complaints was significantly higher than that of the general population without voice complaints: 14 (23.8) versus 4 (6.0) ($p < 0.001$). The VHI scores (median; inter-quartile range) in the subjects with voice complaints did not differ significantly between the student teachers and the general population ($p = 0.284$).

In Table 8b, the VHI was assessed in student teachers and the general population who reported disability in relation to their voice complaints (unable to perform activities; question C15) and for the subjects not reporting disability. In the student teachers reporting disability in relation to their voice problem, the median VHI score (inter-quartile range) was significantly higher than that of the student teachers without disability: 22 (26.3) versus 7 (11.2) ($p < 0.001$). Similar findings were observed in the general population. The median VHI score (inter-quartile range) in the general population reporting disability in relation to their voice problem, was significantly higher than that of the general population without disability: 15 (16) versus 6 (11) ($p < 0.001$). The VHI scores (median; inter-quartile range) in the subjects reporting disability in relation to their voice problem did not differ significantly between the student teachers and the general population ($p = 0.213$).

Table 8a.The association between the Voice Handicap Index (VHI) and voice complaints was analysed by the Man-Whitney U test. The VHI was estimated for the subjects with voice complaints and without voice complaints.

Voice Handicap Index	Voice complaints +/-	Median	Inter-quartile range	p-value
Stud-teach	Voice complaints+	14.0	17.0	< 0.001
	No voice complaints	6.0	8.5	
Gen-pop	Voice complaints+	14.0	23.8	< 0.001
	No voice complaints	4.0	6.0	
Stud-teach	Voice complaints+	14.0	17.0	0.284
Gen-pop	Voice complaints+	14.0	23.8	

Table 8b.The association between the Voice Handicap Index (VHI) and disability was analysed by the Man-Whitney U test. The VHI was also estimated for subjects who reported disability in relation to their voice complaints (unable to perform activities) and for the subjects without disability.

Voice Handicap Index	Disability in relation to a voice problem +/-	Median	Inter-quartile range	p-value
Stud-teach	Disability +	22.0	26.3	< 0.001
	No disability	7.0	11.2	
Gen-pop	Disability +	15.0	16.0	< 0.001
	No disability	6.0	11.0	
Stud-teach	Disability +	22.0	26.3	0.213
Gen-pop	Disability +	15.0	16.0	

Discussion

This study is a cross sectional survey describing the prevalence, impact and risk factors for voice complaints in female student teachers and females in the general population. This design of research has been reported to be worthwhile to demonstrate whether teachers experience vocal problems to a larger degree than the general population.[2] In this study, student teachers are compared with the general population. A self-report survey questionnaire system was used. Russell et al.[8] reported a high degree of agreement between the prevalence of voice problems determined by direct examination and interview on one hand and the prevalence found by mail survey. Mail survey is reportedly a cost effective and accurate method of collecting data from a large group of people and this approach is useful to collect a large amount of information in a practical way.[8]

In the present study only females among the student teachers and the general population were assessed because voice disorders in general, and occupational voice disorders in particular, occur more frequently and to a larger degree in women than in men.[8,12,14]

Because of the shortage of teachers in the Netherlands, older students ["late students"] are actively recruited. This explains the relative older age of few student teachers. However, the mean age of the female student teachers was 20 years and the mean age of the females in the general population was 32 years. It may be assumed that voice capacity and voice complaints are similar in this range of age.

In order to have a random representation of the general population, subjects reporting to have a voice demanding profession were not excluded. The general population is expected to contain also subjects with a voice demanding profession and excluding them would lead to bias and would influence the results. Moreover, literature has mentioned that exactly delineating groups of people that represent non-professional voice users is problematic and a difficult task.[2]

The prevalence period of voice problems has been reported in various studies[8,9,14,20] and it was stated that the one-year prevalence seems to be more reliable than the two-year prevalence.[9] In the present study the prevalence of voice complaints at the moment and during the past year was calculated. Data concerning prevalence and risk factors are important in elucidating the causes of voice disorders, the frequency with which new disease develops in a population, the characteristics that increase the risk, and developing early screening or disease prevention programmes in order to protect against further deterioration of the larynx or related structures.[30] The prevalence value may give an indication of the influence of voice problems on work performance. No significant difference in the prevalence of voice complaints [at the moment and / or during the past year] in the student teachers and the general population, respectively 39.6 and 32.6 percent was found.
It is surprising to see that nearly forty percent of the student teachers and over thirty percent of the general population reported recent voice complaints. At the same time it is remarkable that student teachers did not report more voice complaints than the general population. An average voice capacity is sufficient for most professions, but teaching requires the extensive use of the voice above the demands of everyday speaking and requires a high vocal endurance.[20] The findings that student teachers did not report more voice complaints than the general population may indicate an insufficient awareness of the student teachers about their vocal status.

Various studies suggest that teachers are at a high risk for disability from voice problems[9,30] and that this health problem has significant work related and economic effects.[2,3] The most important prevalence value may be the value that indicates the impact of vocal symptoms on work performance.[9] The severity of voice complaints may also be estimated indirectly by inquiring about the impact of voice symptoms on the performance at work.[9] In this study over 15 percent of the student teachers and the general population with voice complaints reported being disabled due to the voice problem. Disability in relation to voice complaints may

also be demonstrated in the Voice Handicap Index.[33,34] The groups reporting voice complaints and disability in relation to their voice complaints had significantly higher VHI scores than those without voice complaints and disability, which indicates a higher psychosocial impact of voice complaints.

In a study among prospective teachers voice problems were found to be frequent and twenty percent of the students needed voice therapy or medical care.[20] Sapir et al.[7] in a study of vocal attrition in voice students noted that nearly half of the students had sought medical help for voice problems. In the present study among subjects with voice complaints, over a third of the student teachers and over a quarter of the general population underwent clinical examination and treatment for reported voice complaints. Over a third of the student teachers and general population with voice complaints reported seeking paramedical help. It is remarkable to note that despite reporting voice complaints, only a third of the student teachers with voice complaints sought care for their voice. This raises again the question whether the majority were unaware of the risks of voice problems or whether they were not aware of the voice care available. Timmermans et al.[19] reported in a study among future professional voice users that the subjects seemed to underestimate the negative implications of poor vocal hygiene and they did not take the necessary precautions for the care of their voice. On the other hand the student teachers may not have been of the view that their voice complaint is that severe to warrant medical examination and treatment. This reveals the need to educate the student teachers about voice problems and the associated risk factors. They should be informed about the importance of reporting voice complaints early in order to prevent voice problems from being established. Periodic anonymous questionnaires such as the one used in this study may help in encouraging student teachers in reporting their voice complaints early.

Apart from rising educational costs and high costs for therapy and treatment,[2] voice problems in student teachers can be a danger to their future career. Among the subjects with voice complaints, significantly more student teachers than those in the general population were of the opinion that they would develop a voice problem due to their profession, and that their profession would have a negative influence on their voice. However, this number is less than 50 percent. This means that despite having voice complaints, less than half the student teachers with voice complaints were aware of the potential negative influence of teaching on their voice. All the more, this points to the need to educate student teachers about the potential risks of voice problems and the impact voice problems may have on their professional teaching careers.

Vocal load was assessed by enquiring about the number of hours the subject uses her voice per week in the context of her study and/or work and whether the number of people they communicate with had a negative influence on their voice. In subjects with voice complaints, nearly three quarters (71.1%) of student teachers and two third (60.0%) of the general population reported voice use for twenty hours or more per week in the context of their study and/or work. This may point to lack of voice recovery time and voice overuse. It has been reported that with smaller groups of children, teachers should be able to achieve their pedagogical goals better.[25] Contrary to this, the results of this study suggest that only a minority of student teachers (18.6%) and the general population (29.5%) with voice complaints were of the opinion that the number of people they communicated with had a negative influence on their voice. This opinion among student teachers may be revealing unawareness and a lack of experience in the teaching profession. The student teachers have not fully experienced the effect a group of pupils can have on their voice. Students should be educated and made aware that the number of pupils in the group taught can have a influence on the voice load and should be equipped with sufficient skills to address a large group of pupils. Reduction of the number of children in the class and restriction of vocal use with adequate voice rest may reduce the vocal load. The results reveal that vocal loading is present in both the student teachers and the general population. This may be more significant for the teachers as they are entering a voice demanding profession and require a greater voice capacity for their profession than the general population.

It has been reported that the composition of the group taught can have an effect on the voice load.[25] In the present study among those with voice complaints, student teachers were significantly more of the opinion than the general population that the composition of the group they communicate with has a negative influence on their voice. The composition of the group may also contribute to stress and work pressure. The prevalence of stress in relation to voice complaints in subjects with voice complaints was significantly lower in the student teachers (36.3%) than in the general population (60.0%). This is probably a reflection of the student teacher's unawareness of the influence of stress on their voice complaints. Stress is known to be a major cause of voice problems, articulation disorders and even psychological and physical problems.[13] Emotion is known to be a link in the stress chain[13] and in this study over two thirds of student teachers and the general population with voice complaints felt their emotions had a negative influence on their voice. In addition approximately half the group of student teachers and the

general population with voice complaints were of the opinion that work pressure had a negative influence on their voice. In a survey of voice students, Sapir et al.[7] reported that one half of the students sought medical help for voice problems. Students presenting with multiple symptoms were more likely to report a general tendency to be worried, depressed or anxious or have mood swings. Vocal attrition was found to have a significant impact on performance, career goals, and psychological well being of voice students and is considered to be a significant source of stress. The negative image projected by a dysphonic voice may also contribute to stress.[7] De Jong et al.[28] described a psychological cascade for persisting voice problems in teachers and suggested that stress management and psychological counselling may be helpful for prevention of voice problems. It may be worthwhile to include stress management techniques in the curriculum for student teachers.

Over two thirds of the student teachers and the general population with voice complaints reported that mucosal problems had a negative influence on their voice. Intensive voice use reportedly increases the mechanical load on the mucous membranes and conversely, mucosal disorders may affect voice production and reduce vocal capacity.[6] Allergy, sinusitis, laryngitis, inflammation of the oropharynx[6], hydration[17], humidity[29] and decrease of lubrication of the mouth and throat[13] can affect the condition of the mucosa. Mucosal problems may also arise due to environmental irritants. Unfavourable conditions of the environment, for example dry air, dust, smoke, air pollution and temperature changes can irritate the mucosa and negatively influence the voice.[17,22,29] Among the subjects with voice complaints, student teachers were significantly more of the view than the general population that environmental irritants had a negative influence on their voice. This reveals that student teachers are probably exposed to an environment that they perceive as a risk to their voices. About half the student teachers and the general population with voice complaints reported that the humidity and the changes of the temperature in the room had a negative influence on their voice. The human voice is very sensitive to decreases of relative humidity of inhaled air and in experimental conditions even after short provocation a significant increase in perturbation measures has been reported[29]. The results of this study brings to our attention the potential harmful effects of the environment on the voice and underlines the need of educating students about the effects of environmental humidity, temperature, hydration, allergy, cigarette smoking and upper airway infections on the voice. Further research is required to identify the irritant factors in the classroom, and to prevent exposure.

In this study, over a third of the student teachers and one fifth of the general population with voice complaints were of the view that their reported decease in hearing had a negative influence on their voice. This points to the need for screening of the student teachers to evaluate whether they have a hearing loss or whether the opinion was secondary to inadequate acoustic feedback, poor acoustics of the classroom or a high background noise. Hearing assessment is presently not part of the pre-admission screening for teacher training in the Netherlands and it may be useful to include this in the screening procedure as impaired hearing is known to hamper adequate feedback and can lead to voice problems[6]. A hearing impairment may be accentuated by background noise and poor acoustics of the classroom. Nearly half of the student teachers and the general population with voice complains, felt that poor room acoustics had a negative influence on their voice. Unfavourable acoustic conditions in the classroom may lead to voice problems[7,35,36] because voice intensity usually increases in noisy conditions[37,38] and voice loudness is considered to be an important factor in vocal load.[26,39,40] Teaching in poor environments increases the possibility of the "Lombard effect", i.e. the tendency to increase vocal intensity in response to increased background noise.[41] Even low background noise levels can affect speech intelligibility, and to be heard in such environments, the speaker has to raise the voice loudness above normal speaking levels. During normal conditions, a noise level of 55 dB A gives 95 percent speech intelligibility for normal running speech at one meter distance.[42] In the Netherlands there are presently no acoustic criteria for classrooms. In addition there are no standards recommended for background noise, humidity or other environmental factors of the classroom. Apart from the teacher, the pupils are also exposed to the same classroom environment, and it may be worthwhile to bring the results of the present study to the attention of education and environmental health planners.

In the present study, in those with voice complaints, the student teachers were significantly less of the opinion that the deterioration of their general physical condition had a negative influence on their voice compared to the general population. This was not remarkable as the mean age of the student teachers was less than the general population. A combination of risk factors and deterioration of the physical condition could lead to a decrease in fine regulation with consequent dysphonia and pathological fatigue of the voice.[6]

Conclusions

The conclusions are based on a questionnaire survey and the opinions of student teachers and the general population**.** No significant difference in the prevalence of voice complaints, Voice Handicap Index scores and impact of voice complaints was observed between student teachers and the general population. The results indicate that voice complaints in student teachers and the general population have a multi-factorial genesis, which includes voice loading, psycho-emotional, physical and environmental factors. The influence of the different risk factors on their voice varied. Further research is required to establish which is the most important combination of risk factors for voice complaints in student teachers. Apparently, student teachers are not sufficiently aware of the impact of the various risk factors on their voice. Furthermore, they are not aware of the potential risk that future teaching may have on their voice. This apparent lack of awareness in student teachers may itself be considered a risk factor for voice complaints. In addition to increase voice capacity, voice training in student teachers should be broader and address more aspects, including awareness of the risks and the importance of the voice as a teaching tool. Appropriate measures should be taken to address the problems posed by the poor environment of the classroom and psycho-emotional problems leading to an ineffective voice. Furthermore, it may be useful to include hearing assessment along with voice screening before admission for teacher training. Student teachers should be encouraged to report voice problems early. Periodic anonymous questionnaire surveys may encourage student teachers to report their voice problems and would help in providing voice care and support before they enter into a voice demanding professional teaching career.

References

1. Titze IR, Lemke JH, Montequin D. Populations in the U.S. workforce who rely on voice as a primary tool of trade: a preliminary report. Journal of Voice 1997; 11: 254-259.
2. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
3. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
4. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomised clinical trial. Journal of Speech, Language and Hearing Research 2001; 44: 286-296.
5. Pekkarinen E, Himberg L, Pentti J. Prevalence of vocal symptoms among teachers compared with nurses: a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics1992; 17: 113-117.
6. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica 1993; 45: 120-129.

7. Sapir S: Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.
8. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-79.
9. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
10. Rantala L, Määtä T, Vilkman E. Measuring Voice under Teachers' Working Circumstances: Fo and Perturbation Features in Maximally Sustained Phonation. Folia Phoniatrica et Logopaedica 1997; 49: 281-291.
11. Sataloff RT. Professional voice users: the evaluation of voice disorders. Occup Med 2001; 16: 633-647.
12. Dejonckere PH. Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001.
13. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (eds): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001: pp 81-100.
14. Roy N, Merril RM, Thibeault S, Parsa A R, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. Journal of Speech, Language, and Hearing Research 2004; 47: 281-293.
15. Fritzell B. Voice disorders and occupations. Logopedics Phoniatrics Vocology 1996; 2: 7-12.
16. Morton V, Watson DR. The teaching Voice: Problems and Perceptions. Logopedics Phoniatrics Vocology 1998; 23: 133-139.
17. Verdolini K, Ramig LO. Review: Occupational Risks for Voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
18. Yiu EM. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
19. Timmermans B, De Bodt MS, Wuyts FI, Van de Heyning PH. Training outcome in future professional voice users after eighteen months of voice training. Folia Phoniatrica et Logopaedica 2004; 56: 120-129.
20. Simberg S, Laine A, Sala E, Ronnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
21. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.
22. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21: 137-41.
23. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia. Myth or reality? in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague: Kugler publications, 2001.
24. Masuda T, Ikeda Y, Manako H, Komiyama S. Analysis of vocal abuse: fluctuations in phonation time and intensity in 4 groups of speakers. Acta Otolaryngol (Stockholm) 1993; 113: 547-552.
25. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
26. Buekers R. Voice Performances in Relation to Demands & Capacity. PhD thesis. University of Maastricht, The Netherlands, 1998.
27. Morrison MD, Rammage LA. Muscle misuse voice disorders: description and classification. Acta Otolaryngologica 1993; 113: 428 - 434.
28. Jong FICRS de, Cornelis BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A Psychological Cascade Model for Persisting Voice Problems in Teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
29. Hemler RJ, Wieneke GH, en Dejonckere PH. The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. Journal of Voice 1997; 11: 295-300.
30. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
31. Andersson K, Fagerlund I. The Indoor Climate in 82 schools in Stockholm-results of a Questionnaire survey. Department of Occupational and Environmental medicine, Örebro Medical Centre Hospital. Report MM 25/99, Örebro, Sweden; 1999.
32. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscle tension in patients with voice disorders. Journal of Voice 2002; 16: 333-343.

33. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): Development and Validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
34. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
35. Blake P, Busby S. Noise levels in New Zealand junior classrooms: Their impact on hearing and teaching. N Z Med J 1994; 107: 357-358.
36. Preciado JA, Garcia TR, Infante JC. Estudio de la prevalencia de los trastornos de la voz en los profesionales de la enseñanza. Factores que intervienen en su aparición o en su mantenimiento (Prevalence of voice disorders among educational professionals. Factors contributing to their appearance or their persistence). Acta Otorrinolaringolo Esp 1998; 49: 137-142.
37. Heusden Ev, Plomp R, en Pols LCW. Effect of ambient noise on the vocal output and the preferred listening level of conversational speech. Applied Acoustics 1979; 12: 31-43.
38. Pick HL, Siegel GM, Fox Pw, Garber SR, Kearney JK. Inhibiting the Lombard Effect. J.Acoust Coc Am 1989; 85: 894-900.
39. Sapienza CM, Crandell CC, Curtis B. Effects of sound-field frequency modulation amplification on reducing teachers' sound pressure level in the classroom. Journal of Voice 1999; 13: 375-381.
40. Jonsdottir V, Rantala L, Laukkanen A-M, Vilkman E. Effects of sound amplification on teachers speech while teaching. Logopedics Phoniatrics Vocology 2001; 26: 118-123.
41. Morton V, Watson DR. Voice in the classroom; in Dejonckere PH (ed); Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 53-69.
42. ISO/TR 3352. Assessment of noise with respect to its effect of the intelligibility of speech. Geneve: International Organization for Standardization; 1974.

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Chapter 4

VOICE COMPLAINTS, RISK FACTORS FOR VOICE PROBLEMS AND HISTORY OF VOICE PROBLEMS IN RELATION TO PUBERTY IN FEMALE STUDENT TEACHERS

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Abstract

The aim of the study was to estimate voice complaints, risk factors for voice complaints and history of voice problems in student teachers before they embarked on their professional teaching career. A cross sectional questionnaire survey was performed among female student teachers. The response rate was 72% and 457 questionnaires were analyzed. Voice complaints at the moment and / or during the past year, were reported by 39.6% subjects. Subjects with voice complaints had significantly higher VHI scores than subjects without voice complaints. In comparison to subjects without voice complaints, overall, subjects with voice complaints reported more frequently that vocal loading factors, physical factors, environmental factors and psychological factors had a negative influence on their voice. Subjects with voice complaints reported more frequently a history of voice complaints during puberty and before puberty in comparison to subjects without voice complaints. Voice complaints in student teachers apparently had a multi-factorial genesis and with roots during puberty or before puberty. Logistic regression analysis revealed that intensive voice use, emotions and history of voice complaints during puberty were the most discriminating set of risk factors for voice complaints. Subjects with voice complaints in comparison to those without voice complaints reported more frequently that they would develop a voice problem due to future teaching and that future teaching would have a negative influence on their voice. Around three quarters of subjects with and without voice complaints reported that attention paid to their voice during their training was sufficient. However, subjects with voice complaints were observed to report the need for a refresher course on voice use more frequently than those without voice complaints. The findings call for more intensive voice training for student teachers to cope with the vocal, physical and psychological demands of the teaching profession. Authorities should take responsibility to monitor and improve working conditions of student teachers and teachers

Introduction

The voice has been considered to be one of the most important tools of the teaching profession, and the need for voice performance and vocal endurance has been found to be high.[1-4] Voice disorders in teachers have been observed to lead to severe personal, social, vocational and economic penalties.[5] Investigators who had surveyed teachers reported a high prevalence of voice problems.[6-12] Even

studies among student teachers reported voice complaints in around one-fifth of the group.[1,13,14] This suggests that a proportion of student teachers could be embarking on the voice demanding teaching profession with voice problems. The high prevalence of voice problems in student teachers called for more voice training and voice care during the training period.[5,7,9] However, studies among teachers have reported that their teacher training was inadequate.[5,7,15-18]

A constitutionally weak voice has been considered to be a risk for developing an occupational dysphonia.[19-21] Damsté[22] used the term habitual dysphonia for laryngeal dysfunction and observed that persons with this disorder had a history of voice strain usually during mutation. Adolescence has been observed to be a period of vocal instability associated with mutation[23,24] and the period of voice mutation was reported to last as long as three years, often being completed by the age fifteen.[25] Investigators have observed that many voice disorders in adults arose during the period of voice change during puberty.[26,27] It would be worthwhile to investigate whether student teachers with voice problems had a history of voice complaints during puberty.

Questionnaires have been reported to be economical and useful to collect data about teachers` awareness, attitudes and personal history in relation to their voice problems.[5, 8, 10] Lack of awareness of voice problems has itself been considered a reflection of unsatisfactory vocal training.[17] Furthermore, a lack of awareness of a voice problem is also known to hamper recovery from voice problems because the subject does not recognize the factors that play a role in the course of the voice problem.[28]

The aim of the study was to estimate voice complaints and risk factors for voice complaints in student teachers. Furthermore inquiry was made to ascertain whether voice complaints in student teachers had a history prior to their training during or before puberty.

Methods

An epidemiological cross sectional survey study was performed among teachers in training. Student teachers without voice complaints were assessed as a comparison group, to determine whether the frequency of risk factors reported was significantly higher in student teachers with voice complaints.

Only female student teachers were selected for this study because studies have revealed that occupational voice disorders were more common among women.[8,11,29] Furthermore, women have been observed to be more susceptible to voice disorders than men.[8,11,29]

The age range of the student teachers was between 16 and 48 (mean age 20 years; median 19), Schneider et al.[21] also reported a similar age range (17 - 41 years) in a study among female student teachers. In The Netherlands candidates are allowed to start teacher training immediately after school, which is usually when they are 17 years old. Few student teachers were found to be 16 years old because in certain cases the candidates are in their 17th year but turn 17 years old only during the current academic year.

The relation between voice complaints and voice complaints before and during puberty was analyzed. Student teachers who were less than 18 years were excluded to estimate the relation of voice complaints with voice complaints during and before puberty, as some subjects could have been in the stage of puberty themselves. As a result there were 369 student teachers in the group assessed for relation with voice complaints during and before puberty.

Directors of teacher training schools for primary education were approached and they were asked to distribute the questionnaires to student teachers. A covering letter was attached to the questionnaire, which explained the aims and objectives of the study. The questionnaires were accompanied by instructions on how to fill out the questionnaire (Appendix A1). The questionnaires were completed anonymously, and returned. The response rate was 72%, which was similar to the response rate of 75% reported by Russell at al.[8] in a survey study among teachers. A total of 457 questionnaires were assessed for voice complaints in relation with risk factors for voice complaints.

The questionnaire was designed with information from literature,[5-8,18,19,30] suggestions from teachers and the clinical experience of the voice team of the Department of Oto-Rhino-Laryngology of the Radboud University Nijmegen Medical Centre. A questionnaire with enclosed (closed-ended) questions was used as a survey tool to collect data. The questionnaire was designed in such a way that various aspects of voice and voice problems were included. It addressed voice not only in relation to vocal load, but also in relation to physical, environmental and psychological aspects.

The questionnaire consisted of 37 questions (Appendix D) and the various questions were categorized into four groups with regard to vocal load, physical factors, psychological factors and environmental factors. These factors were considered as risk factors for voice complaints.

Questions B 6-7 (Appendix D) addressed voice complaints at the present moment (point prevalence) and voice complaints during the past year (period prevalence). Question B 8 referred to voice complaints during puberty and question B 9 referred to voice complaints before puberty. The responses to the following questions were dichotomised to have uniform representation of the results and for clarity of description of the large number of variables. This also provided the opportunity for binominal logistic regression analysis of the risk factors for voice problems with voice complaints at the moment and / or during the past year as the outcome variable. By dichotomizing the results, the statistical power of differentiation may be reduced marginally, however when the difference is significant it implies a high significance. There were four questions pertaining to vocal loading. Inquiry was made whether the student teachers had intensive voice use (question A 3), whether the size of the group (number of people communicated with) had a negative influence on their voice (question D 19) and whether vocal load had a negative influence on their voice (question D 20). Question A 5 addressed specifically the number of hours of vocal use per week in the context of study. The results were dichotomised into less than 20 hours of voice use per week and 20 or more hours of voice use per week. Questions D 17-25 addressed opinions of the subjects in reference to vocal load (D 19) and other risk factors for voice problems. The response 0 was classified as negative (score=0) and the response 1 as positive (score=1). Questions E 26-37 addressed the physical, psychological and environmental risk factors and the results were also dichotomised. The response 0 and 1 were classified as negative (score 0) and the responses 2, 3 and 4 as positive (score 1). The questionnaire referred to whether the risk factors had a negative influence on the voice. The risk factors were assessed in relation to reported voice complaints. The term “voice complaints” was defined based 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 questions allowed student teachers to decide for themselves whether or not they had a voice problem. This selection could have excluded certain subjects with a voice problem and on the other hand could have included subjects with mild or even no voice problems. The use of the VHI[31] (Appendix G) provided an opportunity to check whether subjects who reported voice complaints

were in fact handicapped due to their voice problem when compared to subjects who did not report a voice complaint.

Subjects filled out the Voice Handicap Index (VHI),[31] which was designed to quantify the self-perceived psychosocial consequences of voice disorders. In this study the Dutch version[32] of the Voice Handicap Index was used. It consisted of 30 questions, which covered emotional (10), physical (10) and functional (10) aspects of voice. The questions were rated according to a five point ordinal scale: never (0), almost never (1), sometimes (2), almost always (3) and always (4). The total scores ranged between 0 and 120.

Statistical analysis: The data was analysed using the statistical program SPSS 11.0.
The Kolmogorov-Smirnov test was applied in order to determine if continuous outcome variables were distributed normally. Because the age of the student teachers was not normally distributed the median age was assessed. As the VHI scores were not normally distributed the medians were assessed.

For continuous outcome variables that were not normally distributed (VHI scores), the Mann-Whitney U test was used. The Mann-Whitney U test was used to test the statistical significance of a difference in median VHI scores between student teachers with and without voice complaints. Taking possible Type-I error [33] into account the significance level was set at $p < 0.01$.

Odds Ratios were used to quantify the dependency in 2 x 2 tables. Odds Ratios were estimated with 95% confidence intervals to indicate the relative risks. 95% confidence intervals, which did not include the unit 1.0, were considered to be statistically significant.[7,33] Confidence intervals provided information about the power of the study to detect a difference between the groups.[7,33]

Logistic regression analysis was done to identify the set of risk factor variables of interest that were most significant for voice complaints. The outcome variable for the regression analysis was voice complaints at the moment and / or during the past year. Stepwise backward regression method resulted in the selection of the most discriminating set of risk factors for voice complaints. The following risk factors for voice problems were selected for the analysis: vocal loading factors, physical factors, psychological factors, environmental factors, history of voice complaints during puberty and history of voice complaints before puberty.

Results

Among 457 student teachers, voice complaints at the moment and / or during the past year, were reported by 39.6% subjects. Subjects with voice complaints had significantly high median VHI scores (inter-quartile range) in comparison to subjects without voice complaints: 14 (17.0) versus 6 (8.5) ($p < 0.001$). The results indicated the psychosocial handicap due to voice problems. Furthermore, it affirmed that subjects who reported voice complaints had more problems with their voice in comparison to subjects that did not report voice complaints.

Risk factors were assessed in relation to voice complaints, which were present at the moment and / or during the past year. The Odds Ratios showed the relative risk and 95% confidence intervals showed whether the difference between the groups was statistically significant.

Subjects with voice complaints reported more frequently that vocal loading factors had a negative influence on their voice than subjects without voice complaints (Table 1).

Table 1. The association between vocal loading risk factors and voice complaints was analyzed.

Vocal loading factors	Voice complaints	%(Number of subjects) Yes	%(Number of subjects) No	Missing values %(Number of subjects)	Odds Ratio (Confidence Interval)
(A 3) Intensive voice use	With voice complaints	87.4(146)	12.6(21)	9.1(42)	2.26 (1.32-3.89)
	No voice complaints	75.4(187)	24.6(61)		
(A 5) Voice use for 20hrs or more per week	With voice complaints	71.1(81)	28.9(33)	35.2(161)	2.05 (1.25-3.38)
	No voice complaints	54.4(99)	45.6(83)		
(D 19) Size of the group you communicate	With voice complaints	18.6(26)	81.4(114)	17.2(79)	2.96 (1.54-5.68)
	No voice complaints	7.1(17)	92.9(221)		
(D 20) Voice load - negative influence on the voice	With voice complaints	54.7(81)	45.3(67)	21.8(100)	4.16 (2.63-6.59)
	No voice complaints	22.5(47)	77.5(162)		

Subjects with voice complaints reported more frequently that throat clearing, mucosal problems, deterioration of the general physical condition, neck and

shoulder problems had a negative influence on their voice than subjects without voice complaints (Table 2). The confidence intervals showed that the difference between the groups was not statistically significant for decrease in hearing and lower back problems. However, it was remarkable that the Odds Ratio for lower back problems was 1.84. Lower back problems in relation to voice problems may indicate improper posture during phonation.

Table 2. The association between physical risk factors and voice complaints was analyzed.

Physical factors	Voice complaints	%(Number of subjects) Yes	%(Number of subjects) No	Missing values %(Number of subjects	Odds Ratio (Confidence Interval)
(D 25) Throat clearing	With voice complaints	53.5(84)	46.5(73)	10.9(50)	2.90 (1.91-4.40)
	No voice complaints	28.4(71)	71.6(179)		
(E 26) Decrease in hearing	With voice complaints	32.1(54)	67.9(114)	6.5(30)	1.47 (0.95-2.26)
	No voice complaints	24.3(63)	75.7(196)		
(E 27) Neck, shoulder	With voice complaints	4.9(7)	95.1(135)	16.8(77)	4.06 (1.03-15.96)
	No voice complaints	1.3(3)	98.7(235)		
(E 28) Lower back	With voice complaints	9.5(16)	90.5(153)	5.9(27)	1.84 (0.87-3.88)
	No voice complaints	5.4(14)	94.6(247)		
(E 29) Mucosal problems	With voice complaints	62.5(105)	37.5(63)	7.4(34)	2.12 (1.42-3.16)
	No voice complaints	43.9(112)	56.1(143)		
(E 30) General physical condition	With voice complaints	36.8(63)	63.2(108)	5.4(25)	3.13 (1.98-4.93)
	No voice complaints	15.7(41)	84.3(220)		

The results showed that subjects with voice complaints reported more frequently that environmental risk factors had a negative influence on their voice than those without voice complaints (Table 3).

Table 3. The association between environmental risk factors and voice complaints was analyzed.

Environmental factors	Voice complaints	% (Number of subjects) Yes	% (Number of subjects) No	Missing values % (Number of subjects)	Odds Ratio (Confidence Interval)
(E 33) Noise	With voice complaints	70.6(120)	29.4(50)	5.9(27)	2.25 (1.49-3.40)
	No voice complaints	51.5(134)	48.5(126)		
(E 34) Acoustics	With voice complaints	49.1(81)	50.9(84)	7.6(35)	3.03 (1.99-4.60)
	No voice complaints	24.1(62)	75.9(195)		
(E 35) Humidity	With voice complaints	65.7(111)	34.3(58)	6.5(30)	3.28 (2.18-4.92)
	No voice complaints	36.8(95)	63.2(163)		
(E 36) Temperature	With voice complaints	40.5(68)	59.5(100)	6.5(30)	2.70 (1.75-4.17)
	No voice complaints	20.1(52)	79.9(207)		
(E 37) Irritants	With voice complaints	64.7(110)	35.3(60)	5.9(27)	1.92 (1.29-2.85)
	No voice complaints	48.8(127)	51.2(133)		

Psychological risk factors were assessed in relation to voice complaints (Table 4). The Odds Ratios showed that subjects with voice complaints in comparison to those without voice complaints, reported more frequently that stress, work pressure and composition of the group communicated with had a negative influence on their voice. The Odds Ratio for emotions was 1.21 but as over two thirds of subjects with and without voice complaints reported the negative influence of emotions on their voice, the difference between the groups was not statistically significant.

In comparison to subjects without voice complaints, subjects with voice complaints opined more frequently that the future teaching profession would have a negative influence on their voice and that they would develop a voice problem due to the future teaching profession (Table 5).

Around three quarters of subjects with and without voice complaints reported that the attention paid to their voice during training was sufficient. However, subjects with voice complaints reported more frequently the need for a refresher course on voice use than those without voice complaints (Table 5).

Table 4. The association between psychological risk factors and voice complaints was analyzed.

Psychological factors	Voice complaints	%(Number of subjects) Yes	%(Number of subjects) No	Missing values %(Number of subjects)	Odds Ratio (Confidence Interval)
(E 31) Stress	With voice complaints	36.3(62)	63.7(109)	5.4(25)	2.52 (1.67-3.92)
	No voice complaints	18.4(48)	81.6(213)		
(E 32) Emotion	With voice complaints	66.1(113)	33.9(58)	5.6(26)	1.21 (0.81-1.82)
	No voice complaints	61.5(160)	38.5(100)		
(D 21) Composition of group	With voice complaints	47.7(71)	52.3(78)	18.1(83)	1.61 (1.06-2.46)
	No voice complaints	36.0(81)	64.0(144)		
(D 24) Work Pressure	With voice complaints	45.1(60)	54.9(73)	28.2(129)	1.94 (1.22-3.07)
	No voice complaints	29.7(58)	70.3(137)		

Table 5. Opinions: D17: Opinion: Will you develop a voice problem due to the teaching profession? & D18: Opinion: Will the teaching profession have a negative influence on the condition of your voice? D22: The attention paid to your voice during training has been sufficient? D23: A refresher course on efficient voice use is advisable?

Opinions	Voice complaints	%(Number of subjects) Yes	%(Number of subjects) No	Missing values %(Number of subjects)	Odds Ratio (Confidence Interval)
(D 17) Will you develop a voice problem due to your profession?	With voice complaints	31.1(37)	68.9(82)	33.6(154)	11.40 (4.88-26.67)
	No voice complaints	3.8(7)	96.2(177)		
(D 18) Will the teaching profession have a negative influence on the voice?	With voice complaints	46.8(65)	53.2(74)	27.1(124)	4.61 (2.77-7.67)
	No voice complaints	16.0(31)	84.0(163)		
(D 22) Attention paid to the voice during training is sufficient?	With voice complaints	74.1(103)	25.9(36)	24.2(111)	0.62 (0.37-1.04)
	No voice complaints	82.1(170)	17.9(37)		
(D 23) Is a refresher course for efficient voice use advisable?	With voice complaints	60.1(89)	39.9(59)	21.6(99)	2.45 (1.59-3.77)
	No voice complaints	38.1(80)	61.9(130)		

Past voice complaints, during puberty and before puberty were reported more frequently by subjects with voice complaints than those without voice complaints (Table 6). The subjects who reported a history of voice problems during puberty also reported more frequently a history of voice problems before puberty (37.0%) than those without a history of voice complaints during puberty (4.9%). The Odds Ratio was estimated to be 11.34 with a 95% confidence interval of 5.07-25.36.

Table 6. Voice complaints: positive response to question B6 and / or B7.
Voice complaints before and during puberty are assessed in relation to voice complaints at the moment and / or during the past year

Voice complaints before / during puberty	Voice complaints	%(Number of subjects) Yes	%(Number of subjects) No	Missing values %(Number of subjects)	Odds Ratio (Confidence Interval)
(B 8) Voice complaints during puberty	With voice complaints	31.2(39)	68.8(86)	11.1(41)	7.91 (3.86-16.19)
	No voice complaints	5.4(11)	94.6(192)		
(B9) Voice complaints before puberty	With voice complaints	17.9(22)	82.1(101)	11.7(43)	4.69 (2.08-10.57)
	No voice complaints	4.4(9)	95.6(194)		
(B8, B9) Voice complaints before and during puberty	With voice complaints	33.9(41)	66.1(80)	12.7(47)	5.21 (2.82-9.62)
	No voice complaints	9.0(18)	91.0(183)		

Logistic regression analysis of risk factors revealed that, intensive voice use, emotions and voice complaints during puberty were the most discriminating set of risk factors for voice complaints (Table 7).

Table 7. Logistic regression analysis shows that intensive voice use, emotions and voice problems during puberty were the most discriminating set of risk factors for voice complaints in student teachers.

Final model of Logistic regression analysis	Significance ($p < 0.01$)
Emotions	0.000
Intensive voice use	0.005
Voice complaints during puberty	0.008

Discussion

Questionnaire surveys have proven to be useful to collect epidemiological data among teachers.[5,8,10] 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.[34] Moreover, written instructions are found to give respondents time to think about their answers.[34] 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 studies have been found to be valuable for providing descriptive information about prevalence of a health problem and its correlations.[8,10,35] The data and information may be used to generate a hypothesis regarding risk factors for voice problems in student teachers. The data gathered, will be useful for planners for education and health who want to know how many student teachers have voice complaints and the associated risk factors so that adequate resources can be allocated for voice care and voice training.

Questionnaires can have open (open-ended) or enclosed (closed-ended) questions.[34] Open questions seek answers in the respondents` own words, which leaves the respondent free to answer with fewer limits imposed by the researcher.[34] However, the disadvantage of open questions, has been reported to be the difficulty in coding and analyzing the responses.[34] The questionnaire used in the present study had enclosed questions (closed-ended). Enclosed questions, required respondents to choose from pre-selected answers, which provided a list of possible alternatives. The enclosed questions, however, did not permit the respondents to express their own unique answers. Additionally, it has been found that questionnaires may not always include answers, which may be most appropriate for the particular respondent.[34] The disadvantages were minimized in the present study by asking open questions to teachers, who helped formulate the questionnaire and this approach helped to expand the list of questions and the possible responses. Furthermore, the prior use of the questionnaire in teachers [36] gave information to modify questions for the student teachers. The reported advantages of closed-ended questions are that the possible answers have been found to help to clarify the meaning of the question and they have been found to be quicker to answer, easier to tabulate and analyze.[34]

In a previous study concerning voice disorders among future teachers it was reported that one fifth of the students had a voice disorder.[1] In the present study nearly four out of ten student teachers reported voice complaints at the moment

and / or during the past year. The use of the VHI affirmed that subjects who reported voice complaints were indeed handicapped due to their voice problem when compared to subjects who did not report a voice complaint. A study of the voice of future professional voice users [37] revealed a high mean VHI score of 21.2 and De Bodt et al.[32] reported a mean VHI score of 4.7 for subjects with normal voices. As the VHI scores in the present study were not found to be normally distributed the medians of the VHI scores were estimated, rather than the means. The VHI scores have been found to give an indication of the psychosocial consequence of a voice problem.[31,38] The student teachers with voice complaints had a significantly higher median VHI score of 14.0 compared to the median VHI score of 6.0 in student teachers without voice complaints. Apart from showing the voice handicap of subjects with voice complaints, this finding probably shows that psychosocial factors could have also contributed to the development of their voice complaints. The findings raise questions to which are the risk factors for voice complaints and the onset of voice complaints in student teachers. Voice complaints in future teachers need to be addressed before they start their voice demanding teaching career.

The results suggest that student teachers with voice complaints had higher vocal loading than those without voice complaints. On the other hand, it probably indicated that student teachers with voice complaints were not able to adequately cope with vocal loading during training. Subjects with voice complaints reported more frequently of vocal use for twenty hours or more per week in the context of the study. During training, there are practical periods where student teachers face a challenge of speaking for long durations and subjects with vocal problems probably did not have an adequate vocal endurance to cope with this vocal demand. Reducing speaking time per se is not an appropriate solution, as teaching has been reported to be vocally demanding.[1,4] Voice amplification has been observed to effectively reduce the strain and load on the voice during teaching[39-42] and thereby may reduce the risk of developing voice complaints. Additionally, voice amplification has been seen to be useful for teachers with voice problems.[39] If student teachers are educated of the benefits of voice amplification during teaching, and are accustomed to voice amplifying systems during the training period, they may be more inclined to make use of it during their teaching careers. Training for correct voice use has been found to be essential and various investigators have stressed the need for intensive training and during the formal education.[7,18,43,44] Proper vocal technique and reducing vocal strain should enable the student teacher to efficiently cope with the vocal demands of teaching.

Student teachers with voice complaints than those without voice complaints reported more frequently that throat clearing and mucosal problems had a negative influence on their voice. These findings were in accordance with another study among student teachers, in which Simberg et al.[1] reported that the most frequent symptom among those with voice problems was throat clearing and the most common clinical finding was laryngitis. The findings call for further examination into the causes for throat clearing, as it is harmful to the voice. Habitual throat clearing has been reported to be one of the commonest voice abuses,[45,46] which has been found to be harmful to the vocal folds on account of sphincteric spasm against strong sub-glottic air pressure in order to dislodge mucous.[47,48] Previous studies have reported that teachers are exposed to children who frequently develop upper respiratory infections,[6,7,44] which could contribute to mucosal problems. Recurrent allergy,[49] sinusitis, laryngitis, pharyngitis,[6,7,9,19] hyper-reactivity[19] and gastro-esophageal reflux[19,50,51] have been reported to inflame the mucosa and this could cause habitual clearing of the throat. The student teachers with voice complaints should be investigated for the cause of their mucosal problems and throat clearing and given voice care. The findings suggest that vocal hygiene in student teachers is probably inadequate and student teachers should be educated about the risks and consequences of habitual throat clearing. Timmermans et al.[37] reported that the voice quality among future professionals voice users was poor, they did not take sufficient precaution for the care of their voice, and they underestimated the negative influence of poor vocal hygiene. It has been recommended that vocal hygiene should be taught at an early stage for those who want to pursue a profession with high vocal demands[7,18,52] and that it may reduce vocal symptoms associated with teaching.[7]

In comparison to subjects without voice complaints, subjects with voice complaints reported more frequently that environmental irritants, humidity and temperature had a negative influence on their voice. These findings are in accordance with findings in other studies among teachers. Gotaas and Starr[6] observed that teachers with vocal fatigue reported more allergies than others. Morton and Watson[49] found that, in a group of 200 teachers, central heating and chalk dust were associated with vocal dysfunction. Unfavourable conditions of the environment such as dry air, dust, air pollution and temperature changes have been found to irritate the mucosa and negatively influence the voice.[30,53,54]

Student teachers with voice complaints reported more frequently than those without voice complaints that classroom noise and acoustics had a negative influence on their voice. Classroom background noise has been found to be a

common risk factor for voice problems in teachers[7,9,55,56] and Duclos et al.[57] highlighted the importance of reducing ambient noise to prevent vocal strain. Background classroom noise has been found to cause teachers to raise their voice because the sound levels of their speaking voices significantly increases in ambient noise levels starting from 40 dB (A) due to the Lombard effect (about 3 dB increase for each 10 dB increase in ambient noise).[58] These findings brings to our attention the need to monitor the classroom environment including temperature, humidity, background noise and acoustics to prevent their detrimental effects on the teaching voice.

Student teachers with voice complaints compared to those without complaints, reported more frequently that the deterioration of their general condition, neck and shoulder problems had a negative influence on their voice. Non-organic voice disorders have been found frequently to be due to muscle misuse and have been associated with increased tension in the neck around the larynx.[28,51,59,60] For subjects with physical complaints, an examination to assess whether there is inappropriate muscle tension in the region of the neck and shoulders would be worthwhile to take corrective measures. Advice regarding the benefit of good posture while teaching will be valuable for student teachers who have neck, shoulder or lower back problems. Stress has been observed to lead to increased muscular tension in the regions of the neck, face, larynx, and shoulders,[28,59] which has been found to be a major cause of voice problems and articulation disorders.[59] Therefore it is important to also assess whether the muscle tension is related to psychological factors.

Student teachers with voice complaints compared to students without voice complaints, reported more frequently that stress, work pressure and the composition of the group taught had a negative influence on their voice. It can be assumed that student teachers would be exposed to similar psychological factors during their training. This finding suggests that student teachers with voice complaints may not be coping with stress and work pressure during their training. Teaching has been found to be a highly stressful profession[5,17,18,28,44,49,61,62] and apart from the physical effort involved, professional voice use has been known to require great mental effort.[1,18] Stress has also been observed to lead to habitual throat clearing,[59] which is harmful to the vocal folds. It has been reported that apart from intensive voice use, psychological factors like stress and fear can also increase the voice load.[20] It has also been found that the composition of the group taught can have an effect on the voice load.[56] In the Netherlands, the groups of

students taught in primary schools have increasingly a multicultural composition, which forms a vocal and psychosocial challenge for communication. It was notable that over two thirds of subjects with and without voice complaints reported that emotions had a negative influence on their voice. The findings support the need to impart training to cope with psychological factors during their teaching career.[18,28] A psychological profile of student teachers will be of value to provide information for special attention during voice training when student teachers have voice problems in relation to psychological risk factors.

Student teachers with voice complaints than those without voice complaints, reported more frequently of the potential risks the future teaching profession on their voices. In the presence of voice complaints, student teachers seem to be more conscious of the potential risks of future teaching on their voice. However, it can also be gathered from the data, that even in the presence of voice complaints, over half of the student teachers with voice complaints are still not aware of the risk teaching can have on their voice. The results might also be reflecting an overall lack of awareness that teaching can be a risk for voice problems in the majority of the total group of student teachers (with and without voice complaints).

Studies have revealed that insufficient attention is paid to voice of student teachers during the training period.[1,5,44] Around three quarters of student teachers with and without voice complaints reported that the attention paid to their voice during training was sufficient. However, subjects with voice complaints were observed to report the need for a refresher course on voice use more frequently than those without voice complaints. This finding shows that although majority of the student teachers are apparently content with their voice training, when they have voice problems they feel the need for more voice courses for efficient voice use. This probably shows an overall unawareness of the inadequacy of voice training. Voice care workshops are found to be cost effective, result in improvement of the voice and prevent voice problems.[15,63-67] Periodic workshops on efficient voice use and vocal hygiene may help to reinforce and update vocal skills required for teaching. Voice training has been found to effectively reduce the level of perceived performance anxiety[68] and has achieved a better voice quality in subjects training for professional voice use.[69] Furthermore, Roy et al.[38] reported that direct vocal training in the form of vocal function exercises were more effective than imparting vocal hygiene in the treatment of voice disorders in teachers. Vocal education may be of value in preventing voice disorders among teachers and ensuring that teachers seek assistance before a voice problem becomes chronic.[5]

For student teachers with voice problems early detection and specific vocal re-education and training may prevent persistence of voice problems during the teaching career.

The findings indicate the multi-factorial genesis of voice complaints in student teachers. This is in accordance with studies among teachers.[2,17-19,49,54] It is evident from the results of this study that student teachers are exposed to various risk factors for voice complaints. However, not all student teachers develop voice complaints. This raises a question whether only certain student teachers are predisposed to voice complaints. It was observed in the present study that student teachers with voice complaints in comparison to those without voice complaints reported more frequently that they had a history of voice complaints during their puberty and before puberty. Student teachers with a history of voice complaints during puberty also reported more frequently having a history of voice complaints before puberty. This was significant in comparison to subjects without a history of voice complaints during puberty. It is interesting to observe that logistic regression analysis showed that voice complaints during puberty along with intensive voice use and emotions formed the most discriminating set of risk factors for voice complaints in student teachers. The results suggest that voice problems in student teachers may have their roots during puberty. Studies have observed that many voice disorders arise during the period of voice change during puberty.[26,27] It has also been suggested that voice training should begin in high school where vocally abusive behaviours have been found to be common.[18,52] In a survey of speech disorders among first year college students, it was reported that although voice disorders were evident at examination most subjects were not aware of previous voice problems.[70] Probably not all the student teachers with voice complaints would be aware of past voice complaints and the history of voice complaints may be underestimated. The results suggest that student teachers with a history of voice complaints during puberty and / or before puberty may have a constitutionally weak voice. An individual with a constitutionally weak voice has been found to be at risk for the development of an occupational dysphonia[19-21] and in the presence of risk factors may develop recurrent and chronic voice complaints. This finding supports the need for screening of individuals before starting training for teaching.[1,5,13] Additionally, specific voice training is necessary for these student teachers to cope with the demands on the voice during the teaching profession.

It is apparent from this study that even before commencing their teaching career there are so many student teachers, which need urgent individual help with their voice technique and voice care. The results also imply that voice ergonomic education might be of help for student teachers during their professional careers.

Conclusions

The prevalence of voice complaints was high among student teachers. Subjects with voice complaints reported more frequently of vocal loading, physical, psychological and environmental risk factors, which shows the multi-factorial genesis of voice complaints and this problem needs to be urgently addressed before they begin professional teaching**.** Intensive voice training and refresher courses are required to meet with the vocal demands of teaching. The classroom environment needs to be monitored. Coping methods need to be taught to cope with psychological factors. Voice problems in student teachers apparently have roots during puberty, which also constitutes a risk factor for voice complaints. Voice screening and voice care should be imparted even during schooling. A history of voice problems calls for upgrading of screening for voice problems prior to teacher training. Apart from vocal capacity, screening methods should also address specific problems such as habitual throat clearing, postural problems, inappropriate muscle tension, hearing loss, allergy, upper respiratory tract infections, history of voice problems and a psychological evaluation. A multi-dimensional profile of student teachers encompassing physical and psychosocial aspects will aid to prepare student teachers for the voice demanding teaching career.

References

1. Simberg S, Laine A, Sala E, Rönnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
2. Vilkman E, Lauri E-R, Alku P, Sala E, Sihvo M. Ergonomic conditions and voice. Log Phon Vocol 1998; 23: 11-19.
3. Vilkman E. Voice problems at work: a challenge for occupational safety and health arrangement. Folia Phoniatrica et Logopaedica 2000; 52: 120-125.
4. L Rantala, E Vilkman, R Bloigu. Voice changes during work: subjective complaints and objective measurements for female primary and secondary schoolteachers. Journal of Voice 2002; 16: 344-355.
5. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
6. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica 1993; 45: 120-129.

7. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers` voice problems. Journal of Voice 1997; 11: 81-87.
8. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-79.
9. Smith E, Lemke J, Taylor M, Kirchner HL, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
10. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
11. Roy N, Merril RM, Thibeault S, Parsa AR, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. Journal of Speech Language and Hearing Research 2004; 47: 281-293.
12. Jong FICRS de, Kooijman PGC, Thomas G, Huinck WJ, Graamans K, Schutte HK. Epidemiology of voice problems in Dutch teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
13. Simberg S, Sala E, Laine A, Rönnemaa AM. A fast and easy screening method for voice disorders among teacher students. Logopedics Phoniatrics Vocology 2001; 26: 10-16.
14. Simberg S, Sala E, Rönnemaa AM. A comparison of the prevalence of vocal symptoms among teacher students and other university students. Journal of Voice 2004; 18: 363-368.
15. Martin S. Voice care and development for teachers: survey report. Voice 1994; 3: 92-98.
16. Martin S, Darnley L. The teaching voice. London, Whurr Publishers, 1996.
17. Morton V, Watson DR. Voice in the classroom: Occupational Voice; Care and Cure. The Hague, Kugler publications, 2001, pp 53-69.
18. Sapir S. Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.
19. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia; myth or reality? in Dejonckere PH (ed): Occupational Voice; Care and Cure. The Hague, Kugler Publications, 2001, pp 101-112.
20. Buekers R. Voice Performances in Relation to Demands & Capacity (thesis). University of Maastricht, The Netherlands, 1998.
21. Schneider B, Bigenzahn W. Vocal risk factors for occupational voice disorders in female teaching students. European Archives of Oto-Rhino-Laryngology and Head and Neck 2004 (published online).
22. Damsté PH. Vocal disorders; a guide to their diagnosis. ORL (Basel) 1973; 35: 149-153.
23. Sataloff RT. Professional Voice; the science and art of clinical care. New York, Raven press, 1991.
24. Boltezar IH, Burger ZR, Zargi M. Instability of voice in adolescence: pathologic condition or normal developmental variation? Journal of Paediatrics 1997; 130: 185-90.
25. Hagg U, Tarranger J. Menarche and voice change as indications of the pubertal growth spurt. Acta Odontal Scand 1980; 38:179-186.
26. Harrington R. Children with voice disorders; in Johnson W (ed): Speech problems of children. New York, Grune and Stratton, 1950, pp 192-193.
27. Brodnitz FS. Vocal Rehabilitation. Ed. 4 American Academy of Ophthalmology and Otolaryngology, Rochester, MN, 1971, pp 61.
28. Jong FICRS de, Cornelis BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A psychological cascade model for persisting voice problems in teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
29. Dejonckere PH. Gender differences in the prevalence of occupational voice disorders; some anatomical factors that possibly contribute; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 11-20.
30. Verdolini K, Ramig LO. Review; occupational risks for voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
31. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): development and validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
32. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
33. Greenberg RS, Daniels SR, Flanders WD, Eley JW, Boring JR III; in Foltin J, Edmonson K, Brown RY (eds): Medical Epidemiology. New York, Lange Medical Books/McGraw-Hill, 2005, pp 112.

34. Cummings SR, Strull W, Nevitt MC, Hulley SB; in Hulley SB, Cummings SR (eds): Designing clinical research. Baltimore, Williams and Wilkins, 1988, pp 42-44.
35. Newman TB, Browner WS, Cummings SR, Hulley SB; in Hulley SB, Cummings SR (eds): Designing clinical research. Baltimore, Williams and Wilkins, 1988, pp 75-78.
36. Kooijman PGC, Jong FICRS de, Thomas G, Huinck WJ, Donders R, Graamans K, Schutte HK. Risk factors for voice problems in teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
37. Timmermans B, De Bodt MS, Wuyts FL, Boudewijns A, Clement G, Peeters A, Van de Heyning PH. Poor voice quality in future elite vocal performers and professional voice users. Journal of Voice 2002; 16: 372-382.
38. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. Journal of Speech Language and Hearing Research 2001; 44: 286-296.
39. Roy N, Weinrich B, Gray SD, Tanner K, Toledo SW, Dove H, Corbin-Lewis K, Stemple JC. Voice amplification versus vocal hygiene instruction for teachers with voice disorders: a treatment outcomes study. Journal of Speech Language and Hearing Research 2002; 45: 625-638.
40. Jonsdottir V, Laukkanen AM, Llomaki I, Roininen H, Alastalo-Borenius M, Vilkman E. Effects of amplified and damped auditory feedback on vocal characteristics. Logopedics Phoniatrics Vocology 2001; 26: 76-81.
41. Jonsdottir V. Cordless amplifying system in classrooms. A descriptive study of teachers` and students` opinions. Logopedics Phoniatrics Vocology 2002; 27: 29-36.
42. Jonsdottir V, Laukkanen AM, Vilkman E. Changes in teachers` speech during a working day with and without electric sound amplification. Folia Phoniatrica et Logopaedica 2002; 54: 282-287.
43. Yiu EM. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
44. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.
45. Wilson K. Voice Problems of Children (3rd edition). Baltimore, Williams & Wilkins, 1987.
46. Comins R. Helping people to keep their voices healthy and to communicate effectively. International journal of language and communication disorders- Royal College of Speech and Language Therapists 1998; 33 Suppl: 310-315.
47. Greene MCL. The Voice and its Disorders. Pitman Medical. London, Pitman publishing, 1978.
48. Brodnitz FS. Keep Your Voice Healthy. New York, Harper, 1953.
49. Morton V, Watson DR. The teaching voice: problems and perceptions. Log Phon Vocol 1998; 23: 133-139.
50. Koufman JA. The otolaryngologic manifestations of gastro-esophageal reflux disease (GERD). Laryngoscope 1991; 101 (supp53): 1-78.
51. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscle tension in patients with voice disorders. Journal of Voice 2002; 16: 333-343.
52. Andrews M, Summers A. Voice therapy for adolescents. Boston, Little, Brown & Co, 1988.
53. Hemler RJ, Wieneke GH, Dejonckere PH. The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. Journal of Voice 1997; 11: 295-300.
54. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21: 137-41.
55. Andersson K, Fagerlund I. The indoor climate in 82 schools in Stockholm - results of a questionnaire survey. Department of occupational and environmental medicine, Örebro medical centre hospital. Report MM 25/99, Örebro, Sweden, 1999.
56. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
57. Duclos JC, Dubreuil C, Faure MA. Bruit et larynx (Noise and the larynx). J Franc Orl 1980; 29 : 605-607.
58. Heusden E, Plomp R, Pols LCW. Effect of ambient noise on the vocal output and the preferred listening level of conversational speech. Applied Acoustics 1979; 12: 31-43.
59. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (eds): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 81-100.

60. Morrison MD, Rammage LA . Muscle misuse voice disorders; description and classification. Acta Otolaryngologica 1993; 113: 428-434.
61. Russell DW, Almaier E, Van Velzen D. Job related stress, social support, and burnout among classroom teachers. J Applied Psychol 1987; 72 : 269-74.
62. Malone J, Denny T, Dalton P, Addley K. Stress at work. Part 1: recognition, causes, outcomes and effects; in Addley K (ed): Occupational stress; A practical approach. Oxford, Butterworth-Heinemann, 1997.
63. Bistrisky Y, Frank Y. Efficacy of voice and speech training of prospective elementary school teachers. Israeli J Speech Hear 1981; 10: 16-32.
64. Comins R. Voice in the curriculum. Voice 1992; 1: 67-73.
65. Ohlsson AC. Preventive voice care for teachers. Voice 1993; 2: 112-115.
66. Chan RWK. Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers. Journal of Voice 1994; 8: 279-291.
67. Dennik R. Long term retention of teaching skills after attending the teaching improvement project: a longitudinal, self-evaluation study. Med-Teach 2003; 25: 314-318.
68. Merritt L, Richards A, Davis P. Performance anxiety: loss of the spoken edge. Journal of Voice 2001; 15: 257-269.
69. Timmermans B, De Bodt MS, Wuyts FL, Van de Heyning PH. Training outcome in future professional voice users after 18 months of voice training. Folia Phoniatrica et Logopaedica 2004; 56: 120-129.
70. Culton GL. Speech disorders among college freshmen: a 13-year survey. Journal of Speech and Hearing Disorders 1986; 51: 3-7.

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Chapter 5

A COMPARATIVE STUDY OF VOICE COMPLAINTS AND RISK FACTORS FOR VOICE COMPLAINTS IN FEMALE STUDENT 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 2x2 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.

References

1. Titze IR, Lemke JH, Montequin D. Populations in the U.S. workforce who rely on voice as a primary tool of trade: a preliminary report. Journal of Voice 1997; 11:254-259.
2. Verdolini K, Ramig LO. Review: Occupational Risks for Voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
3. Russell A, Oates J, en Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-479.
4. Roy N, Merril RM, Thibeault S, Parsa A R, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. Journal of Speech, Language, and Hearing Research 2004; 47: 281-293.
5. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.

6. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
7. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. Journal of Speech, Language and Hearing Research 2001; 44: 286-296.
8. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica 1993; 45:120-129.
9. Sapir S. Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.
10. Rantala L, Määtä T, Vilkman E. Measuring voice under teachers' working circumstances: F0 and perturbation features in maximally sustained phonation. Folia Phoniatrica et Logopaedica 1997; 49: 281-291.
11. Sataloff RT. Professional voice users: the evaluation of voice disorders. Occup Med 2001; 16: 633-647.
12. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (ed): Occupational Voice: Care and Cure. Kugler Publications, The Hague, 2001, pp 81-100.
13. Simberg S, Laine A, Sala E, Ronnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
14. Pekkarinen E, Himberg L, Pentti J. Prevalence of vocal symptoms among teachers compared with nurses - a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics 1992; 17: 113-117.
15. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers voice problems. Journal of Voice 1997; 11: 81-87.
16. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
17. Morton V, Watson DR. The impact of impaired vocal quality on children`s ability to process spoken language. Logopedics Phoniatrics Vocology 2001; 26: 17-25.
18. Dejonckere PH. Gender differences in the prevalence of occupational voice disorders; in Dejonckere PH (ed): Occupational Voice: Care and Cure. Kugler Publications, The Hague, The Netherlands, 2001; pp 11-20.
19. Timmermans B, De Bodt MS, Wuyts FL, Boudewijns A, Clement G, Peeters A, Van de Heyning PH. Poor voice quality in future elite vocal performers and professional voice users. Journal of Voice 2002; 16: 372-382.
20. Yiu EML. Impact and prevention of voice problems in the teaching profession: embracing the consumers view. Journal of Voice 2002; 16: 215-228.
21. Morton V, Watson DR. The teaching Voice: Problems and Perceptions. Logopedics Phoniatrics Vocology 1998; 23:133-139.
22. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21:137-41.
23. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia. Myth or reality? in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague: Kugler publications, 2001; pp 101-112.
24. Vilkman E. Voice Problems at Work: A Challenge for Occupational Safety and Health Arrangement. Folia Phoniatrica et Logopaedica 2000; 52: 120-125.
25. Sapienza CM, Crandell CC, Curtis B. Effects of sound-field frequency modulation amplification on reducing teachers' sound pressure level in the classroom. Journal of Voice 1999; 13: 375-381.
26. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
27. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscle tension in patients with voice disorders. Journal of Voice 2002; 16: 333-343.
28. Morrison MD, Rammage LA. Muscle misuse voice disorders: description and classification. Acta Otolaryngologica 1993; 113: 428-434.
29. Jong FICRS de, Cornelis BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A Psychological Cascade Model for Persisting Voice Problems in Teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
30. Hemler RJ, Wieneke GH, en Dejonckere PH. The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. Journal of Voice 1997;11:295-300.

Chapter 6

THE VOICE HANDICAP OF STUDENT TEACHERS AND RISK FACTORS PERCEIVED TO HAVE A NEGATIVE INFLUENCE ON THE VOICE

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Abstract

A cross sectional questionnaire survey was performed. The objectives were to assess the psychosocial impact of current voice complaints as perceived by the student teachers with voice complaints in comparison to student teachers without voice complaints, and to observe the pattern of risk factors in relation to the voice handicap. Subjects in the general population without a voice demanding profession were selected as a reference group for limited comparison with the total group of student teachers (future professional voice users). Among the student teachers, 17.2% reported current voice complaints in comparison to 9.7% of the reference group and the Odds Ratio was 1.94, which showed the relative risk. Student teachers had significantly greater total VHI scores than the reference group ($p = 0.034$). The VHI subscale scores were not significantly different ($p > 0.05$). Student teachers with current voice complaints were observed to have significantly higher total VHI and subscale scores than student teachers who did not report voice complaints ($p < 0.001$). Of the student teachers who did not report a voice complaint 17.0% had a VHI score greater than the 75th percentile. These individuals may have been neglecting the voice handicap and probably represent the false negative cases in the estimation of voice complaints. Logistic regression analysis of each of the given risk factors with the VHI as the independent variable showed that the perceived negative influence of the given risk factors on their voices was observed to be significantly greater with increasing VHI scores across the VHI range. A significant correlation was observed between number of perceived risk factors and increasing voice handicap index scores across the VHI range. An increased awareness of the risk factors in relation to their voice handicap would serve to motivate student teachers to change factors that contribute to their voice problem. Attention to all the risk factors, which the subjects perceive to be a risk would aid in effective management of the voice handicap.

Introduction

Voice problems have been observed to have a significant psychological, social, physical, occupational and communicational impact on an individual.[1-6] Professional voice users are those who depend on the voice for their occupation[7-9] and studies have associated professional voice use with a high risk for voice disorders.[10-12] Additionally, voice problems in professional voice users have been

observed to frequently lead to work related problems and absenteeism.[3,7,12-14] The term handicap has been used in literature. The World Health Organization defined handicap as a restriction of participation in an activity that is normally performed by the individual.[15] The term handicap indicates a social, economic or environmental disadvantage, resulting from an impairment or disability.[15,16] With regard to voice disorders, this has been interpreted as a reduction or avoidance of voice activities by the individual, which results in an occupational or economic consequence.[6] Clinical laryngeal examination and voice analysis cannot assess the degree of handicap that a person has or what the individual perceives as a result of a voice disorder.[2,17-19] The Voice Handicap Index was developed and validated by Jacobson et al.[2] to quantify the psychosocial consequences of voice disorders and it was developed using a diverse sample of patients with voice disorders, representing the breadth of pathology in most clinical settings. The Voice Handicap Index inventory consists of 30 statements, that describe the psychosocial impact of a subject's voice (problem). The inventory is grouped into three domains that represent functional (F), emotional (E) and physical (P) aspects of voice, each consisting of 10 statements. Each statement is rated on a 5 point ordinal scale with the following values: 0= never, 1= almost never, 2=sometimes, 3=almost always, 4=always. The total VHI score ranges from 0 (no problem perceived) to 120 and three sub-scale scores, functional (F), physical (P), and emotional (E). The VHI has been proven to be a statistically robust instrument and it has been psychometrically validated with strong internal consistency, reliability, and test-retest stability.[2,4,5] Investigators have confirmed that VHI is a useful instrument to quantify the psychosocial consequence of voice disorders and it is an excellent tool to assess subjective voice problems.[2,4,5,17,19,20] The Voice Handicap Index (VHI) apart from representing the subjective perception of disability, handicap and distress resulting from voice difficulties, gives an indication of the quality of life status of the student teachers in relation to their voice problem.[2]

Teachers have been observed to report a higher rate of voice problems compared to professionals in other occupations, and they are considered among those at greatest risk for vocal disability.[3,6,12,14,21] Voice disorders are observed to have a multi-factorial genesis.[22-24] Voice load,[3,24-27] environmental factors,[23,26,28,29] physical factors[10,24,30,31] and psycho-emotional factors[10,11,13,26,30,32-38] are known to have a negative influence on the voice and cause voice problems.
Student teachers are embarking on the teaching profession and they need to be prepared to meet the, stress, work pressure, communicative, physical and vocal

demands of teaching during the training period. For effective voice rehabilitation and prevention of voice problems, it would be useful to know the impact of the voice problem and the risk factors, which may contribute to it.

The objectives of the study are to assess the psychosocial impact of current voice complaints as perceived by the student teachers in comparison to student teachers without voice complaints, and to explore risk factors perceived to have a negative influence on the voice in relation to the perceived voice handicap.

Methods

Subjects

Student teachers for primary education were selected for the study. Subjects in the general population without a voice demanding profession were included as reference group.

Questionnaire survey

The pertinent study was part of a larger epidemiological cross sectional questionnaire survey (anonymous) study among student teachers and teachers. The subjects for the reference group were recruited from the general population as a sample of convenience, i.e. quasi randomly. For recruitment of the students the directors of teacher training schools were approached and the objectives of the study were explained. The directors distributed the questionnaires among the student teachers. The questionnaires required, were estimated according to the number of student teachers. A covering letter was attached to the questionnaire explaining the aims and objectives of the study and it was accompanied by instructions on how to fill out the questionnaire, (Appendix A 1) for the student teachers and (Appendix A 2) for the general population. In the design of the questionnaire, data from the literature[3,29] and clinical experience of the voice team of the department of ORL, Radboud University Medical Centre were taken into consideration. Additionally, comments and suggestions from workers in the teaching profession were used to formulate the questions.

The general questionnaire was tested previously in studies among teachers and the general population.[39,40] The questionnaire consists of 37 questions (Appendix D). The questions that pertain specifically to the teaching profession were modified for the general population group (Appendix E). Question B 6 addresses voice complaints at the present moment and is indicated as “current voice complaints” in

the pertinent study. The various questions pertaining to perceived risk for voice complaints and absence from work due to voice problems were categorized into four groups with regard to vocal load, physical factors, psycho-emotional factors and environmental factors. The responses in these four groups were dichotomised. Question A 5 addresses specifically the number of hours of vocal use per week in the context of study. The results were dichotomized into less than 20 hours of voice use per week, and 20 or more hours of voice use per week. In questions E 26-37 the response 0 and 1 were classified as negative and the responses 2, 3 and 4 as positive.

The Dutch version of the Voice Handicap Index[4] was added to the questionnaire (Appendix G). The questionnaires were anonymously collected from the students at the school, and returned. The subjects from the general population returned the questionnaires by pre-paid envelopes.

Statistics

The data was analysed with the statistical program SPSS 12. For discrete outcome variables Chi-square tests were used. Odds Ratios were used to quantify the dependency in 2 x 2 tables. One-Sample, 2-tailed Kolmogorov-Smirnov (K-S) tests were applied in order to determine if continuous outcome variables were distributed normally. For continuous outcome variables that were normally distributed, t-tests were used and for continuous outcome variables that were not normally distributed, Mann-Whitney U (M-W U) tests were used. Spearman`s rho was used for nonparametric correlations. The significance level was set at $p \leq 0.05$. Logistic regression was used to test the relation between the VHI and whether or not a given risk factor was deemed important.

Results

Subjects

The questionnaires of 457 female student teachers and 144 female subjects from the general population could be analyzed. Among the general population 67.4% reported not having a voice demanding profession (question A 3 of the questionnaire for general population) and only these 94 subjects were selected for the study as reference group. The mean age of the female student teachers was 20 years and the mean age of the females in the general population was 32 years. As the age of the subjects was not-normally distributed the medians were

assessed. The median age (range) of the student teachers was 19 (16 - 48) years. The median age (range) of subjects in the reference group was 31.5 (17 - 49) years.

Current voice complaints / Voice handicap

The prevalence of current voice complaints among student teachers was 17.2% (75 student teachers) and among the reference group 9.7% (9 subjects). Because of the low sample size of the subjects with current voice complaints in the reference group and consequently low power, the Chi-Square test was not performed. The Odds Ratio was observed to be 1.94 (95% confidence interval 0.93 – 4.03).

The scores of the total VHI and VHI subscales were not-normally distributed (Kolmogorov-Smirnov tests: $p < 0.001$). It was observed that student teachers had significantly higher total VHI scores compared to the reference group (Table 1). The VHI subscale scores were found to be not significantly different.

Table 1. The total VHI and VHI subscale scores of student teachers, and the general population without a voice demanding profession. VHI = Voice Handicap Index; IQR = inter-quartile range.

VHI	Subjects	VHI scores Median (IQR)	Mann-Whitney U
Total VHI	Student teachers	8 (11.0)	$p < 0.034$
	General population	6 (10.3)	
Functional subscale	Student teachers	3 (4.0)	$p < 0.854$
	General Population	3 (4.0)	
Emotional subscale	Student teachers	1 (3.0)	$p < 0.107$
	General population	0 (2.0)	
Physical subscale	Student teachers	4 (6.0)	$p < 0.059$
	General population	3 (5.3)	

Student teachers that reported current voice complaints were observed to have significantly higher total VHI scores and VHI subscale scores than student teachers that did not report voice complaints (Table 2).

The fourth quartile, i.e. the scores greater than the 75th percentile VHI score, represents the group with a relatively high voice handicap. In the total group of student teachers, the 75th percentile VHI score was 15. Among the student teachers that reported current voice complaints, 61.3% had VHI scores greater than the 75th percentile, in comparison to 17.0% of student teachers that did not report a current voice complaint ($p < 0.001$; Odds Ratio: 7.75; 95% Confidence Interval 4.52 – 13.30).

Table 2. The total VHI and VHI subscale scores of student teachers with and without current voice complaints. VHI = Voice Handicap Index; IQR = inter-quartile range.

VHI of Student teachers	Current voice complaints (No/Yes)	VHI scores Median (IQR)	Mann-Whitney U
Total VHI	No voice complaints	7 (9)	$p < 0.001$
	Current voice complaints	21 (21)	
Functional subscale	No voice complaints	2 (3)	$p < 0.001$
	Current voice complaints	5 (5)	
Emotional subscale	No voice complaints	1 (3)	$p < 0.001$
	Current voice complaints	3 (7)	
Physical subscale	No voice complaints	3 (5)	$p < 0.001$
	Current voice complaints	11(14)	

Risk factors perceived to have a negative influence on the voice, and the VHI

The results were based on the subjective opinions of the student teachers. The factors that were perceived to be a risk for voice problems were examined in relation to the VHI scores.

Logistic regression analysis of each of the given risk factors with the VHI as the independent variable showed that the perception that the given risk factors were a negative influence on the voice was significantly greater with increasing VHI scores across the VHI range (Table 3). All Odds Ratios were significantly greater than 1, and were assessed using 95% confidence intervals.

Table 3. Logistic regression analysis of each of the given risk factors with the VHI as the independent variable showed that the perceived negative influence of the given risk factors on their voices was observed to be significantly greater with increasing VHI scores across the VHI range. The Odds Ratios were observed to be greater than 1.0 and within the 95.0% confidence interval (CI-lower, CI-upper).

Risk factors, VHI Logistic regression	Significance ($p \leq 0.05$)	Odds Ratio	CI-lower	CI-upper
VOCAL LOAD				
Intensive use	= 0.004	1.05	1.01	1.08
Voice use ≥ 20hrs	= 0.024	1.03	1.00	1.06
No.of people	< 0.001	1.07	1.05	1.10
Voice load neg.	< 0.001	1.13	1.09	1.16
PHYSICAL				
Throat clearing.	< 0.001	1.05	1.03	1.08
Neck/shoulder	< 0.001	1.10	1.05	1.15
Lower back	< 0.001	1.06	1.04	1.09
Mucosa	< 0.001	1.07	1.05	1.10
General	< 0.001	1.05	1.03	1.07
Hearing	< 0.005	1.03	1.01	1.05
ENVIRONMENT				
Acoustics	< 0.001	1.07	1.05	1.09
Noise	< 0.001	1.12	1.08	1.15
Humidity	< 0.001	1.08	1.06	1.11
Temperature	< 0.001	1.08	1.05	1.10
Irritants	< 0.001	1.05	1.03	1.07
PSYCHO-EMOT				
Stress	< 0.001	1.04	1.02	1.06
Emotion	= 0.004	1.03	1.01	1.05
Composition	< 0.001	1.06	1.04	1.08
Work pressure	< 0.001	1.04	1.02	1.07

Abbreviations

VOCAL LOAD: Intensive use: Do you use your voice intensively? Voice use ≥ 20hrs: Voice use for 20 hours or more in the context of study. No.of people: Does the number of people you communicate with have a negative influence on your voice? Voice load neg.: Voice load has a negative influence on your voice?

PHYSICAL: Throat clearing: You have a tendency to clear your throat and cough? Neck/shoulder: Problems with neck or shoulders have a negative influence on your voice? Lower back: Problems with lower back have a negative influence on your voice? Mucosa: Problems with mucosa have a negative influence on your voice? General: Deterioration of general physical condition has a negative influence on your voice? Hearing: Decrease of hearing has a negative influence on your voice?

ENVIRONMENT: Acoustics: Bad acoustics in the room you speak has a negative influence on your voice? Noise: Noise in the room you speak has a negative influence on your voice? Humidity: Dry or moist air in the room you speak has a negative influence on your voice? Temperature: Changes of temperature in the room you speak has a negative influence on your voice? Irritants: Irritants in the room you speak have a negative influence on your voice?

PSYCHO-EMOT: Stress: Stress has a negative influence on your voice? Emotion: Emotion has a negative influence on your voice? Composition: Composition of the group has a negative influence on your voice? Work pressure: High work pressure has a negative influence on your voice?

A positive relation between the number of perceived risk factors mentioned and the VHI was also found (see Figure 1). The (nonparametric) correlations were found to be highly significant: 0.528 ($p < 0.001$).

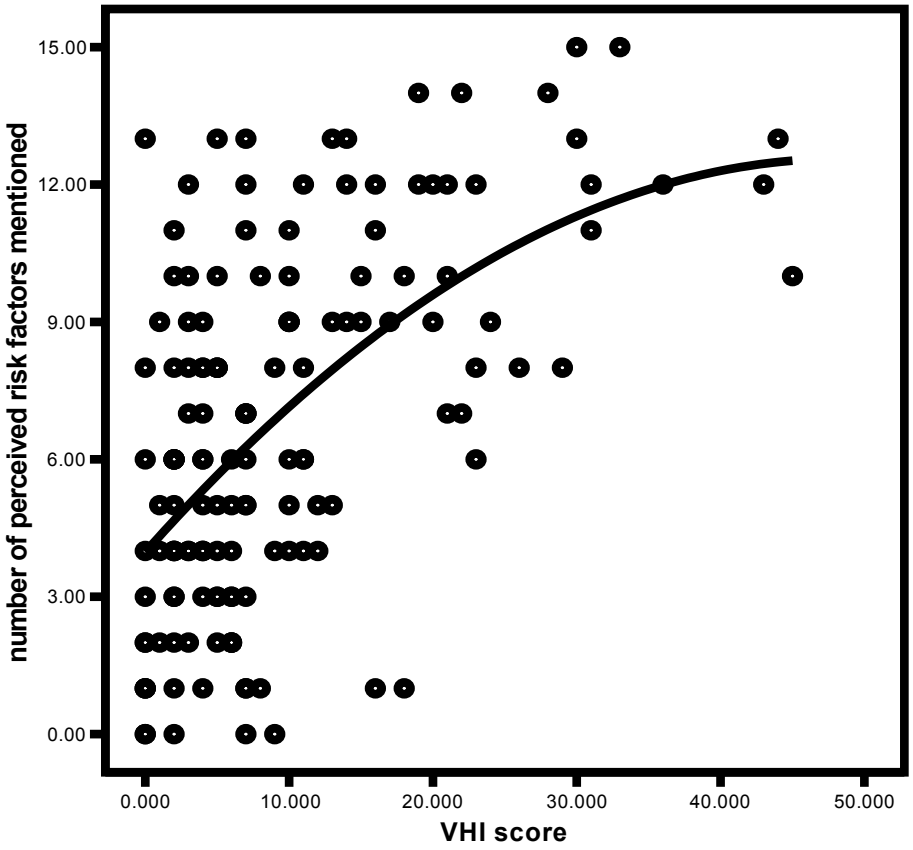

Figure 1. X-axis: VHI scores, Y-axis: the number of perceived risk factors mentioned. The graph depicts increasing number of perceived risk factors for voice problems with increasing VHI scores.

Discussion

General

The pertinent study was part of a larger project among student teachers and teachers. For the present study only female subjects were selected for the study, as voice problems are known to be more common in females than males.[21,39,41,42]

Reporting current voice complaints

Teachers have been found to be at a higher risk of voice problems than the general population.[10,21,42,43]. The findings of this study are also on these lines, since the relative risk for voice complaints appears to be greater for student teachers than the reference group in the general population (Odds Ratio 1.97).

It is worrisome that more than 17 percent of the student teachers reported current voice problems. This is probable due to the fact that the student teachers are training for a voice demanding profession and it may reflect their reliance on the voice and increased voice usage evening during the training period. Also it indicates that adequate care for the future professional voice is obvious.

Voice handicap

The impact of a voice problem has been found to be in relation to daily functioning, living and quality of life [2]. The psychosocial impact of voice and voice problems can be assessed with the Voice Handicap Index.[2,4,17,19,44] It was observed that the student teachers had a significantly higher total VHI score than the general population without a voice demanding profession, 8 and 6 respectively. The probable reasons for this are that student teachers reported voice problems more frequently and that they are training for a vocally demanding profession. Consequently, voice has a greater psychosocial impact. These findings may also indicate that student teachers are more concerned and bothered about their voice. Student teachers who reported current voice complaints were observed to have a significantly higher VHI scores compared to student teachers without voice complaints. The results revealed that the psychosocial impact of the voice of student teachers with voice complaints was significantly greater than student teachers without complaints.

Jacobson et al.[2] developed the Voice Handicap Index in 1997. They recruited 65 patients with various voice disorders at the voice clinic; mass lesions: 32%, neurogenic: 26%, laryngectomy: 26%, musculoskeletal tension; 8%, inflammatory: 5%, and atypical: 3%.[2] The VHI scores in relation to the voice disorder severity assessment ranged from mild: mean 33.69, moderate: mean 44.37, to severe: mean 61.39.[2] The mean VHI scores were estimated but Jacobson et al.[2] did not mention the type of distribution of the VHI scores in their study. In the pertinent study, the total VHI scores and VHI subscale scores were not-normally distributed. The mean of the VHI scores have also been estimated in most other studies. A study among future occupational voice users (students for audiovisual communication) revealed a mean VHI score of 21.2 and was reported to be high[20] in comparison to a study by De Bodt et al.,[4] which reported a mean score of 4.7 for subjects with normal voices. De Jong et al.[38] reported not-normally distributed VHI scores in a group of teachers with persistent voice problems and a history of absence from work due to voice problems. In this group a high median VHI score of 70 was found in comparison to a median VHI score of 3 in teachers with no voice problems. In line with the study of De Jong et al.,[38] in the present study the

median VHI scores were estimated and non-parametrical tests were applied as the VHI scores were not-normally distributed. The findings raise questions how the VHI scores in the various mentioned studies were distributed, normally or not-normally, and whether the mean or median scores should have been taken into account. These methodological issues hamper a solid comparison between the various studies.

The 75th percentile VHI score was used as a level of reference and the fourth quartile of the VHI range represents the student teachers with a relatively great voice handicap. In this quartile, the odds for having a current voice complaint, was observed to be 7.75. It is of concern to notice that among the student teachers that did not report a voice complaint, 17.0% had a VHI score greater than the 75th percentile. These student teachers appear to have a relatively considerable voice handicap but did not report a current voice complaint. This raises a question whether these student teachers are neglecting their voice problems or that they may not be aware of the consequences of voice problems in the teaching career. This shows a parallel with the study of Timmermans et al.[20] among future professional voice users. They used a questionnaire on daily habits by which the prevalence of smoking, eating habits and vocal abuse were recorded. It was observed that future professional voice users did not take sufficient care of their voices, even though they had been informed about these bad habits.[20] Jacobson et al.[2] observed that subjects were often unaware of the severity of their voice problems until completing the VHI and also found that when patients understood the implications of their voice problem in the context of daily living and functioning they were more likely to work towards changing the factors that contributed to the development of their dysphonia. Awareness of the presence, severity and implication of voice problems may be considered as a “turning point” that has been described in the “psychological cascade model” for persisting voice problems in teachers.[38] Awareness of their voice problems can release student teachers from a vicious circle of (future) voice problems and problem maintaining factors. At this “turning point” they are ready to cope with the voice problem and are on the way to prevention or recovery of a voice problem.[38] Further research efforts are required to evaluate the student teachers with voice complaints and the group of apparent “false negative” cases by non-anonymous questionnaires combined with clinical examination, speech evaluation and a long-term follow-up of their voice qualities.

Measurement of voice handicap should take into account not only physical aspects but also emotional, and functional consequences of a voice problem.[2,4,17,19] The physical subscale represents the self-perceptions of laryngeal

discomfort and voice output, the emotional subscale of the VHI represents the affective responses to a voice disorder, and the functional subscale of the VHI includes statements that describe the impact of a persons voice disorder on daily activities.[2] It is remarkable that no significant difference was observed in the VHI functional, emotional and physical subscale scores between the student teachers and the general population without a voice demanding profession, while the total VHI was significantly greater in the student teachers. The finding may suggest that voice problems have a nearly equal impact psycho-emotionally, physically and on the daily functions in both groups. The total voice handicap is the outcome of the combination of these three aspects. The functional, emotional and physical subscale scores were observed to be significantly greater in student teachers with current voice complaints than student teachers without voice complaints. Focusing only on voice technique training may not be sufficient in the management of voice problems in student teachers, and should involve psychosocial rehabilitation and coping methods.

Risk factors perceived to have a negative influence on the voice in relation to the voice handicap of student teachers

Previous studies have described and discussed risk factors for voice problems in teachers.[3,10,13,27,42] In the pertinent study, risk factors for voice problems[29,35,39,40] were categorized into four groups with regard to voice loading factors, physical factors, psycho-emotional factors and environmental factors. The used self-report inventory contains questions pertaining to factors that are perceived as risk factors for voice problems by the individuals.[24,29,39,40] It is of interest and value to examine risk factors that are perceived to have a negative influence on the voice in relation to the perceived voice handicap. This would contribute in taking adequate remedial measures and ensure that student teachers start their careers with an optimal vocal health not only physically but also psychosocially.

Studies have demonstrated that the voice disorders have a multi-factorial genesis.[3,10,13,23,24,27,42,45-47] The findings of the pertinent study showed that the perception that the given risk factors were a negative influence on the voice was significantly greater with increasing VHI scores across the VHI range. This suggests that student teachers maybe more aware of the potential risk factors when they experience a voice handicap, and apparently the awareness is greater as the handicap increases.

A significant correlation was found between the number of perceived risk factors mentioned and increasing VHI scores (see Figure 1). This indicates that management of voice problems and the associated handicap should be multidimensional, and should also consider all the risk factors, which the subjects perceive to be a risk. In the lower range of the VHI, it could be assumed from the relative lower VHI scores that these student teachers may not be severely handicapped due to their voice problem. The findings (Figure 1) suggest that student teachers may be exposed to potential risk factors, which they perceive to be a negative influence on their voice even when the voice handicap is not severe or considerable. Vocal loading calls for more voice training to cope with the vocal demands of teaching, and psycho-emotional risk factors brings to attention the need to impart coping methods during the training period. Screening and management of physical factors, and monitoring of the classroom environment would also be useful in preventive vocal health care.

An increased awareness of the risk factors in relation to their voice handicap would serve to motivate student teachers to change factors that contribute to their voice problem. This may prevent persistence of voice problems into their teaching career. Further research is required to ascertain which set or combination of risk factors are the most discriminating for a greater voice handicap, and would help to provide more efficient preventive vocal health care. Efforts to reduce or eliminate risk factors for voice problems probably will serve to reduce the psychosocial impact of voice problems in student teachers.

Conclusions

Student teachers apparently have a relative high risk for voice problems and a significantly greater voice handicap compared to the general population without a voice demanding profession. Within the group of student teachers, subjects that reported current voice complaints were observed to have a significantly higher VHI score compared to subjects without voice complaints. A proportion of student teachers with a VHI score greater than the 75^{th} percentile did not report a current voice complaint, which probably represents the false negative cases when estimating voice complaints. The VHI would thus be valuable as a screening tool. Student teachers appear to be more aware of the potential risk factors for voice problems when they experience a voice handicap, and the awareness apparently is greater with increasing handicap. Management of the handicap due to voice

problems should be multidimensional, and should consider all the risk factors, which the subjects perceive to be a risk.

References

1. Smith E, Verdolini K, Gray S, Nichols S, Lemke J, Barkmeier J et al. Effect of voice disorders on quality of life. J Med Speech-Lang Pathol 1996; 4: 223-244.
2. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): Development and Validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
3. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
4. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
5. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An Evaluation of the Effects of Two Treatment Approaches for Teachers With Voice Disorders: A Prospective Randomized Clinical Trial. J Speech Lang Hear Res 2001; 44: 286-296.
6. Yiu EM-L. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
7. Titze IR, Lemke JH, Montequin D. Populations in the U.S. workforce who rely on voice as a primary tool of trade: a preliminary report. Journal of Voice 1997; 11: 254-259.
8. Koufman JA, Isaacson G. Voice disorders. Philadelphia: WB Saunders; 1999.
9. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague: Kugler Publications, 2001, pp 81-100.
10. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica. 1993; 45: 120-129.
11. Sapir S.Vocal attrition in voice students: survey findings. Journal of Voice. 1993; 7: 69-74.
12. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
13. Sapir S, Keidar A, Van Velzen D. Vocal attrition in teachers: survey findings. Europ J Disord Commun 1993; 28: 177-185.
14. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
15. World Heath Organization. International classification of impairment, disability and handicap-Beta 2: A manual of dimensions of disablement and participation. Geneva: World Health Organization; 1997.
16. World Health Organization. International classification of impairment, disability and handicap. Geneva: World Health Organization; 1980.
17. Murry T, Rosen CA. Outcome measurements and quality of life in voice disorders. Otolaryngol Clin North Am 2000; 33: 905-916.
18. Murry T, Rosen CA. Occupational voice disorders and the Voice Handicap Index; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 113-128.
19. Rosen CA, Murry T, Zinn A, Zullo T, Sonbolian M. Voice handicap change following treatment of voice disorders. Journal of Voice 2000; 14: 619-623.
20. Timmermans B, De Bodt MS, Wuyts FL, Boudewijns A, Clement G, Peeters A, Van de Heyning PH. Poor voice quality in future elite vocal performers and professional voice users. Journal of Voice 2002; 16: 372-382.
21. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-479.
22. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.
23. Vilkman E. Occupational risk factors and voice disorders. Logopedics Phoniatrics Vocology 1996; 21: 137-141.

24. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia: myth or reality? in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 101-112.
25. Masuda T, Ikeda Y, Manako H, Komiyama S. Analysis of vocal abuse: fluctuations in phonation time and intensity in 4 groups of speakers. Acta Otolaryngol (Stockholm) 1993; 113: 547-552.
26. Buekers R. Voice performances in relation to demands and capacity. PhD thesis. University of Maastricht, The Netherlands, 1998.
27. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behaviour and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
28. Hemler RJ, Wieneke GH, Dejonckere PH. The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. Journal of Voice 1997; 11: 295-300.
29. Verdolini K, Ramig LO. Review: Occupational risks for voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
30. Morrison, MD, Rammage LA. Muscle misuse voice disorders: description and classification. Acta Otolaryngologica 1993; 113: 428-434.
31. Angsuwarangsee T, Morrison M. Extrinsic laryngeal muscle tension in patients with voice disorders. Journal of Voice 2002; 16: 333-343.
32. Morrison M, Nichol H, Rammage L. Diagnostic criteria in functional dysphonia. Laryngoscope 1986; 94: 1-8.
33. House A, Andrews H. The psychiatric and social characteristics of patients with functional dysphonia. J Psychosom Res 1987; 31: 483-490.
34. Butcher P, Elias A, Raven R, Yeatman J, Littlejohans D. Psychogenic voice disorder unresponsive to speech therapy: psychological characteristics and cognitive behaviour therapy. Br J Disord Commun 1987; 22: 81-92.
35. Sundberg J. The Science of the Singing Voice. Dekalb, IL: Northern Illinois university press; 1987: 146-156.
36. Long G. The measurement of stress by voice analysis. J Soc Behav Person 1990; 5: 723-731.
37. Green G. Psycho-behavioural characteristics of children with vocal nodules. WPBIC ratings. J Speech Hear Disord 1989; 54: 306-12.
38. Jong FICRS de, Cornelius BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A Psychological Cascade Model for Persisting Voice Problems in Teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
39. Jong, FICRS de, Kooijman PGC, Thomas G, Huinck WJ, Graamans K, Schutte HK. Epidemiology of voice problems in Dutch teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
40. Kooijman PGC, Jong FICRS de, Thomas G, Huinck WJ, Donders R, Graamans K, Schutte HK. Risk factors for voice problems in teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
41. Dejonckere PH. Gender differences in the prevalence of occupational voice disorders; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 11-20.
42. Roy N, Merrill RM, Thibeault S, Parsa RA, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. J Speech Lang Hear Res 2004; 47: 281-293.
43. Herrington-Hall BL, Lee L, Stemple JC, Niemi KR, McHone M. Description of laryngeal pathologies by age, sex, and occupation in a treatment seeking sample. J Speech Hear Disord 1988; 53: 57-64.
44. Benninger MS, Ahuja AS, Gardner G, Grywalski C. Assessing outcomes for dysphonic patients. Journal of Voice 1998; 12: 540-550.
45. Morton V, Watson DR. The teaching Voice: Problems and Perceptions. Logopedics Phoniatrics Vocology 1998; 23: 133-139.
46. Thibeault SL, Merrill RM, Roy N, Gray SD, Smith EM. Occupational risk factors associated with voice disorder in teachers. Annals of Epidemiology 2004; 14: 786-792.
47. Vilkman E. Occupational safety and health aspects of voice and speech professions. Folia Phoniatrica et Logopaedica 2004; 56: 220-253.

Chapter 7

UTILITY OF THE TYPE-D SCALE-16 (DS16) AND VOICE HANDICAP INDEX (VHI) TO ASSIST VOICE CARE IN STUDENT TEACHERS AND TEACHERS

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Abstract

An epidemiological cross sectional survey study was performed among female student teachers and teachers for primary education, using a general questionnaire, the Type-D Scale-16 (DS16) and Voice Handicap Index (VHI) questionnaires. Type-D personality is the combination of high "negative affectivity" and high "social inhibition", and the DS16 scale has been considered to be a reliable and valid measure of these two stable personality traits, which determine the Type-D personality. The objectives of the study were to assess the Voice Handicap Index of Type-D subjects in comparison to non-Type-D subjects, to explore the utility of the DS16 and the VHI to assess if subjects of the Type-D personality were more handicapped due to their voice complaints, and whether they behaved differently in seeking voice care. It was investigated whether subjects of the Type-D group in comparison to the non-Type-D group had a voice handicap even when they did not report voice complaints. The Type-D group did not report more voice complaints than the non-Type-D group. However, the Type-D group had higher VHI scores than the non-Type-D group. Furthermore, significantly more Type-D subjects had a VHI score greater than 75th percentile than the non-Type-D subjects, and they sought less voice care than the non-Type-D subjects. Also among subjects who reported voice complaints, the Type-D group sought less care than the non-Type-D group. Even among the subjects who did not report voice complaints, significantly more Type-D subjects than non-Type-D subjects had VHI scores higher than the 75th percentile. The findings indicated that Type-D subjects were apparently more bothered by their voice than the non-Type-D subjects (high VHI scores), however, they did not report more voice complaints and they also sought less voice care. The DS16 used along with the VHI, were useful to identify subjects of the Type-D trait with a voice handicap. This enables specific voice care, encompassing not only physical but also psychosocial aspects of vocal health.

Introduction

Voice disorders have been observed to be common among teachers during their training.[1-3] This is alarming and it is important that student teachers embarking on a vocally demanding teaching profession have a fully functional and optimal voice.[3,4] Voice therapy currently has predominantly focussed on decreasing the vocal load and improving the vocal behaviour,[5-9] however voice problems in

teachers remain a major problem.[10-19] Voice problems have been seen to have significant negative impacts on the physical, psychological, occupational, social spheres of an individual.[1,20] This raises the question whether voice care apart from restoring and increasing the physical vocal capacity and vocal endurance should expand to include other domains.

There are physical, cognitive, behavioural and psychosocial issues relevant to the assessment of vocal health and management of voice problems.[1,4,20-22] A multidimensional approach to voice care (physical, mental, social) probably may be valuable to improve the vocal health of teachers and reduce voice complaints in teachers and its consequences. Personality has been observed to also have a role in voice disorders.[23-25] Research about personality scales in relation to voice problems in teachers is a new area of study. There are reports that psycho-emotional factors are also associated with some voice problems.[4,11,12,15,21,26-28] Certain studies have suggested that personality traits and psychological factors may even influence the ability of the voice to withstand a voice demanding profession.[26,27,29,30] Personality has also been linked to important life outcomes.[31,32] Type-D personality is the combination of high “negative affectivity” and high “social inhibition”.[32, 33] Negative affectivity denotes the stable tendency to experience negative emotions across time and situations, and has been seen to be associated with emotional distress, including anxiety and depression.[34,35] Social inhibition denotes the stable tendency to inhibit the expression of emotions and behaviours in social interaction.[32,36] The DS16 questionnaire described by Denollet et al.[32] is considered to be a reliable and valid measure of these two basic personality traits which determine the Type-D personality.[32,37] The Type-D has been conceptualised as a marker of general emotional distress, anxiety and has been associated with post-traumatic stress disorder.[37] The Type-D personality has also been associated with increased risk of depression, vital exhaustion and social alienation.[37] Denollet et al.[32,33] observed that patients with coronary heart disease who had a Type-D personality had more cardiac events, deaths and incidence of cancer compared to other patients. Investigators of the Type-D personality have emphasized the role of normal personality characteristics in coronary heart disease rather than psychopathology.[32,37] The Type-D personality was not considered as an aetiological risk factor for coronary heart disease but as a poor prognostic factor in those with confirmed coronary heart disease.[32,37] The poor prognosis of Type-D cardiac patients was observed to be independent of traditional biomedical risk factors.[37] This raises questions whether Type-D subjects with voice problems would also have a poorer prognosis than non-Type-D

subjects. It has been observed that the impact of voice problems on an individual also depends on how an individual perceives and reacts to the problem.[1] Therefore, it would be interesting to assess whether there is a difference in the perception and report of voice problems as well as seeking of voice care between Type-D and non-Type-D subjects. These factors may have an influence on the prognosis of a voice problem.

The aims of the study are to assess the Voice Handicap Index of Type-D subjects in comparison to non-Type-D subjects, to explore the utility of the DS16 and the VHI to assess if subjects of the Type-D personality are more handicapped due to their voice complaints, and whether they behave differently in seeking voice care. It is investigated whether subjects of the Type-D group in comparison to the non-Type-D group have a voice handicap even when they do not report voice complaints.

Methods

An epidemiological cross sectional survey study was done among student teachers and teachers for primary education as part of a larger project. In the pertinent study only females among the student teachers and teachers were assessed because voice disorders in general, and occupational voice disorders in particular, have been observed to occur more frequently and to a larger degree in women than in men.[10,13,38,39]

The questionnaires included a general questionnaire, the Type-D Scale-16 (DS16) and Voice Handicap Index (VHI). Directors of teacher training schools for primary education and schools for primary education were approached and they were asked to distribute the questionnaires to student teachers and teachers. A covering letter was attached to the questionnaire, which explained the aims and objectives of the study. The questionnaires were accompanied by instructions on how to fill out the questionnaire ((Appendix A 1). The questionnaires were completed anonymously and returned.

The Type-D group has been observed to be around 25% of the population.[32,37] In the present study the Type-D group was 28.4% of the population. Furthermore, investigators have observed that the Type-D distribution was not significantly different in those with cardiac complaints and those without complaints.[32,33,37] In the present study there was no significant difference ($p = 0.755$) in the distribution of Type-D subjects (243) in the group with voice complaints (101) and without

voice complaints (142) and was representative. The strength of the study is the large number of subjects. Furthermore, the anonymous response to the questionnaire is likely to have encouraged honest responses from the subjects. A total of 457 questionnaires from female student teachers and 475 questionnaires from female teachers from primary education were assessed.

The questionnaire was designed using information from literature,[4,11-13,15,21] suggestions from teachers, and the clinical experience of the voice team of the Department of Oto-Rhino-Laryngology of the Radboud University Nijmegen Medical Centre.
The general questionnaire (Appendix B) was previously tested in studies among teachers.[39,41] Certain questions were modified for the student teachers where applicable (Appendix D). Unlike the Voice Handicap Index and DS-16 questionnaires, which are measurement scales, in the general questionnaire the questions were assessed individually. The subjects were asked questions in relation to their voice problems.
The term “voice complaints” was defined as voice complaints at the moment and / or during the past year. This was based 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?). This selection avoided exclusion of subjects who may not have had voice complaints at the time of the survey but who had voice complaints in the recent past. The one-year period prevalence has been reported to be a more reliable measure than the two-year prevalence.[16] The questions allowed student teachers to decide for themselves whether or not they had a voice problem. This selection could have excluded certain subjects with a voice problem and on the other hand could have included subjects with mild or even no voice problems. The use of the VHI (Appendix G) provided an opportunity to check whether subjects who reported voice complaints were in fact handicapped due to their voice problem when compared to subjects who did not report a voice complaint.

Subjects filled out the Voice Handicap Index (VHI)(Appendix G), which was designed to quantify the self-perceived psychosocial consequences of voice disorders.[42,43] It consists of 30 questions in total. The questions cover emotional (10), physical (10) and functional (10) aspects of the voice. The questions were rated according to a five point ordinal scale: never (0), almost never (1), sometimes (2), almost always (3) and always (4). The total score ranges between

0 and 120. In this study the Dutch version of the Voice Handicap Index was used.[43]

Personality Type-D was assessed using the DS16 questionnaire, which was developed as a scale to measure negative affectivity (the tendency to experience negative emotions) and social inhibition (the tendency to inhibit self-expression in social interaction).[32,37] The subjects were asked to fill the DS16 list (Appendix H) which is a brief self-report measure comprising an eight item negative affectivity and an eight-item social inhibition scale.[32] The subjects were instructed to encircle a number next to the appropriate statement, to indicate an answer. The subjects described how they felt and there were no right or wrong answers. The response was on a 5 point scale: false (0), rather false (1), neutral (2), rather true (3), true (4). Using this data a Type-D classification was made.[32] Subjects who scored high on both negative affectivity and social inhibition, as determined by a median split were classified as the Type-D group.[32, 37]

Statistical analysis

The data was analysed using the statistical program SPSS 12.0. For discrete outcome variables Chi-square (Chi-sq.) tests were used. Odds Ratios (OR) were used to quantify the dependency in 2 x 2 tables and indicated the number of times one group was more likely to have a certain outcome than the other group.

One-Sample, 2-tailed Kolmogorov-Smirnov (K-S) tests were applied in order to determine if continuous outcome variables were distributed normally. For continuous outcome variables that were normally distributed, t-tests were used. For continuous outcome variables that were not normally distributed, Mann-Whitney U (M-W U) tests were used. The significance level was set at $p \leq 0.05$.

Results

Subjects and selection of Type-D and non-Type-D groups

The questionnaires of 457 female student teachers and 475 female teachers were analysed. Age was not normally distributed (K-S: < 0.001); the median age (years) was 25, inter quartile range 19-42. In the total population the scores of negative affectivity were not normally distributed (K-S: $p < 0.001$), while those of social inhibition were distributed normally (K-S: $p = 0.063$). The negative affectivity and social inhibition scores did not differ significantly between the students and teachers (M-W U: $p = 0.932$ and t-test: $p = 0.201$, respectively). The subjects were classified as “group Type-D” if they had a score higher than the median of both

"negative affectivity" and "social inhibition" (6 and 12, respectively).[32,37] This resulted in 28.4 % (249/876) of the total population as the Type-D group and 71.6 % (627/876) as the non-Type-D group. The pooled group breakdown showed 119 student teachers and 130 teachers as the Type-D group (Chi-sq.: p = 0.486).

VHI of total group of Type-D and non-Type-D subjects

The Voice Handicap Index (VHI) scores were not normally distributed in the total population (K-S: p < 0.001). Therefore, the median of the VHI scores was estimated, measuring 7.5 (the 25th percentile score was 3 and the 75th percentile was 16).

The group of subjects with the most severe voice handicap was determined as having a VHI score > 75th percentile, i.e. < 25 % of the total population.

Type-D and non-Type-D subjects with VHI scores > 75th percentile

A significantly greater percentage of the Type-D group (32.4 %, 77/238) belonged to the group with the most severe voice handicap than the non-Type-D group (21.0 %, 126/600) (Chi- sq.: p = 0.001; OR = 1.79), and they sought less voice care (Table 1.)There was no significant difference in the median VHI scores above the 75th percentile in Type-D (23) and non-Type-D subjects (25) (M-W U: p = 0.739) (Table 1.).

Table 1. The results of having sought voice care in relation to a voice complaint at present or in the past for the Type-D and the non-Type-D groups with a VHI score above the 75th percentile. The significant results are indicated by an asterix.

Subjects with VHI > 75 percentile				
Seeking voice care	Type-D Yes / No	Positive answer % (Number)	Chi-Square ($p \leq 0.05$)	Odds Ratio
Sought (para) medical help?	Non-Type-D	53.6 (67/125)	p = 0.034*	0.53
	Type-D	38.2 (29/76)		
Undergone an examination?	Non-Type-D	49.2 (61/124)	p = 0.059	0.57
	Type-D	35.5 (27/76)		
Undergone a treatment?	Non-Type-D	54.4 (68/125)	p = 0.001*	0.36
	Type-D	30.3 (23/76)		

Type-D and non-Type-D groups with VHI scores ≤ 75th percentile

The Type-D subjects had significantly higher VHI scores (median score 6) than the non-Type-D group subjects (median score 5) (M-W U: p = 0.003). (Table 2).

Table 2. The results of having sought voice care in relation to a voice complaint at present or in the past for the Type-D and the non-Type-D groups with a VHI score equal / below the 75th percentile.

Subjects with VHI ≤ 75 percentile				
Seeking voice care	Type-D Yes / No	Positive answer % (Number)	Chi-Square p ≤ 0.05	Odds Ratio
Sought (para) medical help?	Non-Type-D	16.6 (76/459)	p = 0.165	0.68
	Type-D	11.9 (19/159)		
Undergone an examination?	Non-Type-D	13.0 (60/460)	p = 0.101	0.59
	Type-D	8.2 (13/159)		
Undergone a treatment?	Non-Type-D	14.3 (66/460)	p = 0.113	0.62
	Type-D	9.4 (15/159)		

Voice complaints / voice handicap in Type-D and non-Type-D groups

There was no significant difference in reported recent voice complaints between the Type-D group (41.6%, 101/243) and non-Type-D groups (40.4%, 244/604) ($p = 0.755$; OR: 1.04). In contrast, the Type-D group had significantly higher VHI scores than the non-Type-D group (median = 10 and 7, respectively) (M-W U: $p < 0.001$).

VHI of Type-D and non-Type-D groups who reported voice complaints

The Type-D subjects who reported recent voice complaints did not have significantly higher VHI scores (median = 16) than the non-Type-D group subjects who reported recent voice complaints (median = 14) (M-W U: $p = 0.100$). This pattern was also reflected in the percentage of the Type-D group (47.9 %, 46/96) and non-Type-D group (40.9 %, 95/232), who reported voice complaints and had a severe voice handicap (> 75th percentile), (Chi sq.: $p = 0.246$; OR = 1.32). However, the Type-D group sought less voice care than the non-Type-D group (Table 3.).

VHI in Type-D and non-Type-D groups who did not report voice complaints

In contrast to the subjects who reported recent voice complaints, the Type-D subjects who did not report recent voice complaints had significantly higher VHI scores (median = 7) than non-Type-D group subjects who did not report recent voice complaints (median = 5) (M-W U: $p < 0.001$). This pattern was also reflected in the percentage of Type-D (19.9 %, 27/136) and non-Type-D (8.1 %, 28/346) groups who had a severe voice handicap, but did not report voice complaints despite having a severe voice handicap (Chi sq.: $p < 0.001$; OR = 2.81) (Table 4.)

Table 3. The results of having sought voice care in relation to a voice complaint at present or in the past for the Type-D and the non-Type-D groups who reported recent voice complaints. The significant results are marked by an asterix.

Subjects with recent voice complaints				
Seeking voice care	Type D Yes / No	Positive answer % (Number)	Chi-Square $p \leq 0.05$	Odds Ratio
Sought (para) medical help?	Non-Type-D	44.0 (107/243)	p = 0.051*	0.62
	Type-D	32.7 (33/101)		
Undergone an examination?	Non-Type-D	37.4 (91/243)	p = 0.084	0.64
	Type-D	27.7 (28/101)		
Undergone a treatment?	Non-Type-D	39.3 (96/244)	p = 0.016*	0.53
	Type-D	25.7 (26/101)		

Table 4. The results of having sought voice care in relation to a voice complaint at present or in the past for the Type-D and non-Type-D groups who did not report recent voice complaints.

Subjects without recent voice complaints				
Seeking voice care	Type-D Yes / No	Positive answer % (Number)	Chi-Square $p \leq 0.05$	Odds Ratio
Sought (para) medical help?	Non-Type-D	12.9 (45/348)	p = 0.850	1.05
	Type-D	13.6 (19/140)		
Undergone an examination?	Non-Type-D	10.6 (37/348)	p = 0.855	0.94
	Type-D	10.1 (14/139)		
Undergone a treatment?	Non-Type-D	13.2 (46/348)	p = 0.238	0.68
	Type-D	9.4 (13/139)		

Discussion

The selection of the Type D group depends on both the median of social inhibition and negative affectivity of the group concerned.[32,37] Therefore, labelling an individual as a “Type-D personality” is relative and may be unwarranted. However, it could provide an indication as to which individuals of the group could have a tendency to be affected more psychosocially when experiencing vocal problems. Furthermore, if the individuals with a voice complaints are aware that they have a tendency towards negative affectivity and social inhibition they are more likely to do something about it. Being aware of a problem is known to motivate an individual recovering from voice complaints and restoring vocal health.[27,42]

Social inhibition and negative affectivity are considered to be stable and broad personality traits of the Type-D personality, therefore it was not surprising that the

scores and the percent of Type-D subjects did not differ significantly between the student teachers and teachers. The student and teacher groups were therefore assessed as one group. In the pertinent study, subjects with a Type-D personality did not report more recent voice complaints than those with a non-Type-D personality. Reporting recent voice complaints took place on a nominal level (yes / no) in the questionnaire. In contrast, in response to a more detailed 5-point ordinal scale in the form of the Voice Handicap Index, subjects with a Type-D personality scored significantly higher than those with a non-Type-D personality. Furthermore, significantly more Type-D subjects had a VHI score greater than 75th percentile than the non-Type-D subjects. This suggests that the prevalence of voice problems may be underestimated in the Type-D group if based only on reported voice complaints. This showed that Type-D subjects were apparently more bothered by their voice than the non-Type-D subjects. These findings indicate that subjects of the Type-D group may not readily report their voice problems on a nominal scale of a questionnaire, but when asked leading specific questions as in the VHI may reveal their voice problems. These findings were in line with the observation of Jacobson et al.[42] who reported that subjects were often unaware of the degree of severity of their voice problem until they completed the Voice Handicap Index.

In the group of subjects who had a VHI score greater than the 75th percentile, there were significantly more Type-D subjects than non-Type-D subjects. Furthermore, significantly fewer Type-D subjects than non-Type-D subjects sought paramedical help and underwent treatment for their voice problem. These findings showed that although the Type-D group estimated their voice handicap they sought less voice care in comparison to the non-Type-D subjects. This may be revealing a tendency to seek less voice care among Type-D subjects when compared to non-Type-D subjects.
In the group of subjects with VHI scores less than the 75th percentile, the Type-D subjects had significantly greater scores (total VHI 7) than the non-Type-D subjects (total VHI 5). These scores may not be high or clinically relevant, however, this may indicate that Type-D subjects were more sensitive to the psychosocial aspects of their voice.

Among subjects who reported voice complaints, the Type-D group did not have higher voice handicap scores than the non-Type-D group. However, the Type-D subjects apparently had a tendency to seek less (para) medical help and had less treatment in relation to their voice problem compared to their non-Type-D

colleagues. To a less extent this was true for having undergone an examination in relation to a voice complaint. The significance was reflected in the p-values (Chi-Square test). This was not observed in the Type-D subjects who did not report recent voice complaints, or among the Type-D subjects who had a VHI score less than or equal to the 75th percentile. This suggests that when Type-D subjects have a voice problem they appear to be reluctant to seek voice care in comparison to the non-Type-D group.

Student teachers and teachers of the Type-D personality with voice complaints or a voice handicap appeared to ignore, underestimate or deny the consequences of their voice problem and behaved differently in seeking voice care. Investigators have reported that despite having voice problems, teachers have been often reluctant to seek voice care.[1,13,14,16,44] It has been suggested that teachers probably thought that the voice disorder was not severe enough to warrant voice care.[1] The social inhibition trait of Type-D personalities is observed to be associated with a tendency to seek less social support.[32,45] Additionally, Type-D personalities are considered to consciously suppress emotions and behaviour in order to avoid disapproval by others.[32,33] The Type-D scale-16 scale includes a measure of a general distress factor that is shared by negative emotions such as anxiety, depression, sadness and anger and introversion, low self-expression, sub-assertiveness, withdrawal and social alienation.[32,37] The Type-D trait was even found to be associated with post-traumatic stress disorder.[37] Identifying subjects with voice complaints with the Type-D trait could be valuable to guide them to recovery. De Jong et al.[27] described the psychological cascade model for persisting voice problems. The first phase is characterized by psychological factors such as anxiety, fear, terror of loss and depression, and the subject struggles against the loss. The second phase is marked by surrender to the loss and seeking and acceptance of help, which then leads to the third phase of rehabilitation. The Type-D personality being a stable combination of high negative affectivity and high social inhibition would probably require more assistance in the first and second phases to progress to the third phase of rehabilitation leading to recovery. Though personality traits are considered to be stable, it is possible to reduce the psychological distress experienced by Type-D persons.[37] By identifying Type-D subjects who have voice complaints and / or a high voice handicap they could be encouraged to seek voice care.

Within the group which reported voice complaints, the Type-D group did not have higher voice handicap scores than the non-Type-D group, which showed that

those with voice complaints were nearly equally handicapped by their voice problem. In contrast to this, within the group, which did not report voice complaints the Type-D group had higher voice handicap scores than the non-Type-D group. Furthermore, significantly more Type-D subjects than non-Type-D subjects had VHI scores higher than the 75th percentile despite not reporting a voice complaint. This finding again indicates that voice problems may be underestimated in the Type-D group if they are based only on reported voice complaints. It suggests that Type-D personalities maybe more bothered by their voice than non-Type-D personalities, however they tend to respond negatively for the question “Have you experienced voice complaints?” This raises a question whether Type-D subjects have a tendency to report less voice complaints despite being handicapped by it. The Type-D subjects may be underestimating the consequences of their voice handicap.

In longitudinal prospective studies in groups of patients with coronary heart disease,[32,33,37] patients with the Type-D personality were observed to have a poor prognosis compared to the other patients. The findings of a six to ten year follow-up study indicated that Type-D personalities had a four-fold mortality risk, when compared to non-type-D personalities.[32,33] The poor prognosis of Type-D cardiac patients was observed to be independent of traditional biomedical risk factors.[37] Voice problems have also been observed to have psychological sequelae, which have a negative prognostic impact and was independent on the severity of the voice problem.[27] The long-term overall impact of voice problems may be more in the Type-D group than the non-Type-D group as they apparently have a tendency to seek less care for their voice and report less voice complaint even when having a high voice handicap. These findings raises questions whether Type-D teachers with voice complaints will have recurrent or persistent voice complaints than non-Type-D teachers. Further research is required, and it would be worthwhile to follow the prognosis of student teachers (Type-D) with voice complaints in a longitudinal study. Additionally, for Type-D subjects with voice problems, it would be useful to impart strategies to cope with their personality trait during their education and teaching career. They should be encouraged to report voice complaint and to seek voice care early. This probably would be useful to maintain their vocal health.

Conclusions

Concomitant use of the 5-point ordinal scale VHI with the DS16 revealed voice problems that Type-D subjects were apparently reluctant to report on a nominal scale of a questionnaire. The impact of voice problems may be greater for the Type-D group than the non-Type-D group as they sought less voice care, had higher VHI scores and did not report more voice problems despite having higher VHI scores. The Type-D Scale-16 scale used with the Voice Handicap Index would be an asset to identify student teachers and teachers of the Type-D trait with a voice handicap. They could be encouraged to report voice complaints early and to seek voice care. Voice care can be imparted not only for physical, but also for psychosocial domains, which could improve the vocal health of student teachers and teachers. Study of personality of teachers with regard to voice problems is a new area of study and further research is required. The Type-D scale being a practical and brief measurement scale could be used for further research into personality Type-D and voice disorders. Longitudinal studies are required to study the prognosis of voice problems in the Type-D group.

References

1. Yiu E M-L. Impact and prevention of voice problems in the teaching profession: embracing the consumers view. Journal of Voice 2002; 16: 215-228.
2. Simberg S, Laine A, Sala E, Rönnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
3. Thomas G, Jong FICRS de, Cremers CWRJ, Kooijman PGC. Prevalence of voice complaints, risk factors and impact of voice problems in female student teachers. Folia Phoniatrica et Logopaedica 2005 (accepted for publication).
4. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia: myth or reality; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler, 2001, pp 101-112.
5. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC. An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomized clinical trial. Journal of Speech, Language and Hearing Research 2001; 44: 286-296.
6. Sabol JW, Lee L, Stemple JC. The value of vocal function exercises in the practice regimen of singers. Journal of Voice 1995; 9: 27-36.
7. Chan RWK. Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers. Journal of Voice 1994; 8: 279-291.
8. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.
9. Jonsdottir V. Cordless amplifying systems in classrooms. A descriptive study of teachers and students opinions. Logopedics Phoniatrics Vocology 2002; 27:29-36.
10. Roy N, Merril RM, Thibeault S, Parsa A R, Gray SD, Smith EM. Prevalence of voice disorders in teachers and the general population. Journal of Speech, Language, and Hearing Research 2004; 47: 281-293.
11. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica 1993; 45: 120-129.

12. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
13. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-79.
14. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
15. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12:489-499.
16. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
17. Herrington-Hall BL, Lee L, Stemple JC, Niemi KR, McHone M. Description of laryngeal pathologies by age, sex, and occupation in a treatment seeking sample. J Speech Hear Disord.1988; 53: 57-64.
18. Pekkarinen E, Himberg L, Pentti J. Prevalence of vocal symptoms among teachers compared with nurses: a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics1992; 17: 113-117.
19. Rantala L, Määtä T, Vilkman E. Measuring voice under teachers' working circumstances: F0 and perturbation features in maximally sustained phonation. Folia Phoniatrica et Logopaedica 1997; 49: 281-291.
20. Smith E, Verdolini K, Gray S, Nichols S, Lemke J, Barkmeier J. Effect of voice disorders on quality of life. J Med Speech-Lang Pathol 1996; 4: 223-244.
21. Sapir S. Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.
22. Andrews ML. Intervention with young voice users: a clinical perspective. Journal of Voice 1993; 7: 160-164.
23. Roy N, Bless DM, Heisey D. Personality and voice disorders: a multitrait-multidisorder analysis. Journal of Voice 2000; 14: 521-548.
24. Roy N, Bless DM, Heisey D. Personality and voice disorders: a superfactor trait analysis. Journal of Speech Language & Hearing Research 2000; 43: 749-68.
25. Roy N, Bless DM. Personality traits and psychological factors in voice pathology: a foundation for future research. Journal of Speech Language & Hearing Research 2000; 43: 737-748.
26. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckre PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 81-100.
27. Jong FICRS de, Cornelius BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A psychological cascade model for persisting voice problems in teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
28. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.
29. Rosen DC, Sataloff RT. Psychology of Voice Disorders. San Diego, Singular Publishing Group, 1995.
30. Sataloff RT. Stress, anxiety, and psychogenic dysphonia; in Sataloff RT (ed): Professional Voice: The Science and Art of Clinical Care. New York, Raven Press, 1991, pp 195-200.
31. Watson D, Clark LA, Harkness AR. Structures of personality and their relevance to psychopathology. Journal of Abnormal Psychology 1994; 103: 18-31.
32. Denollet J. Personality and Coronary Heart Disease: The Type-D Scale-16 (DS-16). Annals of Behavioural Medicine 1998; 20:209-215.
33. Denollet J, Sys SU, Stroobant N, H Rombouts, Gillebert TC, Brutsaert DL. Personality as independent predictor of long-term mortality in patients with coronary heart disease. Lancet 1996; 347: 417-421.
34. Watson D, Pennebaker JW. Health complaints, stress, and distress: exploring the central role of negative affectivity. Psychological Review 1989; 96: 234-254.
35. Denollet J. Negative affectivity and negative coping: Pervasive influence on self reported mood, health and coronary-prone behaviour. Psychosomatic Medicine 1991; 53: 538-556.
36. Asendorpf JB. Social Inhibition: A general-development perspective; in Traue HC, Pennebaker JW (eds): Emotion, Inhibition and Health. Seattle. WA, Hogrefe & Huber Publishers, 1993, pp 80-99.
37. Pedersen SS, Denollet J. Validity of the Type-D personality construct in Danish post-MI patients and health controls. Journal of Psychosomatic Research 2004; 57:265-272.

38. Dejonckere PH. Gender differences in the prevalence of occupational voice disorders; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, The Netherlands, Kugler publications, 2001, pp 11-20.
39. Jong FICRS de, Kooijman PGC, Thomas G, Huinck WJ, Graamans K, Schutte HK. Epidemiology of voice problems in Dutch teachers. Folia Phoniatrica et Logopaedica, 2005 (accepted for publication).
40. Verdolini K, Ramig LO. Review; occupational risks for voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
41. Kooijman PGC, Jong FICRS de, Thomas G, Huinck WJ, Donders R, Graamans K, Schutte HK. Risk factors for voice problems in teachers. Folia Phoniatrica et Logopaedica, 2005. (accepted for publication).
42. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): development and validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
43. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL. De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
44. Morton V, Watson DR. The teaching voice: problems and perceptions. Logopedics Phoniatrics Vocology 1998; 23: 133-139.
45. Berry DS, Hansen JS. Positive effect, negative effect, and social interaction. Journal of Personality and Social Psychology 1996; 71: 796-809.

Chapter 8

GENERAL DISCUSSION

Selection of subjects

The present study was part of a larger project assessing voice problems in student teachers and teachers in the Dutch population. In order to assess voice complaints and absence of work due to voice problems in teachers, primary and secondary school teachers were selected. Student teachers in the first four years of training and practicing primary school teachers in the first four years of their career were selected to assess and compare voice complaints and perceived risk factors for voice problems. This provided an opportunity to assess the effect of starting professional teaching, whether there were more voice complaints reported, or different risk factors perceived in relation to voice complaints and whether there was a difference in awareness of teacher training and in patterns of seeking voice care. Teachers in the first four years of their career were selected so as to mirror the training period and it ensured that they have professional teaching experience.

The possible effects of personality traits of student teachers and teachers in relation to their voice problems were explored. The Type-D personality has been defined as the combination high “social inhibition” and high “negative affectivity”, which have been reported to be stable and broad personality traits.[1,2,3] Therefore, to assess the influence of personality Type-D in relation to voice problems student teachers and teachers were assessed as one group.

For comparison with student teachers and teachers, subjects from the general population were selected quasi-randomly as a sample of convenience. In order to have a true representation of the general population, subjects that reported a voice demanding profession were not excluded as the general population is also expected to have subjects with a voice demanding profession. In selected parts of the study, comparisons were also made with subjects in the general population without a voice demanding profession. As the study was a cross sectional study, the difference in the number of subjects in the study populations was not expected to affect the results.

Age of subjects

It has been reported that voice capacity diminishes with age.[4,5] In the present study, to avoid the possible effects of age on the voice[6-10] and due to the very small number of subjects older than 50 years, subjects 50 years and older were

not selected. In The Netherlands, currently there is a shortage of teachers and more late students are being recruited and the group of student teachers would not be truly representative if they were left out. Furthermore, Schneider et al.[11] also reported a similar age range (17 - 41 year) in a study among female student teachers. In future, the number of late students is expected to rise due to this shortage of teachers. In teachers, various studies reported no association between the age of the teacher, years in the profession and voice problems.[5,12] In accordance with these studies, in the present study among Dutch teachers, the effects of age of the teachers on voice problems could not be detected. The findings suggest that factors other than the age of the teacher and duration of the teaching career play a role in the development of voice problems in teachers.

Gender

In the epidemiological study of voice problems in Dutch teachers, female teachers reported more voice complaints and more absence from work due to voice problems than male teachers. For the group of student teachers and for comparisons, only females were assessed because voice disorders in general and occupational voice disorders in particular, have been reported to be more common among women than in men.[5,13-15] Moreover, women have been observed to be more susceptible to voice disorders than men.[4-6,13-21] Various studies among teachers have observed that female teachers reported voice problems more frequently and sought help for voice problems more frequently than male teachers.[5,13,21,22] Even during the entire teaching career, female teachers have been observed to report more voice problems during their teaching careers than male teachers in a ratio of approximately 2:1.[5] Furthermore, chronic voice disorders have been found to be more common in females than males regardless of age.[15]

Apart from physiological changes, voice changes during puberty have been found to be associated with anatomical changes in the larynx that occur coincident with the development of secondary sexual characters.[23,24] The hormonal changes during the menstrual cycle have also been observed to have transient influences on the larynx.[12,25,26] Compared to males, females have been found to have anatomical differences in the laryngeal framework and soft tissues of the larynx.[15,27,28] In comparison to males, in females lesser amounts of elastin and

hyaluronic acid have been found in the superficial layer of the lamina propria of the vocal folds, with less shock absorbing properties.[14,15,28-30]

Functional variations in the voice have also been reported between males and females. A greater tendency to raise the voice level and to use a strained or hyper-functional voice[31-34] has been observed in females. The range of fundamental frequency of voice in males has been found to be 110-131 Hz and in females 196-233 Hz[35], and in identical phonation times the total number of vocal fold vibrations in females has been estimated to be approximately 50% more than males[14,36,37] Gender differences have been observed in the voice even in relation to environmental factors like humidity and background noise. Vilkman et al.[36] reported that female subjects had more vocal symptom scores than male subjects in dry environmental conditions. Furthermore, it has been found that female gender may also be a factor in the ability to cope with background noise.[38]

Utility of questionnaires in the survey study

General questionnaire

The results of this thesis were based on a cross sectional questionnaire survey in the year 2003. Questionnaires, which were completed anonymously, were used to assess the subjective opinions of student teachers about the condition of their voice. In the design of the general questionnaire, data from the literature,[4-6,39-42] clinical experience of the voice team of the department of Oto-Rhino-Laryngology, Radboud University Medical Centre, Nijmegen were taken into consideration. Open-ended questions were asked to teachers and their comments and suggestions were used to formulate the closed-ended questions of the general questionnaire. The general questionnaire was tested in a study among teachers[43] in the year 2003. Certain questions were modified for the student teachers and the general population in areas where applicable. The various questions covered different aspects of voice and voice problems such as risk factors, voice complaints, history of voice complaints, impact of voice problems and opinions regarding teaching in accordance to the multidimensional character of the voice. Unlike the Voice Handicap Index and DS-16 questionnaires, which are measurement scales, in the general questionnaire the questions were assessed individually. Inquiry was made into, which risk factors the subjects perceived as a negative influence on their voice. The opinions of the subjects were sought in relation to their voice problems.

Questionnaires can have open-ended and / or closed-ended questions. Open-ended (open) questions have been reported to be useful[44] as they seek an answer in the respondents` own words, which leaves the respondent free to answer with fewer limits imposed by the researcher. However, the disadvantages of open-ended questions have been found to be the difficulty in coding and analyzing the responses.[44]

The questionnaires used in the present study consisted of closed-ended (enclosed) questions. The closed-ended questions required respondents to choose one of the given pre-selected answers, which provided a list of possible alternatives from which the respondent could choose. The closed-ended questions did not allow the respondents to express their own unique answers. Cummings et al.[44] reported that questionnaires with closed-ended questionnaires sometimes did not include answers, which may be the most appropriate for the particular respondent. The disadvantages were minimized in the present study by asking open-ended questions to teachers who helped design the questionnaire and this helped to expand the list of questions and the possible responses. Furthermore, prior use of the questionnaire in teachers,[43] gave information to modify questions for the student teachers. The reported advantages of closed-ended questions are that the possible answers help to clarify the meaning of the question and they are found to be quicker to answer, easier to tabulate and analyze.[44]

The disadvantage of inquiry into the subjective opinions of the student teachers and teachers is that it does not conclusively prove that the risk factors are present or quantify the exposure to the risk factors. Nevertheless, there are advantages in inquiring into the subjective opinions of the subjects, as it provides insight into what the subjects are experiencing with regard to their voice problem and the risk factors they perceive to be a negative influence on their voice. The opinions and perceptions of subjects have been observed to determine the outcome of a voice problem.[45,46] Occupational safety and vocal health care is in terms of what the student teachers and teachers experience. It can be assumed that teachers and student teachers of schools in different regions would be exposed to variable risk factors depending on the environment of the classroom, availability of voice amplification and different standards of voice training. Therefore, it was worthwhile to inquire into the opinions of subjects, which provided an opportunity for subjects to express their point of view. As the questionnaires were completed anonymously an honest response can be expected. This would help to plan voice care, which is specific to a group of teachers.

Questionnaires have been found to be useful for collecting data about peoples` attitudes, behaviours, knowledge, and personal history.[5,44] Russell et al.[5] reported a high degree of agreement between the prevalence of voice problems determined by direct examination and interview and the prevalence found by mail survey. Self-report in questionnaires is known to be a useful method to estimate the extent, which teachers suffer from vocal dysfunction.[5,12,17,40,47] Clinical examination is undoubtedly valuable, however physical examination of large samples has been observed to be intrusive and expensive.[5] Furthermore, it has been found that clinical assessment alone could underestimate the scale of vocal problems in teachers.[5,40]

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.[48] 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.[48] 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.[48] 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.

Questionnaire surveys have been found to be useful to collect data from a large population practically, accurately and cost effectively.[5,12,44,47] The reported advantages of questionnaires include (a) economy - self-administration reduces staff time, (b) standardisation - written instructions reduce biases from differences in administration and interactions with an interviewer, and (c) anonymity - privacy encourages candid and honest responses to sensitive questions.[44] The cross sectional survey study is the only study design reported to give the prevalence of a disease or risk factor.[44]

The difference in the response rate of the questionnaires could lead to bias. However, response bias regards more the prevalence than the correlations. Therefore, the difference in the return rate between the students, teachers and the general population did not essentially affect the results of this study. The question is whether these groups were representative of student teachers and teachers. The frequency of reporting of voice complaints in student teachers and teachers in

the present study was in accordance with other studies in student teachers[49-51] and teachers around the world.[4,5,7,12,15,40,47] As voice problems in teachers is a worldwide problem, the population studied in the pertinent study was representative. Furthermore, the anonymous response to the questionnaire probably encouraged honest responses from the subjects. A strong point of the present study was the large numbers of subjects in the groups studied.

Voice handicap and the Voice Handicap Index (VHI)

In order to quantify the psychosocial consequences of voice disorders, the Voice Handicap Index was developed and validated by Jacobson et al.[45] using a diverse sample of patients with voice disorders, which represented the breadth of pathology in most clinical settings. In the pertinent study the Dutch version of the VHI was used.[52] 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.[45,52,53] Investigators have found that the VHI was a useful instrument to quantify the psychosocial consequence and handicap due to voice disorders. Furthermore, it has been found to be a valuable tool to assess subjective voice problems,[45,52-56] whereby subjects could describe their voices with regards to daily use and interactions.[45] Investigators have reported that the Voice Handicap Index (VHI) apart from representing the subjective perception of disability, handicap and distress resulting from voice difficulties, also gave an indication of the quality of life status of the subjects in relation to their voice.[45,52,54,55]

Use of the Voice Handicap Index with the general questionnaire

In the pertinent study, subjects with voice complaints were observed to have a significantly greater voice handicap than those without voice complaints. This affirmed that subjects with voice complaints faced physical and psychosocial consequences because of their voice problems. The VHI scores of student teachers with voice complaints reported in the general questionnaire, ranged from low to high. This provides the opportunity to impart voice care based on the perceived severity[54] and to monitor the efficacy of treatment.[45,55] Voice care for student teachers could therefore be provided more efficiently.

The VHI is a multidimensional, detailed questionnaire using an ordinal scale and this could reveal voice problems that subjects are apparently reluctant to report on a nominal scale (yes / no) of the general questionnaire. The group of greatest interest in the pertinent study was the student teachers who did not report a voice

complaint in the general questionnaire despite having considerably high VHI scores. This group may constitute a high-risk group, which probably may be underestimating or even ignoring their voice problem as they probably do not realize the risks to their career. Use of the VHI along with the general questionnaire (Figure 1) provided an opportunity to identify these subjects, which may make up the occult false negative cases in the estimation of voice complaints. Furthermore, attention can be given to causes for this apparent neglect. On the other hand there may be false positive cases as there are subjects with low VHI scores who also have voice complaints. Further examination is required to assess whether these are false positive cases, or whether they have voice complaints with a less degree of handicap.

Subjects	VHI scores (quartiles)			
Voice complaints reported in questionnaire	+ ??	++	+++	++++ ##
No voice complaints reported in questionnaire	+	++	+++	++++ !!

Figure 1. The figure depicts advantages in concomitant use of general questionnaire (i.e. voice complaints yes/no) with Voice Handicap Index.

Key of figure:
?? mild voice handicap or false positive voice complaint?
greater than 75th percentile VHI: severe voice handicap.
!! greater than 75th percentile VHI: false negative voice complaint.

The responses to the general questionnaire and the VHI were observed to be parallel and complimentary. The findings of the pertinent study showed that the perception that the given risk factors were a negative influence on the voice was significantly more with increasing VHI scores across the VHI range. This probably indicates that student teachers are more aware of the potential risk factors when they experience a voice handicap and the awareness is more when the voice handicap is greater. A significant correlation was also found between the number of perceived risk factors and increasing VHI scores. These findings contributed to the validity of the general questionnaire. Furthermore, the results were in accordance with the observation of Jacobson et al.[45] who reported that respondents were often more aware of the degree of severity of their voice problems after completing the VHI.[45] Jacobson et al.[45] stated that when subjects understood the implications of their voice problem in the context of daily living and

functioning they were more likely to work towards changing factors that contributed to the development of their voice problem.[45]

Type-D scale-16 questionnaire (DS 16) and selection of the Type-D group

As personality has been considered to be a stable personality trait,[1-3] the student teachers and practicing teachers early in their career were assessed as one group to study the possible effects of the Type-D personality trait with regard to voice problems. Subjects were classified as "Type-D" if they had a score higher than the median of both "negative affectivity" and "social inhibition". This represents the group with a combination of a high negative affectivity and high social inhibition. 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 relative. It provides an indication of which individuals of the group have a relative tendency towards psychosocial health problems. The selection resulted in 28.4 % of the total population as the Type-D group and 71.6 % as non-Type-group. If the subjects with voice complaints are aware that they have a tendency towards negative affectivity and social inhibition, they are more likely to cope with it. Being aware of a problem is known to motivate an individual recovering from voice complaints and restoring vocal health.[42,45]

Type-D and non-Type-D: voice complaints / voice handicap / seeking voice care

Groups	Voice complaints in total groups	VHI scores in total groups	% of groups with VHI scores greater than 75th percentile	Seeking of voice care in groups with VHI scores greater than 75th percentile
Non-Type-D	~~	<	<	>
Type-D	~~	>	>	<

Figure 2. Depicts voice complaints, VHI and having sought voice care in Type-D and non-Type-D groups.

Key of figures 2 - 4:
~~ indicates no significant difference between the groups
>< indicates significant difference between the groups; greater and lesser respectively.

With regard to voice complaints, there was no significant difference in reported voice complaints between the Type-D group and non-Type-D group (Figure 2). In contrast, in the total group the Type-D group had significantly higher VHI scores than the non-Type-D group. Furthermore, a significantly greater proportion of the

Type-D group belonged to the group with most severe handicap than the non-Type-D group (>75th percentile). The concern was greatest for Type-D subjects who did not report voice complaints although they had a considerable voice handicap. They form the occult “false negative cases”, which is a challenge for screening and voice care.

Reporting of voice complaints at the moment and / or during the past year was on a nominal scale (yes / no) in the general questionnaire. In contrast to this, when the detailed ordinal scale Voice Handicap Index was used, in the total group, subjects with a Type-D personality scored significantly higher than those with a non-Type-D personality. This showed that those with the Type-D trait were more bothered by the condition of their voice. It is however remarkable that there was no significant difference observed in the reporting of voice complaints. This finding suggests that reported voice complaints, may be underestimated in the Type-D group due to an apparent tendency not to report voice complaints despite having a voice handicap.
Alternatively it can be expected that there will be subjects with voice complaints with lower VHI scores. Further examination will help to ascertain whether they require voice care or whether they are false positive cases for voice complaints, with a follow up to study this behaviour.

Seeking of voice care
The Type-D personality trait may be considered as a risk for student teachers and teachers because although they had a considerable voice handicap they sought less voice care than non-Type-D subjects (Figure 3). The consequences of voice problems were apparently underestimated or ignored.

Groups	VHI scores greater than 75th percentile	Seeking voice care
Non-Type-D	~~	>
Type-D	~~	<
	VHI scores equal/less than 75th percentile	Seeking voice care
Non-Type-D	<	~~
Type-D	>	~~

Figure 3. Depicts comparisons of having sought voice care in those with VHI scores equal/less and greater than the VHI 75th percentile in Type-D and non-Type-D groups.

Concomitant use of the VHI and general questionnaire with the DS16 provided the opportunity to examine the subjects with regards to their Type-D trait, voice

handicap, reported voice complaints and seeking voice care (Figure 4). In subjects who reported voice complaints, although the voice handicap of the Type-D subjects with voice complaints was not significantly different from the non-Type-D subjects, the long-term overall impact of voice problems may be more in the Type-D group than the non-Type-D group as they apparently showed a tendency to seek less voice care.

Groups	Voice complaints	VHI scores	% of groups with VHI scores greater than 75th percentile	Seeking of voice care
Non-Type-D	Yes ~~	~~	~~	>
Type-D	Yes ~~	~~	~~	<
Non-Type-D	No	<	<	~~
Type-D	No	>	>	~~

Figure 4. Depicts VHI and having sought voice care in relation to voice complaints in Type-D and non-Type-D groups.

Among subjects who did not report voice complaints, it is remarkable that Type-D subjects had significantly higher VHI scores than the non-Type-D group subjects (Figure 4). Furthermore, in this group, a greater proportion of the Type-D group than the non-Type-D group had VHI scores greater than the 75th percentile. Despite having higher VHI scores they did not seek more voice care than the non-Type-D subjects. This again supports the view, that Type-D subjects have an apparent tendency to report less voice complaints despite having a considerable voice handicap and also seek less voice care.

The above findings possibly show that subjects classified as the Type-D group tend to behave differently with regard to their voice problems in comparison to non-Type-D subjects. The findings of the study indicate that Type-D personality is a group that requires more attention for voice training and voice care. The usefulness of using different questionnaires i.e. VHI, DS16 and the general questionnaire for assessment of the subjects was also observed.

Voice problems: the impact, risks and history

Voice problems in teachers

In the epidemiological study of voice problems in Dutch teachers, female teachers reported more voice complaints and more absence from work due to voice problems than male teachers. No relationship between age and voice complaints

and voice related absenteeism was observed. Over 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 were relatively high compared to controls with and without a vocally demanding profession. Over one-fifth of the teachers sought voice care. The VHI of the primary and secondary education teachers with voice complaints and a history of absence from work were significantly greater than teachers without such a history. The results of the study indicated that teaching was a high-risk profession for the development of voice problems.

With regard to history of voice problems, it was found that one in seven teachers had history of voice problems during the training period. Moreover, ninety percent of these teachers also experienced voice problems during their teaching career. Furthermore, it was observed that this group of teachers, in comparison to teachers without a history of voice problems during training, also had significantly more current voice complaints and absenteeism. The findings in female practicing teachers early in their career were in accordance with these findings. History of voice problems during the training period was found to be significantly more for early career teachers with voice complaints than those without voice complaints. These reports suggest that voice complaints in teachers apparently have a history during the training period and calls for more intensive voice training and voice care during the training period.

Voice complaints, risk factors for voice problems across the threshold of teaching

The following findings elucidate the differences, similarities, risks and voice complaints, across the threshold of teaching. Voice complaints at the moment and during the past year, were more frequently reported by teachers early in their career than student teachers. The difference was found to be significant. The transition from a student teacher to a professional teacher is apparently a big step for the voice. New causal mechanisms or aggravating factors across the threshold of teaching may occur. A significant difference was found in the pattern of risk factors for voice complaints in student teachers and practicing teachers early in their career. There was an indication that vocal loading factors and environmental factors were more influential in student teachers with voice complaints. Psycho-emotional factors apparently played a greater role in practicing teachers with voice complaints early in their career than in student teachers. The findings also may be due to a greater awareness in relation to voice problems after starting professional teaching.

The perceptions that stress, work pressure and composition of the group of pupils, were a negative influence on their voice was more frequently reported by practicing teachers early in their career, than student teachers. This trend was also observed on comparison of the Odds Ratios of psycho-emotional (psychological) factors for voice problems. The composition of the group of pupils has been reported to have an effect on the voice load of the teacher.[34] In The Netherlands for economic reasons opportunities for special education are decreasing. Pupils that often require special attention attend mainstream primary schools. Moreover, the group of pupils increasingly have a multicultural composition, which is psychosocially challenging. Student teachers may not be prepared to cope with this challenge, the associated stress, emotions, and work pressure. Emotions and stress have been found to contribute to increased muscle tension and somatic problems.[57-61]

Furthermore, increased muscular tension in the head, larynx, neck and shoulder regions have been observed to lead to voice discomfort and dysphonia.[8,39,42,57,62-66] Psycho-emotional factors were analyzed in relation to voice complaints. It may be assumed from these results that student teachers may be suddenly exposed to more psychological factors when they commence professional teaching, which they are not prepared to cope with.

Apart from being a risk factor for voice problems, psychological factors have also been found to be responsible for persistence of voice problems.[42] Stress management, psychological counseling[12,42], and coping methods have been recommended to prevent and to avoid persistence of voice problems.[42]

The psychological cascade model was first presented by Anderson et al.[67] to describe the clinical course of patients with chronic back pain (Figure 5). This model was also found to depict the dynamics of persisting voice problems in teachers.[42] This model pertained to the psychological challenges that the subjects faced due to the voice problem.

The psychological cascade consists of three phases. In the first phase, the subject experiences the disorder as a threat and is characterized by anxiety, fear, struggle against the loss, searching for help, isolation and depression. Coping has been found to depend on personal factors, such as flexibility, tenacity, and taking personal responsibility.[42,67] Factors that maintain and prevent recovery may consist of physical, functional or even socioeconomic factors. If the influence of the maintaining factors is not too high and if coping is adequate, the subject may enter the second phase of the cascade model. The second phase called “the pit” is characterized by surrender to the loss, clarity and acceptance of the disorder. This is a turning point that enables the subject to proceed to the third phase of renewal,

characterized by hope and can lead to recovery. Identifying subjects with voice problems in the first phase is important to impart voice care, to assist coping with the problem, and to prevent persistence of the voice problem.

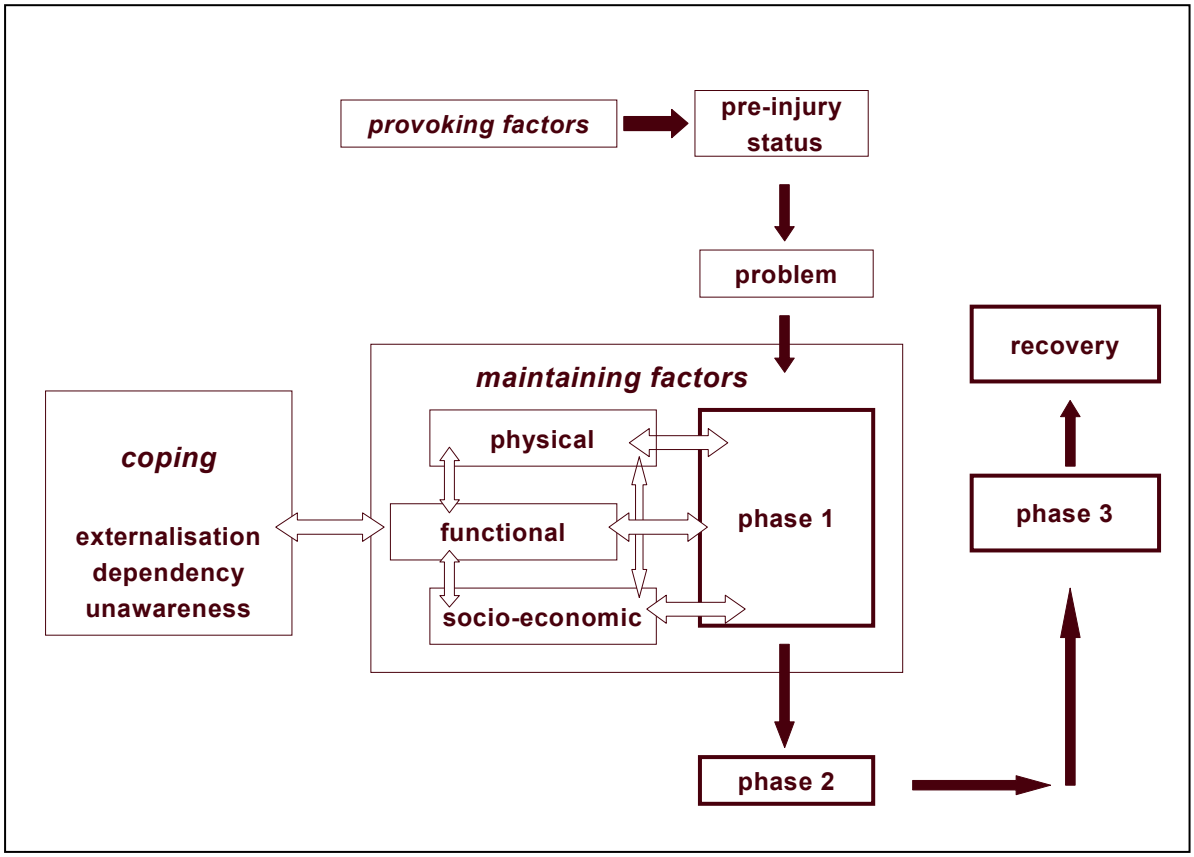

Figure 5. The psychological cascade model.[42,67] The maintaining and coping factors are put in relation to each other and to the cascade model (dotted arrows).

The perception that the number of people (size of the group) they communicated with had a negative influence on the voice was significantly less reported by student teachers than teachers. This could mean that student teachers may not fully know the effect of the audience size on their voice. Moreover, they may not be prepared to teach a large number of pupils. Student teachers may not be accustomed to the vocal demands of teaching and with onset of the teaching career, the subjects are expected to have even more vocal demands and should be prepared to meet the challenges.[49]

The perception that their general physical condition had a negative influence on their voice was significantly more reported by teachers early in their career than student teachers. However, on comparison of the relative risk it was seen to be similar. Multiple factors may influence the general physical condition of the

individual and probably more psycho-emotional factors in teachers could be a contributing factor. The interaction of multiple risk factors has been found to increase the vulnerability to vocal dysfunction.[68]

It was alarming that over a third of student teachers and early career teachers with voice complaints felt that decrease in hearing had a negative influence on their voice. Furthermore, within the group of student teachers, subjects with voice complaints reported more frequently that noise and acoustics had a negative influence on their voice than those without voice complaints. This opinion may be due to poor acoustic feedback due to poor acoustics or background noise. On the other hand it could be due to an actual hearing loss, which may not be a handicap for normal conversation but with background classroom noise and poor acoustics of the classroom, it may have a negative influence on the voice of the teacher. It could be assumed that in the presence of even a mild hearing loss, this problem will be accentuated. Additionally, if there is a hearing loss, it is important to determine how severe it is and whether it warrants hearing amplification. The findings point to the need for auditory screening of the student teachers and teachers to evaluate whether they have a hearing loss or whether the opinion was secondary to inadequate acoustic feedback, poor acoustics of the classroom or a high background noise. The finding brings to attention that hearing screening is presently not a part of the pre-admission screening for teacher training in The Netherlands. It may be of value to include this in the screening procedure, because impaired hearing has been found to hamper adequate feedback while speaking, causing the subject to raise the voice, which can lead to voice problems.[7]

The frequent report of mucosal problems in student teachers and teachers with voice complaints probably shows that mucosal problems such as allergy, hyper-reactive airways, sinusitis and laryngitis are not adequately managed. Nearly half of the student teachers and teachers with voice complaints reported that the given environmental factors had a negative influence on their voice. For the variables humidity and environmental irritants it was significantly greater for student teachers than the teachers. This brings to our attention that future teachers and teachers are exposed to a classroom environment, which they perceive as a negative influence on their voice. It can be assumed that student teachers and teachers in different schools are exposed to different environmental conditions in classrooms. Surveys such as this study bring to light environmental factors they

perceive to be a negative influence on their voice. This could serve as a guide for classroom environmental monitoring and control.

Voice complaints and awareness in student teachers

Timmermans et al.[56] reported that future voice professionals did not take adequate care of their voices and were often unaware of the condition of their voices. A lack of awareness has also been observed to reflect inadequate training.[68]

In the present study, the relative risk for voice complaints was greater for student teachers than the general population in non-voice demanding professions. However, overall, in comparison with the total general population, no significant difference was observed in the reporting of voice complaints. This is remarkable, as student teachers are training to be future voice professionals and have increased voice use in the course of their practical training. It can be assumed that there is no difference from the general population at the phase of training. On the other hand, the findings may indicate neglect, ignorance or an insufficient awareness of the student teachers about their vocal status. These views are supported by the following findings of this study.

The perception that the given risk factors were a negative influence on the voice was observed to be greater with increasing VHI scores, which probably shows that the awareness of voice problems was related to the extent student teachers experienced a voice problem. On the other hand, a proportion of student teachers did not report a voice complaint although they had a considerable voice handicap score (>75th percentile VHI). This shows that these future teachers may be neglecting their voice, underestimating their voice handicap and probably are not aware of the impact and consequences of a voice problem.

A lack of awareness was also observed in that Type-D subjects had an apparent tendency not to report voice complaints and to seek less voice care although they had a voice handicap. Student teachers may not be aware of their psychosocial traits, the possible consequences with regard to their voice problems and the means to cope with it.

An apparent lack of awareness in student teachers was also reflected in the reluctance to avail voice care despite having a voice complaint. Reports from literature have also shown that although teachers had voice problems, they were often reluctant to seek help,[4,5,12,20,21,46] so the rates of vocal dysfunction could

underestimate their true prevalence in the teaching population.[40] Russell et al.[5] interpreted the reluctance to seek help for voice problems as that, teachers may have viewed their voice problems as an occupational hazard and may not have been aware of voice care available. On the other hand, teachers might not have perceived their voice problem to be severe enough to warrant medical care.[46] The overall lack of awareness of the student teachers with regard to their voice itself may constitute a considerable risk factor for voice complaints.

History of voice problems during puberty and before puberty was more frequently reported by student teachers with voice complaints than those without voice complaints. This finding suggests that certain subjects may have a constitutionally weak voice, which itself is a risk factor for voice problems.[16,42,69,70] Selecting and training for the voice demanding teaching profession despite having a history of voice problems, possibly reveals a lack of knowledge in the student teachers of the high vocal requirements for teaching. This was also reflected in the findings that student teachers apparently were not aware of the increased risk of the future teaching profession on their voice. Culton et al.[71] found that self-perception of previous voice problems was poor, in a thirteen-year study of college students. It is possible that the history of voice problems may also be underestimated in student teachers.

Although the inadequacy of teacher training has been reported in various studies among teachers,[6,12,40,49,51,68,72,73] it is remarkable to observe that the majority of student teachers in the present study, reported that present voice training was sufficient. This opinion was significantly more, even in comparison to practicing teachers with voice complaints. On the other hand, the results could also indicate that student teachers are probably less aware than practicing teachers of the inadequacy of voice training. A lack of awareness has itself been considered as an indication of unsatisfactory training.[68] The need for refresher courses for efficient voice was reported more frequently by student teachers with voice complaints in comparison to those without complaints. The response was similar in comparison to teachers early in their career having voice complaints. The findings suggest that when student teachers have voice problems, they appear to be more aware of the need for courses to improve their voice.
Various investigators have stressed the need for vocal hygiene and intensive vocal training in future voice professionals.[6,12,46,49,56] Vocal education programs, vocal training and refresher courses have been observed to be useful to improve the condition of the voice.[40,70,74-78] Roy et al.[53] reported that voice training in the form

of vocal function exercises were more effective than vocal hygiene methods in treating teachers with voice problems. Furthermore, literature indicates that voice training positively influences the voice in female professional voice users.[70,79-82] The high prevalence of voice problems in student teachers and teachers` is in favour of voice care and voice training not only during education but also throughout the teaching career. This may prevent voice disorders, and may encourage teachers to seek assistance before a voice problem becomes chronic.[40]

Multidimensional voice profile of student teachers and teachers

With regard to vocal health, psychosocial aspects have not been given adequate attention during the training of teachers. It would be useful to make a profile of student teachers for training. A multidimensional profile of student teachers encompassing both physical and psychosocial aspects would aid training and preparation of student teachers to cope with the vocal, physical and psychosocial demands of the voice demanding teaching career. The VHI and the DS16 could be useful tools to create a profile, which would serve as a reference during the training and during the teaching career. The D16 would aid to identify student teachers that have a Type-D trait. For student teachers with no voice handicap, training to cope with the personality traits would be useful to maintain their vocal health. Identifying student teachers with the Type-D trait and with a voice handicap could be useful for voice therapy and further voice training.

Occupational safety and health

In accordance with other studies among teachers,[5,40] and student teachers[49-51,69,70], the results of the present study suggest that vocal problems are common among Dutch student teachers and teachers. They are apparently exposed to various risk factors that they perceive to be a negative influence on their voice. This raises questions as to how this problem can be tackled with regard to occupational safety and health care.

The occupational health care of professional voice users is surprisingly undeveloped compared to the attention given to occupational hearing disorders and other occupational health problems.[83] The lack of recognition of voice disorders of voice professionals as an occupational disease by various countries[36,83,84] including The Netherlands is of concern. Lack or inadequate occupational security may be a source of stress and insecurity to voice professionals. Improvement in occupational safety and health would provide

security, which has been described as a basic need of an individual[85] and was found to be necessary to teach creatively.[57] Inadequate occupational voice care is a great disadvantage and the recommended ways to develop occupational health in voice professionals are to demonstrate the relationship between voice problems and voice usage[83] and to demonstrate the relationship between voice problems and risk factors.[86] An occupational disease has been defined as a disease that is most likely or most probably principally caused by exposure at work.[47] It is therefore, important to demonstrate the relationship between voice complaints, voice handicap and risk factors for voice complaints. Further research as field studies are required to quantify exposure and to establish a causal link between risk factors and voice complaints.

Screening

The high reporting of voice complaints and history of voice problems in student teachers calls for expansion of pre-admission screening to be more multidimensional. Routine screening of prospective teachers for susceptibility to voice disorders has been recommended to prevent vocal dysfunction.[40,49,50,69,86] It has been suggested that voice disorders should be diagnosed and treated early preferably before or during the training for that profession.[49-51] Screening apart from voice assessment should also address specific problems such as hearing loss, inappropriate muscle tension, postural problems, allergy, upper respiratory tract infections, habitual throat clearing, history of voice problems and a psychological evaluation, which includes personality traits and coping. The VHI and the DS-16 could be used as one of the screening procedures for student teachers.

References

1. Friedman HS, Tucker JS, Reise SP. Personality dimensions and measures potentially relevant to health: A focus on hostility. Annals of Behavioral Medicine 1995; 17: 245-253.
2. Clark LA, Watson D, Mineka S. Temperament, personality, and the mood and anxiety disorders. Journal of Abnormal Psychology 1994; 103: 103-116.
3. Denollet J. Personality and coronary heart disease: the Type-D scale-16 (DS16). Annals of Behavioral Medicine 1998; 20: 209-215.
4. Smith E, Lemke J, Taylor M, Kirchner L, Hoffman H. Frequency of voice problems among teachers and other occupations. Journal of Voice 1998; 12: 480-488.
5. Russell A, Oates J, Greenwood KM. Prevalence of voice problems in teachers. Journal of Voice 1998; 12: 467-479.
6. Smith E, Gray SD, Dove H, Kirchner L, Heras H. Frequency and effects of teachers' voice problems. Journal of Voice 1997; 11: 81-87.
7. Gotaas C, Starr CD. Vocal fatigue among teachers. Folia Phoniatrica et Logopaedica 1993; 45: 120-129.

8. Morrison MD, Nichol H, Rammage LA. Diagnostic criteria in functional dysphonia. Laryngoscope 1986; 96: 1-8.
9. Hodge FS, Colton RH, Kelley RT. Vocal intensity characteristics in normal and elderly speakers. Journal of Voice 2001; 15: 503-511.
10. Ramig LA, Ringel RL. Effects of physiological aging on selected acoustic characteristics of voice. J Speech Hear Res 1983; 26: 22-30.
11. Schneider B, Bigenzahn W. Vocal risk factors for occupational voice disorders in female teaching students. European Archives of Oto-Rhino-Laryngology and Head and Neck 2004 (published online).
12. Sapir S. Vocal attrition in voice students: survey findings. Journal of Voice 1993; 7: 69-74.
13. Smith E, Lester Kirchner H, Taylor M, Hoffman H, Lemke J. Voice problems among teachers: differences by gender and teaching characteristics. Journal of Voice 1998; 12: 328-334.
14. Dejonckere PH. Gender differences in the prevalence of occupational voice disorders; some anatomical factors that possibly contribute; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp11-20.
15. Roy N, Thibeault MRM, Gray SD, Smith EM. Voice disorders in teachers and the general population: effects of work performance, attendance and future career choices. J Speech Lang Hear Res 2004; 47: 542-551.
16. Buekers R. Voice Performances in Relation to Demands & Capacity (PhD Thesis). University of Maastricht, The Netherlands, 1998.
17. Pekkarinen E, Himberg L, Pentti J. Prevalence of vocal symptoms among teachers compared with nurses: a questionnaire study. Scandinavian Journal of Logopedics and Phoniatrics 1992; 17: 113-117.
18. Urrutikoetxea A, Ipsizua A, Matellanes F, Aurrekoetxea J. Prevalence of vocal nodules in teachers. Presentation at the First World Congress of Voice, Oporto, Portugal, 1995.
19. Calas M, Verhulst J, Lecoq M, Dalleas B, Seilhean M. Vocal pathology of teachers. Revue de Laryngologie-Otologie-Rhinologie 1989; 110: 397-406.
20. Marks JB. A comparative study of voice problems among teachers and civil service workers [master`s thesis]. Minneapolis: University of Minnesota, 1985.
21. Morton V, Watson DR. The teaching voice: problems and perceptions. Logopedics Phoniatrics and Vocology 1998; 23: 133-139.
22. Fritzell B. Voice disorders and occupations. Logopedics Phoniatrics Vocology 1996; 2: 7-12.
23. Weiss DA. The pubertal change of the human voice (Mutation). Folia Phoniatr 1950; 2: 126-159.
24. Sataloff RT. The effects of age on the voice; in Sataloff RT (ed): Professional Voice: the science and art of clinical care. New York, Raven press, 1991, pp 141-151.
25. Smith FM. Hoarseness, a symptom of prementrual tension. Arch Otolaryngol 1962; 75: 66-68.
26. Abitbol J, Abitbol P, Abitbol, B. Sex hormones and the female voice. Journal of Voice 1999; 13: 424-446.
27. Fried MP, Meller SM. Adult laryngeal anatomy; in Fried MP(ed): The larynx (2nd Ed). St Louis, MO:CV, Mosby, 1995.
28. Hammond TH, Zhou R, Hammond EH, Pawlak A, Gray SD. The intermediate layer: A morphological study of the elastin and hyaluronic acid constituents of normal human vocal folds. Journal of Voice 1997; 11: 59-66.
29. Butler JE, Gray SD, Hammond TH. Gender related differences of hyaluronic acid distribution in the human vocal cord. Laryngoscope 2001; 11: 907-911.
30. Ward PD, Thibeault SL, Gray SD. Hyaluronic acid: Its role in voice. Journal of Voice 2002; 16: 303-309.
31. Vilkman E, Lauri E-R, Alku P, Sala E, Sihvo M. Loading changes in time based parameters of glottal flow waveforms in different ergonomic conditions. Folia Phoniatrica et Logopaedica 1997; 49: 247-263.
32. Lauri E-R, Alku P, Vilkman E, Sala E, Sihvo M. Effects of prolonged oral reading on time based glottal flow waveform parameters with special reference to gender differences. Folia Phoniatrica et Logopaedica 1997; 49: 234-246.
33. Vilkman E, Lauri E-R, Alku P, Sala E, Sihvo M. Ergonomic conditions and voice. Log Phon Vocol 1998; 23: 11-19.
34. Södersten M, Granqvist S, Hammarberg B, Szabo A. Vocal behavior and vocal loading factors for pre-school teachers at work studied with binaural DAT recordings. Journal of Voice 2002; 16: 356-371.

35. Hirano M. Clinical examination of Voice.Vienna / New York, Springer Verlag, 1981.
36. Vilkman E. Occupational safety and health aspects of voice and speech professions. Folia Phoniatrica et Logopaedica 2004; 56: 220-253.
37. Titze IR. Criteria for occupational risk in vocalization; in Dejonckere (ed): Occupational Voice: Care and Cure, The Hague, Kugler publications, 2001, pp1-10.
38. Hay B. A pilot survey of classroom noise levels and teachers reaction. British Voice Association. Voice 1995; 4: 127-134.
39. Sundberg J. The Science of the Singing Voice. Dekalb, IL, Northern Illinois, University press, 1987.
40. Mattiske JA, Oates JM, Greenwood KM. Vocal problems among teachers: a review of prevalence, causes, prevention, and treatment. Journal of Voice 1998; 12: 489-499.
41. Verdolini K, Ramig LO. Review: Occupational risks for voice problems. Logopedics Phoniatrics Vocology 2001; 26: 37-46.
42. Jong FICRS de, Cornelis BE, Wuyts FL, Kooijman PGC, Schutte HK, Oudes MJ, Graamans K. A psychological cascade model for persisting voice problems in teachers. Folia Phoniatrica et Logopaedica 2003; 55: 91-101.
43. Kooijman PGC, Jong FICRS de, Thomas G, Huinck WJ, Donders R, Graamans K, Schutte HK. Risk factors for voice problems in teachers. Accepted for publication by Folia Phoniatrica et Logopaedica, 2005.
44. Cummings SR, Strull W, Nevitt MC, Hulley SB. Planning the measurements: questionnaires; in Hulley SB, Cummings SR (eds): Designing Clinical Research, Baltimore, Williams and Wilkins, 1988, pp 42-52.
45. Jacobson BH, Johnson A, Grywalski C, Silbergleit A, Jacobson G, Benninger MS, Newman CW. The Voice Handicap Index (VHI): development and validation. American Journal of Speech Language Pathology 1997; 6: 66-70.
46. Yiu EM-L. Impact and prevention of voice problems in the teaching profession: embracing the consumers' view. Journal of Voice 2002; 16: 215-228.
47. Sala E, Laine A, Simberg S, Pentti J, Suonpaa J. The prevalence of voice disorders among day care centre teachers compared with nurses: A questionnaire and clinical study. Journal of Voice 2001; 15: 413-423.
48. Newman TB, Browner WS, Cummings SR, Hulley SB. Designing a new study: II. Cross-sectional and case-control studies; in Hulley SB, Cummings SR (eds): Designing Clinical Research, Baltimore, Williams and Wilkins, 1988, pp 75-86.
49. Simberg S, Laine A, Sala E, Ronnemaa AM. Prevalence of voice disorders among future teachers. Journal of Voice 2000; 14: 231-235.
50. Simberg S, Sala E, Laine A, Ronnemaa AM. A fast and easy screening method for voice disorders among student teachers. Logopedics Phoniatrics Vocology 2001; 26: 10-16.
51. Simberg S, Sala E, Rönnemaa A-M. A comparison of the prevalence of vocal symptoms among teacher students and other university students. Journal of Voice 2004; 18: 363-368.
52. De Bodt MS, Jacobson BH, Musschoot S, Zaman S, Heylen L, Mertens F, Van de Heyning PH, Wuyts FL: De Voice Handicap Index. Een instrument voor het kwantificeren van de psychosociale consequenties van stemstoornissen. Logopedie 2000; 13: 29-33.
53. Roy N, Gray SD, Simon M, Dove H, Corbin-Lewis K, Stemple JC: An evaluation of the effects of two treatment approaches for teachers with voice disorders: a prospective randomised clinical trial. Journal of Speech Language and Hearing Research 2001; 44: 286-296.
54. Murry T, Rosen CA. Outcome measurements and quality of life in voice disorders. Otolaryngol Clin North Am 2000; 33: 905-916.
55. Rosen CA, Murry T, Zinn A, Zullo T, Sonbolian M. Voice Handicap Index change following treatment of voice disorders. Journal of Voice 2000; 14: 619-623.
56. Timmermans B, De Bodt MS, Wuyts FL, Boudewijns A, Clement G, Peeters A, Van de Heyning PH. Poor voice quality in future elite vocal performers and professional voice users. Journal of Voice 2002; 16: 372-382.
57. Wellens WAR, Van Opstal MJMC. Performance stress in professional voice users; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler Publications, 2001, pp 81-100.
58. Hazlett RL, MacLeod DR, Hoehn-Saric R. Muscle tension in generalized anxiety disorder: elevated muscle tonus or agitated movement? Psychophysiology 1994; 31: 189-195.
59. Lundberg U. Methods and applications of stress research. Technol Health care 1995; 3: 3-9.

60. Holte KA, Westgaard RH. Daytime trapezius muscle activity and shoulder-neck pain of service workers with work stress and low biomechanical exposure. Am J Ind Med 2002; 41: 393-405.
61. Holte KA, Vasseljen O, Westgaard RH. Exploring perceived tension as a response to psychosocial work stress. Scand J Work Environ Health. 2003; 29: 124-133.
62. Morrison MD, Rammage LA, Beslisle GM, Pullan CB, Nichol H. Muscular tension dysphonia. Journal of Otolaryngology 1983; 12: 302-306.
63. Morrison M. Pattern recognition in muscle misuse voice disorders: how I do it. Journal of Voice 1997; 11: 108-114.
64. Beslisle GM, Morrison MD. Anatomic correlation for muscle tension dysphonia. Journal of Otolaryngology 1983; 12: 319-321.
65. Vilkman E, Sonninen A, Hurme P, Körkkö P. External laryngeal frame function in voice production revisited: a review. Journal of Voice 1996; 10: 78-92.
66. Hulse M. Zervikale dysphonia [cervical dysphonia]. Folia Phoniatrica et Logopaedica 1991; 43: 181-196.
67. Anderson DJ. The psychological cascade; in White AH, Schofferman JA (eds): Spine Care. London, Mosby, 1995, pp 36-44.
68. Morton V, Watson DR. Voice in the classroom; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 53-69.
69. Schneider B, Cecon M, Hanke G, Wehner S, Bigenzahn W. Significance of voice constitution as a predisposition for occupational voice disorders. HNO 2004; 52: 461-470.
70. Schneider B, Bigenzahn W. How we do it: Voice therapy to improve vocal constitution and endurance in female student teachers. Clinical Otolaryngology 2005; 30: 66-71.
71. Culton GL. Speech disorders among college freshmen: a 13-year survey. Journal of Speech and Hearing Disorders 1986; 51: 3-7.
72. Martin S, Darnley L. The teaching voice. London, Whurr, 1996.
73. Martin S. Voice care and development for teachers: survey report. Voice 1994; 3: 92-98.
74. Bistrisky Y, Frank Y. Efficacy of voice and speech training of prospective elementary school teachers. Israeli J Speech Hear 1981; 10: 16-32.
75. Chan RWK. Does the voice improve with vocal hygiene education? A study of some instrumental voice measures in a group of kindergarten teachers. Journal of Voice 1994; 8: 279-291.
76. Merritt L, Richards A, Davis P. Performance anxiety: loss of the spoken edge. Journal of Voice 2001; 15: 257-269.
77. Dennik R. Long term retention of teaching skills after attending the teaching improvement project: a longitudinal, self-evaluation study. Med-Teach 2003; 25: 314-318.
78. Timmermans B, De Bodt MS, Wuyts FL, Van de Heyning PH. Training outcome in future professional voice users, after 18 months of voice training. Folia Phoniatrica et Logopaedica 2004; 56: 120-129.
79. Stemple JC, Lee L, D`Amico B, Pickup B. Efficacy of vocal function exercises as a method of improving voice production. Journal of Voice 1994; 8: 271-278.
80. Eustace CS, Stemple JC, Lee L. Objective measures of voice production in patients complaining of laryngeal fatigue. Journal of Voice 1996; 10: 146-154.
81. McKinney J. The singing / acting young adult from a singing instruction perspective. Journal of Voice 1997; 11: 153-155.
82. Zeine L, Walter KL. The Voice and its care: survey findings from actor's perspectives. Journal of Voice 2002; 16: 229-243.
83. Rantala L, Vilkman E, Bloigu R. Voice changes during work: subjective complaints and objective measurements for female primary and secondary school teachers. Journal of Voice 2002; 16: 344-355.
84. Vilkman E. Voice problems at work: a challenge for occupational safety and health arrangement. Folia Phoniatrica et Logopaedica 2000; 52: 120-125.
85. Maslov A. The Further Reaches of Human Nature. New York, NY, Viking, 1971.
86. Jong FICRS de, Kooijman PGC, Orr R. Predictive parameters in occupational dysphonia; in Dejonckere PH (ed): Occupational Voice: Care and Cure. The Hague, Kugler publications, 2001, pp 101-112.

Chapter 9

SUMMARY AND CONCLUSIONS

SAMENVATTING

Summary

Chapter 2

The aim of the study was to assess voice complaints and absence from work due to voice problems among teachers of primary education and secondary education (1878 teachers). A group of 239 controls were quasi randomly selected for comparisons. Female teachers reported more voice complaints and more absence from work due to voice problems than their male colleagues. No unequivocal relationship between age and voice complaints and absence from work due to voice problems was observed. Therefore, matching was done for sex but not for age. Over 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 were relatively high compared to controls with and without a vocally demanding profession. Over one-fifth of the teachers sought voice care. Over a one-tenth of the teachers had a history of voice problems during their training. Remarkably, this group reported significantly more voice complaints and absence from work due to voice problems during their career, than their colleagues without a history of voice problems during their training. The results of the Voice Handicap Index (VHI) scores followed these trends. The results of this study indicated that teaching was a high-risk profession for the development of voice problems. Furthermore, it brought to attention the need for more voice care during training, as well as during the teaching career.

Chapter 3

The findings and conclusions of this chapter were based on the opinions of female student teachers in comparison to quasi randomly selected females in the general population through a cross sectional questionnaire survey. Female subjects were assessed as voice complaints and susceptibility to voice complaints has been reported to be higher in females. No significant difference was found between the groups in the prevalence of voice complaints at the moment and / or during the past year. The groups reporting voice complaints and disability in relation to their voice complaints had significantly higher VHI scores than those without voice complaints and disability, which indicated a higher psychosocial impact of their voice. The results indicated that voice complaints in student teachers and the general population had a multi-factorial genesis, which included voice loading, psycho-emotional, physical and environmental factors. The perceived negative influence of the given risk factors on their voice was compared. The perception that vocal loading had a negative influence on their voice was reported to a similar

extent by both student teachers and the general population. The perception that environmental irritants in the room had a negative influence on their voice was reported more frequently by student teachers than the general population. The perception that the composition of the group they communicated with had a negative influence on their voice was more frequently reported by student teachers than the general population. The perception that stress and deterioration of their general physical condition had a negative influence on their voice was less frequently reported by student teachers than the general population. Over a third of subjects with voice complaints in both groups, were of the opinion that decrease of hearing had a negative influence on their voices. With regard to the impact of voice problems, no significant difference in VHI scores and impact of voice complaints was found between student teachers and the general population. The student teachers were apparently not sufficiently aware of the risks to their voice. This apparent lack of awareness in student teachers could itself be considered a risk factor for voice complaints.

Chapter 4

In this chapter female student teachers with voice complaints were compared to female student teachers without voice complaints to estimate the risk for voice complaints before they embark on their professional teaching career. In total, 457 questionnaires were analyzed. Of the subjects 39.6% reported voice complaints at the moment and / or during the past year. Subjects with voice complaints had a significantly higher VHI score than subjects without voice complaints. Overall, subjects with voice complaints reported more frequently than those without voice complaints that vocal loading factors, physical risk factors, environmental risk factors and psychological risk factors had a negative influence on their voice. Subjects with voice complaints reported more frequently a history of voice complaints during puberty and before puberty in comparison to subjects without voice complaints. Logistic regression analysis revealed the most discriminating set of risk factors for voice complaints, which were intensive voice use, emotions and voice complaints during puberty. Voice complaints in student teachers apparently had a multi-factorial genesis, often with roots during puberty. Subjects with voice complaints in comparison to those without voice complaints reported more frequently that they would develop a voice problem due to future teaching and that future teaching would have a negative influence on their voice. Around three quarters of subjects with and without voice complaints reported that the attention paid to their voice during training was sufficient, whereas subjects with voice complaints were observed to report the need for a refresher course on voice use

more frequently than those without voice complaints. Student teachers with voice complaints seemed to be more aware of the inadequacy of voice training, risks factors for voice problems and the potential risk of the teaching profession on their voice than those without voice complaints.

Chapter 5

This chapter focused on student teachers (1st to 4th year of training) in comparison to practicing teachers early in their career (1st to 4th year of teaching career) to explore the prevalence of voice complaints and whether risk factors perceived to be a negative influence on their voice were different across the threshold of teaching. Voice complaints at the moment and / or during the past year, were significantly more frequently reported by teachers than student teachers. Only around a third of the subjects of both groups sought voice care. Risk factors were assessed in relation to voice complaints. To check whether professional status was an effect modifier for the given risk factors, Odds Ratios were compared between the groups of teachers and student teachers to search for interactions between the risk factors and professional status. There was a significant difference in the pattern of risk factors for student teachers and teachers. There was an indication that vocal loading factors and environmental factors were more influential in student teachers and psycho-emotional factors were more influential for teachers early in their career. In early career teachers, history of voice problems during the training period was reported significantly more in teachers with voice complaints than teachers without voice complaints, which showed the importance of improving voice care and training for student teachers. The findings suggested an overall unawareness in student teachers in comparison to early career teachers, with regard to voice training and the potential risks of the teaching profession on their voice.

Chapter 6

This chapter focused on the psychosocial impact of current voice complaints in student teachers with voice complaints in comparison to student teachers without voice complaints, and to observe the pattern of perceived risk factors in relation to the voice handicap. Quasi randomly recruited subjects in the general population without a voice demanding profession were selected as a reference group for a general comparison with the total group of student teachers. Student teachers had a relative high risk of voice problems and a significantly greater voice handicap compared to the general population without a voice demanding profession. However, the VHI subscale scores were not significantly different. Within the group

of student teachers, the total VHI and subscale scores were significantly greater for student teachers with current voice complaints than student teachers who did not report voice complaints. A proportion of student teachers with a VHI score greater than the 75th percentile did not report a current voice complaint, which probably represented the false negative cases in the estimation of voice complaints. Logistic regression analysis of each of the given risk factors with the VHI as the independent variable revealed that the perceived negative influence of the given risk factors on their voices was significantly greater (more frequently reported) with increasing VHI scores across the VHI range. Student teachers were apparently more aware of the risk factors for voice problems when they had a voice handicap and the awareness appeared to be greater when the voice handicap was higher. A significant correlation was also observed between number of perceived risk factors and increasing VHI scores across the VHI range.

Chapter 7

This chapter addressed the concomitant use of the VHI and Type-D scale-16 (DS16) questionnaires used along with the general questionnaire among 457 female student teachers and 475 female teachers in primary education. Type-D personality is the combination of high “negative affectivity” and high “social inhibition”, and the DS16 scale has been considered to be a reliable and valid measure of these two stable personality traits, which determine the Type-D personality. The objectives of the study were to assess the VHI of Type-D personality subjects in comparison to non-Type-D personality subjects and to examine the voice handicap in relation to reported voice complaints and seeking voice care. Type-D subjects did not report more voice complaints at the moment and / or during the past year than non-Type-D subjects on the nominal scale questionnaire. However, when a detailed ordinal measurement scale was used in the form of the VHI, Type-D subjects scored significantly higher than non-Type-D subjects. The finding indicated that reported voice complaints could be underestimated in the Type-D group. Furthermore, the percentage of subjects with VHI scores greater than the 75th percentile was significantly more among Type-D subjects than non-Type-D subjects. Within this group, the Type-D subjects did not score significantly higher than the non-Type-D subjects, however, they sought less voice care compared to the non-Type-D subjects. Among subjects with reported voice complaints, the Type-D personalities did not have higher voice handicap scores than those with a non-Type-D personality, but showed a tendency to seek less voice care compared to their non-Type-D colleagues. Due to this tendency to seek less care for their voice problem, the impact of the voice problem could be

greater for the Type-D than non-Type-D subjects. In subjects who did not report a voice complaint, VHI scores of the Type-D group were significantly higher than those of the non-Type-D group. Furthermore, the percentage of subjects with VHI scores higher than the 75th percentile was significantly more for Type-D subjects than non-Type-D subjects. The findings indicated that Type-D subjects were apparently more troubled or bothered by their voice (more VHI scores in the fourth quartile) than the non-Type-D subjects, but had an apparent tendency to report less voice complaints and sought less voice care. The Type-D scale-16 used along with the Voice Handicap Index could serve as useful supplementary screening tools and would help to identify subjects of the Type-D trait with a voice handicap, enabling specific training and voice care, encompassing not only physical but also psychosocial aspects of vocal health. Concomitant use of the 5-point ordinal interval scale VHI with the DS16 could reveal voice complaints that Type-D subjects were apparently reluctant to report on a nominal scale of a questionnaire.

Conclusions

- Voice complaints were a common problem in teachers, often leading to absenteeism and requiring voice care. Teachers reported more frequently voice complaints than non-vocal professionals in the general population. Voice problems during the career and a history of absence from work due to voice problems were relatively more frequently reported by teachers compared to controls with and without a vocally demanding profession. Voice problems in teachers often had a history during the training period, which calls for more attention to student teachers before they start their professional teaching career.

- The transition from a student teacher to a professional teacher apparently constitutes a high-risk period, as there was a sharp increase in voice complaints in teachers early in their career. Voice complaints appeared to have a multi-factorial genesis. There is an indication of more psycho-emotional factors related to voice problems when teachers begin their professional careers. Student teachers may not be adequately prepared to cope with the psychosocial demands of teaching during the training period. This finding calls for a more multidimensional training encompassing physical and psychosocial domains of vocal health.

- Voice complaints were common in student teachers. In comparison to non-voice professionals in the general population, student teachers were at a higher risk for developing voice problems and had a greater voice handicap. Remarkably there was no significant difference in comparison to the total general population. Voice complaints could have been underestimated as it was observed that student teachers did not always report voice complaints although they had a considerable voice handicap. The VHI would be a useful tool to detect the occult false negative cases in the estimation of voice complaints.

- Overall, Type-D subjects were more handicapped by their voice than the non-Type-D subjects. They had an apparent tendency to report less voice complaints and sought less voice care even though they had a considerable voice handicap. The DS16 together with the VHI questionnaire could be useful as supplementary tools to screen these subjects to impart voice training and voice care.

- Student teachers and practicing teachers early in their career were apparently not fully aware of the risks to their voice. Inadequate availing of voice care while having voice complaints, and not reporting voice complaints when having a considerable voice handicap probably reflected this lack of awareness. Furthermore, student teachers were not aware of the potential risks of future teaching on their voice. This apparent lack of awareness in student teachers could itself be considered a risk factor for voice complaints.

- Voice problems in student teachers appeared to often have roots during puberty. This probably means that certain subjects had a constitutionally weak voice and may have had a greater susceptibility to voice problems. Dealing with student teachers and teachers with voice complaints who have a history of voice problems is a challenge for voice training.

These reports are a call for action as student teachers are embarking on a career that is voice demanding and dependent on the voice. It is important that student teachers begin their careers with a robust and optimally functional voice and require intensive voice training and preventive voice care. Additionally, teachers voice should be cared for during the entire teaching career.

De stem van Pabo-studenten en docenten: een uitdaging voor docentenopleidingen, werkveiligheid, en gezondheidszorg

Het onderzoek is een cross-sectional studie middels vragenlijsten (een algemene vragenlijst, Voice Handicap Index (VHI) en Type-D scale-16 (DS16)) naar stemproblemen bij Pabo studenten en docenten.

De vrouwelijke docenten in het basis en voortgezet onderwijs rapporteerden vaker stemklachten en verzuim als gevolg van stemklachten dan de mannelijke docenten. Andere studies tonen aan dat stemklachten in het algemeen en beroepsmatig vaker voorkomen bij vrouwen dan bij mannen. Daarom werden alleen vrouwen geïncludeerd in de studie met Pabo studenten. Vergelijkingen werden gemaakt met docenten in het basisonderwijs en een controlegroep. De personen van de controlegroep werden quasi at random uit de algemene bevolking geselecteerd en hadden wel of geen stembelastend beroep. Tevens werd de invloed van Type-D persoonlijkheid (een combinatie van grote negatieve affectiviteit en grote sociale inhibitie) onderzocht in relatie tot stemhandicap en het zoeken naar stemzorg.

Stemklachten kwamen zowel bij studenten en docenten, alsook bij de controlegroep voor en leidden frequent tot verzuim en zorgvraag. Er waren meer stemklachten onder de docenten dan onder de studenten en onder de controle groep met en zonder een stembelastend beroep. Daarnaast hadden de docenten die stemklachten rapporteerden vaker stemproblemen tijdens de opleiding dan docenten zonder stemklachten. Dit vraagt om meer aandacht voor de stem tijdens de opleiding en het is aannemelijk dat de overgangsperiode van student naar docent een risico voor het ontstaan van stemklachten vormt. Stemklachten lijken door meerdere factoren van diverse aard te ontstaan. Een belangrijk verschil in patroon van risicofactoren voor stemklachten tussen studenten en docenten bestond hieruit dat er meer psycho-emotionele factoren bij de docenten en meer omgevingsfactoren en factoren betreffende stembelasting bij de studenten voorkwamen. Dit wijst op de noodzaak van een dynamische multidimensionale aanpak van stemproblemen, waarbij niet alleen aandacht wordt geschonken aan fysieke aspecten, maar ook aan psycho-emotionele aspecten.

In vergelijking met personen in de controlegroep die hun stem niet professioneel gebruiken hadden de studenten een hoger risico op het ontwikkelen van stemproblemen en een grotere stemhandicap. De studenten met stemklachten

waren significant meer gehandicapt als gevolg van hun stemklachten in vergelijking met studenten zonder stemklachten, maar opmerkelijk was dat er geen significant verschil was in vergelijking tot de totale controlegroep. Stemklachten konden bij studenten zijn onderschat omdat zij niet altijd aangaven stemklachten te hebben ondanks hun relatief hoge VHI. Dit wijst er ook op dat de VHI een bruikbaar instrument is om verborgen stemproblemen te detecteren.

Studenten die stemproblemen rapporteerden vermeldden vaker stemproblemen tijdens de puberteit dan studenten die geen stemproblemen rapporteerden. Dit wijst erop dat bepaalde personen preëxistent (mogelijk constitutioneel) een zwakke stem hadden en daardoor meer stemproblemen kregen. Daarom is een voorgeschiedenis met stemproblemen een uitdaging voor stemtraining voor studenten en docenten.

In het algemeen hadden personen met een Type-D persoonlijkheid een grotere stemhandicap dan personen die niet een Type-D persoonlijkheid hadden. Echter zij gaven minder vaak een stemprobleem aan. Bovendien zochten zij minder stemzorg, ondanks hun relatief hoge stemhandicap (VHI). De DS16 lijkt samen met de VHI bruikbaar te zijn als toegevoegd instrument bij de screening van personen met een verhoogd risico op het krijgen van stemproblemen.

Studenten en docenten vroeg in hun loopbaan waren zich blijkbaar niet bewust van de risico's voor hun stem. Immers zij die wel stemklachten rapporteerden zochten vaak geen hulp en velen die een relatief grote stemhandicap aangaven (VHI) rapporteerden geen stemklachten. Bovendien waren Pabo studenten zich niet bewust van de potentiële risico's voor hun stem bij het lesgeven in de toekomst. Het klaarblijkelijk ontbreken van het bewustzijn bij studenten zou een risico kunnen vormen voor stemklachten.

De resultaten van deze studie vragen om actie want Pabo studenten starten een loopbaan waarbij zij te maken krijgen met een grote stembelasting. Het is belangrijk dat de Pabo studenten hun loopbaan beginnen met een robuuste en optimaal functionerende stem. Het is noodzakelijk dat zij intensieve stemtraining en preventieve stemzorg genieten. Bovendien zou er voortdurende zorg voor de stem moeten zijn gedurende de gehele carrière van de docent.

Appendix

Appendix AI.

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

I would first like to thank the head of the department of Ear Nose Throat, Head and Neck Surgery prof. dr. K. Graamans for permitting me to pursue a doctorate in the Radboud University Medical Centre, Nijmegen. Thank you for your patronage and benevolence.

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Curriculum vitae

George Thomas was born in 15th October 1970 in Bangalore in India to George Thomas (senior) a surgeon and Mary Thomas an anaesthesiologist. As his parents were working and studying in the United Kingdom his initial schooling was in England for a period of 4 years first at the New Road school and subsequently the Byron Road school in Kent. After his parents went to work in Africa, George Thomas and his elder sister joined a boarding school in India. He finished his primary and secondary schooling at the Corpus Christie school in Kottayam and his plus two schooling at the St. Thomas school, Trivandrum.

After his schooling, George Thomas then joined the medical school P.S.G. Institute of Medical Sciences and Research, Coimbatore in 1988 and graduated as Bachelor of Medicine and Surgery M.B.B.S. in 1994.

Following his internship he worked as a demonstrator in Anatomy at the Christian Medical College, Vellore for a year.

George Thomas then pursued his post-graduate studies at the Christian Medical College Vellore, Diploma in Otorhinolaryngology D.L.O. from 1995 to 1997 and Master of Surgery M.S. from 1997 to 2000. During his post-graduate studies, with the guidance of prof. Anand Job he completed a thesis “An epidemiological study of hearing loss and otitis media in the rural south Indian population” under the auspices of the World Health Organization. During this period he presented a paper “Tube exchanger in the management of soft tracheal stenosis” at the Tamil Nadu E.N.T. state conference 1998 and was awarded the prof. S.Kameswaran Gold medal for best paper presentation by a post-graduate.

After completion of his five year Ear, Nose, Throat surgery training he worked at the Madras E.N.T. Research Foundation in Madras (Chennai) under the guidance of prof. Mohan Kameswaran for a period of three years. During this period he presented a paper “A rare presentation of Glomus jugulare and its management” at the Tamil Nadu E.N.T. state conference, 2000 and was awarded the prof.K.K.Ramalingam Gold medal for best paper presentation by a practicing E.N.T. surgeon. Subsequently he was awarded a bronze medal for his paper presentation “The application of the K.T.P 532 laser in tropical diseases” at the Tamil Nadu state conference in 2001.

Following this period, George Thomas came to The Netherlands to pursue a doctorate at the reputed Radboud University Nijmegen. Till date he has twelve research papers to his credit and is looking forward to a career combining clinical work and academics.

George Thomas is married to Susan Thomas and they have a delightful son Ashish Thomas George.