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USING A QUESTIONNAIRE DESIGN IN THE INVESTIGATION OF TEACHERS' VOICE RISK FACTORS

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Many authors are sceptical of the use of a qualitative questionnaire survey. Data gathered by qualitative questionnaires is seen to be of a more subjective nature than those that generate objective measurements. However using a qualitative survey methodology is most common in epidemiological voice research. A person who uses their own voice can describe it from a personal sense and from their personal experience. Their subjective and individual descriptors provide important rich information. Consequently qualitative questionnaires are an integral part of voice investigations. The purpose of this research was to develop and validate a questionnaire for use in investigating the prevalence of risk factors in teacher's voice disorders. The methods used were content, face and convergent validity for the validation of the questionnaire. Cronbach's alpha coefficient was used for the measurement of internal consistency. The results showed that the questionnaire consisted of four separate scales concerned with voice risk factors and one additional scale determining the presence and onset of voice problems. There were 57 items. Nominal and ranking scales were used for responses. The internal consistency reliability using Cronbach's alpha coefficient was 0.72. Content validity was ensured during the design process. The findings found that the questionnaire was appropriate for use in the determination of and onset of voice problems and also for the identification os factors affecting voice quality.

Keywords: *voice problems, questionnaire, risk factors, teachers.*

Introduction

Epidemiological studies concerning the prevalence and risk factors of voice problems in the teacher population are nonexistent in Latvia nor do any exist in the Baltic countries at all. According to the International Classification of Functioning, Disability and Health, voice quality depends on body functions and structures as well as environmental and personal factors. A healthy voice enables an active involvement in different life situations and in the execution of tasks by individuals (WHO, 2001).

The human voice is affected by a dynamic interaction between one's health conditions and additional related factors of the internal and external environment. There are risk factors such as excessive vocal load, within the physical environment in the condition of rooms, and through psychological stress. Gender, age and length of service in the voice profession also affect the voice in direct and indirect ways. Risk factors can include aspects of personal habits or environmental exposure that is associated with an increased probability of the occurrence of disease (Bonita, Beaglehole, Kjelstrom, 2006). The identification and investigation of risk factors can reduce the probability of disease.

The challenge of epidemiology is to investigate the prevalence of these risk factors and the causes of voice disorders. A survey is the most common data gathering instrument in epidemiological cross-sectional studies (Bonita, Beaglehole, Kjelstrom, 2006). Many types of surveys are used to investigate aspects of voice usage. These include specifically designed questionnaires, telephone interviews (Roy, Merrill, Thibeault et al, 2004) and the face-to-face interview (Roy, Stemple, Merrill, Thomas, 2007) An analysis of many epidemiological voice studies conducted in the last decade shows that the questionnaire is the main and often single method of data collection (Thomas, de Jong, Cremers, Kooijman, 2006; Jones, Sigmon, Hock et al, 2002; Russell, Oates, Greenwood, 1998; Fairfield, Richards, 2007; McHenry, Carlson, 2004; Simberg, Sala, Vehmas, Laine, 2005; Mesquita de Medeiros, Barreto, Assuncao, 2008; Kooijman, de Jong, Thomas et al, 2006; de Jong, Kooijman Thomas et al, 2006).

A review of the literature shows very few epidemiological studies were conducted where questionnaires were used together with objective methods of instrument assessment of voice function and larynx such as perceptual, acoustic and videolaryngoscopic examination (Simberg, Sala, Laine, Ronnemaa, 2001; Sliwinska-Kowalska, Niebudek-Bogusz, Fiszer et al, 2006; Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, Preciado-Ruiz, 2008). The number of respondents in these studies is relatively small compared with surveys without the individual evaluation of each participant. Consequently, the nature of epidemiological study in this field has been hazardous because the proportion between the sample and the population must be adequate. A combined subjective – objective approach is suitable for investigations with a limited, comparative small sample. The use of objective instrument assessment in epidemiological studies is related to human and financial resources. The use of instrumental methods are not only objective but also expensive.

Why are subjective questionnaires so wide spread in voice research? Russell (1998) reported that evidence from clinical practice suggests that a significant number of people who attended voice specialists do not have voice pathology; therefore a clinical examination of the larynx does not always give information about the prevalence of voice disorders in a population (Russell, Oates, Greenwood, 1998). There could be different stages of voice dysfunction ranging from single episodic symptoms to constant voice disorders that restrict activities in everyday life. The term "voice disorders" is mainly used by professionals as opposed to the term "voice problems" a more common term well understood by everyone. Individuals characterise changes of voice as voice problems. The main differences between voice disorders and voice problems, between objective and subjective facts are that the diagnosis of voice disorders is based on the results of a complex assessment whereas voice problems are mostly related to the number and frequency of voice symptoms. They are mainly based on a self-assessment of changes in the signs perceived by other people. Voice disorders always implies that voice symptoms are experienced as problems, but merely experiencing symptoms does not always mean that a person has a voice disorder (Lehto, 2007).

According to the European Laryngology Society, the subjective self evaluation of voice has a growing importance in daily clinical practice (Dejonckere, Bradley, Clemente et al, 2001). It is the patient who has to live with his/her voice. Who better than he/she can evaluate his/her voice? Brief, concise but clinically useful self reporting questionnaires are highly attractive in the clinical environment (Deary, Webb, Mackenzie et al, 2004). They can provide valuable information about functional abilities and quality of life that cannot be achieved by using objective assessment methods. Therefore self-assessment questionnaires are one of the evaluative instruments used in the everyday practice of phoniatrist, speech pathologists and physicians in occupational health. There is no unified standard questionnaire for evaluating factors that affect voice. The aim of the study was to develop and validate a questionnaire for investigating: (1) the prevalence of voice problems among teachers; (2) teachers' opinion about the risk factors related with their voice problems. The questionnaire didn't anticipate an investigation of symptomatology or the regularity of voice disorders.

Methods

The development of the questionnaire was based on empirical observations and an analysis of scientific publications. The reliability and validity of the questionnaire was examined within a teacher population. An expert analysis and two pilot studies provided validation of the questionnaire.

The validity of the content analysis and the data from the face-to-face interviews was established during a process of agreement on the risk factors scale. A construct convergent validity was calculated for the Voice Problems Prevalence Scale.

The content validity was determinated by an analysis of questionnaires investigating voice risk factors and by expert judgement. Face validity is where items in a questionnaire appear to be valid depending on the respondents who complete it (Rascevska, 2005). Face validity was estimated by respondents statements where items in the questionnaire measured potential voice risk factors and the existence of voice problems. Two pilot studies were organized to determine face to

face validity. The aim of the first pilot was to determine the correspondence between the items in the questionnaire and the measurement of voice affecting factors. 17 teachers participated in the first pilot study including school teachers representing all educational levels. Seven of them taught in grades 1–4, seven in grades 5 to 9, and three of them were high school teachers. The average age was 41 years (range 25–58 years), the average length of service in teacher profession was 13 years (range 1–29 years), and the average total work hours per week was 36. The aim of the second pilot study was to examine the validity and reliability of the upgraded version of the questionnaire. Like the first pilot study teachers of all educational levels were included. Eight teachers had an average age of 42 years (range 24–62 years) and with an average length of service of 18 years (range 1–44 years). All respondents were interviewed.

Construct convergent validity was confirmed by a comparison of Voice problem prevalence and an onset scale from the questionnaire and the Latvian version of the Voice Handicap Index (VHI-Lat). All respondents filled out the Voice Handicap Index questionaires. The results of both questionaires were compared. It should be mentioned that construct convergent validity was not measured for Voice risk factors scales because there are no adequate scales available in Latvian.

SPSS 16.0 for Windows was used for statistical analysis. Cronbach's alpha scale was used to determine the internal consistency of the questionnaire. According to Cronbach, the reliability of the internal consistency of the whole questionnaire can also be interpreted as the internal consistency of the variables (items). The modification of Cronbach's alpha formula can be used for tests with variables in ordinate and dichotomic scales (Rascevska, 2005).

Results

The development of the questionnaire

The questionnaire consists of five separate scales – Voice usage risk factors scale (A), Environmental risk factors scale (B), Medical risk factors scale (C), Psycho-social risk factors scale (D), and Voice problems prevalence and onset scale. There were 34 questions and 57 items (see Appendix A). The questionair also had a sociodemographic data scale.

Knowledge about vocal hygiene and everyday vocal load are the main components of voice usage. In our study vocal load was directly related with intensity and length of use of the vocal apparatus. The aim of the Voice Usage Risk Factors Scale was to investigate typical voice behaviour in teachers and the effects of this behaviour on the quality of voice. Does neglecting voice hygiene and vocal overload create voice problems? The inclusion of those items was based on evidence of other research on the statistical significance of one or another risk factor in the aetiology of voice disorders (Kooijman, de Jong, Thomas et al, 2006; Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, Preciado-Ruiz, 2008; Mattiske, Oates, Greenwood, 1998; Ilomaki, Maki, Laukkanen, 2005; Smolander, Huttunen, 2006). The Voice Usage Risk Factors Scale includes two separate subscales. The first was related to voice load factors: (a) number of teaching hours per week; (b) total work hours in the school per week (teaching hours, groundwork, home work check, consultations); (c) extra vocal load out of school (coach, choir conductor or some other activity related to large vocal load); (d) average voice loudness during lessons; (e) shouting during the working day; (f) speaking in a noisy environment. The second subscale consisted of questions about vocal hygiene: (a) knowledge about voice ergonomics; (b) using this knowledge in everyday life; (c) throat clearing; (d) teaching with a sore throat; (e) speaking in breaks; (f) amount of water drunk during the working day; (g) amount of coffee, black tea or caffine type beverages drunk during the working day.

Scale B of the questionnaire included items characterising the influence of environmental factors on vocal function and voice quality (Kooijman, de Jong, Thomas et al, 2006; Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, Preciado-Ruiz, 2008; Mattiske, Oates, Greenwood, 1998; Smolander, Huttunen, 2006; Jónsdóttir, 2003). Voice problems in teachers arise from the interplay of the individual and the environment (Lyberg Ahlander, 2011). The aim of the environmental scale was to investigate how the classroom environment can influence teachers' voices. Similar to scale A, the items were grouped into two subgroups. The first subgroup covers items related to classroom acoustics: (a) average number of pupils in the class; (b) average noise level in the classroom during the lessons; the sources of background

noise (c) outside; (d) the neighbouring classroom ; (e) the corridor; (f) heating and/or ventilation systems; (g) light fixtures; (h) computers, projectors, overhead projectors; (i) furniture; (j) lack of discipline in the classroom; and (k) reverberation in the classroom. The second subgroup of the Environmental Risk Factors Scale includes items related to air quality: (a) dust; (b) blackboard chalk; (c) chemical fumes; (d) mould; (e) dry air from heating; (f) cold or hot temperatures from heating; (g) air humidity from heating; (h) degree of classroom air quality (good/ rather good/ rather bad/ bad).

Certainly voice problems are closely linked to general health. However the causal relationships are disputable. Problems in general health cause pathological voice changes and conversely the use of an inappropriate voice technique over long periods influences health and physical condition. The third scale in the questionnaire (C) includes items related to different states of health (Kooijman, de Jong, Thomas et al, 2006; Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, Preciado-Ruiz, 2008). The Medical Risk Factors Scale includes the following items: (a) a general health evaluation; (b) the existence of any health problem(s); (c) any chronic illnesses of the upper respiratory tract; (d) endocrine diseases; (e) respiratory allergies; (f) oesophageal reflux; (g) lower back pain; (h) shoulders – neck muscles pain; (i) other medical conditions; and (j) smoking.

The aim of scale D was to investigate any psychological risk factors in a teacher's everyday life. Teachers commonly work in a stressful environment with high vocal and psychological demands and a large number of students (Lyberg Ahlander, 2011). The importance of stress and tiredness in the development of voice problems were investigated in this part of the questionnaire. The items on this scale explore sources of stress (Kooijman, de Jong, Thomas et al, 2006; Mattiske, Oates, Greenwood, 1998) and work satisfaction. Reasons that causes stress – (a) pupils; (b) relationships with colleagues; (c) relationships with administration; (d) heavy workload; (e) salary; (f) family problems; (g) other stress sources. Evaluation of: (h) stress levels; (i) tiredness levels; and (j) satisfaction with the job.

With the purpose of investigating the prevalence and onset of voice problems among teachers, the following items were included in the questionnaire: (a) Have you ever had problems with your voice? (b) When did you expierence voice problems for the first time? (during childhood, at school/ during studies at university/ working as a teacher) (Simberg, 2004; Gottliebson, Lee, Weinrich, Sanders, 2007); (c) Are you suffering from voice problems? (at present/ during this school year/ during the years of teaching) (Sliwinska-Kowalska, Niebudek-Bogusz, Fiszer et al, 2006; Vilkman, 2004); (d) Have you ever applied for medical help because of voice problems? (e) Has a doctor ever diagnosed voice disorders?

Each item on the questionnaire had a separate answer scale. The nominal and ranked scales were used for responses. During the analysis of the results the responses scales were dichotomized (Thomas, de Jong, Cremers, Kooijman, 2006).

The validity of the questionnaire

The content validity of the questionnaire was based on an analysis scientifically approved, through the common ideas of similar kinds of research (Roy, Merrill, Thibeault et al, 2004; Thomas, de Jong, Cremers, Kooijman, 2006; Mesquita de Medeiros, Barreto, Assuncao, 2008; Kooijman, de Jong, Thomas et al, 2006; Simberg, Sala, Laine, Ronnemaa, 2001; Sliwinska-Kowalska, Niebudek-Bogusz, Fiszer et al, 2006; Preciado-Lopez, Perez-Fernandez, Calzada-Uriondo, Preciado-Ruiz, 2008). The questionnaire was amended as a result of an evaluation of existing items; having the lowest ranking items excluded from the form. In order to get a more precise standard of teachers' voice level and the classroom noise levels, the answers for these items were provided in the form of a similar kind of setting for all teachers – very quiet (empty classroom), quiet (silent voices, students doing the same work), average or raised (students talking), loud (nursery group), very loud (school break at a lunch hour at a canteen). In the second pilot study there were eight respondents who, after completing the questionnaire, stated that the items were clear and comprehensible, that they represented the full range of the voice affecting factors and were valid. The questionnaire can be used for research and in the evaluation of voice problems and measurement in the teacher population.

One of the main goals of the survey was to reveal the prevalence of voice problems among the teacher population. Within the framework of the present research the Voice Problem Prevalence and Onset Scale has a statistically significant corelation with the Voice Handicap Index. The correlation coefficient was 0.75. Therefore the convergent validity of the present construct is high.

Basined on the experts judgement, statements of the face-to-face validity, and evidence of the construct validity, the authors claim that the questionnaire is useful for the investigation of the prevalence and risk factors of voice problems in the teacher population.

The reliability of the questionnaire

In order to test the internal consistency of each scale and questionnaire in general the Cronbach's alpha approach was used (see table 1).

Table 1

The internal consistency of the scales of survey questionnaire

Scale	Items (N)	Cronbach's alpha (α)
A	13	0.40
B	19	-0.20
C	10	0.06
D	10	0.40
A, B, C, D	52	0.72
Voice problem prevalence and onset	5	0.75

According to Cronbach, the reliability of the internal consistency can be interpreted also as the consistency of responses of all the questionnaire (Rascevska, 2005). Cronbach's alpha ratio for all risk factor scales (A,B,C,D) totalled 0.72 which is considered as a good ratio. In fact, Cronbach's alpha ratio characterises the average reliability of combinations of all scales. There are grounds for concluding that the high internal consistency also signifies the construct validity.

Discussion

Questionnaires are formed based on the available scientific information, teacher interviews and the clinical research of voice experts (Thomas, de Jong, Cremers, Kooijman, 2006; Jones, Sigmon, Hock et al, 2002; Mesquita de Medeiros, Barreto, Assuncao, 2008). Many questionnaires are not validated and they do not have scale reliability ratios calculated. Nevertheless, despite the lack of statistical evidence in many studies, survey methods allow for the disclosesure of the main factors in voice problems, preponderance of them in certain population groups and provides information about factors affecting voice functions. Therefore, subjective, self-assessment methods are acceptable in voice research. According to Russell et al items included in a questionnaire allow the respondent to decide him/her self whether he/she has voice problems (Russell, Oates, Greenwood, 1998). Theoretically, such an approach could exclude teachers with voice problems, where they deny or refuse to believe that they have voice problems. Alternatively it may include those who haven't objective voice findings but believe they have voice problems. We can find a lot of people with voice problems with a questionnaire. Yet there is no single method sufficient to detect those who have problems (Simberg, Laine, Sala, Ronnemaa, 2000).

In our research we had approval that the questionnaire was a valid and reliable tool for data gathering. The validity and reliability of the questionnaire was made in order to lessen the subjectivity of it. Using the Cronbach's alpha method each separate scale indicated a low ratio of internal consistency, but all the scales together indicated an adequate measurement. This proved that in order to do research all of the scales had to be used. It has to be emphasized, that the origin of voice disorders is multifactoral and the approach is complex. All the factors influencing voice have to be seen in one system. When performing a risk factor study of voice problems a unified scale of items has to be used including voice usage, environmental, medical and psycho-social factors.

The data obtained should be through holistic research showing the real situation and possessing a certain reliability degree.

The specific feature of the teaching profession is that they have constant workloads, use the same classrooms, and teach one and the same pupils. The factors influencing teacher voice do not change in lengthy periods. Due to this the re-test reliability was not determined.

The survey questionnaire combines two constructs – prevalence/ onset and risk factors of voice problems. The convergent validity of the prevalence and onset of the voice problem construct was proved through a comparision with the VHI Latvian version. It meant that the items of the newly developed questionnaire made it possible to find the existence of voice problems. If all four risk factor scales are considered as one construct then the construct is of a sufficiently high validity, confirmed by high internal consistency of all scales. The high internal consistence of the scale characterises the validity of the construct (Rascevska, 2005).

Conclusions

Questionnaires can be used in voice problem research and in the diagnosis of voice problems in the teacher population. The Voice Problems Prevalence and Onset Scale facilitates the determination of teachers' voice problems. In the research of risk factors, a questionnaire has to be used in totality and not by using a separation of the questions individually. By modifying individual items the questionnaire can be used in the research of voice problems of other professionals. It is easily administered and low cost. It is adviseable to use additional resources and instruments for research alongside this questionnaire in order to lessen the subjectivity of the findings.

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Appendix

Questionnaire for the teachers

General questions

Age: **Gender: male / female**

1.	**Tick the educational level that you teach**	**Length of service in a teacher profession:**
		☐ Grade 1–4
		☐ Grade 5–9
		☐ Grade 10–12
2.	**Tick the subjects that you teach**	☐ All subjects in primary school
		☐ Languages
		☐ Mathematics, Informatics, Biology, Physics, Geography
		☐ Chemistry
		☐ Social sciences, History, Ethics
		☐ Sport
		☐ Art, Housekeeping
		☐ Music
		☐ Other .....

A							
3.	**Please indicate if you are a coach, choir conductor or you have some other activity related to large vocal load**	☐					
4.	**Number of teaching hours per week**	☐ ..... hours / week					
5.	**Tick the total hours worked in the school per week** (teaching hours, groundwork, homework check, consultations, and other additional work)	< 10 h	11–20 h	21–30 h	31–40 h	41 <	
6.	**Evaluate your average voice loudness during lessons**	**relaxed**	**normal**	**raised**	**loud**	**very loud**	**shouting**
7.	**Evaluate your knowledge about voice ergonomics (voice using and protection)**	☐ very good ☐ rather good ☐ rather bad ☐ very bad					
8.	**Do you use this knowledge in everyday life?**	☐ yes ☐ no ☐ sometimes					
9.	**Do you shout during your work day?**	No	yes	difficult to answer			
10.	**Do you speak in a noisy environment?**	No	yes	difficult to answer			
11.	**Do you clear your throat?**	No	yes	difficult to answer			
12.	**Do you teach with a sore throat?**	No	yes	difficult to answer			
13.	**Do you speak in breaks?**	No	yes	difficult to answer			
14.	**How much water do you drink during your working day?**	..... glasses / cups* * glass / cup – 250 ml					
15.	**How much coffee, black tea or caffine beverages do you drink during your work day?**	..... glasses / cups					

B						
16.	**Average number of pupils in the class**	..... pupils				
17.	**Evaluate average noise level in the classroom during the lessons (tick one)**	**very quite**	**quite**	**rather load**	**load**	**very load**
		empty class	*silent voices, small noise*	*everyday speech*	*nursery group*	*corridor canteen during breaks*
18.	**The background noise in the classroom comes from:** **(tick one or more from the following factors)**	☐ outside (street) ☐ classroom alongside ☐ corridor ☐ heating and/or ventilation system ☐ light fixtures ☐ computers, projectors, overhead projectors ☐ furniture ☐ lack of discipline in the classroom				
19.	**The classroom has :** **(tick one or more from the following factors)**	☐ dust ☐ blackboard chalk ☐ chemical fumes ☐ mould ☐ dry air during heating season ☐ too low or too high temperature during heating season				
20.	**Evaluate the quality of air in the classroom (dust, blackboard chalk, chemical fumes, t⁰)**	good	rather good	rather bad	bad	
21.	**Evaluate the humidity of air in the classroom during heating**	☐ sufficient ☐ insufficient (very dry air) ☐ difficult to answer				
22.	**Does reverberation exist in the classroom (echo)?**	☐ no ☐ yes ☐ difficult to answer				
Voice problems prevalence and onset scale						
23.	**Have you had problems with your voice?**	☐ no – follow to item 28. ☐ yes				
24.	**When did you experience voice problems for the first time? (tick one)**	☐ during childhood, at school ☐ during studies at university ☐ during your teaching career ☐ other.....				
25.	**I suffer from voice problems (tick one or more)**	☐ at present ☐ during the past year ☐ earlier during teaching career				
26.	**Have you ever applied for medical help because of voice problems?**	☐ no ☐ yes				
27.	**Has a doctor ever diagnosed voice disorders?**	☐ no ☐ yes, what kind ..... ☐ yes he has, but I don't remember what kind				

C		
28.	**Evaluate your general health**	☐ very good ☐ rather good ☐ rather bad ☐ very bad
29.	**Tick if you have any health problems:**	☐ no problems ☐ chronic illnesses of upper respiratory tract ☐ endocrine diseases ☐ respiratory allergies ☐ oesophageal reflux ☐ lower back pain ☐ shoulders – neck muscles pain ☐ other .....
30.	**Do you smoke?**	☐ No and never done it ☐ I smoke before, but not now. ☐ Yes, I am a social smoker ☐ Yes I smoke regularly. How many years? .....

D									
31.	**Evaluate your stress level at work** (*1 – very low, 8 – very high*)	1	2	3	4	5	6	7	8
32.	**Tick the reasons that cause you stress**	☐ pupils ☐ relationships with colleagues ☐ relationships with administration ☐ heavy workload ☐ salary ☐ family problems ☐ other							
33.	**Evaluate your tiredness level** (*1 – very low, 8 – very high*)	1	2	3	4	5	6	7	8
34.	**Evaluate your satisfaction with work**	☐ satisfied ☐ rather satisfied ☐ rather unsatisfied ☐ unsatisfied							