



ORIGINAL ARTICLE

Risk factors for voice disorders in public school teachers in Cyprus

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Keywords

Voice disorders • Risk factors • Teachers, Cyprus

Summary

Aims. The purpose of this study was to investigate risk factors for self-perceived voice disorders in teachers in Cyprus in order to determine the necessity for a preventative vocal hygiene education program which could improve their work performance.

Methods. An online questionnaire was completed by 449 teachers. The questionnaire extracted data regarding risk factors that may contribute to the development of voice disorders, occupational consequences of voice disorders and vocal hygiene education, as well as, a self-perceived severity of a participant's voice problem. Subjects were split into two groups, teachers with Voice Disorder Index (VDI) ≤ 7 and teachers with VDI > 7 . The chi-squared test was used to explore the differences in responses

for each voice risk factor, occupational consequence and vocal hygiene education between the two groups.

Results. Teachers in the VDI > 7 group were more likely to frequently experience nasal allergies and respiratory infections, coughing, throat clearing, stress and yelling, have shorter breaks between classes, use loud voice, use their voice to discipline students, teach above students talking, etc. than teachers in the VDI ≤ 7 group. Moreover, teachers in the VDI > 7 group were more likely to limit their ability to perform certain tasks at work and reduce their activities or interactions "3-5 or more days" annually due to voice problems.

Conclusions. Health, voice use, lifestyle, and environmental factors may play a part in the development of voice disorders in teachers and have an impact on their job. Therefore, a preventative vocal hygiene education program is suggested.

Introduction and literature review

Teachers belong to one of the occupational groups that tend to overuse their voice (i.e., repeatedly use their voice or require heavy voice use) for their work and consequently have a tendency to have a higher prevalence of voice disorders in comparison to the general population worldwide [1-4]. Many different studies all over the world that investigated teachers' prevalence of voice disorders in different geographic areas and cultures indicated that teachers have a higher incidence of voice disorders. Roy et al. [1] explored the prevalence of voice disorders in elementary and secondary school teachers in comparison to the general population in the United States and revealed that teachers stated a significantly higher prevalence of having a present voice problem than nonteachers (11.0% for teachers vs. 6.2% for nonteachers). Behlau et al. [2] compared the frequency of occurrence of current voice disorders in Brazilian elementary and secondary school teachers and nonteachers that was found to be 11.6% for teachers and 7.5% for nonteachers. Trinite [5] investigated the prevalence of voice disorders in primary and secondary school teachers in Latvia and disclosed that 8% of the teachers self-reported that they currently had a voice disorder and 36.9% said they have experienced voice problems during the last 9 months. Seifpanahi et al. [3] compared the prevalence of voice disorders among teachers and nonteachers in Iran and found that 54.6%

of teachers and 21.1% of nonteachers experienced vocal complaints. Devadas et al. [6] investigated the prevalence of voice problems among primary school teachers in India and discovered that 17.4% of the teachers self-reported voice problems. Lyberg-Ahlander [4] studied the prevalence of self-reported voice disorders in the general population in Sweden and revealed that the highest prevalence of voice problems was reported in teaching professions (19.3%).

Several recent studies identified risk factors that place teachers at risk for developing voice disorders in various countries. Rantala et al. [7] investigated associations between voice and postures used during teaching. Outcomes indicated that specific postures such as twisted head and torso and raised arms were associated with specific voice symptoms (e.g., voice breaks, aphonia etc.). Devadas et al. [6] investigated risk factors for voice problems among primary school teachers in India. Significant identified factors were: the number of years of teaching, high background noise levels while teaching, psychological stress while teaching, improper breath management (holding breath while speaking), upper respiratory tract infections, thyroid problems, and acid reflux. Bolbol et al. [8] studied risk factors for voice disorders among Egyptian school teachers. Significant risk factors pinpointed were the number of years of teaching (15 or more years of teaching) and the number of classes per week (15 or more classes per week). Abo-Hasseba et al. [9] assessed teachers' voice symptoms in

relation to noise in public and private schools in Upper Egypt and identified noise at work as being a risk factor for the development of voice disorders. Particularly, 82.2% of the teachers who reported moderate or severe dysphonia stated a feeling of sometimes or always being in noise during their working day and they needed to raise their voice. Alva et al. [10] explored various risk factors that influence the onset and progression of voice disorders in teachers in India and showed a statistically significant association between voice disorders and upper respiratory infections, Deviated Nasal Septum and gastroesophageal reflux disease. Trinite's [5] research looked into voice risk factors in teachers in Latvia and found that the chances of a teacher having a voice disorder increase if the following risk factors exist: extra vocal load (duties of a coach, conductor of choir, etc), shouting, throat clearing, neglecting personal health (e.g., teaching with a sore throat), background noise, chronic upper respiratory tract infections, allergies, job dissatisfaction, and stress at work. Seifpanahi et al. [3] studied voice risk factors among teachers and nonteachers in Iran and pinpointed a significantly higher vocal load risk factor (e.g., number of pupils in the classroom, number of teaching years, number of teaching hours per week, etc.) for teachers (70.77%) in comparison with nonteachers (27.44%).

Given the existence of such challenges in high risk populations such as teachers, voice disorders may impact teachers' life, as well as, their work such as affecting their work performance and attendance. Few investigations examined the specific occupational effects of voice disorders in teachers such as the effects on work attendance, work performance and future career choices. Van Houtte et al. [11] investigated voice related absenteeism in kindergarten, elementary and high school teachers and found that teachers experienced a significantly higher number of missed days of work because of their voice compared to the control group. More precisely, 34.6% of the teachers missed 1 day, 29.3% missed 1 week, 4.75% missed 2 weeks and 6.8% missed more than 2 weeks of work. Roy et al. [12] examined the effects of voice disorders on work performance and attendance in teachers and nonteachers and revealed that more than 43% of teachers had reduced activities or interactions for at least 1 day due to their voice problems. In addition, 18.3% of teachers versus 7.2% of non-teachers had missed at least 1 day of work and 3% of teachers versus 1.3% of nonteachers had missed more than 5 days of work due to their voice problems.

Taking into consideration the existing data on the high prevalence of voice disorders in teachers and the impact that voice disorders can have on their work, as well as, the abundance of data on examining risk factors for developing voice pathologies in teachers worldwide; the aim of this study is to investigate the prevalence and risk factors as well as the occupational impact of voice disorders in preschool-kindergarten and grade 1st-6th school teachers in Cyprus in order to determine the need for vocal hygiene education in this population.

Methods

DESIGN OF THE QUESTIONNAIRE

The questionnaire was uploaded online via a Survey Monkey website and was set up to not allow more than one completion from the same participant (Appendix A). It included 58 questions which were constructed based on the researchers' clinical experience, feedback received from teachers who completed a preliminary pilot study and other questionnaires that exist in the voice disorder literature [13-15]. It consisted of five parts. One section was "Demographic Information" which consisted of questions 1-6 that inquired information about the participant's age, gender, region of origin, region of work, etc. Another section was "Risk Factors for Voice Disorders" that included questions 7-51 and was divided into four parts, which included: 1) risk factors related to general health such as nasal allergies, gastroesophageal reflux, and upper respiratory infections; 2) risk factors related to voice use such as years of teaching, teaching grade, teaching subject, teaching hours per week; 3) risk factors related to lifestyle such as smoking, alcohol consumption, caffeine use, water intake, stress; and 4) risk factors related to the environment such as the physical size of the classroom, level and source of noise at work and air quality at work. Another section was the "Occupational Consequences of Voice Disorders" that consisted of questions 52-54 which requested information on work absenteeism and reduction of duties due to voice problems. One more part was "Vocal Hygiene Education" which entailed questions 55-56 that requested information on vocal hygiene education during teachers' training and its usefulness. The other unit of the online questionnaire was the "Voice Disorder Index" (VDI) which was comprised of question 57. The VDI is a reliable instrument that portrays the subject's perceived severity of his/her voice problem as it relates to his/her quality of life [16]. It entails twelve statements that are used in the Voice Handicap Index-30, four of those statements are also included on the Voice Handicap Index-10 [16, 17]. Its range of scores is 0-48. A score of 0-7 shows normal voice whereas a score of 8-14 signifies a voice which is slightly (i.e., scores 8-14), moderately (i.e., scores 15-22) or profoundly disordered (i.e., scores 23-48) [16] (F. Ingolf, personal communication, June 26, 2017).

PARTICIPANTS

An email with a link to an online questionnaire was sent to primary public school teachers in Cyprus via their school inspector, principle or speech therapist. Also, a message with a link to an online questionnaire was posted on teachers' social media groups. Four hundred and forty-nine out of four thousand seven hundred questionnaires were completed, yielding about a 10% response rate. Participants were 25-60 years old and were preschool/kindergarten (n = 148) and grade 1st-6th (n = 301) public school teachers. They consisted of 422 females and 27 males who work in primary schools

in various geographic rural and urban regions of Cyprus (i.e., Nicosia (n = 158), Limassol (n = 186), Larnaca (n = 48), Famagusta (n = 20) and Paphos (n = 37)). Participants were divided into two groups (i.e., Group 1: VDI \leq 7; n = 135 and Group 2: VDI > 7; n = 314) based on their VDI score. The participants' mean and range score on their VDI were 13.49 and 48 respectively.

PROCEDURES

The subsequent procedures were followed. In stage one, either an email with a link to an online questionnaire was sent to primary public-school teachers or/and a message with a link to the electronic questionnaire was posted on teachers' social groups in Cyprus. In stage two, each subject was requested to complete questions 1 to 56 of the survey that inquired information on demographic information, voice disorder risk factors and occupational consequences, as well as, vocal hygiene education. In Step three, every participant was asked to complete question 57 which was the VDI. Subjects' responses on question 57 were scored and were given a self-perceived severity of their voice problem (i.e., normal, slightly, moderately or profoundly disordered) as it relates to their quality of life. Subjects whose VDI score was normal were placed into the VDI \leq 7 group which is defined as the group of teachers who sense that they do not have voice difficulties that impact their quality of life. Subjects whose VDI score was slightly, moderately or profoundly disordered were assigned to the VDI > 7 group which is defined as the group of teachers who feel that they have voice difficulties that impact their quality of life.

DATA ANALYSIS

The chi-squared test of goodness of fit was applied to investigate the differences in responses between the teachers with VDI \leq 7 and those with VDI > 7 with regard to risk factors related to general health, voice use, lifestyle, and environment, as well as, occupational effects of voice disorders and vocal hygiene education. The significance level was appointed to 0.05 throughout. An adjusted residual analysis was further employed to identify groups for voice risk factors, occupational consequences and vocal hygiene education that were responsible for the significant chi-square statistic [18, 19]. A residual value greater than 1.96 or lower than -1.96 indicated that the group made a significant contribution to the chi-square statistic for a voice risk factor, occupational consequence, etc. The Statistical Package for the Social Sciences, Version 22 (SPSS Inc.) was used for all statistical analyses.

RESULTS

The results of the present investigation indicate that the estimated prevalence of self-perceived voice problems in the sample of 449 preschool/kindergarten and grade 1st-6th public-school teachers investigated is 69.9%. Particularly, 314 out of 449 teachers examined received

a VDI score 8-48 which indicates a voice that is slightly, moderately, or profoundly disordered.

The results of the current study additionally show that the risk for developing voice disorders in preschool/kindergarten and grade 1st-6th school teachers in Cyprus involves risk factors related to general health, voice use, lifestyle, and the environment. Tables I-IV show the significant risk factors detected and the adjusted residual values for each risk factor group.

RISK FACTORS RELATED TO GENERAL HEALTH

The significant risk factors recognized and the adjusted residual values for the risk factors associated to general health are displayed in Table I.

The VDI > 7 class had significantly more individuals who had "frequently" (32.2% vs 23.0%, $z = 2.0$) experienced nasal allergies (e.g., nasal discharge, stuffy nose, sneezing) than the VDI \leq 7 group, and significantly fewer participants who had "never" (7.3% vs 14.8%, $z = -2.5$) had nasal allergies [χ^2 (4, n = 449) = 10.81, $p < 0.05$]. A significantly higher number of participants in the VDI > 7 category reported to "frequently" (39.2% vs 21.5%, $z = 3.6$) and significantly fewer individuals declared to "never" (6.7% vs 12.6%, $z = -2.1$) and "infrequently" (19.4% vs 28.1%, $z = -2.0$) experience upper respiratory infections (e.g., pharyngitis and laryngitis) than the VDI \leq 7 group [χ^2 (4, n = 449) = 19.78, $p < 0.05$].

RISK FACTORS RELATED TO VOICE USE

The significant risk factors identified and the adjusted residual values for the risk factors related to voice use are shown in Table II.

A significantly higher number of participants in the VDI > 7 group reported to teach kindergarten (36.6% vs 26.7%, $z = 2.0$) and significantly fewer subjects noted to teach 6th grade (5.4% vs 11.1%, $z = -2.2$) compared with the VDI \leq 7 group (χ^2 (7, n = 449) = 17.32, $p < 0.05$).

The VDI \leq 7 category had significantly more subjects who stated that their longest break between classes is more than 91 minutes (9.6% vs 2.2% vs, $z = 3.5$) than the VDI > 7 category (χ^2 (4, n = 449) = 15.40, $p < 0.05$). A significantly lower number of subjects in the VDI > 7 group stated to use "not loud" (0.6% vs 7.4%, $z = -4.1$) and "slightly loud" (11.8% vs 21.5%, $z = -2.7$) voice in class compared to the VDI \leq 7 category. In contrast, a significantly higher number of participants in the VDI > 7 group reported to use "very loud" (33.8% vs 20.7% vs, $z = 2.8$) and "excessively loud" (4.8% vs 0.7% vs, $z = 2.1$) voice in class than the VDI > 7 group (χ^2 (4, n = 449) = 31.92, $p < 0.001$).

The number of participants in the VDI > 7 category who stated to "never" (0.6% vs 3.0%, $z = -2.0$) and "rarely" (4.1% vs 12.6%, $z = -3.3$) use their voice to discipline students was significantly lower than in the VDI \leq 7 category and the number of participants in the VDI > 7 category who stated to "frequently" (49.4% vs 40.7%, $z = 1.7$) and "always" (21.0% vs 10.4%, $z = 2.7$) use their voice to discipline students was significantly

Tab. I. Risk factors related to general health in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Nasal allergies						
Never	20	14.8	23	7.3	2.5	
Infrequently	35	25.9	64	20.4	1.3	
Sometimes	40	29.6	110	35.0	-1.1	0.029
Frequently	31	23.0	101	32.2	-2.0	
Always	9	6.7	16	5.1	0.7	
Gastroesophageal reflux						
Never	61	45.2	121	38.5	1.3	
Infrequently	35	25.9	82	26.1	0.0	
Sometimes	24	17.8	62	19.7	-0.5	0.595
Frequently	10	7.4	36	11.5	-1.3	
Always	5	3.7	13	4.1	-0.2	
Upper respiratory infections						
Never	17	12.6	21	6.7	2.1	
Infrequently	38	28.1	61	19.4	2.0	
Sometimes	49	36.3	94	29.9	1.3	0.001
Frequently	29	21.5	123	39.2	-3.6	
Always	2	1.5	15	4.8	-1.7	

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

Tab. II. Risk factors related to voice use in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Age						
25-34	47	34.8	120	38.2	-0.7	
35-44	66	48.9	157	50.0	-0.2	
45-54	22	16.3	33	10.5	1.7	0.202
55-60	0	00.0	4	1.3	-1.3	
Teaching years						
≤ 5	16	11.9	47	15.0	-0.9	
6-10	34	25.2	74	23.6	0.4	
11-20	61	45.2	147	46.8	-0.3	0.705
≥ 21	24	17.8	46	14.6	0.8	
Nature of employment						
Teaching	112	83.0	268	85.4	-0.6	
Teaching + duties	23	17.0	46	14.6	0.6	0.520
Grade being taught						
Kindergarten	36	26.7	115	36.6	-2.0	
1	17	12.6	42	13.4	-0.2	
2	6	4.4	31	9.9	-1.9	
3	7	5.2	21	6.7	-0.6	
4	9	6.7	21	6.7	0.0	0.015
5	8	5.9	17	5.4	0.2	
6	15	11.1	17	5.4	2.2	
None	37	27.4	50	15.9	2.8	
Teaching a split-grade						
No	118	87.4	281	89.5	-0.6	
Yes	17	12.6	33	10.5	0.6	0.520

Continues

Follows

Tab. II. Risk factors related to voice use in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Split-grade being taught						
N/A	118	87.4	286	91.1	-1.2	
1-2	3	2.2	11	3.5	-0.7	
2-3	5	3.7	5	1.6	1.4	
3-4	3	2.2	5	1.6	0.5	0.402
4-5	2	1.5	1	0.3	1.4	
5-6	4	3.0	6	1.9	0.7	
Subject being taught						
Greek	77	57.0	160	51.0	1.2	
Math	3	2.2	11	3.5	-0.7	
Physics	6	4.4	9	2.9	0.9	
English	5	3.7	14	4.5	-0.4	0.090
Music	7	5.2	9	2.9	1.2	
Physical education	0	0.0	6	1.9	-1.6	
Arts	7	5.2	6	1.9	1.9	
Other	30	22.2	99	31.5	-2.0	
Teaching hours per week						
$\leq 23 \times 40$ min	27	20.0	58	18.5	0.4	
24-28 $\times 40$ min	64	47.4	129	41.1	1.2	0.283
29 $\times 40$ min	44	32.6	127	40.4	-1.6	
Teaching hours per week in the past						
$\leq 23 \times 40$ min	24	17.8	60	19.1	-0.3	
24-28 $\times 40$ min	27	20.0	51	16.2	1.0	0.624
29 $\times 40$ min	84	62.2	203	64.6	-0.5	
Duration of most frequent classes						
< 40 min	6	4.4	24	7.6	-1.2	
40 min	7	5.2	26	8.3	-1.2	0.211
80 min	122	90.4	264	84.1	1.8	
Duration of most frequent classes in the past						
< 40 min	14	10.4	31	9.9	0.2	
40 min	6	4.4	29	9.2	-1.7	0.221
80 min	115	85.2	254	80.9	1.1	
Duration of breaks between classes						
10 min	12	8.9	45	14.3	-1.6	
20 min	51	37.8	139	44.3	-1.3	
21-60 min	40	29.6	87	27.7	0.4	0.004
61-90 min	19	14.1	36	11.5	0.8	
≥ 91 min	13	9.6	7	2.2	3.5	
Duration of shortest break between classes						
10 min	118	87.4	284	90.4	-1.0	
20 min	9	6.7	22	7.0	-0.1	
21-60 min	7	5.2	8	2.5	1.4	0.221
61-90 min	1	0.7	0	0.0	1.5	
Maximum number of students in classroom						
≤ 10	13	9.6	17	5.4	1.6	
11-15	12	8.9	21	6.7	0.8	
16-20	37	27.4	69	22.0	1.2	0.092
21-25	73	54.1	207	65.9	-2.4	

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Follows

Tab. II. Risk factors related to voice use in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Maximum number of students in classroom in the past						
≤ 10	10	7.4	13	4.1	1.4	
11-15	7	5.2	20	6.4	-0.5	
16-20	27	20.0	49	15.6	1.1	0.282
21-25	91	67.4	232	73.9	-1.4	
Voice loudness in class						
Not loud	10	7.4	2	0.6	4.1	
Slightly loud	29	21.5	37	11.8	2.7	
Moderately loud	67	49.6	154	49.0	0.1	0.000
Very loud	28	20.7	106	33.8	-2.8	
Excessively loud	1	0.7	15	4.8	-2.1	
Voice loudness in class in the past						
Not loud	6	4.4	8	2.5	1.1	
Slightly loud	19	14.1	28	8.9	1.6	
Moderately loud	64	47.4	139	44.3	0.6	0.168
Very loud	42	31.1	122	38.9	-1.6	
Excessively loud	4	3.0	17	5.4	-1.1	
Voice loudness outdoors (e.g., teaching physical education, supervising children during recess, etc.)						
N/A	1	0.7	2	0.6	0.1	
Not loud	3	2.2	8	2.5	-0.2	
Slightly loud	15	11.1	22	7.0	1.5	
Moderately loud	42	31.1	75	23.9	1.6	0.268
Very loud	63	46.7	167	53.2	-1.3	
Excessively loud	11	8.1	40	12.7	-1.4	
Voice loudness at home						
Not loud	39	28.9	84	26.8	0.5	
Slightly loud	53	39.3	112	35.7	0.7	
Moderately loud	38	28.1	98	31.2	-0.6	0.576
Very loud	5	3.7	16	5.1	-0.6	
Excessively loud	0	0.0	4	1.3	-1.3	
Singing in the classroom						
Never	20	14.8	25	8.0	2.2	
Infrequently	26	19.3	58	18.5	0.2	
Sometimes	35	25.9	72	22.9	0.7	0.098
Frequently	28	20.7	71	22.6	-0.4	
Always	26	19.3	88	28.0	-2.0	
Vocally discipline students						
Never	4	3.0	2	0.6	2.0	
Infrequently	17	12.6	13	4.1	3.3	
Sometimes	45	33.3	78	24.8	1.9	0.000
Frequently	55	40.7	155	49.4	-1.7	
Always	14	10.4	66	21.0	-2.7	
Using microphone when teaching						
Never	134	99.3	300	95.5	2.0	
Infrequently	1	0.7	7	2.2	-1.1	
Sometimes	0	0.0	3	1.0	-1.1	0.365
Frequently	0	0.0	2	0.6	-0.9	
Always	0	0.0	2	0.6	-0.9	

Continues

Follows

Tab. II. Risk factors related to voice use in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Using microphone when teaching in the past						
Never	134	99.3	301	95.9	1.9	
Infrequently	1	0.7	8	2.5	-1.3	
Sometimes	0	0.0	4	1.3	-1.3	0.284
Always	0	0.0	1	0.3	-0.7	
Teaching above students talking						
Never	43	31.9	69	22.0	2.2	
Infrequently	45	33.3	92	29.3	0.9	
Sometimes	23	17.0	63	20.1	-0.7	0.036
Frequently	22	16.3	73	23.2	-1.7	
Always	2	1.5	17	5.4	-1.9	
Speaking over a natural breath cycle						
Never	26	19.3	16	5.1	4.7	
Infrequently	47	34.8	70	22.3	2.8	
Sometimes	34	25.2	114	36.3	-2.3	< 0.001
Frequently	25	18.5	96	30.6	-2.6	
Always	3	2.2	18	5.7	-1.6	
Coughing during the day						
Never	18	13.3	11	3.5	3.9	
Infrequently	47	34.8	81	25.8	1.9	
Sometimes	49	36.3	131	41.7	-1.1	< 0.001
Frequently	19	14.1	80	25.5	-2.7	
Always	2	1.5	11	3.5	-1.2	
Clearing throat during the day						
Never	32	23.7	52	16.6	1.8	
Infrequently	36	26.7	84	26.8	0.0	
Sometimes	41	30.4	69	22.0	1.9	0.012
Frequently	22	16.3	93	29.6	-3.0	
Always	4	3.0	16	5.1	-1.0	
Yelling						
Never	7	5.2	3	1.0	2.8	
Infrequently	36	26.7	37	11.8	3.9	
Sometimes	61	45.2	125	39.8	1.1	< 0.001
Frequently	29	21.5	132	42.0	-4.2	
Always	2	1.5	17	5.4	-1.9	

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

higher than in the VDI ≤ 7 group ($\chi^2(4, n = 449) = 23.91$, $p < 0.001$).

A significantly higher number of teachers in the VDI ≤ 7 category reported to "never" (31.9% vs 22.0%, $z = 2.2$) teach above students talking than the teachers in the VDI ≤ 7 group [$\chi^2(4, n = 449) = 10.25$, $p < 0.05$].

The VDI > 7 category had significantly less participants who declared to "never" (5.1% vs 19.3%, $z = -4.7$) and "rarely" (22.3% vs 34.8%, $z = -2.8$) and significantly more subjects who stated to "sometimes" (36.3% vs 25.2%, $z = 2.3$) and "frequently" (30.6% vs 18.5%, $z = 2.6$) speak over a natural breath cycle (i.e., they say the last words of a sentence when they do not have sufficient air) compared with the VDI ≤ 7 category [$\chi^2(4, n = 449) = 37.05$, $p < 0.001$].

The number of subjects in the VDI > 7 group who noted to "never" (3.5% vs 13.3%, $z = -3.9$) cough during the day was significantly less and the number of participants who stated to "frequently" (25.5% vs 14.1%, $z = 2.7$) cough was significantly greater than in the VDI ≤ 7 group [$\chi^2(4, n = 449) = 24.41$, $p < 0.001$]. A significantly greater number of subjects in the VDI > 7 party testified to "frequently" (29.6% vs 16.3%, $z = 3.0$) clear their throat throughout the day than in the VDI ≤ 7 party [$\chi^2(4, n = 449) = 12.80$, $p < 0.05$].

The number of participants who testified to "never" (1.0% vs 5.2%, $z = -2.8$) yell was significantly less in the VDI > 7 group and the number of subjects who reported to "frequently" (42.0% vs 21.5%, $z = 4.2$) yell was significantly greater than in the VDI ≤ 7 group [$\chi^2(4, n = 449) = 35.68$, $p < 0.001$].

Tab. III. Risk factors related to lifestyle in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Smoking						
Never	99	73.3	245	78.0	-1.1	
Infrequently	9	6.7	11	3.5	1.5	
Sometimes	1	0.7	19	6.1	-2.5	0.020
Frequently	16	11.9	22	7.0	1.7	
Always	10	7.4	17	5.4	0.8	
Smoking in the past						
Current smoker	18	13.3	14	4.5	3.4	
Never	82	60.7	191	60.8	0.0	
Infrequently	7	5.2	29	9.2	-1.4	
Sometimes	11	8.1	40	12.7	-1.4	0.006
Frequently	12	8.9	20	6.4	1.0	
Always	5	3.7	20	6.4	-1.1	
When did former smoker stopped smoking						
N/A	115	85.2	267	85.0	0.0	
<1	2	1.5	5	1.6	-0.1	
1-3	3	2.2	8	2.5	-0.2	0.720
3-5	6	4.4	7	2.2	1.3	
> 5	9	6.7	27	8.6	-0.7	
Drinking alcohol						
Never	21	15.6	71	22.6	-1.7	
Infrequently	70	51.9	135	43.0	1.7	
Sometimes	35	25.9	88	28.0	-0.5	0.349
Frequently	8	5.9	19	6.1	-0.1	
Always	1	0.7	1	0.3	0.6	
Drinking caffeine						
Never	4	3.0	9	2.9	0.1	
Infrequently	11	8.1	25	8.0	0.1	
Sometimes	21	15.6	34	10.8	1.4	0.472
Frequently	58	43.0	126	40.1	0.6	
Always	41	30.4	120	38.2	-1.6	
Taking medications						
Never	21	15.6	43	13.7	0.5	
Infrequently	68	50.4	125	39.8	2.1	
Sometimes	22	16.3	80	25.5	-2.1	0.106
Frequently	18	13.3	42	13.4	0.0	
Always	6	4.4	24	7.6	-1.2	
Drinking water						
≤ 2 glasses per day	19	14.1	44	14.0	0.0	
3-5	54	40.0	109	34.7	1.1	
6-8	34	25.2	100	31.8	-1.4	0.529
> 8	28	20.7	61	19.4	0.3	
Having stress and anxiety						
Never	4	3.0	2	0.6	2.0	
Infrequently	11	8.1	13	4.1	1.7	
Sometimes	44	32.6	78	24.8	1.7	0.021
Frequently	53	39.3	153	48.7	-1.8	
Always	23	17.0	68	21.7	-1.1	
Daily hours of sleep						
≤ 6 hours	52	38.5	122	38.9	-0.1	
7	63	46.7	153	48.7	-0.4	
8	16	11.9	34	10.8	0.3	0.787
> 8	4	3.0	5	1.6	1.0	

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

RISK FACTORS RELATED TO LIFESTYLE

The significant risk factors distinguished and the adjusted residual values for the risk factors related to lifestyle use are revealed in Table III.

The VDI > 7 category had significantly more participants who noted to “sometimes” (6.1% vs 0.7%, $z = 2.5$) smoke than the VDI ≤ 7 category [χ^2 (4, $n = 449$) = 11.61, $p < 0.05$].

The number of participants in the VDI > 7 group who stated to “never” (0.6% vs 3.0%, $z = -2.0$) have had stress and anxiety was significantly less than in the VDI ≤ 7 group [χ^2 (4, $n = 449$) = 11.59, $p < 0.05$].

RISK FACTORS RELATED TO ENVIRONMENT

The significant detected risk factors and the adjusted residual values for the risk factors related to the environment are displayed in Table IV.

Tab. IV. Risk factors related to the environment in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Physical size of the most frequent classroom in workday						
Small	34	25.2	85	27.1	-0.4	
Medium	84	62.2	202	64.3	-0.4	0.421
Large	17	12.6	27	8.6	1.3	
Physical size of the most frequent classroom in workday in the past						
Small	33	24.4	85	27.1	-0.6	
Medium	82	60.7	200	63.7	-0.6	0.215
Large	20	14.8	29	9.2	1.7	
Air moisture in classroom						
Not at all moist	85	63.0	160	51.0	2.3	
Moderately moist	48	35.6	145	46.2	-2.1	0.057
Very moist	2	1.5	9	2.9	-0.9	
Air dryness in classroom						
Not at all dry	30	22.2	55	17.5	1.2	
Moderately dry	88	65.2	208	66.2	-0.2	0.377
Very dry	17	12.6	51	16.2	-1.0	
Dust exposure in classroom						
Not at all	7	5.2	7	2.2	1.7	
Small amount	24	17.8	48	15.3	0.7	
Moderate amount	47	34.8	118	37.6	-0.6	0.194
Large amount	49	36.3	106	33.8	0.5	
Excessive amount	8	5.9	35	11.1	-1.7	
Noise from passing airplanes and/or street						
Not at all noisy	42	31.1	65	20.7	2.4	
Slightly noisy	46	34.1	123	39.2	-1.0	
Moderately noisy	38	28.1	74	23.6	1.0	0.011
Very noisy	7	5.2	46	14.6	-2.9	
Extremely noisy	2	1.5	6	1.9	-0.3	
Outside noise (e.g., construction, lawnmowers, industrial activity)						
Not at all noisy	51	37.8	81	25.8	2.6	
Slightly noisy	49	36.3	119	37.9	-0.3	
Moderately noisy	17	12.6	77	24.5	-2.8	0.009
Very noisy	14	10.4	34	10.8	-0.1	
Extremely noisy	4	3.0	3	1.0	1.6	

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Tab. IV. Risk factors related to the environment in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Noise from children playing outside						
Not at all noisy	22	16.3	33	10.5	1.7	
Slightly noisy	51	37.8	75	23.9	3.0	
Moderately noisy	30	22.2	99	31.5	-2.0	0.004
Very noisy	27	20.0	86	27.4	-1.7	
Extremely noisy	5	3.7	21	6.7	-1.2	
Noise from children having physical education outside						
Not at all noisy	28	20.7	46	14.6	1.6	
Slightly noisy	52	38.5	101	32.2	1.3	
Moderately noisy	31	23.0	93	29.6	-1.4	0.122
Very noisy	21	15.6	57	18.2	-0.7	
Extremely noisy	3	2.2	17	5.4	-1.5	
Noise from inside the building (e.g., classrooms, hallways)						
Not at all noisy	23	17.0	38	12.1	1.4	
Slightly noisy	68	50.4	127	40.4	1.9	
Moderately noisy	34	25.2	101	32.2	-1.5	0.042
Very noisy	8	5.9	37	11.8	-1.9	
Extremely noisy	2	1.5	11	3.5	-1.2	
Noise from inside the classroom (e.g., children talking, chairs scraping on the floor)						
Not at all noisy	7	5.2	3	1.0	2.8	
Slightly noisy	60	44.4	77	24.5	4.2	
Moderately noisy	42	31.1	94	29.9	0.2	0.000
Very noisy	21	15.6	104	33.1	-3.8	
Extremely noisy	5	3.7	36	11.5	-2.6	
Noise from heating or air conditioning						
Not at all noisy	83	61.5	156	49.7	2.3	
Slightly noisy	35	25.9	100	31.8	-1.3	
Moderately noisy	14	10.4	41	13.1	-0.8	0.173
Very noisy	2	1.5	13	4.1	-1.4	
Extremely noisy	1	0.7	4	1.3	-0.5	
Electronic noise (e.g., computers, lights)						
Not at all noisy	67	49.6	117	37.3	2.4	
Slightly noisy	57	42.2	131	41.7	0.1	
Moderately noisy	8	5.9	43	13.7	-2.4	0.012
Very noisy	2	1.5	15	4.8	-1.7	
Extremely noisy	1	0.7	8	2.5	-1.3	
Echo in the classroom when speaking						
Not at all noisy	111	82.2	208	66.2	3.4	
Slightly noisy	19	14.1	68	21.7	-1.9	
Moderately noisy	4	3.0	25	8.0	-2.0	0.007
Very noisy	0	0.0	9	2.9	-2.0	
Extremely noisy	1	0.7	4	1.3	-0.5	
Noise from public address system (e.g., microphones, speakers)						
Not at all noisy	83	61.5	157	50.0	2.2	
Slightly noisy	42	31.1	104	33.1	-0.4	
Moderately noisy	8	5.9	36	11.5	-1.8	0.062
Very noisy	2	1.5	15	4.8	-1.7	
Extremely noisy	0	0.0	2	0.6	-0.9	

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

A significantly higher number of subjects in the VDI > 7 group proclaimed to hear a large amount of noise (14.6% vs 5.2%, $z = 2.9$) and a significantly fewer number of participants stated to hear no noise at all (20.7% vs 31.1%, $z = -2.4$) generated from the passage of airplanes and/or from the road at their workplace than the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 13.00, p < 0.05$]. The VDI > 7 category had significantly more subjects who reported to hear “moderate” (24.5% vs 12.6%, $z = 2.8$) and significantly fewer subjects who stated to hear “no” (25.8% vs 37.8%, $z = -2.6$) external noise derived from construction sites, lawnmowers, industrial activity, etc. at their workplace in comparison to the VDI ≤ 7 category [$\chi^2 (4, n = 449) = 13.55, p < 0.05$]. The number of participants in the VDI > 7 category who stated to hear “moderate” noise that originated (31.5% vs 22.2%, $z = 2.0$) from children playing outside in their workplace was significantly greater than the VDI ≤ 7 group. The number of participants who noted to hear a “small” (23.9% vs 37.8%, $z = -3.0$) amount of noise from this source was significantly lower in the VDI > 7 category group than the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 15.42, p < 0.05$].

A significantly higher number of subjects in the VDI > 7 group reported to hear an “excessive” (11.5% vs 3.7%, $z = 2.6$) and “great” (33.1% vs 15.6%, $z = 3.8$) amount of noise within the classroom (e.g., children who talk, chairs that scrape on the floor) and a significantly fewer number of subjects stated to hear “small” (24.5% vs 44.4%, $z = -4.2$) and “no” (1.0% vs 5.2%, $z = -2.8$) noise within the classroom than the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 36.60, p < 0.001$].

A significantly higher number of teachers in the VDI > 7 group, reported hearing a “moderate” (13.7% vs 5.9%, $z = 2.4$) amount of noise and significantly lower percentage stated hearing “no” (37.3% vs 49.6%, $z = -2.4$) noise from electronic devices (e.g., computers and lights) than the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 12.79, p < 0.05$].

The VDI > 7 group had significantly more subjects who stated to hear a “great” (2.9% vs 0.0%, $z = 2.0$) and “moderate” (8.0% vs 3.0%, $z = 2.0$) amount of echo in class when they teach and significantly fewer subjects who declared to hear “no” (66.2% vs 82.2%, $z = -3.4$) echo in the classroom compared with the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 13.96, p < 0.05$].

VOICE DISORDERS OCCUPATIONAL CONSEQUENCES AND USEFULNESS OF VOCAL HYGIENE PROGRAM

The outcomes of the survey show the consequences of voice disorders on teachers' occupation and the helpfulness of vocal education seminars. The significant consequences of voice disorders and vocal hygiene valueness are pinpointed in Tables V and VI along with their residual values.

A significantly higher number of subjects in the VDI > 7 group declared to “frequently” (29.3% vs 7.4%, $z = 5.1$) and significantly fewer number of subjects noted to “rarely” (22.0% vs 36.3%, $z = -3.2$) and “never” (7.0% vs 15.6%, $z = -2.8$) allow their

voice problems to limit their ability to perform certain tasks in the workplace (e.g., teaching, etc.) than in the VDI ≤ 7 group [$\chi^2 (4, n = 449) = 43.54, p < 0.001$].

The number of participants in the VDI > 7 category who reported to have reduced their activities (e.g., teaching) or interactions annually due to voice problems “3 to 4 days” (25.5% vs 11.1%, $z = 3.4$) and “5 or more days” (19.1% vs 5.9%, $z = 3.6$) was significantly greater than in the VDI ≤ 7 category. The number of participants in the VDI > 7 category who stated to have reduced their activities or interactions annually because of voice issues “0 days” (24.2% vs 40.0%, $z = -3.4$) was significantly lower in the VDI > 7 category than in the VDI ≤ 7 category [$\chi^2 (4, n = 449) = 44.06, p < 0.001$].

A significantly higher number of participants in the VDI > 7 group declared that voice hygiene seminars during their training would have been useful to them (98.4% vs 92.6%, $z = 3.1$) and significantly fewer subjects stated that voice hygiene seminars would not have been useful (1.6% vs 7.4%, $z = -3.1$) than in the VDI ≤ 7 category [$\chi^2 (1, n = 449) = 9.89, p < 0.05$].

Discussion

The present investigation, which represents the first survey that investigated prevalence, risk factors and occupational consequences of self-perceived voice problems in Cypriot public school teachers, revealed that the estimated prevalence of self-reported voice problems in the sample of 449 preschool-kindergarten and grade 1st-6th public school teachers investigated is 69.9%. This outcome may be partly attributable to the fact that the survey may have attracted teachers who have voice problems. Nevertheless, this finding corroborates with previously reported research which indicated that the prevalence of self-reported voice disorders in one hundred and four elementary, secondary and high school teachers in Iran was 54.6% [3]. On the other hand, it contradicts other earlier reported studies which revealed that the prevalence of voice disorders was 11.0% for elementary and secondary school teachers in the State of Iowa and Utah [1], 11.6% for Brazilian elementary and secondary school teachers [2], 8% for primary and secondary school teachers in Latvia [5] and 17.4% for primary teachers in India [6].

The current research study also revealed that teachers with a VDI > 7 were more likely to frequently experience upper respiratory infections (e.g., pharyngitis, laryngitis, etc.) and less likely to have never or infrequently experienced this health condition than the teachers with a VDI ≤ 7. These results are consistent with previously reported findings which indicated that teachers with VD (Voice Disorders) were more likely to experience upper respiratory tract infections than teachers with NVD (No Voice Disorders) [5, 6, 10, 20].

Tab. V. Occupational consequences of voice problems in teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Missed days of work annually due to voice problems (e.g., sore throat)						
N/A	13	9.6	8	2.5	3.3	
0 days	70	51.9	143	45.5	1.2	
At least 1 day	20	14.8	47	15.0	0.0	0.005
At least 2 days	15	11.1	43	13.7	-0.7	
At least 3 days	7	5.2	34	10.8	-1.9	
At least 4 days	10	7.4	39	12.4	-1.6	
Voice problems limited ability to do certain tasks (e.g., teaching)						
N/A	10	7.4	6	1.9	2.9	
Never	21	15.6	22	7.0	2.8	
Infrequently	49	36.3	69	22.0	3.2	0.000
Sometimes	45	33.3	125	39.8	-1.3	
Frequently	10	7.4	92	29.3	-5.1	
Days that activities (e.g., teaching) were reduced annually due to voice problems						
N/A	12	8.9	4	1.3	4.0	
0 days	54	40.0	76	24.2	3.4	
1-2	46	34.1	94	29.9	0.9	0.000
3-4	15	11.1	80	25.5	-3.4	
≥ 5	8	5.9	60	19.1	-3.6	

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

Tab. VI. Vocal hygiene education for teachers in the VDI ≤ 7 and VDI > 7 groups showing the percent of those responding to the statements.

Risk factors	VDI ≤ 7 teachers (n = 135)		VDI > 7 teachers (n = 314)		Adjusted residual	P-value ¹
	N	%	N	%		
Received vocal hygiene education during training						
No	115	85.2	270	86.0	-0.2	
Yes	20	14.8	44	14.0	0.2	0.824
Seminars on vocal hygiene education during training would have been beneficial						
No	10	7.4	5	1.6	3.1	
Yes	125	92.6	309	98.4	-3.1	0.002

¹: Pearson's Chi-Square test. Significant differences between teachers in the VDI ≤ 7 and the VDI > 7 groups are indicated in bold in the last column.

Moreover, the results of our study showed that the VDI > 7 class had significantly more individuals who had "frequently" experienced nasal allergies (e.g., nasal discharge, stuffy nose and sneezing) and significantly fewer participants who have "never" had allergies compared to the VDI ≤ 7 group. The current finding is in sync with Trinite's [5] research that reported that the primary and secondary teachers in Latvia who suffer from respiratory allergies are 5.5 times more likely to have voice problems than the ones without allergies. Furthermore, Roy et al. [12] also indicated that the prevalence of VD was significantly higher for participants with respiratory allergies, and the outcomes of Simberg's et al. [21] investigation also suggested that participants with allergies had

more voice disorders symptoms than those without allergies. In contrast, Devadas et al. [6] revealed that nasal allergies are not a significant risk factor in Indian teachers with self-reported voice problems in comparison with teachers with no voice problems. Another significant finding of the survey disclosed that a significantly higher number of participants in the VDI > 7 group reported to teach kindergarten and fewer subjects reported to teach 6th grade than in the VDI ≤ 7 group. This result agrees with Munier's & Kinsella's [22] investigation, which reported that teachers of the junior classes were more vulnerable to develop a voice problem as vocal fatigue and dry throat were reported more frequently by teachers of the junior classes than those of the senior classes.

In contrast, this result disagrees with Da Rocha et al.'s [23] investigation, which reported that teachers in Brazil who lectured in the fourth grade and below presented with a lower risk (20% less) of having a perceived voice disorder than the teachers who lectured in the fifth grade and up. Also, this outcome is inconsistent with Houtte's, Claeys', Wuyts' & van Lierde's [11] findings which found that there was no significant difference in teaching different grade levels between the Belgian teachers with voice problems when comparing them to teachers without voice problems.

Another key finding of this study revealed that there were more teachers in the VDI > 7 group who reported using "very loud" and "excessively loud" voice in class and fewer subjects who stated to use "not at all loud" and "slightly loud" voice compared to the VDI ≤ 7 group. Similarly, Bolbol, Zalát, Hammam, and Elnakeb [8] identified that high voice loudness is a significant voice disorder risk factor that affects elementary, middle, and high school teachers' voice in Egypt. Sathyanarayan, Boominathan and Nallamuthu [24] found that speaking in an uncomfortable loud voice was identified as one of the vocal abuse or misuse behaviors frequently used by teachers in India. Moreover, Ferreira et al. [25] found that speaking loudly was significantly associated with hoarseness and vocal fatigue in Brazilian teachers. On the other hand, Devadas et al. [6] found no significant difference between teachers with voice disorders and the ones with no voice disorders who used soft, loud or too loud vocal loudness while teaching.

One more outcome that the research indicated is that there were fewer participants in the VDI > 7 category who stated to "never" and "rarely" and more participants who stated to "always" use their voice to discipline students than in the VDI ≤ 7 group. This result supports the findings of De Alvear, Javier Barón & Ginés Martínez-Arquero [26] that revealed that children's indiscipline significantly increased the chances of kindergarten and elementary school teachers in Spain having vocal problems.

The results additionally showed that teachers with VDI > 7 were less likely to "never" and "rarely" and more likely to "sometimes" and "frequently" speak over a natural breath cycle (i.e., they say the last words of a sentence when they do not have sufficient air) than the teachers with VDI ≤ 7. Our investigation is the first study that investigated the factor speaking over a natural breath cycle in teachers and identified it as a significant risk factor for voice disorders among preschool-kindergarten and grade 1st-6th school teachers in Cyprus.

Furthermore, more teachers in the VDI > 7 group stated "frequently" coughing, clearing their throat and yelling throughout the day than those in the VDI ≤ 7 party. Likewise, Trinite [5] identified that throat clearing had a statistical significant impact on teachers' voice as 18.3% of the teachers in the voice disorder group had the habit of clearing their throats

compared to 8% in control group. Also, Seifpanahi et al. [3] reported that Iranian teachers with voice complaints were more likely to experience coughing and throat clearing than teachers without voice complaints. Similarly, Devadas et al. [6] revealed that teachers with voice problems were more likely to yell in the classroom than teachers with no voice problems.

An additional significant finding of the survey disclosed that there were more teachers in the VDI > 7 category who reported to "sometimes" currently smoke than teachers in the VDI ≤ 7 category. This finding is in accordance with the findings of Preciado-Lopez et al. [27] which reported that significantly more dysphonic teachers smoke compared with non-dysphonic ones. Conversely, Trinite [5] did not confirm any statistically significant correlation between smoking and the occurrence of voice disorders in Latvian teachers. Also, Devadas et al. [6] found no significant relationship between teachers reporting voice problems and smoking. Likewise, de Medeiros et al. [20] revealed that smoking was not statistically associated with probable dysphonia in Brazilian female public school teachers.

Another important result of this study showed that teachers in the VDI > 7 group were less likely to report "never" having stress and anxiety than those in the VDI ≤ 7 group. A similar tendency is observed in Trinite's [5] research who stated that the likelihood of voice problems increased in teachers who felt regular stress in their working place for various reasons. Specifically, 62.1% of teachers with voice disorders considered that children generated stress, and 51.5% of them mentioned that overloading caused stress. Likewise, Devadas et al. [6] indicated that a higher percentage of teachers in the voice disorder (VD) group reported that they were stressed while teaching than the teachers in the no voice disorder (NVD) group. In contrast, Pereira [28] examined stress symptoms and its impact on voice in teachers with dysphonia compared with teachers with no voice changes and found no significant association between dysphonia and stress.

Other key findings of this investigation demonstrated that there were more teachers in the VDI > 7 category who reported to hear "moderate" or "great" and fewer subjects who stated to hear "no" or "small" noise generated from construction sites, lawnmowers and industrial activity, as well as, children playing outside in their place of work and echo in the classroom when speaking than the teachers in the VDI ≤ 7 category. Conversely, Preciado-Lo'pez et al. [27] indicated that there were no statistically significant differences between the normal and the dysphonic teachers' responses with regards to the amount of noise that originates from construction work and children playing in the school yard.

One other crucial outcome of this investigation is that teachers in the VDI > 7 group were more likely to hear a large amount of noise and less likely to hear no

noise at all generated from the passage of airplanes and/or from the road at their workplace than the teachers in VDI ≤ 7 group. This result agrees with Phadke's [29] research which revealed a significant correlation between classroom location being close to main traffic roads and the frequency of laryngeal and neck pain in teachers. In contrast, Preciado-Lopez et al. [27] indicated that there were no statistically significant differences between the normal and the dysphonic teachers' responses with regards to the amount of noise that comes from the road in their classrooms.

Another significant finding of our investigation disclosed that there were more teachers in the VDI > 7 group who reported to hear an "excessive" and "great" amount of noise within the classroom (e.g., children who talk and moving chairs) and fewer who stated to hear "small" and "no" noise within the classroom than in the VDI ≤ 7 group. Similar to the current study, Preciado-Lopez et al. [27] indicated that there were statistically significant differences between the normal and the dysphonic teachers' responses with respect to the amount of noise that comes from inside the classroom (i.e., the murmur of the students and the students moving chairs and tables). Also, Devadas et al. [6] disclosed that a significantly higher percentage of teachers in the voice problem group reported a higher level of student noise in the classroom than the teachers in the no voice problem group.

In general research studies indicate that teachers who experience noise at their workplace generated from different sources such as airplanes, roads, construction sites, children playing outside and children's murmur in the classroom may be more perceptible to voice disorders. Devadas [6] revealed that teachers who experienced high background noise in the classroom (generated from student noise, external noise and fan or air conditioning noise) were found to be at a 4.4 times higher risk of developing voice problems than teachers who did not experience high background noise. A possible rationale is that speaking in high background noise increases the vocal loading because the speaker automatically increases the loudness level of a voice signal so that he/she can be heard. An increase in loudness may increase the medial compression of the vocal folds that may increase the risk of vocal fatigue [6] and lead to voice pathologies. Furthermore, our investigation did not find any significant correlation between noises generated from inside the building such as other classrooms, hallways, etc. and noise resulting from computers and projectors. This result may be attributable to the facts that the primary schools in Cyprus usually are not designed to have inside hallways and the projectors and computers may not always be turned on. In contrast, Phadke [29] showed a significant association between frequent laryngeal or neck pain symptoms and noise from other classrooms. Out of 44.8% of teachers who declared to hear noise from neighboring classrooms, 13.5% stated experiencing a daily recurrence and

9.4% experienced a monthly recurrence of laryngeal pain. Additionally, Trinite [5] identified a statistically significant association between noise generated from computers and projectors and the occurrence of voice problems in teachers.

Other substantial findings that this survey disclosed is that there were more teachers in the VDI > 7 group who declared that "often" their voice problems limited their ability to perform certain tasks in their workplace (e.g., teaching etc.) and reduced their activities (e.g., teaching etc.) or interactions "3 to 5 or more days" annually than teachers in the VDI ≤ 7 group. The results from this study are in general agreement with the outcomes from an earlier report by Roy et al. [12] which revealed that teachers were significantly more likely to report that their voice limited their ability to do certain tasks at their job and experienced a significantly higher number of days in which they intentionally reduced their activities or interactions because of their voice problems than nonteachers. Particularly, 43% of teachers versus 16.0% of nonteachers stated that they reduced activities or interactions for at least 1 day because of their voice problems.

An additional significant result of the survey disclosed that more teachers (98.4% vs 92.6%) in the VDI > 7 group declared that voice hygiene seminars during their training would have been useful and fewer subjects (1.06% vs 7.4%) stated that voice hygiene seminars would not have been useful compared with teachers in the VDI ≤ 7 category.

Similarly, Yiu (2002) stated that more than 50% of practicing and prospective teachers believed that information on breathing exercises and vocal hygiene strategies would help them prevent voice problems.

Conclusions/implications of conclusions

The present survey is the first study to investigate risk factors that may lead to self-perceived voice disorders in public-school teachers in Cyprus. The results of the study concluded that health (i.e., nasal allergies and upper respiratory infections), voice use (e.g., teaching lower grades, having shorter breaks between classes, using loud voice, etc.), lifestyle (i.e., smoking and stress), and environmental factors (e.g., teaching in a noisy environment where noise is generated from the passage of airplanes and/or roads, children playing outside, children talking within the classroom etc.) are job related risk factors that may contribute to the development of voice disorders in public school teachers in Cyprus. The results of the current investigation also determined the occupational impact of voice disorders on teachers which is that voice problems often limit teachers' ability to perform certain tasks in their job (e.g., teaching) and obligate them to reduce their activities (e.g., teaching) or interactions 3-5 or more days annually. The outcomes of the present research also showed that the estimated prevalence of self-reported voice problems in four

hundred and forty-nine preschool-kindergarten and grade 1st-6th public school teachers surveyed is 69.9%. Additionally, the results revealed that more participants in the VD group felt that vocal hygiene seminars during their training would have been useful. These conclusions infer that the development and implementation of a preventative voice hygiene program is recommended. The voice hygiene program can provide guidelines to current and future teachers to inhibit them from developing voice disorders and consequently improve their occupational performance. The results of the investigation disclosed that the strategies of the voice hygiene program should aim to promote optimal voice production and to eliminate abusive voice behaviors and may include:

1. consulting a doctor for experiencing gastroesophageal reflux and nasal allergies;
2. consulting teachers to have at least an hour and a half of a break between classes;
3. modeling techniques such as the silent cough and or the sip of water to reduce throat clearing;
4. receiving voice therapy training that focuses on eliminating talking over a natural breath cycle (e.g., instruct the teacher to say as many numbers as possible in one breath and stop before he/she feels any strain);
5. counseling teachers to use a microphone when teaching;
6. encouraging teachers to eliminate smoking and yelling [30, 31];
7. advising them to close classroom windows and doors to eliminate outside noise;
8. advising them to wait until the noise within the classroom (e.g., students murmur, moving chairs) stops before they start or continue talking [30, 32].

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Conflict of interest statement

The authors declare no conflict of interest.

Authors' contributions

The individual contributions of authors to the manuscript should be specified in this section.

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Appendix A: risk factors for voice disorders questionnaire

Please note the answer that is most appropriate for you. Answer all questions. Please note that there is no right or wrong answer.

1. DEMOGRAPHIC DATA

1. How old are you?	25-34 years old	35-44	45-54	55-60		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
2. What is your gender?	Male	Female				
	<input type="checkbox"/>	<input type="checkbox"/>				
3. What position do you hold?	Preschool/Kindergarten Teacher	Teacher	Assistant Director	Director	Substitute Kindergarten Teacher	Substitute Teacher
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. From which geographical region of Cyprus do you come from?	Nicosia	Limassol	Larnaca	Famagusta	Paphos	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Where is the school you work for?	City	Village				
	<input type="checkbox"/>	<input type="checkbox"/>				
6. In which geographical region of Cyprus do you work?	Nicosia	Limassol	Larnaca	Famagusta	Paphos	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. RISK FACTORS FOR VOICE DISORDERS

RISK FACTORS RELATED TO GENERAL HEALTH

	Never	Infrequently	Sometimes	Frequently	Always
7. Do you have nasal allergies (e.g., runny nose, stuffy nose, sneezing, etc.)?	<input type="checkbox"/>				
8. Do you have gastroesophageal reflux (i.e., backflow of stomach fluid into your esophagus and mouth)?	<input type="checkbox"/>				
9. Do you have upper respiratory tract infections (e.g., pharyngitis and laryngitis)?	<input type="checkbox"/>				

RISK FACTORS RELATED TO VOICE USE

10. How many years have you been teaching?	≤ 5	6-10	11-20	≥ 21				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
11. What is the nature of your work?	Teaching	Teaching and administrative duties		No teaching and administrative duties				
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
12. Which class do you teach most of your teaching time?	Preschool/Kindergarten	1 st	2 nd	3 rd	4 th	5 th	6 th	I'm not responsible for a class
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Does your school have combined-grade classrooms?	No	Yes						
	<input type="checkbox"/>	<input type="checkbox"/>						
14. Which combined-grade class do you teach (e.g., 1 st and 2 nd grade)?	N/A	1 st -2 nd	2 nd -3 rd	3 rd -4 th	4 th -5 th	5 th -6 th		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. What subject do you teach most of the time?	Greek	Mathematics	Natural Sciences	English	Music	PE	Art	Other
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	$\leq 23 \times 40$ minutes per week	24-28 x 40 minutes per week	29 x 40 minutes per week			
16. How many teaching hours per week do you have?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	$\leq 23 \times 40$ minutes per week	24-28 x 40 minutes per week	29 x 40 minutes per week			
17. How many teaching hours per week did you have 5 years ago?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	< 40 minutes	40 minutes	80 minutes			
18. What is the longest duration of continuous teaching time without a break in your daily workday?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	< 40 minutes	40 minutes	80 minutes			
19. What was the longest duration of continuous teaching time without a break in your daily workday 5 years ago?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
	10 minutes	20	21-60	61-90	> 90	
20. What is the duration of your longest break between classes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	10 minutes	20	21-60	61-90	> 90	
21. What is the duration of your shortest break between classes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	≤ 10	11-15	16-20	21-25		
22. What is the maximum number of students in your class?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	≤ 10	11-15	16-20	21-25		
23. What is the maximum number of students in your class for the last 5 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
	Not at all loud	Slightly loud	Moderately loud	Very loud	Excessively loud	
24. How loud are you using your voice in the classroom the current school year?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Not at all loud	Slightly loud	Moderately loud	Very loud	Excessively loud	
25. How loud were you using your voice in the classroom 3 years ago?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	N/A	Not at all loud	Slightly loud	Moderately loud	Very loud	Excessively loud
26. How loud do you use your voice outdoors (e.g., physical education and children supervision during recess, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Not at all loud	Slightly loud	Moderately loud	Very loud	Excessively loud	
27. How loud do you use your voice at home?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
28. Do you sing in the classroom?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
29. Do you use your voice to discipline students?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
30. Do you use a microphone when teaching?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
31. Did you use a microphone when teaching for the last 5 years?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
32. Do you teach above students talking?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
33. Do you speak over a natural breath cycle (e.g., Do you squeeze out the last words when you do not have enough air)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Never	Infrequently	Sometimes	Frequently	Always	
34. Do you cough throughout the day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

35. Do you clear your throat throughout the day? Never Infrequently Sometimes Frequently Always
36. Do you scream? Never Infrequently Sometimes Frequently Always

RISK FACTORS RELATED TO LIFESTYLE

37. Do you currently smoke? Never Infrequently Sometimes Frequently Always
38. Have you smoked in the past? Current smoker Never smoked Infrequently Sometimes Frequently Always
39. If you are a former smoker, when did you stop smoking? N/A < 1 year ago Before 1-3 years Before 3-5 years > 5 years
40. Do you drink alcohol? Never Infrequently Sometimes Frequently Always
41. Do you drink caffeine (e.g., coffee, tea, and coke)? Never Infrequently Sometimes Frequently Always
42. Are you taking medications? Never Infrequently Sometimes Frequently Always
43. Do you drink water? ≤ 2 glasses per day 3-5 glasses 6-8 glasses > 8 glasses
44. Do you have stress and anxiety? Never Infrequently Sometimes Frequently Always
45. How many hours do you sleep daily? ≤ 6 hours 7 hours 8 hours > 8 hours

RISK FACTORS RELATED TO THE ENVIRONMENT

46. What is the size of the classroom that you use frequently? Small (< 40 m²) Medium (40-50 m²) Large (> 50 m²)
47. What was the size of the classroom that you used most frequently the last 5 years? Small (< 40 m²) Medium (40-50 m²) Large (> 50 m²)
48. Do you consider the air to be humid in the classroom where you usually teach? Not humid at all Moderately humid Very humid
49. Do you consider the air to be dry in the classroom where you usually teach? Not dry at all Moderately dry Very dry
50. To what extent are you exposed to dust in your workplace? Not at all Small amount Medium amount Large amount Excessive amount
51. To what extent do you experience noise from the following source? Not at all Small amount Medium amount Large amount Excessive amount
- a. Passing airplanes and/or road noise
- b. Outside noises such as construction, lawnmowers, industrial activity, etc.
- c. Children playing outside.
- d. Children having physical education outside or inside.
- e. Noises from inside the building (e.g., classrooms, hallways, etc.)

- f. Noises from inside the classroom (e.g., children talking, chairs sliding on flooring, etc.)
- g. Heating or air conditioning noises.
- h. Electronic noises (e.g., computers, lights, etc.)
- i. Echoing in the classroom when you speak.
- j. Public address system (e.g., microphones, speakers, etc.)

3.OCCUPATIONAL CONSEQUENCES OF VOICE DISORDERS

- | | | | | | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | N/A | 0 days | At least 1 day | At least 2 days | At least 3 days | At least 4 or more days |
| 52. How many missed days of work did you have yearly due to voice problems (e.g., sore throat)? | <input type="checkbox"/> |
| | N/A | Never | Infrequently | Sometimes | Frequently | |
| 53. Do you voice problems limit your ability to perform certain tasks in your workplace (e.g., teaching, etc.)? | <input type="checkbox"/> |
| | N/A | 0 days | 1-2 days | 3-4 days | 5 or more days | |
| 54. How many days have you reduced your activities (e.g., teaching, etc.) or your interactions yearly because of your voice problems? | <input type="checkbox"/> |

4.VOCAL HYGIENE EDUCATION

- | | | |
|--|--------------------------|--------------------------|
| | No | Yes |
| 55. Have you received any vocal hygiene education during your training? | <input type="checkbox"/> | <input type="checkbox"/> |
| | No | Yes |
| 56. Do you think seminars on vocal hygiene education during your training would have been beneficial to you? | <input type="checkbox"/> | <input type="checkbox"/> |

5.VOICE DISORDER INDEX

57. These are statements that many people have used to describe their voices and the effects of their voices on their lives. Circle the response that indicates how frequently you have the same experience.
 0=never, 1=almost never, 2=sometimes, 3=almost always, 4=always

The clarity of my voice is unpredictable.	0	1	2	3	4
My voice is worse in the evening.	0	1	2	3	4
I feel as though I have to strain to produce voice.	0	1	2	3	4
I am less outgoing because of my voice problem.	0	1	2	3	4
I tend to avoid groups of people because of my voice.	0	1	2	3	4
I feel left out of conversations because of my voice.	0	1	2	3	4
People have difficulty understanding me in a noisy room.	0	1	2	3	4
My family has difficulty hearing me, when I call them through the house.	0	1	2	3	4
My voice makes it difficult for people to hear me.	0	1	2	3	4
I feel embarrassed when people ask me to repeat.	0	1	2	3	4
I feel annoyed when people ask me to repeat.	0	1	2	3	4
I'm ashamed of my voice problem.	0	1	2	3	4