

VOICE CHARACTERIZATION IN TEACHERS AND NON-TEACHERS WITH AND WITHOUT SELF-REPORTED VOICE DISORDERS

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Introduction

A professional voice user may be defined as an individual who depends on a consistent and appealing voice quality as a main tool in their employment [1]. Studies across several continents consistently point to teaching as a particular occupational risk for the appearance of voice problems [2]. Teachers are more likely to define themselves as having a voice problem, having a tired, weak, or effortful voice, and having a higher frequency of symptoms of physical discomfort with speaking [3].

The aim of the study was to investigate whether voice parameters differ in teachers with and without self-reported voice disorders as well as in non-teachers.

Methods

Several questionnaires (VHI-30, Perceived Stress Scale, PSS) assessed two teachers' groups – teachers with voice disorders, teachers without voice disorders (N=138, n=20, n=21) and a non-teachers' group – health care workers (N=20).

Aerodynamic (Vital Lung Capacity (VC), Maximum Phonation Time (MPT), Phonation Quotient(PQ)) and acoustic (MDVP, VRP, SRP) investigations of voice were made. The Dysphonia Severity Index (DSI) was calculated for all respondents.

Voice and speech samples were recorded in the Computerized Speech Lab (CSL), mod.4500 (KayPENTAX, USA). For audio signal recording, the professional dynamic Shure microphone was used according to the instructions was positioned at a 45° angle and 15cm away from the subject.

A method of spirometry (the manual spirometer Riester Spirotest, 1-7l) was performed for determining of VC and calculation of the PQ. PQ or average phonation airflow = VC (ml) / MPT (s). MPT was determined based on three trials of the vowel /a/ producing.

The DSI is based on the weighted combination of the selected set of voice measurements and calculated as $(0.13 \times \text{MPT}) + (0.0053 \times \text{Fo-high}) - (0.26 \times \text{I-low}) - (1.18 \times \text{Jitter} (\%)) + 12.4$. The DSI for perceptually normal voices equals +5 and for severely dysphonic voices -5 [4].

Results

Teachers with self-reported voice disorders (VD) vs Teachers without self-reported voice disorders (CT)

Fifty-eight percent of all teachers positively responded that they had ever had voice problems.

The Vocal Symptoms scale was used as an additional tool for participant selection. Forty (29%) teachers had marked two or more symptoms, which occur every day or once a week and more often (Table 1).

Table 1. The Number of Vocal Symptoms in Teachers (N 138)

Number of Vocal Symptoms	Teachers, No. (%)	Females, No. (%)
0	75 (54)	73 (97)
1	23 (17)	21 (91)
2	11 (8)	10 (91)
3	9 (7)	9 (100)
4	10 (7)	10 (100)
5	6 (4)	6 (100)
6	3 (2)	3 (100)
7	1 (1)	1 (100)
Total No. of Teachers	138 (100)	133 (96)

Dysphonia Severity Index

The calculations of the DSI Index were based on objective measurements (MPT, $F_{o,max}$, Int_{min} , Jitt). The lowest DSI value was found in the VD group, and the highest DSI median value was observed in the CNT group (Table 2). A statistically significant ($P = 0.001$) difference was found between groups in the DSI scores. Comparing both teachers' group, we found that teachers with self-reported voice disorders had lower median DSI score (2.65) than teachers without voice disorders (3.21), $P = 0.001$.

Table 2. Median and Quartile Dispersions Values of the Dysphonia Severity Index

Group	n	Me	Q ₁ ; Q ₃	P
VD	20	2.65	1.06; 3.39	
CT	21	3.21	2.09; 4.54	0.001
CNT	20	4.57	3.31; 6.06	

Perceived Stress Scale & Voice Handicap Index-30

The median scores of the Perceived Stress Scale (PSS) have statistically significant ($P = 0.021$) differences between groups $Me_{VD} = 18$ (15; 20); $Me_{CT} = 13$ (9; 17); $Me_{CNT} = 16$ (12; 21). The VHI total scale score in the VD group was higher ($Me_{VD} = 25$), than in the CT and CNT groups (respectively, $Me_{CT} = 13$, $Me_{CNT} = 6$). Teachers with voice disorders had higher perceived stress level ($Me = 18$, $P = 0.009$) and higher VHI-30 score ($Me = 25$, $P < 0.001$) than the control group teachers ($P = 0.009$).

Aerodynamic & Acoustic measurements

Teachers without self-reported voice disorders had a higher median score of MPT than teachers with self-reported voice disorders. Teachers with voice disorders had higher median scores of jitter and shimmer than teachers without voice disorders (Table 3). Statistically significant differences between teachers with and without voice disorders were not found in vital lung capacity, MPT, PQ, FO, Jitt, Shimm, and HNR.

Teachers (VD, CT) vs Health care workers (CNT)

Aerodynamic & Acoustic measurements

Statistically significant differences between the teachers' groups (teachers with and without self-reported voice disorders) and the healthcare workers' group were observed in the MPT score ($P = 0.001$) and the phonation quotient ($P = 0.002$; $P = 0.011$) (Table 3).

Table 3. Vital Lung Capacity (VC), Maximum Phonation Time (MPT) and Phonation Quotient (PQ) Median Values, and Quartile Dispersions (Kruskal-Wallis Test)

Group	n	VC (ml/s)		MPT (s)		PQ (ml/s)				
		Me	Quartile	Me	Quartile	Me	Quartile			
			25	75	25	75	25	75		
VD	20	3050	2625	3700	17.5	13	22.75	201	146.75	238.1
CT	21	3000	2700	3300	18.0	16	21.50	157	137.50	187.1
CNT	20	3500	2700	3950	26.0	22	33.75	128	100.00	156.1
P			NS			0.010			0.003	

Fo, Jitt, and Shim parameters showed statistically significant differences between the VD and CNT groups, as well as Fo and Jitt between the CT and CNT groups (Table 4).

Table 4. Medians and Quartile Dispersions of Acoustic Parameters Acquired in the MDVP Analysis (Kruskal – Wallis test)

Parameter	VD (n = 20)	CT (n = 21)	CNT (n = 20)	P
Fo (Hz)	206.22 (196.09; 232.05)	216.39 (197.78; 236.87)	254.16 (229.35; 267.03)	0.001
Jitt (%)	1.18 (0.42; 1.88)	0.89 (0.60; 1.68)	0.53 (0.31; 0.96)	0.013
Shim (%)	3.43 (2.85; 4.32)	3.08 (2.85; 3.63)	2.41 (1.80; 3.41)	0.025
NHR	0,12 (0,11; 0,13)	0,11 (0,10; 0,13)	0,11 (0,10; 0,12)	NS

Conclusions

1. Teachers with self-rated voice disorders had lower DSI score and higher VHI scores than teachers without self-rated voice disorders. Therefore the Dysphonia Severity Index and the VHI-30 can be used for the identification of voice problems in the teachers' population.

2. Acoustic (Fo, Jitt) and aerodynamic (MPT, PQ) measurements may show the voice differences between teachers and non-teachers.

References

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