

A Cross-sectional Survey of Voice Disorders among Primary School Teachers in Hong Kong

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Abstract: A Cross-sectional Survey of Voice Disorders among Primary School Teachers in Hong Kong: Sophie Yick-yu Lee, et al. Tseung Kwan O Hospital, China—Objective: The purpose of the study was to investigate the prevalence of voice disorders and associated risk factors among primary school teachers in Hong Kong. **Methods:** A cross-sectional survey was conducted based on a random sample of 20 primary schools in Hong Kong. A total of 714 full-time primary school teachers were invited to participate in the survey. Data were collected through a self-administered questionnaire addressing the prevalence of voice disorders and potential risk factors. Stepwise logistic regression was used to assess the associations between voice disorders and the different risk factors. **Results:** The response rate for the questionnaire was 69.7% (498/714). Among the teachers who responded, 348 (69.9%) had suffered from a voice disorder in the past 12 mo. Thirty-one teachers (8.9%) rated their voice disorders as minimal, 124 (35.6%) as mild, 151 (43.4%) as moderate, and 42 (12.1%) as severe. Of the 348 teachers reporting voice disorders, 215 (61.8%) had sought professional help for their voice problems. The univariate analyses showed that the factors significantly associated with voice disorders included talking quietly ($p=0.018$), using a microphone ($p=0.002$), speaking against background noise ($p<0.001$), consuming alcohol ($p=0.027$), and having a history of asthma ($p=0.001$), colds ($p=0.012$), sinusitis ($p=0.039$), or laryngitis ($p<0.001$). After adjusting for potential confounds, the significant risk factors included speaking against background noise (adjusted OR=1.8), alcohol consumption (adjusted OR=0.40), history of asthma (adjusted OR=3.3), or laryngitis (adjusted OR=4.2). **Conclusions:** Approximately 70% of the sampled primary school teachers were affected by voice disorders. A substantial proportion of the effected

teachers suffered both functional and psychological adverse effects. The findings indicate an urgent need for further investigation to identify the risk factors for voice disorders and to develop preventive strategies for primary school teachers.

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Key words: Chinese, Occupational risk, Prevalence, Teacher, Voice disorder

Teachers face one of the highest demands of any professional group to use their voices at work¹. Thus, they are at higher risk of developing voice disorders than the general population^{2,3}. Teachers are ranked in the top 10 occupational groups for frequency of attending speech therapy sessions to treat vocal dysfunction⁴, and they were found to be at higher risk of developing voice-related symptoms than other occupational groups^{5–7}.

Voice disorder was originally defined by Aronson in 1985 as the condition arising when the quality, pitch, loudness, or flexibility of one's voice differs from that of others of similar age, sex, and culture⁸. Voice disorders can affect all aspects of an individual's life, and their impact has been reported to be as great as that of life threatening illnesses⁹. Roy *et al.* stated that voice problems in teachers had resulted in job restrictions, missing work days, and an increased likelihood of leaving the profession². Verdolini and Ramig reported that the cost of sick leave and treatment for voice problems in teachers in the U.S. was about \$2.5 billion annually¹⁰. In short, voice disorders can have a negative impact on teachers' job performance and quality of life, and they increase the economic burden of the society.

The etiology of voice disorders is multidimensional¹¹. Occupational risk factors clearly play an important role in the development of voice disorders in teachers. It has been suggested that these disorders should be conceptualized as occupational diseases rather than problems of particular individuals¹². The reported occupational risk factors include excessive use of the voice, excessive background noise, teaching a large

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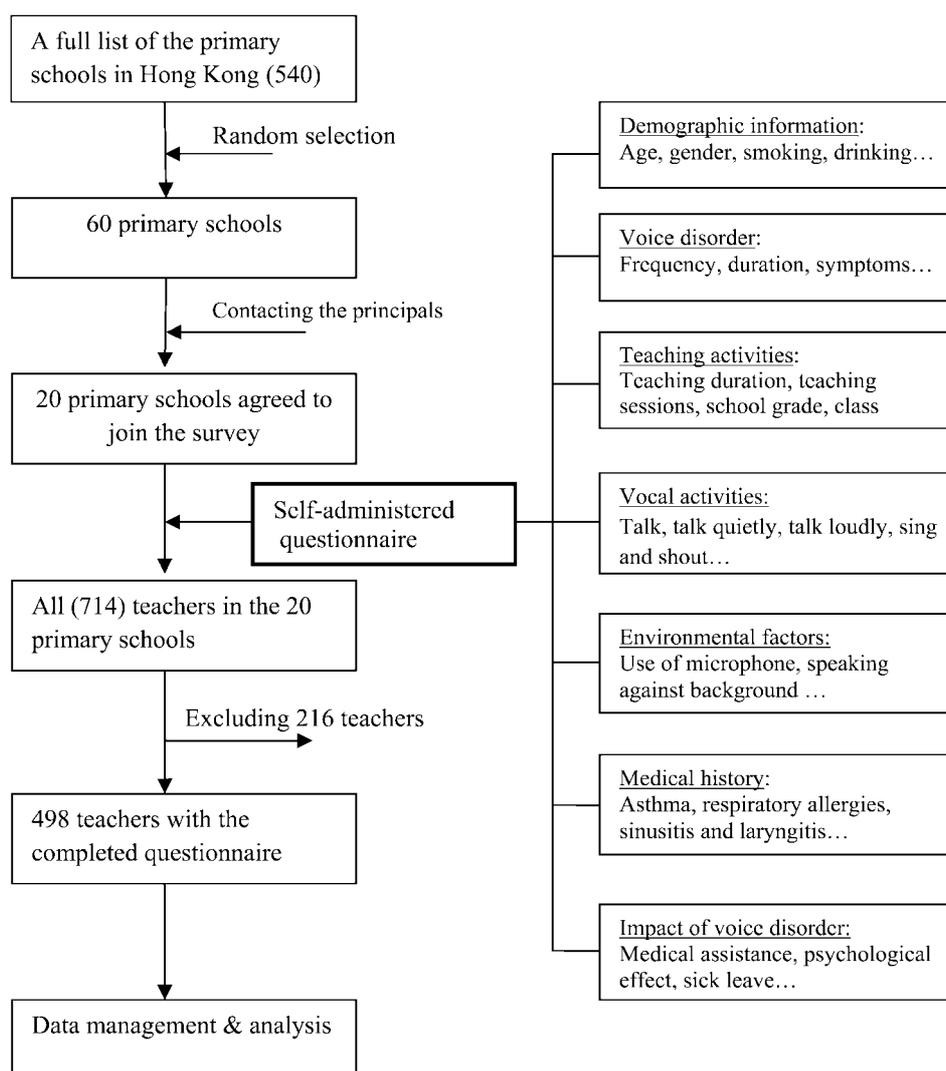


Fig. 1. Flowchart of the survey.

number of students, teaching special courses, teaching students at lower grade levels, overwork, poor teacher-student relationships, a stressful environment, and a lack of didactic materials and equipment¹¹⁻¹⁵). Other risks include demographic factors such as gender and socioeconomic status^{16,17}. Certain lifestyle factors, such as smoking and a history of poor respiratory health, have also been reported to be associated with voice disorders^{7,18}).

Several studies on voice disorders in teachers have been conducted in Western countries, but relevant data for teachers in Hong Kong are limited. Is the prevalence of voice disorders in Hong Kong teachers similar to that of teachers in Western countries? What are the risk factors of developing voice disorders for Hong Kong teachers? Answers to these questions will help us develop strategies for the prevention of voice disorders in Hong Kong and worldwide.

We thought it desirable as a first step to conduct a survey of the prevalence of voice disorders and the associated risk factors among teachers in Hong Kong. We focused on primary school teachers; because the risk of developing voice disorders is different for primary and secondary school teachers, and it is not appropriate to combine them in a single sample¹⁵.

Methods

The survey was approved by the Chinese University of Hong Kong Survey Ethics Committee. A written consent form was required to sign by each participant prior to participation in the survey. A flow chart of the survey steps is presented in Fig. 1.

Setting and participants

Our first task was to determine the appropriate sample

size for estimating the prevalence of voice disorders in Hong Kong teachers. Based on reports of the prevalence of voice disorders among teachers in Western countries, we assumed the prevalence in Hong Kong to be around 60%. A sample of 369 primary school teachers in Hong Kong would be needed to estimate the prevalence in the corresponding population with a 95% confidence interval and a precision level of 5%^{19, 20}.

A list of all 540 primary schools in Hong Kong (excluding special education schools) was obtained from the Education and Manpower Bureau of the Hong Kong SAR Government in 2006. There were around 19,800 primary school teachers in Hong Kong that year, which means that each primary school had an average of 36.6 teachers²¹. Based on our previous experience²², we expected the response rate for school principals responding to the survey to be low. Taking into account the expected participation rates for schools and individual teachers, we randomly selected 60 primary schools from the list and contacted their principals. Twenty of the 60 schools agreed to participate in the survey. The 714 full-time teachers in these 20 schools (an average of 35.7 teachers per school) were invited to complete a self-administered questionnaire.

Measures

A questionnaire was developed consisting of the following seven sections:

(1) *Demographic characteristics*: (a) Age, (b) Sex, (c) Smoking, defined as consuming at least 1 cigarette/day or 7 cigarettes/wk for at least half a year, (d) Alcohol consumption was assessed with the question "Have you consumed an alcoholic beverage (beer, wine, and spirits) in the last 12 mo (yes/no)?" Those who answered "yes" were asked: "Do you consume alcohol frequently (yes/no)?" Those who answered "yes" were categorized as consuming alcohol frequently.

(2) *Voice disorders*: Participants were classified as having a voice disorder if they answered "yes" to the question, "For the purposes of this study, we consider a voice disorder to be any time your voice does not work, perform, or sound as you feel it usually does, so that it interferes with communication. Have you had a voice disorder like this in the last 12 mo?"¹⁴. The frequency, duration, and symptoms representing the voice disorder were recorded. Participants selected the symptoms from a list, and they were asked to write down ones they had that were not included in the list.

(3) *Teaching activities*: (a) Number of working years, (b) Duration of each class, (c) Number of classes per day, (d) Grade (s) taught, (e) Class size (s), (f) Subject (s) taught, and (g) Extra-curricular activities involved in.

(4) *Frequency of specific vocal activities during the workday*: (a) Speaking, (b) Speaking quietly, (c) Speaking loudly, and (d) Singing and shouting.

(5) *Environmental factors*: (a) Using a microphone, (b) Speaking against background noise, (c) Speaking in an enclosed classroom with permanent walls, (d) Speaking in an open area with a distance greater than 10 feet.

(6) *Health status*: (a) Asthma, (b) Respiratory allergies, (c) Nasal drip, (d) Gastric reflux, (e) Colds, (d) Sinusitis, and (e) Laryngitis.

(7) *The impact of voice disorders and how teachers handled them*: (a) Severity of voice disorders, (b) Psychological response to voice disorders, (c) Seeking professional help, (d) sick leave due to voice disorders.

Procedure

The survey was conducted from September 2006 to January 2007. An invitation letter was developed which included information on the aims of the survey, the institute responsible for it, and its voluntary and confidential nature. It also included detailed instructions for completing the self-administered questionnaire. The invitation letter, the questionnaire, and a consent form, were distributed to the 714 teachers.

Statistical analyses

Analyses were performed using SPSS 13.0 statistical software. Chi-square tests were used to detect differences between teachers with and without a voice disorder. Multivariate logistic regression was used to document the independent effects of the important risk factors after adjusting for potential confounding factors. Only variables with $p \leq 0.10$ in the univariate analyses were included as covariates in the regression model. The model employed backward stepwise logistic regression and only variables with $p \leq 0.10$ were retained. Odds ratios (ORs) for the selected risk factors with corresponding 95% confidence intervals (CIs) were then calculated. Effects with $p < 0.05$ were considered statistically significant.

Results

Among the 714 teachers who were invited to participate in the survey, 20 refused to participate and another 196 did not return the questionnaire. This left 498 completed questionnaires, a response rate of 69.7% (498/714). The general characteristics of the participants are presented in Table 1.

Of the 498 teachers in the final sample, 348 had developed a voice disorder over the previous 12 mo, representing a prevalence of 69.9% (95% CI: 65.7–73.4%). The prevalence for female teachers was 71.9% (95% CI: 67.2 to 76.1%), compared to 62.6% (95% CI: 53.2 to 71.2%) for male teachers.

The most common voice symptom experienced by the teachers was hoarseness, followed by throat pain and dry throat (Fig. 2). The only significant sex differences for symptoms were "voice getting low" ($\chi^2=5.76$, $p=0.016$)

Table 1. General characteristics of the 498 participants

		N	%
Age (years)	20–29	177	35.5
	30–39	188	37.8
	40–49	81	16.3
	50+	49	9.8
Sex	Female	391	78.5
	Male	107	21.5
Teaching experience (yr)	1–9	258	51.8
	10–19	146	29.3
	20–29	56	11.3
	30+	34	6.8
Smoking	Never	488	98.0
	Ever	9	1.8
Alcohol consumption	Never or rarely	438	88.0
	Frequently	57	11.5
Karaoke singing (h/mo)	≤5	471	94.6
	≥6	26	5.2
Choral singing (h/mo)	≤5	456	91.6
	≥6	40	8.0
Asthma	Yes	59	11.9
	No	438	88.0
Respiratory allergies	Yes	216	43.4
	No	281	56.4
Nasal drip	Yes	109	21.9
	No	388	77.9
Gastric reflux	Yes	43	8.6
	No	454	91.2
Colds	0 times	23	4.6
	1–5 times	305	61.3
	>5 times	168	33.7
Sinusitis	0 times	435	87.4
	1–5 times	45	9.0
	>5 times	16	3.2
Laryngitis	0 times	63	12.7
	1–5 times	262	52.6
	>5 times	168	33.7

The sum of percentages do not always sum to 100 because of missing data.

and “restricted pitch” ($\chi^2=8.58, p=0.003$).

As for the severity of the voice disorders, 31 teachers (8.9%) rated it as minimal, 124 (35.6%) as mild, 151 (43.4%) as moderate, and 42 (12.1%) as severe. Female teachers reported that their voice disorder symptoms generally lasted for 3–4 days, compared to 1–2 days for

the male teachers. However, 142 teachers (40.8%) reported that they had once suffered a voice disorder lasting four weeks or more. Few of the teachers took sick leave due to their voice disorders.

Two hundred and sixty-two teachers (75.3%) felt upset and 276 (79.3%) experienced stress because of their voice disorders. Two hundred and fifteen (61.8%) had sought professional help at least once for their voice problems, 98 of whom sought it from more than one professional.

Table 2 shows the results of the univariate analyses of the associations between voice disorders and the risk factors (Only effects with $p<0.10$ are presented in the table). Voice disorders were significantly associated with speaking quietly ($p=0.018$), using a microphone during teaching ($p=0.002$), and speaking against background noise ($p<0.001$). Teachers who consumed alcohol frequently had a lower risk of voice disorders than those who consumed it rarely or never ($p=0.027$). The voice disorders were significantly associated with the presence of asthma ($p=0.001$), nasal drip ($p=0.005$), colds ($p=0.012$), sinusitis ($p=0.039$), and laryngitis ($p<0.001$). Other factors with p values between 0.05 and 0.10 were sex ($p=0.065$), number of classes per day ($p=0.083$), shouting, yelling or cheering ($p=0.095$), speaking in an open area ($p=0.056$), and respiratory allergies ($p=0.066$).

Table 3 shows the associations between developing voice disorders and the risk factors with potential confounds controlled. A higher risk of developing voice disorders was associated with speaking against background noise ($p=0.012$), having asthma ($p=0.009$), and having laryngitis ($p<0.001$). Those who consumed alcohol frequently had a lower risk of voice disorders than those who rarely or never drank alcohol ($p=0.008$). The associations of voice disorders with using a microphone and nasal drip were not statistically significant ($p=0.075$ and $p=0.076$, respectively).

Discussion

Our survey results show that voice disorders are common among Hong Kong primary school teachers, with almost 70% reporting at least one during the 12 mo preceding the survey. This figure falls at the upper end of the range of 14.6% to 80% reported for the prevalence of voice disorders in other countries^{5, 6, 11, 15, 23, 24}. The comparison of results among prevalence studies on voice disorders is difficult due to the differences in either the definition or evaluation methods employed by the studies. In most epidemiological studies, the presence of a voice disorder has been defined by the presence of a number of vocal symptoms^{2, 3, 5, 6, 11, 14, 17, 25, 26}. On the other hand, the prevalence of voice disorders is underestimated if the detection of vocal abnormalities is restricted to physical examination of the larynx²⁷. For example, Mathieson reported that there was no identification of vocal pathology in at least one third of the patients who

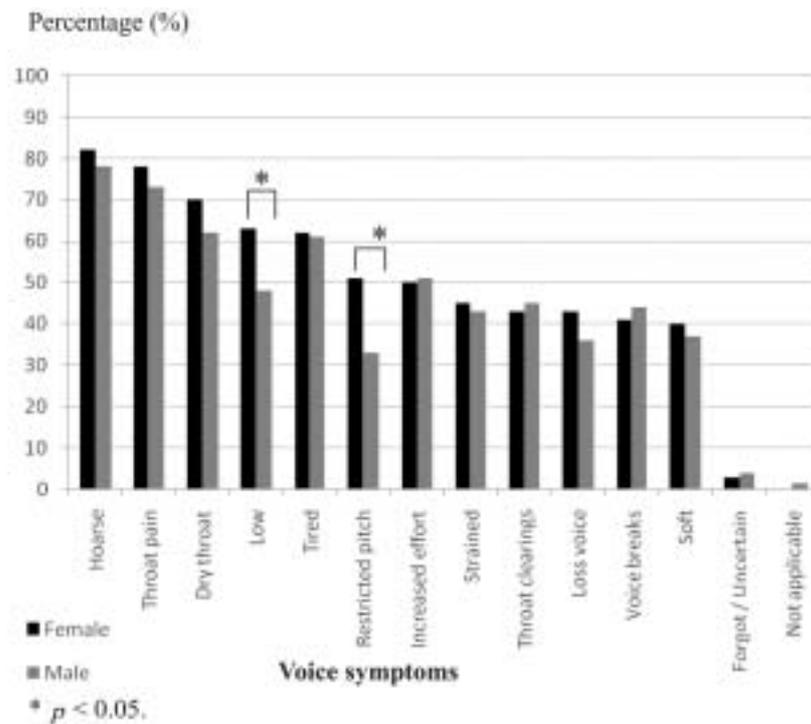


Fig. 2. Percentages of voice symptoms among teachers with voice disorders.

complained about vocal dysfunction²⁸). Interviews with questionnaires remain the most commonly used method of assessing a voice disorder in the existing literature.

The prevalence of voice disorders was greater in our survey than in two previous Western studies that defined and measured voice disorders the same way that we did^{3, 14}). In these cases, the different results might be attributable to sex differences. Smith *et al.* reported that female teachers reported a higher prevalence of vocal symptoms than male teachers even though female teachers had similar teaching characteristics¹⁷). Females have also tended to report more voice disorders than males in other studies^{2, 27}). There was a higher percentage of female teachers in our study than in the two studies cited, and the females in our study reported a higher percentage of vocal symptoms than males, although the difference was not quite statistically significant ($p=0.065$). Also, we tested only primary school teachers, whereas the two cited studies included both primary and secondary school teachers. The possible effect of grade level is supported by a study of Munier *et al.*, who reported that “teachers of the junior classes were more vulnerable to developing a voice problem than those of senior classes” and compared to secondary school teachers “primary school teachers were particularly at risk”¹⁵).

Similar to the results reported by Smith *et al.*⁵), the

most common voice symptom reported by the teachers in our survey was hoarseness. As with voice disorders in general, there were sex differences for specific symptoms. A significantly higher percentage of females than males in our study reported their voice becoming low and their pitch restricted. Our female teachers also reported higher percentages of strained voice, tired voice, soft voice, hoarseness, loss of voice, dry throat, and throat pain, but these higher percentages were not statistically significant.

The reason for the sex differences is not clear. One possibility is an anatomical difference between the male and female larynx²⁹⁻³¹). Another possibility is differences in lifestyle and socioeconomic status between the sexes¹²). Further research is needed if we are to have a definitive explanation for these sex differences.

A large proportion of the teachers with voice disorders in our survey reported feeling upset and experiencing excessive stress at work. A number of previous studies have also shown a positive relationship between voice disorders and various psychological problems³²⁻³⁷). However, because most of these studies used cross-sectional designs, the causal relationship between the voice disorders and psychological conditions could not be determined. As voice disorders can adversely affect quality of life, they have been suggested as a cause of psychological symptoms such as stress, depression, and anxiety³²). On the other hand, psychogenic factors might

Table 2. Risk factors associated with voice disorders

Variables*	Valid responses		Voice disorders		<i>p</i> -value for χ^2
		N	N	%	
Gender					0.065
	Female	391	281	71.9	
	Male	107	67	62.6	
Number of classes per day					0.083
	≤5	132	85	64.4	
	>5	356	258	72.5	
Voice Activities					
Talk quietly					0.018
	Never or rarely	161	125	77.6	
	Frequently	317	213	67.2	
Shout, yell, cheer					0.095
	Never or rarely	153	100	65.4	
	Frequently	331	241	72.8	
Use microphone during teaching					0.002
	Never or rarely	182	113	62.1	
	Frequently	304	229	75.3	
Speak against background noise					<0.001
	Never or rarely	174	104	59.8	
	Frequently	311	238	76.5	
Speak in an open area					0.056
	Never or rarely	219	145	66.2	
	Frequently	267	198	74.2	
Alcohol consumption					0.027
	Never or rarely	438	313	71.5	
	Frequently	57	33	57.9	
Asthma					0.001
	No	438	296	67.6	
	Yes	59	52	88.1	
Respiratory allergies					0.066
	No	281	187	66.6	
	Yes	216	161	74.5	
Nasal drip					0.005
	No	388	260	67.0	
	Yes	109	88	80.7	
Colds					0.012
	0 times	23	14	60.9	
	1–5 times	305	202	66.2	
	>5 times	168	131	78.0	
Sinusitis					0.039
	0 times	435	296	68.1	
	1–5 times	45	39	86.7	
	>5 times	16	12	75.0	
Laryngitis					<0.001
	0 times	63	28	44.4	
	1–5 times	262	181	69.1	
	>5 times	168	139	82.7	

*Only variables with $p < 0.10$ are presented.

Table 3. Adjusted odds ratios (OR) of risk factors for voice disorders

Variable*		OR	95% CI	<i>p</i>
Using microphone during teaching	Never or rarely	Reference		0.075
	Frequently	1.5	1.0–2.4	
Speaking against background noise	Never or rarely	Reference		0.012
	Frequently	1.8	1.1–2.8	
Alcohol consumption	Never or rarely	Reference		0.008
	Frequently	0.4	0.2–0.8	
Asthma	No	Reference		0.009
	Yes	3.3	1.4–8.3	
Nasal drip	No	Reference		0.076
	Yes	1.7	1.0–3.0	
Laryngitis	0 times	Reference		0.024
	1–5 times	2.0	1.1–3.8	
	>5 times	4.2	2.1–8.5	

* The variables with $p < 0.10$ were presented.

cause voice disorders by increasing tension in the laryngeal muscles, especially for muscle tension dysphonia^{34–36}. A bidirectional relationship between psychogenic factors and voice disorders has also been proposed by other authors^{33, 35, 37}. The two kinds of symptoms may reciprocally reinforce each other, resulting in a vicious cycle. The role of psychological symptoms in precipitating, exacerbating, and maintaining voice disorders needs to be further clarified^{33, 37}.

Univariate analyses revealed that speaking quietly, using a microphone during teaching, and speaking against background noise were associated with voice disorders and the latter two variables remained in the final logistic regression model after adjusting for potential confounds. Speaking against background noise was also found to increase the risk of developing voice disorders in a study by Vilkmán³⁸. It is surprising that the use of a microphone during teaching was found not to prevent voice disorders, even though the relationship was not statistically significant ($p=0.075$). Perhaps the use of a microphone was common only for those teachers who already had a voice disorder. However, because our study was cross-sectional, we could not evaluate the temporal relationship.

We found no significant associations between voice disorders and other occupational factors reported in Western studies, including teaching duration, the specific subjects or courses taught, duration of each class, number of classes per day, working as class mistress/master, school grades taught, class size, and participation in extra-curricular activities. We found that frequent alcohol consumption appeared to prevent voice disorders.

The present study had two limitations. First, the

temporal relationships could not be assessed because of the cross-sectional design. Second, because of a lack of sufficient resources, we could not obtain comprehensive information about potential confounds and modifiers.

A specific area where the second limitation is evident is the effect of background noise on the development of voice disorders. For example, vocal symptoms can be exacerbated not only by speaking loudly but also by speaking continuously. Speaking in successive classes without a break is another important risk factor. The symptoms can also be exacerbated by fatigue of the vocal cord, although the voice can recover with rest. Further research is needed to clarify the relationship between voice disorders and speaking against background noise. If the association is confirmed, appropriate strategies should be considered to reduce background noise in classrooms and thereby help prevent voice disorders. The sources of noise must be identified and their effects eliminated, either by engineering controls or administrative measures. One needs to look both outside the classroom (e.g., traffic, construction sites) and inside (e.g., air conditioners, noisy students).

These limitations also affected our ability to fully assess the association between alcohol consumption and voice disorders. Alcohol consumption might be influenced by the symptoms of voice disorders. For example, people with a dry throat or throat pain might be less likely than other people to consume alcohol. Therefore, the prevalence of alcohol consumption among teachers with a voice disorder might be lower than among those without a voice disorder, thereby making it seem that alcohol consumption has a preventive effect.

Finally, we did not identify smoking as a risk factor for voice disorders because there were too few smokers in our sample. This is another relationship requiring further study.

In conclusion, our survey demonstrated that voice disorders are common among primary school teachers in Hong Kong. A substantial proportion of the teachers with voice disorders suffered both functional and psychological adverse effects. Speaking against background noise, alcohol consumption, asthma, and laryngitis were found to be associated with voice disorders. Further research, especially prospective cohort studies, should be carried out to identify risk factors of voice disorders. Appropriate strategies should be developed to prevent voice disorders in school teachers.

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