Vocal Health and Vocal Health Knowledge Among Occupational Voice Users in the Province of Quebec

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Summary: Voice disorders are frequent among occupational voice users such as teachers. Although these disorders can have serious personal and professional consequences, they are not often recognized as occupational diseases and little attention is paid to their prevention. This study aimed to provide a portrait of the self-reported vocal health and vocal health knowledge of occupational voice users in Quebec, Canada, and to identify risk factors associated with voice disorder symptoms. We conducted an online survey targeting occupational voice users in the province of Quebec, Canada, with a focus on those involved in teaching or training. The final sample, after excluding incomplete surveys, included 808 respondents (665 women, M = 41.5 ± 10.4 years old). The survey responses were analyzed using descriptive and inferential statistics. Results indicated that 9.8% of the respondents had a history of a diagnosed voice disorder and 68.8% of the respondents experienced at least one voice symptom on a regular basis. Ordinal logistic regressions revealed that several personal and environmental factors are associated with an increased risk of developing voice disorders symptoms: being a woman, suffering from a breathing disorder, allergies, acid reflux and/or hearing impairment, having less work experience, working with elementary school children and/or with continuous or speech noise in the background. Most of the respondents (94.6%) had never received information regarding voice disorders during their academic training and less than half of them (47.7%) knew which professionals can treat voice disorders. These findings highlight the need for formal vocal health education among both occupational voice users and their employers to improve prevention and treatment for voice disorders in an at-risk population.

Key Words: Vocal health—Occupational voice user—Risk factors—Voice disorders—Survey—Teachers.

INTRODUCTION

A 2012 survey from the United States Department of Health and Human Services revealed that approximately 7.6% of the United States adult population suffers from a voice problem,[1] representing over 20 million people. Voice problems have an even higher prevalence in occupational voice users such as teachers. A meta-analysis of six Slovenian studies using questionnaires including >2000 respondents reported that 88% of teachers had suffered from a voice disorder at least once during their career, most often caused by vocal load.[2] In Canada, the prevalence of voice disorders in occupational voice users is unknown.

Voice disorders have important consequences for workers, especially for occupational voice users. Diagnosed voice disorders and voice problems (ie, vocal symptoms of dysphonia without diagnosis) increase the risk of sick leave,[3–7] which is associated with economic costs such as frequent replacements, an increased workload for colleagues[8] and reduced efficiency in the workplace.[9] Workers with voice problems also report a decrease in the quality of their performance and worse communication abilities.[6,7,9,10] Voice problems are also associated with increased stress level, anxiety, sadness, isolation and depression.[3,4,10–15] One study suggested that teachers that were more likely to suffer from voice disorders based on the Voice Handicap Index were 10 times more at risk of leaving their career than teachers without voice disorders.[4] Voice problems also have societal impacts, including the effect of substitute teachers on student learning. In 2001, the estimated annual cost of voice issues in the United States was of 2.5 billion US dollars.[16]

Despite their important consequences, voice issues remain largely invisible in the workplace and are not well known by the public. Previous studies, conducted mainly in the US or European countries, have shown that less than half of respondents suffering from a voice problem consulted healthcare professionals.[5,17–19] which means that voice disorders may be underdiagnosed and not adequately treated. A large number of studies conducted in Europe, North America and Australia/Oceania have reported that many workers do not receive adequate training on voice use and on work-related voice issues,[2,5,12,14,17–20] which could contribute to explaining the low consultation rate. According to these studies, less than half of occupational voice users receive voice-related information during their academic training or in their work environment. Another factor that could contribute to the low consultation rates is the accessibility of health professionals. One study revealed that 23% of American teachers were afraid their insurance would not cover the cost of voice therapy.[17] Waitlist could also be another factor limiting consultations with speech-language pathologists (SLP) and ear-nose-throat (ENT) doctors.[21,22] The same barriers to the prevention and treatment of voice disorders may be present in Canada. However, to our

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knowledge, no study has investigated the knowledge of occupational voice users regarding vocal health and voice disorders. Furthermore, vocal care has not been a priority for decision makers in Canada.[23] In the province of Quebec, voice disorders can be recognized as occupational diseases. However, as in the other provinces of Canada, voice disorders are not listed as occupational diseases in the Quebec *Act respecting industrial accidents and occupational diseases*.[24] Thus, a person suffering from an occupational voice disorder must demonstrate that their occupation is associated with a risk of voice disorder, which complicates the process and renders access to treatment more difficult. Given that over 400,000 Canadian citizens were educators in 2016−2017 (Statistics Canada, 2018), and considering that many other professionals also use their voice at work, documenting vocal health and voice issues in Canadian occupational voice users is critical.

Another critical issue to document is knowledge of the risk and prevention factors in occupational voice users. Several risks have been identified in the literature. Women have a higher risk of developing a voice disorder than men.[5,14,17−19] Voice disorders are also associated with aging,[5,6,15,17,19] breathing disorders (eg, asthma),[4,6,10] allergic rhinitis[6,12,19] and acid reflux[25] though these risk factors are not supported by all studies.[3,4,9−11,14,15,17] Several personal habits have been shown to increase the risk of voice issues (eg, smoking, caffeine and alcohol consumption, or recreational activities that require the use of the voice), while others may be lower the risk (eg, water consumption).[15,18] Environmental factors that have been identified as risk factors in occupational voice users include years of experience, number of weekly work hours, clients/trainees' age, number of clients/trainees per session, and vocal intensity, which is associated with background noise or inadequate room acoustics (eg[3,4,8,10,13−15,19]), but counter evidence exists.[3,4,9,13−15,17] The most important risk and protection factors therefore remain unclear, which prevents the implementation of science-based prevention programs for occupational voice users.

The objectives of this study were threefold: (1) to provide a portrait of the self-reported vocal health of occupational voice users in teaching and training contexts in the province of Quebec, Canada, through an online survey, (2) to document vocal health knowledge in this population, and (3) to identify personal and environmental risk factors associated with voice disorder symptoms.

MATERIAL AND METHODS

Survey description

The survey targeted occupational voice users working as teachers or instructors in the province of Quebec, Canada. The questionnaire, written in French, consisted of 88 questions, mostly multiple-choice questions. It was divided into four parts: (1) Personal and socioeconomic information, (2) Occupation and work environment, (3) General and vocal health, (4) Knowledge of vocal health and resources for voice issues. The survey took approximately 30−45 minutes to complete. The survey was available online on the LimeSurvey platform using an institutional license. The full survey (original version in French and English translation) is available on the Scholars Portal Dataverse (https://doi.org/10.5683/SP3/ABQUV5).

Inclusion criteria for the final sample

To participate, respondents had to be aged ≥18, working in Quebec, employed within the last 12 months as an occupational voice user in the context of teaching, education, or training (eg, coaches, athletes, teachers, trainers, early childhood educators, tour guides). Participants had to understand French, since the survey was written in this language.

Survey diffusion

Several non-probability sampling methods were used. A message with a link to the survey was sent via email or Facebook to several organizations through the province of Quebec: 10 daycare administrations, 13 elementary and high-school boards, 11 private schools (elementary and high school), 86 teacher labour unions, six different university mailing lists, eight lecturers and professors labour unions, six fitness centres, two dance schools, one group of trainers (*Commission des normes de l'équité, de la santé et de la sécurité au travail*; CNESST), 19 colleges, nine adult professional training centres, and seven Integrated health and social service centres (CISSS and CIUSSS). A link to the survey was also posted on our lab website (https://speechneurolab.ca) and Facebook page (https://www.facebook.com/speechneurolab). The survey was available between September 2020 and March 2021. As a compensation, participants could subscribe to the draw of two $50 gift cards by providing their email after completing the questionnaire. The email was not linked to the respondents' answers. The study was approved by the *Comité d'éthique de la recherche sectoriel en neurosciences et santé mentale* of the Institut Universitaire en Santé Mentale de Quebec (#2021-2065).

Statistical analyses

First, the data were examined using descriptive statistics (objectives 1 and 2). Next, we used inferential statistics to investigate patterns in the data (objective 3). Ordinal logistic regressions were used to examine the relationship between personal and environmental risk factors, and the frequency of voice symptoms (dry throat, sore throat, tightness in the throat, voice not working as usual, unusual voice quality, weak voice, unusual pitch, being breathless while talking). The number of frequently reported vocal symptoms was also calculated and included as a dependent variable. Personal factors included age, and a set of dichotomous variables: sex, breathing disorder, seasonal or dust allergies, acid reflux, hearing impairment and smoking. Environmental factors included the number of weekly work hours and the number of years of experience, and a set of dichotomous variables: the use of a voice amplification system, the presence of

continuous noise, discontinuous noise or speech noise in the background while working. In addition, age group was added as a four-level categorical variable (preschool, elementary education, high school, adults) as well as the number of children living at home (0, 1 child, 2 children, 3 or 4 children).

Ordinal regressions were performed using R version 4.[26] The analytical scripts, as well as the entire survey data are available on the Scholars Portal Dataverse (https://doi.org/10.5683/SP3/ABQUV5). First, the assumptions for ordinal regressions were verified (parallel regression assumption, multicollinearity). Cumulative link models including all independent variables (without the interactions) were computed to test the parallel regression assumption as well as multicollinearity.[27] First, all variables that violated the parallel regression assumption were removed. Multicollinearity was then assessed for all variables. When variation inflation factors (VIF) was ≥10 or more, the variable with the highest value was removed and the new model was tested again until all remaining variables had a VIF <10.[28] Age had to be removed from all analyses because it correlated with other variables, leading to high multicollinearity. The *Builclmm* command from the *Buildmer* R package was then used to find the best fitting converging model.[29] The models did not include interactions to avoid over fitting. The final models and detailed results are presented as supplementary materials.

RESULTS

Participants

One thousand and seventy-nine respondents completed the survey. Two hundred sixty-eight respondents were excluded because of incomplete surveys. Three additional respondents were excluded from the study because their main place of residence in the last 5 years was not the province of Quebec. The final sample thus included 808 respondents. The average response rate for all questions was 96%. Some questions were skipped by a few respondents across the questionnaire; thus, descriptive statistics such as percentages were calculated based on the number of valid answers to each question. The number of respondents is provided for each question.

Socio-demographic characteristics (Table 1, Figure 1)

As shown in Figure 1, participants were aged 19 to 73 years (M = 41.52, SD = 10.44 years); 17.2% of the respondents were men, 82.3% were women and 0.5% declared being neither men nor women. 3.2% of the respondents reported being born outside Canada (19 Europeans, 5 Africans, 2 South Americans). Most respondents (89.5%) had a university degree. Half of the respondents (50.4%) reported being French monolinguals, and 49.6% reported mastering at least one other language. 54.6% of the respondents had at least one child living with them (M = 1.08, SD = 1.13).

Medical conditions and lifestyle

A total of 16.3% of the respondents declared suffering from a breathing disorder (eg, asthma or lung disease), and 52.5% reported having seasonal and/or dust allergies. 19.3% of the respondents reported having a hearing impairment (eg, hearing loss or tinnitus) with or without a medical diagnosis. Other questions related to general health are

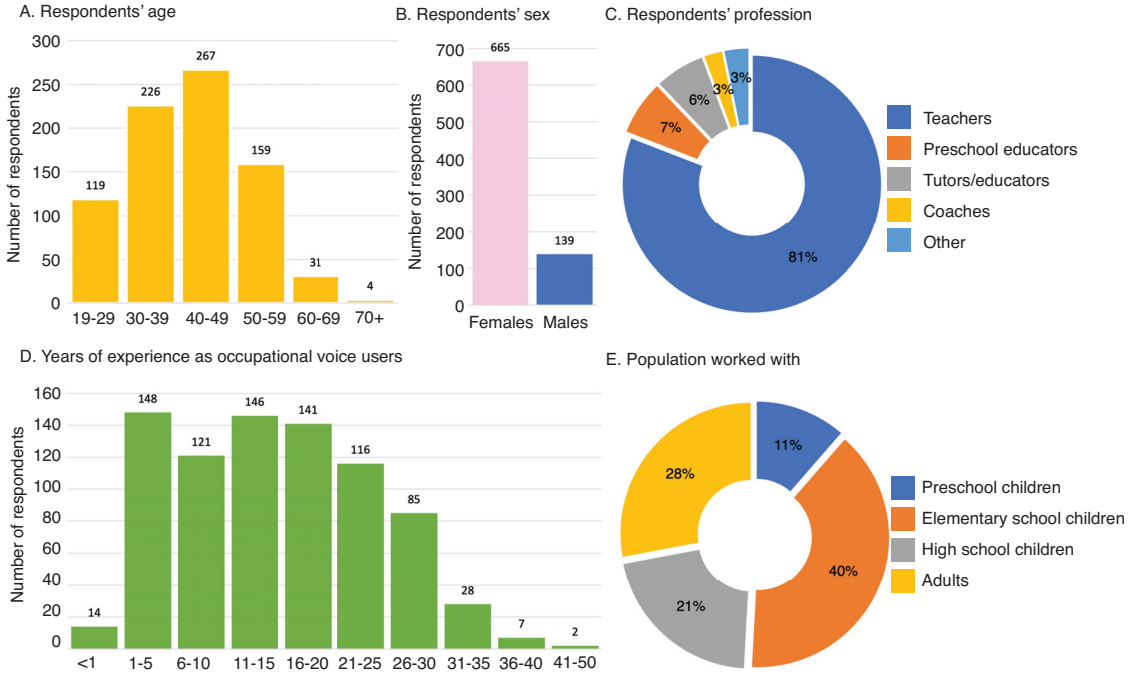

FIGURE 1. Illustration of the main socio-demographic characteristics of the occupational voice users. (**A**) Respondents' age. (**B**) Respondents' sex. Note that four respondents declared being neither man or woman (not shown in the Figure). (**C**) Respondents' profession. (**D**) Respondents' years of experience as occupational voice users. (**E**) Population respondents work with.

TABLE 1.
Respondents' Socio-Demographic and General Health Characteristics

	Answer	N	Percent
Age (years)*		806	
Highest diploma (n = 806)	None	3	0.4
	Elementary education	0	0
	High school education (DES)	6	0.7
	Professional certificate (DEP)	11	1.4
	College (C.E.G.E.P)	65	8.1
	Bachelor's degree	552	68.5
	Master's degree	135	16.7
	Doctoral degree	34	4.3
Number of spoken Languages† (n = 799)	Monolingual (French)	403	50.4
	Bilingual	349	43.7
	Multilingual (≥3)	47	5.9
Breathing disorder (n = 807)	No	665	76.4
	Yes	142	16.3
Swallowing disorder (n = 798)	No	767	96.1
	Yes	31	3.9
Seasonal allergies (n = 805)	No	428	53.2
	Yes	377	46.8
Dust allergies (n = 798)	No	560	70.2
	Yes	238	29.8
Acid reflux (n = 791)	No	569	71.9
	Yes	222	28.1
Hearing impairment (n = 784)	No	633	80.7
	Yes	151	19.3
Menopaused (n = 653)	No	555	85.0
	Yes	98	15.0
Consumption of smoked products (n = 804)	Rare (3 times a year or less)	726	90.3
	Occasional (1 time a month up to a few times a week)	37	4.6
	Regular (every day)	41	5.1
Daily water consumption (n = 798)	Less than 1 L	193	24.2
	1 L	343	43.0
	2 L	178	22.3
	More than 2 L	84	10.5
Daily juice consumption (n = 798)	None	446	55.9
	Less than 1 L	320	40.1
	1 L	24	3.0
	2 L	7	0.9
	More than 2 L	1	0.1
Weekly alcohol consumption (n = 804)	None	237	29.7
	Less than 10 glasses	454	56.9
	10 glasses	74	9.3
	10 to 15 glasses	27	3.4
	More than 15 glasses	12	1.5
Weekly activities that require the use of the voice (n = 808)	To go to a concert	46	5.7
	To see a sports match	56	6.9
	To participate in a team sport	129	16.0
	To go to the restaurant	195	24.1
	To see friends	343	42.5
	Singing practice	85	10.5
	Theatre practice	14	1.7
Number of weekly activities that require the use of the voice (n = 808)‡	0 activities	318	39.4
	1 activity	235	29.1
	2 activities	158	19.6
	3 activities or more	97	12.0
Number of weekly activities that require the use of the voice (n = 808)	0 activities	318	39.4
	1 activity	235	29.1
	2 activities	158	19.6
	3 activities or more	97	12.0

* Respondents were aged 19 to 73 years old (M = 41.54, SD = 10.44).
† Respondents spoke 1 to 5 languages (M = 1.57, SD = 0.65).
‡ Respondents practiced 0 to 5 of these recreational activities (M = 1.08, SD = 1.13).

TABLE 2.
Profession and Working Environment

	Sub-category	N	Percent	M	SD	Range
Types of professions (n = 808)*	Early childhood educators	57	7.1			
	Teachers	676	83.7			
	Education specialists	25	3.1			
	Fitness coaches	23	2.8			
	Instructors/speakers	39	4.8			
	Administrative workers	3	0.4			
	Touristic guides/story tellers	5	0.6			
Number of trainees		801		24.11	23.47	1–500
Average age of the individuals in the group (n = 808)†	Preschool	92	11.4	3.76	1.43	1–6
	Primary education	319	39.5	8.63	1.65	6–12
	High school	171	21.2	14.40	1.28	12–17
	Adults	226	28.0	24.54	8.37	17–70
Years of practice of the profession		808		15.30	9.24	0.08–48
Working hours/week		805		33.23	9.37	1–60
Presence of noise in the working environment (n = 808)	Air conditioning	229	28.3			
	Heating system	210	26.0			
	Ventilation system	377	46.7			
	Photocopier	41	5.1			
	Kitchen appliances	29	3.6			
	Construction/renovation	124	15.3			
	Speech	334	41.3			
	Children speech	512	63.4			

Note. The number in the first column represents the number of respondents who provided a valid answer for the question, when sub-categories are used.
* 808 respondents answered this question, but some reported more than one main profession, which is why the total number in the *N* and *Percent* columns is higher than the sample size.
† Although all respondents were classified as working with people in one of four age category, three respondents from the primary education category and two respondents from the adult category did not answer the question regarding to average age of the individuals they work with. They are thus included in the number of participants for each category, but not in the following statistics (M, SD, range).

presented in Table 1. Most respondents (90.1%) never or rarely consumed smoking products (ie, tobacco, cannabis, or vaping products). 67.2% of the respondents drank 1 L of water or less daily while 32.8% drank at least 2 L daily. 60.6% of the respondents participated in at least one weekly recreational activity requiring a sustained vocal use (eg, singing). 3.9% of the respondents reported using a voice amplification system. Table 1 details all behaviors associated with a risk of voice disorder.

Employment and working environment (Table 2, Figure 1)

Respondents reported working up to three types of jobs in which their voice was their main working instrument. Most respondents (93.9%) worked in the field of education, either as early childhood educators (7.1%), teachers (83.7%) or as an education specialist (eg, social workers, daycare service workers, remedial teachers; 3.1%) (Figure 1C). Other respondents reported working as fitness coaches (2.8%), instructors/speakers (4.8%), administrative workers (eg, receptionist; 0.4%) or touristic guides/story tellers (0.6%). Nineteen teachers reported working a second (n = 18) or two other (n = 1) jobs (touristic guide, fitness coach and/or instructor). The respondents worked at their primary job for 1 month (N = 1) up to 48 years, with an average of 15.30 years (Figure 1D). Most respondents had at least 5 years of experience (84.5%). They worked between 1 and 60 hours weekly (M = 33.23, SD = 9.37 hours), with 82.5% of the respondents working at least 30 hours per week.

The respondents worked one-on-one or with up to 500 people per session (M = 24.11, SD = 23.47 participants). Respondents worked with individuals or groups of people of different ages. Four age group categories were created for analytical purpose, based on the academic level or the age of the clients/trainees with which the respondents worked: (1) preschool or 0 to 5 years old, (2) elementary education (kindergarten up to sixth grade) or 6 to 11 years, (3) high school (7th to 11th grade) or 12 to 17 years, and (4) adults aged ≥18 years (including college and university students). All professions were included in one of these four categories (preschool, elementary education, secondary education, adults) (Figure 1E). 11.4% of the respondents were teachers, educators or story tellers working with children aged 5 years old or under (preschool). 39.5% were teachers or educators in elementary education, and/or fitness coaches working with children aged 6 to 11 years (elementary education). 21.2% were teachers, education specialists,

instructors, fitness coaches or touristic guides working with children at the high school level (grades 7 to 11, aged 12 to 17 years). The last 28% were college and university teachers, education specialists, instructors, fitness coaches, touristic guides and administrative workers that worked with individuals from 17 to 70 years (M = 54.54, SD = 8.37 years). These four categories were used in the inferential analyses.

A total of 94.9% of the respondents reported being exposed to background noise at work. 56.3% of the respondents were exposed to continuous noise (air conditioning, heating and/or ventilation systems), 21.9% were exposed to discontinuous noise (photocopier, kitchen appliances, construction/renovation noises), and 80.4% were exposed to speech noise. Less than 10% of the respondents benefited from measures to limit vocal intensity (voice amplification system: 9.7%, room soundproofing: 2.9%, reduction of the number of participants per group: 4.9%).

Knowledge of voice disorders and strategies (Table 3)

Most participants reported having never received information regarding voice disorders during their academic training (94.6%) or from their employer (97.6%). Ten percent of the respondents received information from pamphlets, emails, web searches, or from a health professional. 45.4% of the respondents declared knowing what a voice disorder is, and 48.1% indicated that they could recognize the manifestations of a voice problem.

36.4% of the respondents reported knowing at least one method to protect their vocal health, including drinking water and avoiding vocal abuse by taking breaks, reducing background noise, and keeping a low voice intensity. Seventy-two percent of these respondents declared using these strategies daily.

47.7% of the respondents declared knowing which professionals can treat voice disorders, and 18.2% reported knowing how to get information about voice and voice disorders. The respondents were also asked to detail where they would search for information regarding vocal health if they needed. The most common answers were to search on the Internet, consult their family doctor, consult a SLP or an ENT doctor.

History of diagnosed voice disorders (Table 4)

This section focuses on formally diagnosed voice-related conditions. 9.8% of the respondents (n = 79) declared having a history of diagnosed voice disorders. 16.5% of this subgroup (n = 13/79) reported a voice disorder related to an infection (tonsillitis, pharyngitis, laryngitis, bronchitis, streptococcus). Fifty-seven percent of this subgroup (n = 45/79) mentioned suffering from benign lesions often associated with vocal abuse or vocal fold trauma (nodules, polyps, cysts, edema, sulcus, tearing). 8.9% of the subgroup (n = 7/79) reported a voice dysfunction of another physiological origin (inflammation, paralysis, thickening, tension, adduction dysfunction). One participant from the subgroup mentioned suffering from vocal fold cancer, which caused dysphonia. Ten respondents from the subgroup (12.7%) did not mention a specific origin but declared suffering from aphonia, dysphonia or vocal fold fatigue. 24.5% of the respondents (n = 198) reported having consulted health professionals (physician, ENT doctor and/or SLP) for a voice-related issue in the past.

Although 71.4% of the respondents agreed that voice problems are a valid reason to take a sick leave, only 25% thought that their employer would agree with this. 58.3% of the participants did not know how their employer would react.

Voice dysfunction symptoms and voice perception (Table 4, Figure 2)

This section focuses on respondents self-reported symptoms, with or without diagnosis. 5.1% of the respondents reported suffering from laryngeal dysfunction (ie, chronic cough, laryngeal hypersensitivity, paradoxical vocal fold motion). In addition, respondents regularly experienced a range of other symptoms (often or very often) (Figure 2A). Several respondents often or very often experienced dry throat (44.8%), sore throat (30.2%), and/or tightness in the throat (21.1%). Others often or very often perceived that their voice was not working as usual (33%), that they had an unusual voice quality (27.6%), a weaker voice (21.1%), or that their pitch was too high or too low (16.2%). Lastly, close to 25% of the respondents indicated that they were often or very often feeling out of breath while talking. Overall, 68.8% of the respondents declared having experienced at least one voice symptom regularly (ie, often or very often), and 36.1% experienced at least 3 symptoms regularly (Figure 2B). In addition to experiencing these symptoms, 59.2% of the respondents agreed (somewhat or totally) that they were feeling at risk of developing a voice disorder (Figure 2C), and 40.6% felt worried about developing a voice disorder (Figure 2D).

Risk factors associated with vocal symptoms: inferential statistics

The ordinal regressions revealed personal and environmental factors associated with increased (OR > 1) and decreased risks (OR < 1) of developing voice symptoms. The number of frequently or very frequently experienced symptoms, which varied from 0 to 8 (sore throat, dry throat, tightness in the throat, voice that does not work as usual, unusual voice quality, weak voice, changes in pitch, feeling breathless while talking) was higher for women (OR = 2.20), for respondents with a breathing disorder (OR = 1.86), acid refluxes (OR = 1.64) and/or with hearing impairment (OR = 1.44). Respondents who worked in speech noise also reported a higher number of frequently experienced symptoms (OR = 1.76). Complete statistics for the cumulative link models are presented in supplementary material 1.

Risk factors associated with vocal symptom frequency: inferential statistics

All personal factors significantly predicted the frequency of vocal symptoms: sex, smoking, suffering from a breathing

TABLE 3.
Respondents and Employers' Knowledge About Voice Disorders and Preventive Strategies

	Answer	N	Percent
Do you know what a voice disorder is? (n = 782)	No	427	54.6
	Yes	355	45.4
Could you recognize the manifestations of a voice problem? (n = 781)	No	405	51.9
	Yes	376	48.1
Have you received information regarding the prevention of voice disorder during your academic training? (n = 781)	No	739	94.6
	Yes	42	5.4
Have you received information regarding the prevention of voice disorder from your employer? (n = 776)	No	757	97.6
	Yes	19	2.4
Have you received information regarding the prevention of voice disorder in another context? (n = 786)	No	711	90.5
	Yes (Pamphlet/Email/Web)	38	4.8
	Yes (Health professional)	41	5.2
Do you know of ways to protect your voice on a daily basis? (n = 786)	No	500	63.6
	Yes	286	36.4
Do you apply strategies to protect your voice on a daily basis? (n = 280)	No	74	25.9
	Yes	206	72.0
Do you know of resources to get information on voice and voice disorders? (n = 776)	No	635	81.8
	Yes	141	18.2
Do you know which professionals can cure voice disorders? (n = 773)	No	404	52.3
	Yes	369	47.7
Tools offered by the employer to prevent voice disorders (n = 803)	Vocal amplification system	78	9.7
	Room soundproofing	23	2.9
	Group reduction	39	4.9
You consider that voice problems are a valid reason to take a sick leave (n = 805)	Totally agree	284	35.3
	Tend to agree	291	36.1
	Neutral	106	13.2
	Tend to disagree	73	9.1
	Totally disagree	23	2.9
	Don't know	22	2.7
The employer considers that voice problems are a valid reason to take a sick leave (n = 805)	Totally agree	45	5.6
	Tend to agree	154	19.1
	Neutral	87	10.8
	Tend to disagree	73	9.1
	Totally disagree	270	33.5
	Don't know	469	58.3

disorder, allergies, acid reflux and hearing impairment. The detailed results for the main effects are presented in Table 5. Cumulative link models are presented as supplementary material 2 (sore throat), 3 (dry throat), 4 (tightness in the throat), 5 (voice not working as usual), 6 (unusual voice quality), 7 (voice sounding weak), 8 (voice perceived as too high or too low pitch), and 9 (feeling breathless while talking).

Women were at higher risk of frequently experiencing a sore throat, tightness in the throat, less functional voice, weak voice or feeling breathless while talking (OR = 1.46 to 2.33). Suffering from acid reflux was associated with a stronger risk of experiencing more frequent sore throat, dry throat, tightness in the throat, less functional voice, unusual voice quality, weak voice and feeling breathless while talking (OR = 1.47 to 1.75). Additionally, suffering from a breathing disorder was associated with increased odds of a dry throat, tightness in the throat, less functional voice, changes in pitch and feeling breathless while talking (OR = 1.47 to 2.92). Seasonal or dust allergies increased the risk of experiencing sore throat and unusual voice quality (OR = 1.37 to 1.44). Hearing impairment was associated with higher odds of experiencing tightness in the throat, less functional voice, and a higher number of frequent symptoms (OR = 1.56 to 1.68). Finally, regularly smoking tobacco, vaping and/or cannabis products were associated with a decrease risk of experiencing tightness in the throat or feeling that one's voice was weak (OR = 0.51 and 0.62).

The ordinal regressions also revealed associations between environmental working conditions and the frequency of voice symptoms. A higher number of years of experience was associated with a small, but significant decreased risk of experimenting tightness in the throat and feeling breathless while talking (OR = 0.98 for both

TABLE 4.
Questions Related to Vocal Health

Question	Answer	N	Percent
Consultation for a voice problem (n = 808)*	No consultation	610	75.5
	Physician	101	12.5
	Ear-nose-throat doctor	129	16
	Speech language pathologist	62	7.7
	Other	6	0.7
Diagnosed voice disorder (n = 808)	No diagnosis	730	90.3
	At least one diagnosis	79	9.8
Laryngeal dysfunction (chronic cough, laryngeal hypersensitivity, paradoxical vocal fold motion) (n = 791)	No	751	94.9
	Yes	40	5.1
Dry throat (n = 797)	Never	54	6.8
	Rarely	386	48.4
	Often	296	37.1
	Very often	61	7.7
Sore throat (n = 756)	Never	30	4
	Rarely	498	65.9
	Often	204	27
	Very often	24	3.2
Tightness in the throat (n = 800)	Never	204	25.5
	Rarely	427	53.4
	Often	145	18.1
	Very often	24	3
Voice seems not to function as it should (eg breaking voice) (n = 796)	Never	76	9.5
	Rarely	458	57.5
	Often	213	26.8
	Very often	49	6.2
Unusual voice quality (n = 792)	Never	87	11
	Rarely	486	61.4
	Often	176	22.2
	Very often	43	5.4
Weak voice (n = 791)	Never	172	21.7
	Rarely	452	57.1
	Often	137	17.3
	Very often	30	3.8
Unusual pitch (n = 801)	Never	312	39
	Rarely	359	44.8
	Often	101	12.6
	Very often	29	3.6
Feeling out of breath while talking (n = 800)	Never	175	21.9
	Rarely	427	53.4
	Often	164	20.5
	Very often	34	4.3
Feeling at risk to develop a voice disorder (n = 781)	Totally disagree	34	4.4
	Somewhat disagree	88	11.3
	Neutral	197	25.2
	Somewhat agree	291	37.3
	Totally agree	171	21.9
Feeling worried about developing a voice disorder (n = 773)	Totally disagree	83	10.7
	Somewhat disagree	149	19.3
	Neutral	227	29.4
	Somewhat agree	199	25.7
	Totally agree	115	14.9

* Some respondents consulted more than one specialist, hence the total number of respondents for each sub-category is higher than the sample size.

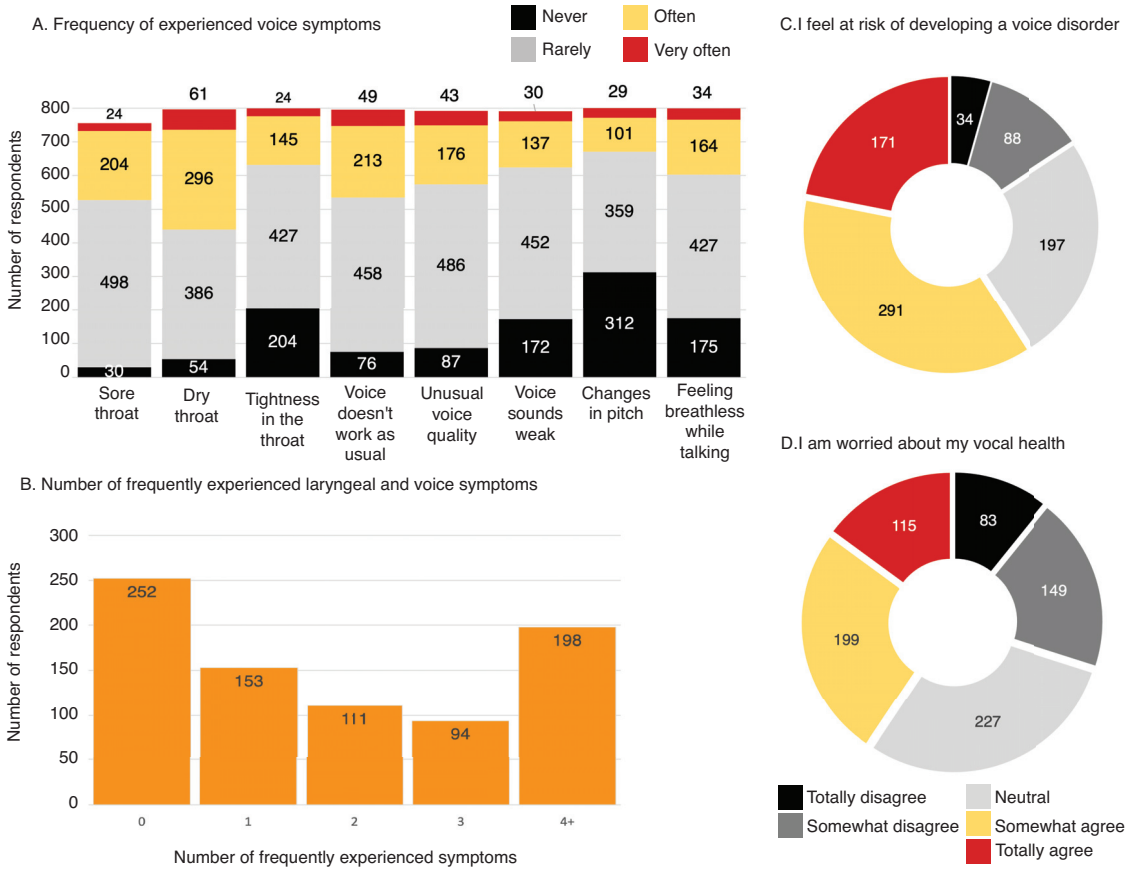

FIGURE 2. Illustration of the number of respondents experiencing laryngeal and other voice symptoms or having concerns about vocal health and disorders. (**A**) Frequency of experienced voice symptoms. (**B**) Number of frequently experienced laryngeal and voice symptoms. (**C**) Proportion of occupational voice users concerned about their vocal health. (**D**) Proportion of occupational users feeling at risk of developing a voice disorder.

symptoms). Respondents working with elementary school children were more likely than other workers to report less functional voice, unusual voice quality and changes in pitch (OR = 1.47 to 2.31). Working with continuous background noise was associated with more frequent dry throat and tightness in the throat (OR = 1.44 and 1.33, respectively). Working in the presence of speech noise was associated with more frequent sore throat, dry throat, tightness in the throat, and feeling breathless while talking (OR = 1.55 to 2.23). Having two children at home was associated with more frequent sore throat than having one child (OR = 1.80), but no significant differences were found between 0 and 1 child, or between 2 and 3 or more children. The number of working hours per week, the presence of discontinuous noises in the background and the use of an amplification system were not significant predictors of vocal symptoms.

DISCUSSION

The objective of this study was to describe the situation of occupational voice users in the contexts of teaching and training in Quebec through an online survey. More specifically, the survey documented participant's general and vocal health, vocal care and potential risk factors. The study also aimed to identify risk factors for voice disorders.

Diagnosed voice disorders, vocal symptoms and knowledge regarding vocal health

Around 10% of the respondents had received a voice disorder diagnosis, which is consistent with previous studies on voice users.[30–33] Approximately 25% of our respondents had consulted for a voice problem, supporting previous evidence of an over-representation of occupational voice users amongst patients with voice problems.[2,16,34,35] In two European studies, 32 to 57% of the sampled teachers received a voice disorder diagnosis after receiving a laryngeal evaluation,[36,37] a number which is considerably higher than the number of respondents who reported consulting health professionals in our sample. Crucially, however, our study reveals that 68.8% of the respondents experienced at least one vocal symptom regularly, and up to 36% experienced 3 or more symptoms regularly. This suggests that occupational voice users are at a high risk of voice disorders, despite their low consultation rate. Most of our respondents

TABLE 5.
Main Results for the Ordinal Regressions: Risk Factors for Voice Disorder Symptoms' Frequency

	Odds Ratios (95% CI)								
	SoreThroat	Dry Throat	Tightness in the Throat	Voice Less Functional	UnusualVoice Quality	Weak Voice	Changes in Pitch	Feeling Breathless	Number of Frequent Symptoms
Sex (woman)	**2.33 [1.50–3.63]**	R	**1.68 [1.16–2.44]**	**1.51 [1.01–2.24]**	1.35 [0.91–2.02]	**1.46 [1.01–2.10]**	1.12 [0.77–1.61]	**2.05 [1.42–2.95]**	**2.20 [1.53–3.18]**
Breathing disorder		**1.75 [1.23–2.48]**	**1.47 [1.03–2.10]**	**1.68 [1.16–2.41]**	-	-	**1.52 [1.07–2.18]**	**2.92 [2.04–4.20]**	**1.86 [1.34–2.59]**
Allergies	**1.44 [1.06–1.95]**	-	R	-	**1.37 [1.03–1.83]**	-	-	R	-
Reflux	-	**1.41 [1.05–1.90]**	**1.75 [1.29–2.38]**	**1.43 [1.04–1.15]**	**1.44 [1.05–1.98]**	**1.58 [1.16–2.15]**	1.27 [0.94–1.70]	**1.58 [1.16–2.14]**	**1.64 [1.24–2.16]**
Hearing impairment	-	-	**1.68 [1.18–2.38]**	**1.56 [1.09–2.22]**	1.36 [0.95–1.95]	-	-	1.04 [0.74–1.48]	**1.44 [1.04–2.00]**
Smoking	-	-	**0.62 [0.39–1.00]**	0.62 [0.38–1.00]	-	**0.51 [0.31–0.80]**	-	-	0.81 [0.52–1.24]
Experience	-	-	**0.98 [0.97–1.00]**	-	-	-	-	**0.98 [0.97–1.00]**	-
Hours per week	R	R	R	R	R	R	-	R	R
High school group	-	-	-	1.28 [0.85–1.93]	1.43 [0.95–2.16]	-	1.45 [0.98–2.14]	-	1.05 [0.71–1.56]
Elementary group	-	-	-	**1.87 [1.30–2.70]**	**2.02 [1.40–2.92]**	-	**1.47 [1.04–2.07]**	-	1.28 [0.88–1.87]
Preschool group	-	-	-	0.68 [0.40–1.15]	1.03 [0.62–1.73]	-	0.92 [0.57–1.49]	-	0.65 [0.40–1.06]
Continuous noise	-	**1.44 [1.09–1.90]**	**1.33 [1.01–1.76]**	-	R	R	-	-	-
Discontinuous noise	-	-	-	-	-	-	-	-	-
Speech noise	**1.58 [1.05–2.38]**	**2.23 [1.57–3.16]**	**1.55 [1.09–2.20]**	-	-	-	-	**1.84 [1.30–2.61]**	**1.76 [1.19–2.59]**
No amplification	R	R	-	0.72 [0.44–1.15]	-	-	1.48 [0.92–2.37]	-	R
Children (1)	1.37 [0.87–2.15]	-	-	-	-	-	-	-	-
Children (2)	**1.80 [1.25–2.60]**	-	-	-	-	-	-	-	-
Children (3–4)	0.96 [0.60–1.54]	-	-	-	-	-	-	-	-

Note. Hyphens represent variables that were removed from the analysis due to assumption violations. R (removed) represents variables that were included in the analyses but failed to enter the final model with the best fitting. Bold fonts indicate significant effects ($P < 0.05$).

felt at risk of developing a voice disorder (59.2%), and 40% were worried about developing one.

Ninety percent of our respondents never received vocal health education, which supports previous findings from studies conducted in seven countries across three continents (Europe, North America and Australia/Oceania) showing that occupational voice users are usually not knowledgeable about voice disorders and vocal care.[2,5,14,17–20] For instance, one study reported that 72.1% of teachers had never received information about vocal care during their training.[15] Our data also highlight the lack of education and workplace prevention measures. One of the most documented ways to prevent voice disorders in this population is the use of a voice amplifier (eg[38–40]). Less than 10% of the respondents reported that their employer provided measures such as voice amplification, room soundproofing or the reduction of the size of the trainees' group. Less than 25% of the respondents believed that their employer would consider voice problems as a valid reason to take time off work, which suggest that employers are unaware of the important functional consequences of voice disorders. Employees are unlikely to report their vocal problems to their employer if they think these issues will not be taken seriously. These results show a lack of awareness regarding vocal health by occupational voice users and their employers. Increasing awareness and voice training in these populations is critical.

Personal and environmental factors related to voice disorders

To address our objective of identifying risk factors associated with voice symptoms (objective 3), we investigated the relative contribution of personal and environmental factors to vocal symptoms using ordinal regression analyses. The prevalence of vocal symptoms was high in our sample. Thirty-six percent of the sample reported experiencing multiple symptoms regularly (≥3). Consistent with previous studies, women were at higher risk of experiencing frequent voice symptoms (eg[6,41–43]). Suffering from a breathing disorder, acid refluxes, a hearing impairment or allergies were also associated with a higher number of frequent voice symptoms. Knowledge of these risk factors is important as it can motivate occupational voice users to seek treatment for these symptoms, which can, in turn, help reduce vocal problems.

Surprisingly, smokers in our sample were less likely to report frequent tightness in the throat or weak voice. Smoking has been shown to impact voice measures such as voice pitch or stability (eg see[44]). In a previous study from our group, we showed that smoking voices are perceived more negatively than non-smoking voices by naive listeners.[45] However, the contribution of smoking to vocal problems in occupational voice users, relative to other medical conditions or environmental factors, remains unclear. A previous survey conducted within the general population in Sweden (N = 70,000+) revealed that sex, hearing impairment and smoking were associated with higher risks of experiencing voice problems.[34] However, the correlation between smoking and voice problems was weak (r_s = 0.014), which suggests that smoking effects on voice, although significant, may be less salient than other factors such as age and sex. The effects of smoking could also be indirect, thus reducing the relative impact of smoking in statistical models. Indeed, smoking can trigger laryngopharyngeal reflux and breathing disorders (eg,[46–49]) which are also predictors of voice disorders. Our finding that smokers were less likely to report vocal symptoms is challenging to interpret because of the heterogeneity in the smoking subgroup. Around 70% of them consumed tobacco, while the other consumed cannabis and/or vaping products. Moreover, some of them smoked only once a month, while others smoked several times a day. Finally, men were slightly more represented in the subgroup (29% of men in this subgroup as compared to 19% in the entire sample). This may have contributed to the association we found between sex and smoking since men were less likely to report voice disorders symptoms.

Having two children at home was associated with more frequent sore throat than having only one child. It is impossible to determine whether this was related to vocal load of more frequent cold, for instance. Moreover, since this variable predicted only one symptom, its contribution to general vocal health appears limited compared to other factors that showed effects on multiple symptoms. Nevertheless, this result raises the question of whether other factors related to daily life outside work, such as having children, interacting with people that have a hearing disability or being involved in social activities that require speaking, could influence vocal symptoms, by increasing the vocal load or by leading to increased risks of developing upper respiratory tract infections. Empirical studies are needed to investigate the contribution of these factors to vocal health and to compare their effects with other factors that are more commonly discussed in the literature (eg, medical conditions).

The presence of speech noise and continuous noise, which is associated with increasing voice intensity during work, was associated with multiple vocal symptoms. This shows that preventive measures are needed to reduce the impact of noise on vocal intensity and, ultimately, reduce the odds of developing voice disorders. Longitudinal studies that investigated the effects of vocal amplification systems have found beneficial effects on vocal intensity and vocal fatigue.[30,38,39] However, the use of a vocal amplification system did not significantly predict voice symptoms in our sample. Similarly, other cross-sectional studies have shown no differences between people working with or without an amplification system on the prevalence of voice problems.[13,14,17,50] The dual use of vocal amplification systems, as either a prevention strategy or a therapeutic tool, in our sample, could explain this lack of relationship.

Another factor that predicted vocal symptoms in our sample is trainees' age. Respondents working with elementary school children were more likely to experience three vocal symptoms (less functional voice, unusual voice quality, changes in pitch). These results may be explained by a

difference in the number of hours that teachers spend addressing the trainees formally, which is higher at the elementary level than in high school or in college/university. A study from Van Houtte et al[19] reported that kindergarten and elementary school teachers were more likely to consult for a voice problem than high school teachers. However, other studies did not find such relationship (eg[5,15,50]). In our study, working with teenagers or adults did not increase the risk of suffering from vocal symptoms. It therefore remains unclear if the trainee's age is a reliable predictor of voice problems when other factors are controlled (eg, room acoustics, number of trainees).

Vocal care documents distributed by Canadian associations often include strategies related to environmental factors like the use of a vocal amplification system, or proper vocal habits (eg, appropriate hydration, reduced voice intensity, taking breaks) (eg[51,52]). Yet, in our sample, personal factors were found to be predictors of vocal symptoms more often than environmental factors. Our results suggest that treating health conditions, especially breathing disorders and acid reflux, might be more efficient to prevent voice problems, as they are more strongly associated with vocal symptoms. Additional empirical research is needed to confirm this finding.

Limits

The first limit of this study is the non-probability sample; respondents with a history of voice disorders or vocal symptoms might have been more likely to participate in this study. The second limit is the relatively low response rate and the high rate of incomplete surveys (25%), which suggests that the survey length may have been too long (up to 45 minutes). The fact that the survey was carried out during the COVID-19 pandemic could also have affected response rate and response quality, though participants were asked to answer according to their pre pandemic situation. Third, since the sample was relatively small and largely represented by teachers (78.4%), it may not have been representative of the entire population of training-related occupational voice users in Quebec. It was, however, more than adequate to conduct inferential statistical analyses. Finally, as with all surveys, symptoms were self-reported, not measured.

CONCLUSIONS

The present study shows that, though only a few respondents received a diagnosis of voice disorder, all respondents except four declared having experienced several voice symptoms. Importantly, our study also shows that occupational voice users and their employers do not have sufficient knowledge about voice disorders and prevention strategies for voice disorders. While further studies are needed to measure vocal health empirically in occupational voice users, the present study clearly identifies a need for formal vocal health education in occupational voice users and their employers. Crucially, systemwide changes are needed not only to educate the population but also to formally recognize voice disorders as occupational diseases through legislation.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at doi:10.1016/j.jvoice.2021.12.016. The full dataset is publicly available on the Scholars Portal Dataverse at https://doi.org/10.5683/SP3/ABQUV5.

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