Prevalence and Risk Factors of Voice Disorders in French Tour Guides

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Summary: Objective/hypothesis. Voice disorders are frequently observed among professionals using their voice as their main working tool (ie, occupational voice users). The objective of this study is to establish the prevalence of voice disorders in tour guides and to evaluate the risk factors associated with these disorders.

Study design. An online survey, containing the VHI-10 test, was sent to the metropolitan France guides in November 2017. The results were analyzed using answers of tour guides dispatched in all metropolitan French departments.

Results. We received 465 replies. Voice disorders were highly prevalent (up to 21.29%) according to the VHI-10 and were comparable to observed rates in other professional categories (teachers and telecommunicators). The proportion of guides complaining about voice disorders episodes (44.94%) is greater than in the overall general population. Specific work-related factors emerged in this study. First, the use of a high-intensity voice for more than 6 hours a week is a factor significantly associated with a higher risk of having a pathological score at VHI-10. Second, a significant proportion of the guides noted that noise pollution and changes in temperature affected their vocal quality.

Conclusions. In light of these results, we can conclude that the tour guide profession is subject to voice-related risks. The prevalence of voice disorders is particularly higher than in the general population and risk factors specific to tour guide population exist.

Key Words: Voice disorders−Professional voice−Prevention−Tour guides-voice handicap index-10.

INTRODUCTION

Studies exploring causes of dysphonia reported multiple causes: physiological factors − in particular an association with female gender,[1] elderly,[2,3] job tenure[4] and stressed personality,[5] environmental factors (dry air,[6,7] significant temperature changes,[8] acoustic environments such as reverberating conditions,[9] and background noises[4,10,11]), lifestyle factors (the combination of esophageal reflux, smoking for one or more years, and alcohol drinking,[12] dehydration[13] or the presence of a deaf person at home[10]), and medical factors (back pain,[14] pharyngolaryngeal reflux,[15,16] asthma,[17] or the combinaton of asthma and respiratory allergy[18]).

Dysphonia has a high prevalence among professionals who need "a clear, dependable, strong, and pleasant voice,"[19] also named occupational voice users, compared to the general population. For instance, in the United States, while dysphonia prevalence averages 7.6% (confidence interval: 7.4−7.8%)[20] in the general population, it peaks at 25% for emergency telecommunicators.[21] Similarly, prevalence varies between 20% and 50% among teachers.[4] In India, it was estimated to be 17.8% among priests in Kerala.[18] Voice disorders impact their quality of life, most of all, their work performance[18,22] when their main work tool is damaged.

Among this population of occupational voice users, this study focuses on French Tour guides (TGs). The European Committee for Standardization defined TG as a "person who guides visitors in the language of their choice and interprets the cultural and natural heritage of an area." A first study including 11 TGs in Lorient, France, revealed that they suffered from voice problems, which incommoded them during their visits.[23] However, as of today, there has been no epidemiological study conducted in this particular population.

Yet, TGs are major assets for tourism, which is a critical component of the economy, especially in France. Indeed, after a remarkable development of tourism in the country, France was recognized as the world's leading destination in 2017, according to the World Tourism Organization. This trend is supported by regional and continental initiatives such as the decision by the European Union to name 2018 the "European Year of Cultural Heritage," which demonstrates that the valorization of cultural wealth is strengthening.

The present research aims to evaluate whether French TGs are at greater risk of developing voice problems than the general population. To this end, this study was designed to establish the prevalence of voice problems and the influence of associated risk factors for French TGs.

MATERIALS AND METHODS

Participants

We designed an online questionnaire, which we addressed to TGs thanks to the relay of national and local TGs organizations (primarily). We limited our analyses to the TGs in possession of a professional card delivered by the Ministry of Culture and Communication and working in the French metropolitan territory.

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Questionnaire

The anonymous self-reported questionnaire contained 53 questions of which an English translation is given in the Appendix.

The questionnaire included the Voice Handicap Index-10 (VHI-10) translated in French. A score of 10/40, or larger, confirms a voice problem.[24]

Additional questions aimed at characterizing the risk factors associated with the presence of voice problems and were grouped in six sections: demographic and professional characteristics, work habits, work environment, lifestyle and vocal hygiene, history with vocal difficulties (complaints and causes), and vocal complaints impact at work.

Prior to the data collection, the questionnaire was provided to a sample of 10 TGs in order to assess its consistency and clarity, leading to the modification of several questions. The adjusted questionnaire was then evaluated again by five new TGs. As there was no ambiguity or difficulty reported in this second evaluation, the questionnaire was subsequently validated.

Analysis

Descriptive statistics were used to characterize the participants (age, gender, locality ie, French Department), and to assess the prevalence of voice handicap (VHI-10 index and yearly frequency of aphonia), the timing of voice disorder appearance, the occurrence of sick leave and, finally, to investigate which environmental factors or work habits may cause voice problems in TGs.

We used a Pearson chi-square test to compare the proportions of different VHI-10 pathological scores in TGs and in other occupational voice users. Then, using likewise Pearson chi-square test, we investigated the association between the pathological scores and its potential correlates, with an emphasis on both individual and professional risk factors. We used a P value = 0.05 as a threshold for statistical significance. To compare more than two groups, we used Bonferroni correction (adjustment of the P value threshold to 0.05 divided by the number of tests) in order to account for the family-wise error rate.

RESULTS

We received the replies of 475 TGs, from which we discarded 10 participants, who did not possess a professional card. Then we analyzed the replies of 465 participants.

Demographic characteristics

Participants' age varied between 22 and 81 (mean = 45.6, n = 465). They were mostly females (85.38% of female, n = 397 and only 14.62% of male, n = 68). The geographic distribution is given in Appendix 4.2.5.1. In our sample, the proportion of TGs by French departments is similar to the dispersion of French TGs.

Prevalence of voice disorders

Nearly half of the participants reported at least one aphonia (complete loss of voice) per year (44.94%; confidence interval: 40.36–49.59%, n = 209; Figure 1). These lasted 3.61 days in average (min: 1 day, max: 62 days).

An important proportion of TGs scored in the clinical range of VHI-10 for having a voice disorder (21.29%; 17.65–25.29%, n = 99). Overall, 49.25% (44.61–53.90%, n = 229) of the TGs were sometimes concerned by voice disorders, which in the vast majority of the cases appeared at the beginning of their career (78.66%; 72.92–83.68%, n = 188).

The percentage of TGs with pathological score revealed by the VHI-10 index is statistically similar to the results observed in a study focusing on US 911 emergency telecommunicators and Brazilian teachers (Table 1).

Vocal handicap and its impact on visits

When encountering voice problems, more than half of the TGs indicated feeling a discomfort at work (71.15%; 65.71–76.16%, n = 217) and 20.98% (16.55–25.99%, n = 64) could not continue working.

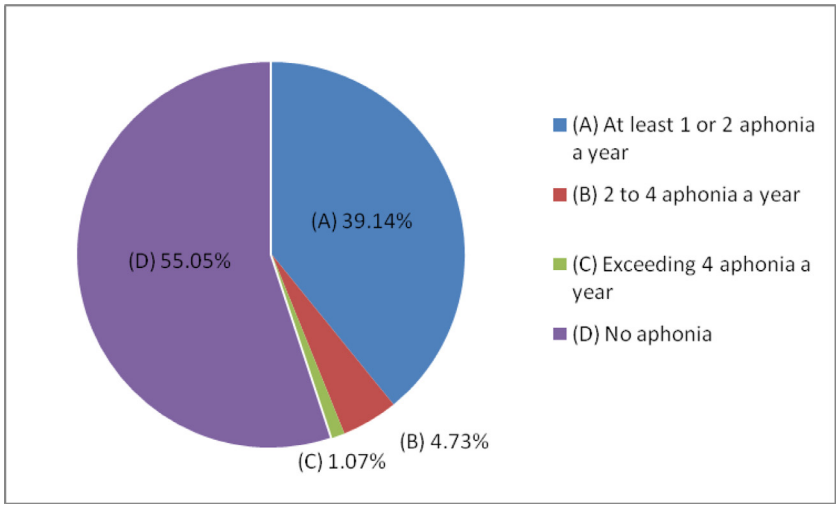

FIGURE 1. Frequency of aphonia per year.

TABLE 1.
Comparison of the Percentage of TGs With a Pathological Score in theVHI-10 Index to Results of Other Studies Focusing on Occupational Voice Users (Chi-Square Test)

	No.	% TG >11/40 VHI-10	*P* value
French TGs	465	21.29	
US 911 emergency telecommunicators[21]	69	24.64	0.64
French TGs	465	21.29	
French teachers[29]	2653	13.00	<3.41e−06
French TGs	465	21.29	
Brazilian teachers[26]	3263	21.30	1

Guidance or professional training to prevent voice disorders

The vast majority of participants 83.23% (79.51−86.51%, n = 387) declared they had not been informed about the risks caused by their work to their voice, neither during preservice program, nor during vocational training. In addition, 65.73% (60.64−69.49%, n = 303) did not receive guidance or professional training invoice care neither during preservice program, nor during vocational training.

Among TGs with pathological scores to VHI-10 (n = 99), 65.66% (55.44−74.91%, n = 65) had never seen a doctor concerning voice problems and only 17.17% (10.33−26.06%, n = 17) had met with a voice specialist. Moreover, 15% (5.71−29.83%; n = 6) of TGs who explained why they never consulted voice specialists (n = 40) said that they ignored their existence.

Risk factors

Descriptive analysis: what environmental factors or work habits cause voice problems?

Almost three-quarters of the TGs (71.61%%; 67.28−75.67%, n = 333) are frequently exposed to temperature changes (Figure 2).

The main environmental factors associated with increasing vocal intensity are background noises near the place of the visit (89.67%; 86.55−92.29%, n = 417), followed by unfavorable acoustics of the place and the composition of the group (scattered and noise level), between 34% and 39% (Figure 3).

The TGs also reported the elements, which tend to be responsible for increasing vocal intensity. During outdoor visits, these were primarily noises from public areas such as road traffic, construction sites, groups of people (55.21%; 50.15−60.20%, n = 217) and from weather conditions such as wind or rain (13.74%; 10.49−17.54%, n = 54). During indoor visits, these were mainly the influx of visitors (34.28%; 25.29−44.18%, n = 36) and room acoustics (33.33%; 24.43−43.20%, n = 35).

Statistical analysis: risk factors

Work-related risk factors: The occurrence of at least one aphonia per year was associated with prolonged weekly use of the voice (more than 31 hours: P value < 0.02). Similarly, the occurrence of a pathological score to VHI-10 was strongly associated with prolonged weekly use of a loud voice during the high season (more than 6 hours a week; P value < 0.01). This latter pattern seemed reinforced in case of long voice use, overall (31−45 hours a week; P value < 0.001; Table 2), thereby suggesting an interaction between the duration of the use of loud voice and voice, overall, in the occurrence of pathological scores to the VHI-10.

Personal risk factors: Female TGs (P value: < 0.001) and stressed or anxious TGs (P value: < 0.001) had significantly greater risks to be assigned a pathological score to the VHI-10 (Table 3).

Life habits risk factors: Table 4.

Medical risk factors: TGs with back pain (P value: < 0.02089) and who had an otolaryngology surgery (P value: < 0.008) statistically have a bigger risk to get a pathological score to VHI-10. A result near the P value threshold was found for gastric reflux (P value: 0.0645; Table 5).

DISCUSSION

This study presents the first epidemiological investigation of the prevalence of voice disorders among TGs.

Our sample is representative of the French TGs population. Indeed, the repartition of TGs by demographic characteristics (age and gender) is similar to the referent population.[25] Moreover, the sample size of 465 participants is representative of the global TGs population. Nevertheless, because of the online questionnaire methodology, we cannot avoid a participation bias, meaning that the proportion of participants who have had a voice disorder is likely to be higher.

Prevalence

Our results tend toward the hypothesis that TGs have greater risks of suffering from voice disorders than the general population. While 7.6% [7.40−7.80%] of the general population of the United States reported a voice problem in the 12 months preceding the survey (Bhattacharyya Neil, 2014)[20], the amount of TGs who have at least one aphonia a year is 44.94% (40.36−49.59%).

According to the VHI-10, 21.29% (17.65−25.29%, n = 99) of the TGs have a voice disorder. This result is comparable to other studies focusing on different occupational voice users, like US 911 emergency telecommunicators[21] and Brazilian teachers.[26] However, the prevalence was significantly higher than what was observed among French teachers (21.29% against 13%). The greater proportion of female (85.38% among TGs against 66% among French teachers) could be an explanation to this discrepancy.

The percentage of guides who have cancelled their tours because of their poor voice condition (20.98%, n = 64) is

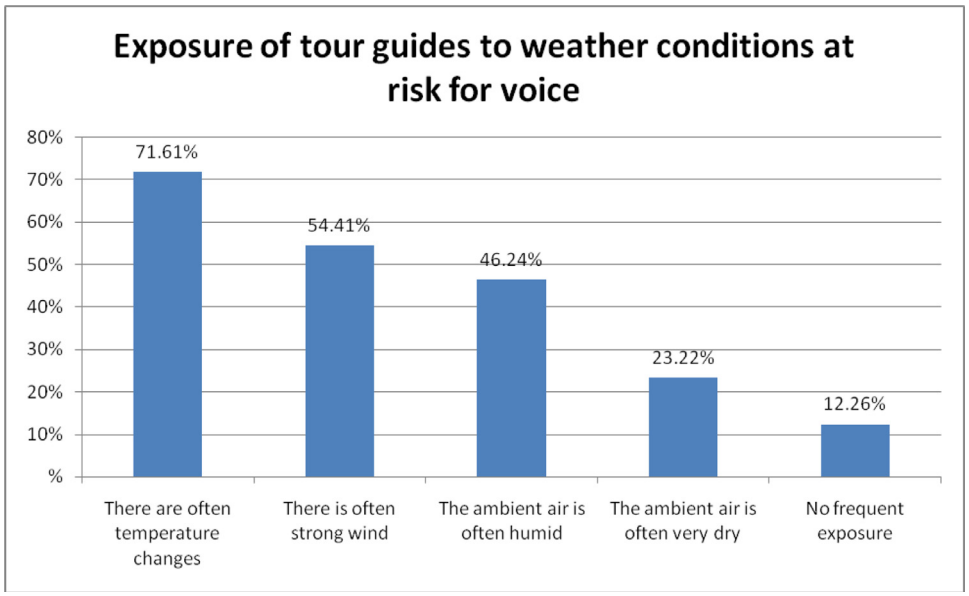

FIGURE 2. Exposure of tour guides to risky weather conditions for the voice.

similar to the percentage of absences among teachers: 23%[4] but far below the percentage observed for priests, in Brazil.[18] We suppose that TGs go on sick leave only in case of severe, invalidating voice problems because TGs tend to work in precarious situations due to seasonal jobs, the plurality of employers for TG, and the precarity of employment contracts. This finding should alarm health professionals. Numerous TGs who show vocal fatigue and who feel discomfort do not seem to enforce a vocal rest even though it is essential to their well-being. Indeed, microtraumatisms caused by the vocal load may be resolved by a physiological restorative process that increases fabrication of hyaluronic acid, collagen, and fibronectin.[27] Excessive exposures to vibrations destroy tissues.

Our study shows that a small proportion of guides have benefited from prevention or educational measures. Overall, TGs do not know how to protect their voice and a surprisingly high proportion of TGs do not even know that health professionals are able to help with their voice (ie, their essential work tool).

Risk factors

Environmental risk factors

Background noises close to the place of the visit (89.67%; 86.55–92.29%, n = 417) are, by far, the most important environmental risk factors for outdoor visits. Nearly all of the TGs are concerned (93.7% of them provide such visits, n = 436). In addition, 71.61% (n = 333) of TGs are exposed to temperature changes. It is an important risk factor because it contributes to the irritation and the inflammation of the laryngeal mucosa. This widespread exposition can be explained by the fact that TGs often work in areas with air conditioning, heating or draught.

Work conditions risk factors

In this study, we found that prolonged voice use (eg, more than 31 hours a week) is a significant risk for TGs to suffer from aphonia. Nevertheless, an extended voice use alone was not sufficient to statistically increase the risk of getting a voice disorder. The use of a loud voice for more than

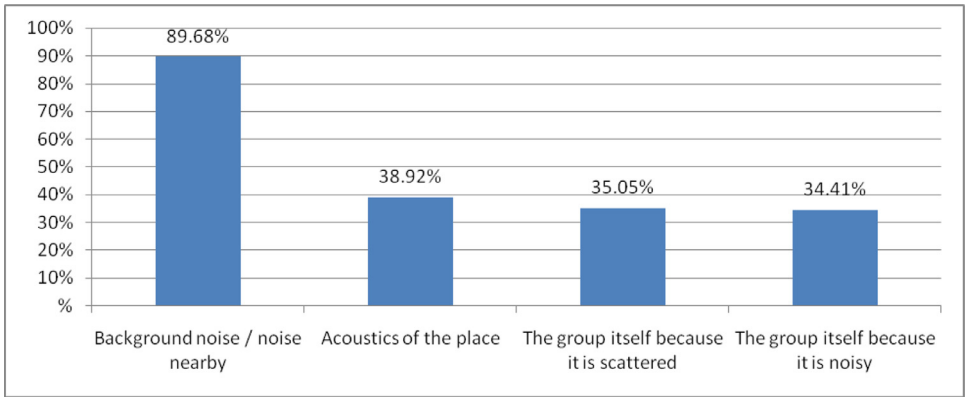

FIGURE 3. Environmental factors linked to increasing vocal intensity.

TABLE 2.
Association Between Work Conditions and Occurrence of Pathological Score to the VHI-10 in TGs (Chi-Squared)

	No.	% TG >11/40 VHI-10	*P* value
Public			
Elderly	63	22.22	
Adults	63	19.05	0.60
Children/teenagers	135	25.93	
Adults	135	18.52	0.18
Duration of the voice use per week (high season)			
>15 h	405	20.99	
<15 h	60	23.33	0.80
Duration of the use of a loud voice per week (high season)			
<6 h	135	13.94	
>6 h	300	25.33	<0.004*
Duration of the use of a loud voice per week (high season) in case of 31-45 hours voice use per week			
<6 h of loud voice per week	38	7.89	
>6 h of loud voice per week	129	33.33	<0.001*
Duration of high season			
<6 mo	176	19.89	
>6 mo	165	20.61	0.89
Number of people per group			
<35 people	135	24.44%	
>35 people	135	20.74%	0.56
TGs using amplifier			
For a group of 35 people: guides with voice amplifier	191	19.37	
For a group of 35 people: guides without voice amplifier	75	20.00	1
For any group size: guides using voice amplifier	201	30.52	
For any group size: guides not using voice amplifier	264	24.53	0.36
Occupational category			
Self-employed	248	20.97	
Employed	215	21.86	0.82
English	342	21.64	
German	104	17.31	
Spanish	133	24.06	
Italian	64	21.88	0.81
Monolingual	88	17.05	
Bilingual	153	20.92	
Trilingual	224	23.21	0.48

6 hours a week is significantly associated with a voice disorder. Similar findings are reported by other studies in the literature. A study about priests conducted by Devadas[18] did not find that the duration of voice use is a significant risk factor. A possible explanation was that most of the time, priests do not use a loud voice. A loud voice is really detrimental for vocal folds because the subglottic pressure, the strength of cord closure, and the contact time are consequently increased.[28]

Personal risk factors

In our study, women TGs are more at risk than men TGs. This result is coherent with the relevant literature on this topic. According to Roy,[12] women's vocal cords endure more vibrations in average since they speak with a high-pitched (high frequency) voice. The high percentage of women in the TGs (85%, n = 397), further increase the overall sensitivity of this population to voice issues.

Furthermore, stress and anxiety are significantly associated with voice disorders. Nearly one-third of the TGs (31.09%, n = 144) declared being stressed. Even if is difficult to determine if these personality traits are a cause or a result of the TGs exercise, it can be conceivable that the TG profession induces stress. Indeed, this is a precarious employment, which is seasonal and can force to have multiple employers. Moreover, it requires a high personal involvement to get a diploma and to organize visits meeting clients' expectations. On the other hand, according to Galinnari,[29] summarizing four studies focusing on teachers, the scientific literature has failed to explain a causal link involving stress.

Even though the elderly are more concerned by voice disorders,[30] we found that this age group was less concerned (12% against 21.2%). We can suppose that elderly guides

TABLE 3.
Association Between Individual Risk Factors and Occurrence of Pathological Score to theVHI-10 in TGs (Chi-Squared)

	No.	% TG >11/40 VHI-10	*P* value
Gender			
Female	397	23.68	
Male	68	7.35	<0.002*
Age (y)			
<=35	131	22.90	
36–50	160	22.50	
51–64	132	21.21	
>=65	42	11.90	0.46
Job tenure (y)			
0–10	206	22.82	
11–20	150	20.00	
21–30	78	19.23	
>31	31	23.33	0.87
Personality			
Dynamic	361	18.84	
Voluntary	290	21.72	
Stressed*	144	31.25	
Anxious*	133	33.08	
Reserved	100	28	
Leader	96	13.54	
Extrovert	62	16.13	
Timid	30	26.67	<0.0007**

* Statistically significant: *P* value < 0.05.
** Bonferroni correction: *P* value < 0.002.

would have already retired if they had an ineffective voice (ie, they are not included in our sample), or that their experience allows them to manage their voice better.

Back pain which disrupts verticality and breathing movement is significantly associated with voice disorders. This risk factor is really widespread in the TGs population. In fact, about two-thirds of the guides (60.6%, n = 282) suffer from it.

TABLE 4.
Association Between Life Habits Risk Factors and Occurrence of Pathological Score to the VHI-10 in TGs (Chi-Squared)

	No.	% TG >11/40 VHI-10	*P* value
Other occupational voice activity			
Yes	78	23.08	
No	387	20.93	0.65
Leisure activity implying voice use			
Yes	67	17.91	
No	398	21.86	0.52
Less than 15 years-old children at home			
Yes	126	24.60	
No	339	20.06	0.30
Deaf family members at home			
Yes	46	30.43	
No	419	20.29	0.11
Smoker (active/passive)			
Yes	113	16.81	
No	352	22.73	0.23

TABLE 5.
Association Between Medical Factors Risk Factors and Occurrence of Pathological Score to the VHI-10 in TGs (Chi-Squared)

	No.	% TG >11/40 VHI-10	*P* value
Gastric reflux			
Yes	130	26.92	
No	335	19.10	0.06
Pollen allergy			
No	293	19.45	
Yes and treatment	59	25.42	
Yes but no treatment	113	23.89	0.44
Asthma			
No	358	21.23	
Yes and treatment	30	23.33	
Yes but no treatment	77	20.78	0.96
Other allergies			
No	318	18.87	
Yes and treatment	48	27.08	
Yes but no treatment	99	26.26	0.17
Respiratory difficulties			
No	361	21.33	
Yes and treatment	32	18.75	
Yes but no treatment	72	22.22	0.92
Back pain			
Yes	282	24.82	
No	183	15.85	<0.02*
Deafness			
Yes	43	20.93	
No	422	21.33	1
Thyroidectomy			
Yes	6	33.33	
No	393	18.83	0.32
Otolaryngology surgery			
Yes	43	37.21	
No	393	18.83	<0.009*
Intubation			
Yes	23	30.43	
No	393	18.83	0.17

Otolaryngology surgeries are also associated with voice disorders. This result could be explained by two factors: a poor wound healing of vocal fold after the surgery or side-effects, such as damage in the recurrent laryngeal nerve.

CONCLUSIONS

The results of this study indicate that TGs are more likely to suffer from voice disorders than the general population. Because of the vocal effort necessary for leading visits, voice disorders can disturb their work.

Some specific risk factors have been identified: background noises, change of temperature, voice use for more

than 31 hours a week, and the use of a loud voice for more than 6 hours a week. Moreover, being a woman, being stressed and/or anxious and suffering from back pain have been pointed out as significant personal risk factors. These factors are widespread in this population.

We conclude that this data demonstrate that dysphonia should be recognized as a work-related condition in the context of occupational voice users. Furthermore, this study highlights the lack of appropriate education and prevention programs for TGs, included in preservice program and vocational training. As occupational voice users, TGs have to be aware of the vocal risks involved in their daily activities. They could really benefit from preventive vocal measures on how to take care of their voice. Future studies may develop our knowledge about specific TGs risk factor sand allow the elaboration of an efficient prevention program by health actors such as speech therapists and phoniatricians.

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SUPPLEMENTARY DATA

Supplementary data related to this article can be found online a https://doi.org/10.1016/j.jvoice.2019.05.002.

REFERENCES

1. Cohen SM, Kim J, Roy N, et al. Prevalence and causes of dysphonia in a large treatment-seeking population. *Laryngoscope*. 2012;122:343–348. https://doi.org/10.1002/lary.22426.
2. Pontes P, Yamasaki R, Behlau M. Morphological and functional aspects of the senile larynx. *Folia Phoniatr Logop*. 2006;58:151–158. https://doi.org/10.1159/000091729.
3. Pernambuco L, Espelt A, Góis ACB, et al. Voice disorders in older adults living in nursing homes: prevalence and associated factors. *J Voice Off J Voice Found*. 2017;31. https://doi.org/10.1016/j.jvoice.2016.11.015. 510.e15-510.e21.
4. Martins RHG, Pereira ERBN, Hidalgo CB, et al. Voice disorders in teachers. a review. *J Voice*. 2014;28:716–724. https://doi.org/10.1016/j.jvoice.2014.02.008.
5. Dietrich M, Verdolini Abbott K. Vocal function in introverts and extraverts during a psychological stress reactivity protocol. *J Speech Lang Hear Res JSLHR*. 2012;55:973–987. https://doi.org/10.1044/1092-4388(2011/10-0344).
6. Hemler RJ, Wieneke GH, Dejonckere PH. The effect of relative humidity of inhaled air on acoustic parameters of voice in normal subjects. *J Voice Off J Voice Found*. 1997;11:295–300.
7. Sivasankar M, Erickson E, Schneider S, et al. Phonatory effects of airway dehydration: preliminary evidence for impaired compensation to oral breathing in individuals with a history of vocal fatigue. *J Speech Lang Hear Res*. 2008;51:1494–1506. https://doi.org/10.1044/1092-4388(2008/07-0181).
8. Giovanni A, Robieux C, Galant C, et al. Le forçage vocal et les lésions induites. *La Voix Parlée et La Voix Chantée*. 2012.
9. Bottalico P. Speech adjustments for room acoustics and their effects on vocal effort. *J Voice Off J Voice Found*. 2017;31. https://doi.org/10.1016/j.jvoice.2016.10.001. 392.e1-392.e12.
10. Huche FL, Giovanni A. *Et votre voix, comment va-t-elle ? : Petit traité de la voix à l'intention de ses usagers… c'est-à-dire de tout un chacun !*. Bruxelles; Marseille: Solal Editeurs; 2012.
11. Kristiansen J, Lund SP, Persson R, et al. A study of classroom acoustics and school teachers' noise exposure, voice load and speaking time during teaching, and the effects on vocal and mental fatigue development. *Int Arch Occup Environ Health*. 2014;87:851–860. https://doi.org/10.1007/s00420-014-0927-8.
12. Roy N, Merrill RM, Gray SD, et al. Voice disorders in the general population: prevalence, risk factors, and occupational impact. *Laryngoscope*. 2005;115:1988–1995. https://doi.org/10.1097/01.mlg.0000179174.32345.41.
13. Sivasankar M, Leydon C. The role of hydration in vocal fold physiology. *Curr Opin Otolaryngol Head Neck Surg*. 2010;18:171–175. https://doi.org/10.1097/MOO.0b013e3283393784.
14. Calais-Germain B, Germain F. *Anatomie Pour La Voix*. 2013. éditions désiris. Italie.
15. Woisard V. Voix et reflux gastro-oesophagien: mythe ou réalité ? In: *La Voix Dans Tous Ses Maux*.; 2009:173−181.
16. Welby-Gieusse M., Woisard V., Calas M., et al. Corrélation entre l'analyse laryngoscopique et le reflux gastro-úsophagien chez un patient dysphonique. 2008;129,2107−114.
17. Hamdan AL, Ziade G, Kasti M, et al. Phonatory symptoms and acoustic findings in patients with asthma: a cross-sectional controlled study. *Indian J Otolaryngol Head Neck Surg Off Publ Assoc Otolaryngol India*. 2017;69:42–46. https://doi.org/10.1007/s12070-016-1035-8.
18. Devadas U, Jose N, Gunjawate D. Prevalence and influencing risk factors of voice problems in priests in Kerala. *J Voice Off J Voice Found*. 2016;30. https://doi.org/10.1016/j.jvoice.2015.11.008. 771.e27-771.e32.
19. Dejonckere PH. *Occupational Voice: Care and Cure*. La Haye Pays-Bas: Kugler Publications; 2001.
20. Neil B. The prevalence of voice problems among adults in the United States. *Laryngoscope*. 2014;124:2359–2362. https://doi.org/10.1002/lary.24740.
21. Johns-Fiedler H, van Mersbergen M. The prevalence of voice disorders in 911 emergency telecommunicators. *J Voice Off J Voice Found*. 2015;29. https://doi.org/10.1016/j.jvoice.2014.08.008. 389.e1-10.
22. Santos CTD, Santos C, Lopes LW, et al. Relationship between working and voice conditions self-reported by telemarketers of an emergency call center. *CoDAS*. 2016;28:583–594. https://doi.org/10.1590/2317-1782/20162015125.
23. Bardi J. Action préventive au service de la voix des guides-conférenciers de Lorient. 2014.
24. Rosen CA, Lee AS, Osborne J, et al. Development and validation of the voice handicap index−10. *Laryngoscope*. 2004;114:1549–1556. https://doi.org/10.1097/00005537-200409000-00009.
25. Lewy R. *Etude Sur l'exercice Des Métiers de Guide-Interprète et Conférencier*. Ministère de l'économie, de l'industrie et de l'emploi; 2009. https://www.google.com/search?q=lewy+guide+conf%C3%A9rencier&ie=utf-8&oe=utf-8&client=firefox-b#.
26. Sampaio MC, dos Reis EJFB, Carvalho FM, et al. Vocal effort and voice handicap among teachers. *J Voice Off J Voice Found*. 2012;26. https://doi.org/10.1016/j.jvoice.2012.06.003. 820.e15-18.
27. Graupp M, Kiesler K, Friedrich G, et al. Vocal fold fibroblast response to growth factor treatment is age dependent: results from an in vitro study. *J Voice Off J Voice Found*. 2014;28:420–423. https://doi.org/10.1016/j.jvoice.2013.11.005.
28. Garnier M. Forçage vocal et efficacité de communication. In: Gatignol P, ed. *La Voix Dans Tous Ses Maux*. Isbergues, France: Ortho Edition; 2009:83–107.
29. Gallinari C, Garsi J-P, Vercambre M-N. Troubles de la voix chez les enseignants français: prévalence, facteurs associés et retentissement sur le bien-être au travail et la qualité de vie. *Arch Mal Prof Environ*. 2016;77:650–664. http://dx.doi.org/10.1016/j.admp.2015.12.008.
30. Olivier L, Laurence L, Alfred W. *Les Clés de La Voix*. Paris, France: De Fallois; 2016.