Dysphonia and throat clearing in singers during the Covid-19 pandemic in Brazil

Sabryna Farneze Nunes Sant'anna, André de Campos Duprat, Marta Assumpção de Andrade, Maria Fernanda de Queiroz Prado Bittencourt

PII: S0892-1997(23)00159-5

DOI: https://doi.org/10.1016/j.jvoice.2023.05.008

Reference: YMVJ3927

To appear in: *Journal of Voice*
Accepted date: 15 May 2023

Please cite this article as: Sabryna Farneze Nunes Sant'anna, André de Campos Duprat, Marta Assumpção de Andrade and Maria Fernanda de Queiroz Prado Bittencourt, Dysphonia and throat clearing in singers during the Covid-19 pandemic in Brazil, *Journal of Voice,* (2023) doi:https://doi.org/10.1016/j.jvoice.2023.05.008

Dysphonia and throat clearing in singers during the Covid-19 pandemic in Brazil

Sabryna Farneze Nunes Sant'anna[1]

André de Campos Duprat[1]

Marta Assumpção de Andrade[1]

Maria Fernanda de Queiroz Prado Bittencourt[1]

[1] Faculty of Medical Sciences of Santa Casa of São Paulo, São Paulo, Brazil.

Corresponding author: Av. Alm. Júlio de Sá Bierrenbach, 200 - rooms 1004 & 1005 - Barra da Tijuca, Rio de Janeiro-RJ. Zip code: 22775-028. Phone number: +5521 98088-0708. E-mail: sabrynafns@gmail.com

Summary

Objective: The COVID-19 pandemic in Brazil affected the lives of singers, with negative impacts of the disease on the voice, such as dysphonia and throat clearing. This study aims to evaluate the presence of dysphonia and throat clearing in singers during the COVID-19 pandemic in Brazil.

Material and Methods: This is a cross-sectional analytical study with a sample of 154 singers from all over Brazil. Data collection was carried out online, by completing the questionnaire created by the researcher using Google Forms. The following were considered the outcome variables: voice impairment and throat clearing. The bivariate analysis was performed to test the relationship between COVID-19 infection and voice impairment, COVID-19 infection and throat clearing, COVID-19 infection and laryngeal complaints (voice impairment and throat clearing).

Results: In this study, the mean age of the singers was 35.8 (Standard deviation=±10.2 years) and 59.2% were female. Most of them worked as professional singers (81.1%) and had more than 10 years of professional experience (57.4%), mainly singing pop music (85.4%). A total of 62% reported vocal alterations during the COVID-19 infection and 53% had vocal alterations after the infection, with 44.0% reporting the onset of throat clearing after the infection. There was a significant association between COVID-19 infection and having voice impairment (p=0.03; prevalence ratio - PR: 2.33; CI: 1.04 – 5.46). An association was observed between the onset of throat clearing and the occurrence of COVID-19 infection (p=0.001; PR: 9.13; CI: 2.47-64.42).

Conclusions: The results indicated that there is an association between COVID-19 infection and complaints of dysphonia and throat clearing in Brazilian singers. This study demonstrates the importance of guidance to singers infected with COVID-19 by health voice processionals.

Key words: Singing; Voice Disorders; COVID-19.

Introduction

The new coronavirus outbreak (COVID-19 disease in 2019), initially reported in China in December 2019,[1-3] caused many changes in global health systems and social relations.[2] To reduce the spread of the disease, public health policies implemented preventive social restriction measures worldwide.[1] However, such measures also had professional, financial and psychological consequences, which were not always desirable. The singers were one of the most affected populations, who commonly depend on their performance and frequent social interactions for career progression.[1]

Among voice professionals, singers are considered a special group, as the voice is their work instrument and related to their professional identity. These professionals

need to maintain their vocal quality during presentations, which can require intense vocal effort.[4] Artistic voice professionals were more affected than others during the COVID-19 pandemic, both professionally and economically. Moreover, they are generally more prone to stress and anxiety compared to the general population.[6]

The reduction in the professional voice use during the COVID 19 pandemic affected singers' routines in several ways. There was a decrease in the acts of practicing, rehearsing, performing and expressing oneself by singing in front of an audience, as well as deprivation of interactions with members of the band or orchestra, conductors and singing professionals.[5-6] The impacts of this decrease on singing frequency among singers, during the COVID-19 pandemic, are associated with negative effects on functional health.[6]

Despite the limited evidence about the effects of lack of work on one's voice among singers during the pandemic, in other situations relative vocal rest can be beneficial for those who have laryngopathies.[2,7] In a series of cases carried out in Italy during the COVID-19 pandemic with patients diagnosed with vocal fold polyps, complete or almost complete remission of dysphonia symptoms was observed after daily vocal load reduction.[8] Vocal rest associated with work leave implies in two situations that can potentially lead to dysphonia improvement: the first is due to the obvious anti-inflammatory possibility resulting from the reduction of friction between the vocal folds; the second is related to the decrease of a possible occupational stress condition that can lead to a decrease in the contracture with muscle relaxation.[9]

As a result of the COVID-19 pandemic, professional singers had to go on forced rest for a long period, which on the one hand, can improve inflammatory processes in the vocal folds related to phonotrauma.[10] On the other hand, changes in life habits also stand out, with increased consumption of alcohol, smoking, unhealthy eating

patterns and irregular practice of physical activity.[12] These aspects can contribute to speech trauma, causing short and long-term vocal changes.[12-13]

As mentioned above, the COVID-19 pandemic itself affected the lives of singers, who may have been even more impacted after becoming infected with COVID-19. Negative impacts of the disease on the voice stand out, such as paresis/paralysis of the laryngeal nerves, dysphonia and long-term changes in respiratory function. The COVID-19 infection also causes otorhinolaryngological symptoms, such as tinnitus, gingivitis, sudden hearing loss, Bell's palsy and hoarseness.[14] Coughing is also a common symptom of COVID-19 infection and can cause trauma to the vocal folds, and even tearing of mucosa or vocal fold hemorrhage. In addition, patients with severe COVID-19 infection may require intubation, with dysphonia and dysphagia being common findings after extubation.[15]

Regarding the reasons associated with these voice changes after COVID-19 infection, evidence shows that the vocal folds express a relatively high amount of ACE2 receptor, and COVID-19 infection can lead to impaired vocals caused by fold dysfunction. As the ACE2 receptor is also expressed in the muscles of the chest, lungs and abdomen, the muscles used in phonation can weaken, leading to voice alterations, such as dysphonia.[16-17]

Throat clearing is an otorhinolaryngological manifestation observed after COVID-19 infection.[18] It is related to the increased viscosity of the mucus in the laryngeal region, being considered an indicator of lack of hydration, poor vocal hygiene and a risk factor for greater vocal abuse.[19] In a study carried out with 364 survivors of COVID-19 infection, 62 (72%) complained of throat clearing.[18]

Depending on the *status* of COVID-19, some authors recommend an in-depth voice assessment to identify patients who need voice care, based on a complete case

history, laryngeal images, acoustic measurements, aerodynamic measurements, auditory-perceptual assessment and patient self-report.[20-21] These recommendations show how COVID-19 has become a source of concern for vocal disorders.

The grade of post-COVID-19 dysphonia may vary according to the race/ethnicity, age, lifestyle and sex of those affected.[22] A retrospective survey carried out in Turkey with 155 patients revealed that otorhinolaryngological symptoms were higher in women, when compared to men.[14] Similarly, a European cohort study carried out with 702 patients, with mild to moderate COVID-19, identified that more women than men suffered from dysphonia, which can be justified by sex-related differences in the inflammatory process, requiring more research to elucidate this issue.[17]

An epidemiological and observational research related to the evaluation of dysphonia in singers is important to implement actions for the prevention and control of voice-related disorders in this target audience during the period of the COVID-19 pandemic, as well as in other periods of social isolation.

The present study aimed to evaluate the presence of dysphonia and throat clearing in singers during the COVID-19 pandemic in Brazil.

Material And Methods

Study type

The present was a cross-sectional analytical study, carried out to assess the impact of the COVID-19 pandemic on singers' voices.

Population and sample

Singers from all over the country constituted the target population of the study. The non-probabilistic sampling technique was used, for convenience, together with the snowball sampling technique, in which participants indicated other individuals who met

the inclusion criteria. The participants were recruited through the dissemination of the research on social networks (Instagram, WhatsApp). The initial sample included 157 singers and the final sample included 154 singers after applying the exclusion criteria.

The study included: singers aged between 18 and 60 years, regardless of whether they had COVID-19 or not. The exclusion criteria comprised singers who were intubated during treatment for COVID-19 infection. The exclusion of these patients is due to the fact that orotracheal intubation can cause laryngeal trauma, leading to dysphonia, which could result in a possible bias in the selection process.[16]

Data collection

The data collection was carried out online, from June 2021 to September 2022, through the completion of the questionnaire created by the researcher using Google Forms. The link to the form was released on the social networks of singers across the country. There was no financial compensation for participation in the study and each participant could answer the form only once.

The questionnaire investigated: changes in the voice routine; frequency of singing or performances during the COVID-19 pandemic; the singers' health habits during the COVID-19 pandemic; occurrence of depression; occurrence of COVID-19 infection and possible vocal alterations after COVID-19 infection.

In addition, the Vocal Handicap Index-10 (VHI-10)-10 protocol was used, an instrument previously validated in Brazil to assess self-perceived vocal impairment.[23] This questionnaire consists of 10 questions with a Likert-type answer format: 0 = never; 1 = almost never; 2 = sometimes; 3 = almost always; 4 = always. For the final score, the simple sum of the answers is performed, ranging from 0 (zero) to 40 points, where 0 (zero) means no voice impairment and 40, maximum impairment. The cutoff point is 7

points, that is, individuals with scores below 7 points are considered "without self-perception of vocal impairment", whereas scores above this number mean "with self-perception of vocal impairment".[24]

Data analysis

Data were collected in a Microsoft Excel spreadsheet, automatically generated by Google Forms.

The univariate analysis was used to describe the variables. Numerical variables were described using measures of central tendency (mean) and dispersion (standard deviation). Nominal variables were described using simple and relative frequencies. The following were considered as outcome variables: voice impairment and throat clearing. The bivariate analysis was used to test the relationship between COVID-19 infection and voice impairment, COVID-19 infection and throat clearing, sex and laryngeal complaints (voice impairment and throat clearing). The chi-square test was used to quantify the statistical association between two variables and the Odds Ratio (OR) to quantify the magnitude of the effect of predictor variables on the outcome variable. In this study, the OR was interpreted as Prevalence Ratio (PR). The 95% Confidence Intervals (95%CI) of the association coefficients are also provided. The associations were considered to be statistically significant when $p<0.05$. All analyses were performed using Stata software, v. 13.

Ethical issues

The study was approved by the Ethics Committee of *Santa Casa de Misericórdia de São Paulo*, under protocol n. 4.960.049, under CAAE n. 51086721.1.0000.5479. The recommendations of Resolution N. 466 of 2012 by the

National Health Council and Circular Letter N. 2/2021 of the National Research Ethics Committee were followed, which provide guidelines for research procedures at any stage in a virtual environment (BRAZIL, 2021). The participants had access to the Free and Informed Consent Form (TCLE), and the option of filling out the online survey form or not was offered to them. Participant anonymity was guaranteed, as well as the secrecy and confidentiality of the collected information.

Results

The singers' mean age was 35.8 years (standard deviation = ±10.2 years) and 59.2% (n=90) of them were female. Most of them worked as professional singers (81.1%; n=124), and 47.7% (n=73) had other paid activities that did not involve singing. Most singers had more than 10 years of professional experience (57.4%; n=62) and mainly sang pop music (85.4%; n=129) (Table 1).

Table 1. Characterization of the singers

Variables	N	%
Sex (n=152)		
Female	90	59.2
Male	62	40.8
Age (mean, maximum, minimum, standard deviation)		
Mean±SD	35.8±10.2	
Do you have any other paid activities that you do most of the time, which does not involve singing? (n=153)		
Yes	73	47.7
No	80	52.3

Variables	N	%
Are you a professional singer?		
Yes	124	81.1
No	29	18.9
Time of experience as a professional singer (n=108)		
<1 year	two	1.8
1-5 years	15	13.9
5-10 years	29	26.9
>10 years	62	57.4
Musical style that you sing (n=151)		
Lyrical	6	4.0
Pop	129	85.4
Lyrical and pop	16	10.6

Regarding the Covid-19 pandemic, 38.3% (n=59) of the singers reported vocal complaints that preceded the pandemic; 90.3% (n=139) changed their vocal routines during the pandemic; 79.9% (n=123) reported a decrease in the frequency of presentations and 49.7% (n=76) said that there was an increase in the use of spoken voice during the pandemic. A total of 48.7% (n=74) reported performances in shows or presentations during the Covid-19 pandemic, with 24.2% (n=29) reporting a number of shows between 1 and 2 per month (Table 2).

Table 2. Changes in voice routines and vocal complaints during the COVID-19 pandemic.

Variables	N	%

Variables	N	%
Vocal complaints before the pandemic		
Yes	59	38.3
No	95	61.7
Changes in vocal routines during the pandemic		
Yes	139	90.3
No	15	9.7
Decreased frequency of singing or performances during the pandemic		
Yes	123	79.9
No	31	20.1
Percentage of decrease (n=125)		
25%	3	2.4
50%	40	32.0
75%	52	41.6
100%	30	24.0
Increased frequency of singing or performances during the pandemic (n=151)		
Yes	27	17.9
No	124	82.1
Percentage of increase (n=36)		
25%	10	27.8
50%	12	33.3
75%	10	27.8

Variables	N	%
100%	4	11.1
Increased use of speaking voice during the pandemic period (n=153)		
Yes	76	49.7
No	77	50.3
Gave performances or presentations during the pandemic (n=152)		
Yes	74	48.7
No	53	34.9
Not applicable	25	16.4
Number of shows (n=120)		
1-2 gigs per month	29	24.2
3-5 gigs per month	25	20.8
6-10 gigs per month	8	6.7
>10 gigs per month	12	10.0
Not applicable	46	38.3

Of the study sample, 65.6% (n=101) had COVID-19. Of these, five (5%) were hospitalized. Of the 101 positive cases, 85% (n=85) had the disease confirmed by PCR. Furthermore, 62% (n=62) reported vocal alterations during the infection and 53% (n=53) had vocal alterations after the infection. It is noteworthy that 44.0% (n=44) of the participants who became ill reported the onset of throat clearing after the infection. As for the self-perception of voice impairment, 65.6% (n=101) of the participants reported having it (Table 3).

Table 3. Occurrence of COVID-19, associated factors in singers and voice impairment

Variables	N	%
Had COVID-19		
Yes	101	65.6
No	53	34.4
Hospitalization due to COVID-19 (n=100)		
Yes	5	5.0
No	95	95.0
Confirmed COVID-19 infection through PCR test (n=100)		
Yes	85	85.0
No	15	15.0
Confirmed through serology test (n=99)		
Yes	46	46.5
No	53	53.5
Experienced vocal changes during the COVID-19 infection (n=100)		
Yes	62	62.0
No	34	34.0
Not applicable	4	4.0
Experienced vocal changes after COVID-19 infection (n=100)		
Yes	53	53.0
No	40	40.0

Variables	N	%
Not applicable	7	7.0
Throat clearing onset after COVID-19 infection (n=100)		
Yes	44	44.0
No	56	56.0
Self-perception of voice impairment		
No self-perceived voice impairment	53	34.4
With self-perceived voice impairment	101	65.6

There was an association between having COVID-19 infection and the presence of voice impairment (p=0.03; PR: 2.33; CI: 1.04 – 5.46). An association was observed between the onset of throat clearing and the occurrence of COVID-19 infection (p=0.001; PR: 9.13; CI: 2.47-64.42).

Table 4 refers to Association between COVID-19 infection and voice impairment. The Table 5 shows the association between the occurrence of COVID-19 and throat clearing onset.

Table 4. Association between COVID-19 infection and voice impairment

Variables	Voice impairment		PR	CI	p-value
	Yes	No			
	>7 points	≤7 points			
Had COVID-19					
Yes	41 (77.4)	60 (59.6)	2.33	1.04 - 5.46	0.03
No	12 (22.6)	41 (77.4)			

Table 5. Association between the occurrence of COVID-19 and throat clearing onset

Variables	Had COVID-19				
	Yes	No	PR	IC	p-value
Did you experience throat clearing onset after having COVID-19 infection?					
Yes	44 (95.6)	2 (4.4)	9.13	2.47 - 64.42	0.001
No	49 (69.0)	22 (31.0)			

As for the other variables, it was not possible to identify a statistically significant association (Table 6).

Table 6. Association between lifestyle habits and throat clearing complaints

Variables	If you did not have a throat clearing problem before, did the throat clearing symptoms appear after COVID 19 infection?				
	Yes	No	PR	CI	p-value
Life habits					
Smoking					
Yes	0 (0.0)	4 (100.0)	**	**	0.101
No	46 (40.7)	67 (59.3)			

Was there an increase in frequency of smoking and the number of cigarettes smoked during the pandemic?					
Yes	1 (33.3)	2 (66.7)	1.16	0.01 - 31.67	0.912
No	3 (30.0)	7 (70.0)	1	-	
Does not apply	32 (41.6)	45 (58.4)	1.65	0.34 - 10.63	0.483
Was there a decrease in the frequency of smoking and the number of cigarettes smoked during the pandemic?					
Yes	1 (100.0)	0 (0.0)	**	**	0.121
No	1 (20.0)	4 (80.0)	1	-	
Does not apply	34 (42.0)	47 (58.0)	2.89	0.27 - 146.60	0.332
Do you consume alcoholic beverages?					
Yes	21 (39.9)	33 (61.1)	0.97	0.43 - 2.17	0.930
No	25 (39.7)	38 (60.3)	1	-	
Was there an increase in consumption of alcoholic beverages during the pandemic?					
Yes	12 (57.1)	9 (42.9)	4.0	1.10 - 14.72	0.010
No	9 (25.0)	27 (75.0)	1	-	
Does not apply	17 (38.6)	27 (61.4)	1.90	0.65 - 5.67	0.195
Was there a decrease in the consumption of alcoholic					

beverages during the pandemic?					
Yes	6 (50.0)	6 (50.0)	1.80	0.36 - 8.77	0.398
No	10 (35.7)	18 (64.3)	1	-	
Does not apply	21 (37.5)	35 (62.5)	1.10	0.38 - 3.14	0.837
Was there a change in eating habits after the pandemic?					
Yes	26 (37.1)	44 (62.9)	0.80	0.35 - 1.82	0.557
No	20 (42.5)	27 (57.5)			
Did you experience weight loss during the pandemic?					
Yes, less than 5kg	4 (36.4)	7 (63.6)	0.82	0.16 - 3.60	0.779
Yes, from 5 to 10 kg	8 (40.0)	12 (60.0)	2.18	0.71 - 6.87	0.124
Yes, more than 10kg	2 (28.6)	5 (71.4)	0.58	0.05 - 3.85	0.527
No	31 (40.8)	45 (59.2)	1	-	
Did you experience weight gain during the pandemic?					
Yes, less than 5kg	4 (26.7)	11 (73.3)	0.58	0.12 - 2.40	0.412
Yes, from 5 to 10 kg	15 (38.5)	24 (61.5)	1.00	0.38 - 2.63	0.987
Yes, more than 10kg	9 (60.0)	6 (40.0)	2.41	0.63 - 9.67	0.140
No	18 (38.3)	29 (61.7)	1	-	

Source: Survey data.

** It was not possible to calculate

Discussion

The present study showed a high percentage of singers who disclosed voice changes after COVID-19 infection (62%). This percentage was higher than that found in a study with COVID-19 survivors who were not singers, in which varying degrees of dysphonia, from mild to severe, with abnormal voice qualities (strained and rough) were recorded in 15.6% of patients.[18]

It is noteworthy that most of the individuals in the present study sample were singers, who had singing as their main source of income. A national study on the vocal self-perception of professional and amateur singers during the COVID-19 pandemic showed that professional singers were more likely to experience voice fatigue and vocal limitations (p=0.045), as well as vocal restrictions (p=0.002), when compared to amateurs.[25]

COVID-19 infection showed a statistically significant association with the onset of throat clearing (p=0.001). The literature shows that throat clearing is a common complaint among professional singers, compared to amateur ones.[19] Clearing one's throat has been an important and persistent symptom in the voice clinic and a common complaint of singers infected with COVID-19.

This complaint can be aggravated by health habits, such as alcohol consumption and poor eating habits,[26] an association demonstrated in the present study, in which higher alcohol consumption was related to the occurrence of throat clearing after infection by COVID-19 (p=0.010). Thus, direct and indirect impacts of the COVID-19 infection on the vocal tract, combined with the change in life habits triggered by social isolation, may have further exacerbated this complaint among the assessed singers.

Similar to our study regarding the finding of dysphonia, a prospective, cross-sectional, case-controlled study carried out with 364 non-critical survivors of COVID-

19 to assess phonatory function identified phonasthenia, dysphonia and decreased Maximum Phonation Time (MPT) as otorhinolaryngological manifestations of COVID -19. In this study, 262 (72%) COVID-19 survivors had phonasthenia symptoms, manifested as dry throat, frequent voice fatigue, frequent throat clearing and sore throat. Dysphonia and excessively soft loudness were significantly more common in survivors than in controls ($p<0.002$ and $p<0.000$, respectively) with no significant difference between patient groups. The MPT was significantly lower in survivors than in controls ($p<0.000$).[19]

Considering the high frequency of vocal complaints after COVID-19 infection, a thorough investigation is necessary, considering the different factors that can influence dysphonia, whether they are factors related to the vocal folds or extralaryngeal ones. Muscle tension and postural changes are directly related to voice quality.[27] Severe dysphonia in patients with post-COVID-19 syndrome requires urgent otorhinolaryngological diagnosis, based on instrumental assessment, with the analysis of laryngeal phonatory function and intensive and comprehensive treatment.

The present study showed a statistically significant association between COVID-19 infection and voice impairment ($p=0.030$). Regarding this aspect, the concept of voice impairment is related to the social, emotional and physical spheres. As the COVID-19 infection affects the individual at the systemic level, this finding may be related to the direct and indirect impacts of the infection on the voice, which were previously mentioned and are aggravated by a potentially lethal infection.

The results of this study are in line with a national study carried out with 206 pop singers, which showed that the ones who had vocal complaints had a self-perception of worse quality of life and greater vocal disadvantage.[29] Based on this result, the need to develop instruments capable of measuring the quality of life of

singers is highlighted, aiming to evaluate the effectiveness of treatments and direct the creation of health policies.

The study demonstrated the association between COVID-19 infection, vocal impairment and throat clearing, as well as the increased risk of throat clearing among singers who consume alcohol. Alcohol consumption is a matter of concern among singers, due to the increased risk of pharyngitis, tonsillitis and gastroesophageal reflux, factors that can affect vocal efficiency.[30]

Based on the present study, the adoption of measures for vocal health promotion and prevention of dysphonia in singers is recommended, especially those who had COVID-19, providing the opportunity to monitor chronic conditions resulting from the infection and promote the safe use of one's voice after returning to the pre-pandemic vocal demands. Moreover, the importance of specific public policies for this target audience is highlighted in the return to their activities.

As study limitations, the impossibility of measuring the effects of the COVID-19 pandemic in the long term and the use of self-reported measures to assess voice changes must be mentioned, which shows that the obtained results must be interpreted with caution, due to limitations related to their generalization. At the same time, this study demonstrates the importance of health professionals in caring for singers exposed to the COVID-19 pandemic.

Competing Interests: No conflict of interest.

Financing: Own financing.

References

1. Akbulut S, Altintas H, Oguz H. Videolaryngostroboscopy versus microlaryngoscopy for the diagnosis of benign vocal cord lesions: a prospective clinical study. Eur Arch

Otorhinolaryngol Suppl. 2015;272(1):131-136. https://doi.org/10.1007/s00405-014-3181-5

2. Xiao C. A novel approach of consultation on 2019 novel coronavirus (COVID-19)-related psychological and mental problems: structured letter therapy. Psychiatry Invest. 2020;17:175-6. Available at: https://www.psychiatryinvestigation.org/journal/view.php?doi=10.30773/pi.2020.0047. Accessed 12 January 2023.

3. Shigemura J, Ursano RJ, Morganstein JC, Kurosawa M, Benedek DM. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. Psychiatry Clin Neurosci. 2020;74:281-2. https://doi.org/10.1111/pcn.12988

4. Campagnolo AM, Benninger MS, Priston P, Assunção A. Dysphonia in performers: prevalence of vocal lesions and voice emergencies in a private otorhinolaryngology practice. J Voice. 2021; S0892-1997(21)00059-X. https://doi.org/10.1016/j.jvoice.2021.02.004.

5. Roberts MS. Conductor Simon Rattle: 'I worry desperately for my orchestra in London'. London, 4 May 2020. Available at: https://www.classicfm.com/artists/sir-simon-rattle/worry-desperately-london-orchestra-coronavirus/. Accessed 7 March 2022.

6. Primov-Fever A, Roziner I, Amir O. Songbirds must sing: how artistic voice users perceive their voice in times of COVID-19. J Voice. 2020;36(4): 586.E1-586.E5. https://doi.org/10.1016/j.jvoice.2020.07.030

7. Eckley CA, Sataloff RT, Silva MAA. Professional voice. In: Campos CAH, Costa HOO, editors. Textbook of Otorhinolaryngology. São Paulo: Roca; 2002. p. 535-45.

8. Fantini M, Succo G, Tascone M, Borrelli G, Pisanu G, Crosetti E. Spontaneous Vocal Fold Polyps Remission after Lockdown for Covid-19 Pandemic: Does Vocal Load Matter? J Voice. 2021;15:S0892-1997(21)00103-X. https://doi.org/10.1016/j.jvoice.2021.03.006.

9. Przysiezny PE, Przysiezny LTS. Work-related voice disorder. Braz J Otorhinolaryngol. 2015;81(2):202-11. https://doi.org/10.1016/j.bjorl.2014.03.003

10. Redcapbrasil. [online]. Software. [cited 2 Jul 2021]. Available at: https://www.redcapbrasil.com.br/?page_id=2 .

11. Prior BR, Cursiol JA, Prado MYA, Ricz LNA. Effect of COVID-19 quarantine on voice handicap index in female classical singers. J Voice. 2020;37(1):145.e1-145.e6. https://doi.org/10.1016/j.jvoice.2020.11.020

12. Di Renzo L, Gualtieri P, Pivari F, Soldati L, Attina A, Cinelli G, et al. Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. J Transl Med. 2020;18(229):1-15. https://doi.org/10.1186/s12967-020-02399-5.

13. Porter L, Cox JS, Wright KA, Lawrence NS, Gillison FB. The impact of COVID-19 on the eating habits of families engaged in a healthy eating pilot trial: a thematic analysis. Health Psychol Behav Med. 2022; 10(1):241-61. https://doi.org/10.1080/21642850.2022.2043750.

14. Esterwood E, Saeed A. Past epidemics, natural disasters, COVID19, and mental health: learning from history as we deal with the present and prepare for the future. Psychiatr Q. 2020; 91:1121-33. https://doi.org/10.1007/s11126-020-09808-4.

15. Elibol, E. Otolaryngological symptoms in COVID-19. Eur Arch Otorhinolaryngol. 2021;278(4):1233-6. https://doi.org/10.1007/s00405-020-06319-7

16. McGrath BA, Wallace S, Goswamy J. Laryngeal edema associated with COVID-19 complicating airway management. Anesthesia. 2020;75:972. https://doi.org/10.1111/anae.15092

17. Vance D, Shah P, Sataloff RT. COVID-19: Impact on the musician and returning to singing; the literature review. J Voice. 2023;37(2):292.e1-292.e8. https://doi.org/10.1016/j.jvoice.2020.12.042.

18. Lechien JR, Chiesa-Estomba CM, Cabaraux P, Mat Q, Huet K, Harmegnies B, et al. Features of mild-to-moderate COVID-19 patients with dysphonia. J Voice. 2022;36(2):249-55. https://doi.org/10.1016/j.jvoice.2020.05.012

19. Yasien DG, Hassan ES, Mohamed HA. Phonatory function and characteristics of voice in recovering COVID-19 survivors. Eur Arch Otorhinolaryngol. 2022;279(9):4485-90. https://doi.org/10.1007/s00405-022-07419-2 19.

20. Zimmer V, Cielo CA, Ferreira FM. Vocal behavior of popular singers. Rev. CEFAC. [online journal] 2012;14(2):298-307. Available at: https://doi.org/10.1590/S1516-18462011005000101. Acessed 12 January 2023.

21. Patel R, Awan S, Barkmeier-Kraemer J, Courey M, Deliyski D, Eadie T, et al. Recommended protocols for instrumental assessment of voice: American Speech-Language-Hearing Association expert panel to develop a protocol for instrumental assessment of vocal function. Am J Speech Lang Pathol. 2018;27(3):887-910. https://doi.org/10.1044/2018_AJSLP-17-0009

22. Mattei A, Amy de la Bretèque B, Crestani S, Crevier-Buchman L, Galant C, Hans S, et al. Guidelines of clinical practice for the management of swallowing disorders and recent dysphonia in the context of the COVID-19 pandemic. Eur Ann Otorhinolaryngol head Neck Dis. 2020;137(3):173-5. https://doi.org/10.1016/j.anorl.2020.04.011

23. Tikka T, Kavanagh K, Lowit A, Jiafeng P, Burns H, Nixon I, et al (2020). Head and neck cancer risk calculator (HaNC-RC)-V.2. Adjustments and addition of symptoms and social history factors. Clin Otolaryngol. 2020;45(3):380-8. https://doi.org/10.1111/coa.13511

24. Costa T, Oliveira G, Behlau M. Validation of the Voice Handicap Index: 10 (VHI-10) to the Brazilian Portuguese. CoDAS. 2013; 25(5):482-5. https://doi.org/10.1590/S2317-17822013000500013

25. Fernandes G, Madazio G, Vaiano TCG, Behlau M. Shyness and voice handicap in voice professionals. Audiol Commun Res. 2020;25:e2304. https://doi.org/10.1590/2317-6431-2020-2304 .

26. Siqueira LTD, Santos AP, Vitor JS, Moreira PAM, Silva RLF, Fernandes G, et al. Vocal self-perception of singers during COVID-19 Pandemic. J Voice. 2021; S0892-1997(21)00243-5. https://doi.org/10.1016/j.jvoice.2021.06.032

27. Fachinatto APA, Duprat AC, Silva MA, Bracher ESB, Benedicto CC, Luz VBC, Nogueira MN, Fonseca BSG. Effect of Spinal Manipulative Therapy on the Singing Voice. J Voice. 2015;29(5):645.e33–645.e39. https://doi.org/10.1016/j.jvoice.2014.10.005.

28. Ferreira LP, Souza GZ, Santos J, Ferraz PRR, Martz ML. Actor's voice: association between vocal symptoms and life habits. Audiol Commun Res. 2019;24:e2093. https://doi.org/10.1590/2317-6431-2018-2093

29. Carvalho CGO, Ribeiro MFM. Correlation between vocal handicap and quality of life of popular singers. CODAS. 2021;33(4):e20190136. https://doi.org/10.1590/2317-1782/20202019136

30. Santos SS, Montagner T, Bastilha GR, Frigo LF, Cielo CA. Singing style, vocal habits, and general health of professional singers. Int Arch Otorhinolaryngol. 2019;23(4):445-50. https://doi.org/10.1055/s-0039-1693140