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The Effect of Online Teaching on Vocal Health Among Saudi Teachers During COVID-19 Pandemic

Abdullah Alarfaj, Khalid Alyahya, Halal Alutaibi, Maryam Alarfaj, and Fai Alhussain, *Alahsa, Kingdom Saudi Arabia*

Summary: Purpose. The goal of this study is to determine how online education affects the vocal health of schoolteachers in Saudi Arabia's Eastern Province. Teachers' phono trauma is well-known as a serious occupational hazard, and online education was the primary mode of delivering instruction to students during COVID-19.

Methods. This is a descriptive cross-sectional study conducted among teachers in the Eastern Province area of Saudi Arabia. Teachers completed a self-administered questionnaire via an online platform, which included socio-demographic data, academic status, and the Voice Handicap Index-10 questionnaire, which assessed their vocal difficulties.

Results. A total of 335 teachers responded to the survey (78.2% females vs. 21.8% males). Nearly half (48.7%) were primary school teachers. 45.7% were currently teaching distance learning. Earphones and microphones (49.3%) were the most commonly used distance learning accessories. Noise in the classroom was a very much disturbing factor in teaching implied by 44.8% of the teachers. During the COVID-19 pandemic, the vocal handicap index-10 was significantly higher among females ($P = 0.007$), primary school teachers ($P < 0.001$), moreover those currently teaching distance learning ($P = 0.001$) and those who perceived that there is more work in distance teaching ($P < 0.001$).

Conclusion. Compared to in-person teaching, online teaching may have a positive impact on vocal health among Saudi teachers. Of all the teachers, phono trauma tends to be more among females who were primary school teachers, currently teaching distance learning, and those who perceived distance learning to be laborious.

Key Words: Vocal health−Phono trauma−VHI-10 questionnaire−Online teaching−Teacher.

INTRODUCTION

• Coronavirus pandemic and its impact

The coronavirus disease (COVID-19) pandemic has caused significant concern, not just in China but around the world.[1] The source is the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This has resulted in a global pandemic, posing a greater public health risk worldwide.[2]

Infected individuals can spread COVID-19 to others via respiratory droplets emitted during coughing or sneezing. Droplets may land on the lips or noses of non-infected individuals in close proximity, or perhaps inhaled.[3] The result of this disease is that society is forcing itself to adopt a new lifestyle in which wearing a mask, washing hands more frequently, and using hand sanitizer extensively are all mandatory in order to prevent the virus from spreading.[4] The most effective protective component is social distancing, especially in places where there are several people in one location, such as schools, businesses, or even shopping malls.[5] Therefore, Schools and colleges are allowed to select platforms that offer appropriate remote teaching options, while teachers work from home.[6]

COVID-19 has an exceptionally significant impact on numerous specialties consequently professionals, like those who use their vocal and body language to communicate daily, this digital conversion has made a significant difference, various teachers have found a drastic change in their everyday work environment.[7]

• Vocal health

The voice is the primary means of communication in both social consequently professional settings.[8] When a person suffers from phono trauma, the voice folds are stressed or damaged because of excessive talking, yelling, coughing, smoking, and frequently clearing their throats.[9,10] Phono trauma can cause voice loss in certain people.[10] Changes in the structures or functions of vocal features such as breathing, vocalization, or resonance produce vocal illnesses, which can manifest in a variety of ways.[11] The most common symptoms include soreness, hoarseness, weak vocals, sore throat and aphonia.

• Teachers and vocal disorders

Certain occupations, such as teachers and singers, are more prone to vocal diseases than others. Vocal professionals make intensive use of their voice, frequently under environmental and organizational constraints.[12] Although benign voice disorders are rarely life threatening, they can have a significant negative impact on a person's career,

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From the College of Medicine, King Faisal University, Alahsa, Kingdom Saudi Arabia.

Address correspondence and reprint requests to Maryam Alarfaj, College of Medicine, King Faisal University, Alahsa, Kingdom Saudi Arabia. E-mail: maryamoth123@gmail.com

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social, psychological, physical, and communication aspects. This same effect has been comparable to what people experience when they are in life-threatening circumstances.[13] The noise, the number of students in the classroom, the working schedule, dust, chalk use, classroom lighting and ventilation, years of teaching, and poor relationships with colleagues, students, and authorities are just the minority of the elements that contribute to an intensive vocal load.[11] Certain lifestyle adjustments, such as not screaming or speaking loudly, and resting the voice regularly, can help to reduce phono trauma. Exercises to relax the vocal folds and extrinsic laryngeal muscles might help in certain cases. Warming up the vocal folds and staying hydrated is important before speaking for lengthy periods.

Phono trauma commonly affects teachers, which is a major job hazard. The study of hoarseness in Saudi teachers is vital because it has a significant impact on their work, as the voice is the primary educational tool for conveying knowledge to students. Teachers have a higher chance of acquiring voice abnormalities than the general population. Roy et al have reported that teachers have significantly more voice complaints than the general population.[14] Research shows that the frequency of dysphonia among teachers varied from 20% to 80% in various parts of the world.[15]

Vocal abnormalities are common among Saudi teachers, according to research.[16] A study about vocal disorders among Saudi teachers reported that 33% of Saudi teachers in Riyadh city have vocal problems and females were more prone to develop vocal problems than males.[16] According to research on hoarseness among schoolteachers conducted in Dammam, Saudi Arabia, 27% of instructors have complained of hoarseness, with public school teachers having a higher prevalence of hoarseness than private school teachers.[17] Dry throat (42.1%), painful throat (33.5%), and hoarseness of voice were the most commonly reported vocal-related symptoms (32.9%).[11] As a preventative step against COVID-19, the Saudi government ordered that distance education compel to be available across the educational system, from elementary to university. As a result of distance teaching, the teaching environment has changed, including changes in acoustics, duration of teaching time, and background noise. The teacher is alone at home and only has screen contact with students, thus vocal performance in school is different from online teaching.[18] Patjas et al, (2021) reported that online teaching has affected teachers' voices positively compared with on-site teaching mostly due to better acoustics and indoor air quality in distance teaching conditions. The study has reported that during distance teaching vocal symptoms appeared less often than in school with 71% of teachers experiencing them in contact teaching and 44% in distance teaching.

This study aims to evaluate the effect of online teaching on the vocal health of schoolteachers in the Eastern Province, Saudi Arabia.

METHODS

• Study design and selection criteria

This is a descriptive cross-sectional study conducted among Saudi Arabian teachers in the Eastern Province. A software self-administered questionnaire was broadcasted randomly through social media among teachers utilizing an online platform that included socio-demographic data, academic status, and the Voice Handicap Index-10 (VHI-10) questionnaire to assess the teachers' vocal abnormalities.

The sample size was determined to be 382 schoolteachers. The representative sample size was calculated using the following statistical formula: The 95% confidence interval; margin of error is 5%.

$$\boldsymbol{n} = \mathrm{P}(1-\mathrm{P})\,(\mathrm{Z}\boldsymbol{\alpha}/\mathbf{2})2 \qquad (\mathrm{E})2$$

School teachers in the Eastern province participated in the selection criteria. All participants younger than 18 years old or older than 60 years, participants with other occupations than teaching, anyone outside the Eastern province, and any not fully answered questionnaires were all excluded.

• Statistical analysis

The software SPSS Statistics version 26.0 (IBM Corp., Armonk, NY) was operated to analyze the data.

• Measures

The Voice Handicap Index-10 (VHI-10) questionnaire, created by Rosen et al (2004), was used to examine vocal health before and throughout the pandemic. This questionnaire assessed voice impairment, with the higher the score, the worse the impairment or voice handicap caused by vocal issues. Wilcoxon signed-rank test was used to compare vocal health concerns before and during the COVID-19 pandemic. The Shapiro Wilk test was used to determine the central tendency to VHI-10 score. The Mann Whitney Z-test and the Kruskal Wallis test were used to determine the relationship between voice handicap scores and certain instructor attributes. The threshold for significance was set at 5% (P 0.05). The descriptive data of the research participants were presented using numbers, percentages, means, and standard deviations. The ethical standards of the institution and national research committee were applied throughout all procedures involving the participants. Ethical approval was obtained from King Faisal University (reference number: KFU-REC-2021-OCT-EA00012).

RESULTS

• Demographics

Number of 335 teachers were enrolled in this study. Table 1 presents the socio-demographic characteristics of the teachers.

TABLE 1.
Socio-Demographic Characteristics of the Teachers (n=335)

Study Variables	N (%)
Age group	
22-29 yrs	23 (06.9%)
30-39 yrs	100 (29.9%)
40-49 yrs	139 (41.5%)
50-59 yrs	73 (21.8%)
Gender	
Male	73 (21.8%)
Female	262 (78.2%)
Working area	
Dammam	68 (20.3%)
Khobar	14 (04.2%)
Jubail	06 (01.8%)
Dhahran	05 (01.5%)
Qatif	05 (01.5%)
Khafji	02 (0.60%)
Nariyah	02 (0.60%)
Ras Tanura	02 (0.60%)
Al Ahsa	227 (67.8%)
Hafar albatin	02 (0.60%)
As Sarrar	02 (0.60%)
Previous history pharyngeal or laryngeal surgery, except tonsillotomy or adenotomy?	
Yes	09 (02.7%)
No	323 (96.4%)
I do not know	03 (0.90%)
Specific name of pharyngeal or laryngeal surgery (n=8)	
Thyroidectomy	03 (33.3%)
Tonsillectomy	02 (22.2%)
Benign tumor removal	01 (11.1%)
Lobectomy	01 (11.1%)
Appendectomy	01 (11.1%)
Adenoidectomy	01 (11.1%)
Smoking status	
Non-smoker	305 (91.0%)
I have ceased smoking and I have been a non-smoker for at least 1 yr	09 (02.7%)
I am still smoking, or I have been a non-smoker less than 1 yr ago	21 (06.3%)

TABLE 2.
Teacher Academic Status and Other Related Characteristics (n=335)

Variables	N (%)
School-level of teaching	
Primary school	163 (48.7%)
Secondary school	57 (17.0%)
Senior high school	95 (28.4%)
Higher education	20 (06.0%)
Years of experience as a teacher	
0-5	32 (09.6%)
6-10	81 (24.2%)
11-15	71 (21.2%)
16-20	41 (12.2%)
21-25	69 (20.6%)
26-30	29 (08.7%)
31-35	12 (03.6%)
Are you *currently* teaching in distance or regular teaching?	
Distance teaching	153 (45.7%)
Regular teaching	97 (29.0%)
Both	85 (25.4%)
Current academic status	
Teacher	284 (84.8%)
Retired teacher	26 (07.8%)
Chief	13 (03.9%)
Guided	12 (03.6%)
How many students per class do you usually teach?	
<20	58 (17.3%)
20-30	130 (38.8%)
31-40	118 (35.2%)
>40	29 (08.7%)
Did you use any of the following accessories during distance learning?	
Earphones + microphone (headset)	165 (49.3%)
Separate microphone	47 (14.0%)
Office speakerphone	17 (05.1%)
None of above	106 (31.6%)

The most common age group was 40-49 years old (41.5%) with mostly being females (78.2%). More than two-thirds were living in Al Ahsa (67.8%). The proportion of teachers who had a history of pharyngeal or laryngeal surgery was 2.7% with thyroidectomy being the most common of them (33.3%). The majority of the teachers were non-smokers (91%) while 6.3% were smokers (Table 1). Table 2 describes teachers' academic status and other related characteristics. Nearly half (48.7%) were teaching in primary school and 24.2% had 6-10 years of experience. Distance learning teachers account for 45.7 % of all teachers. Academic teachers made up a sizable share of the respondents (84.8%). Around 39% of teachers were instructing classes of 20-30 students. Earphones and microphones were the most often utilized accessories during remote teaching (49.3%).

The most common associated chronic disease was allergic rhinitis (15.5%), followed by ear problems (11.9%) and reflux disease (9.3%) (see Figure 1). The most common specialty of the teachers was Islamic (20.6%), followed by Arabic (15.2%) and geography (11.6%) (see Figure 2).

In Figure 3 the most common distributing factors of teaching that very much affected teacher was noise (44.8%), followed by poor working ergonomics (34.9%) and poor indoor air quality (32.8%). Figure 4 shows that 45% of teachers indicated that they got more work in regular teaching while 25% said they had more work in distance teaching.

In Table 3, there was a significant difference being observed between the vocal problems before and during the pandemic regarding related to "My voice difficulties restrict my personal and social life" ($P = 0.002$), "I feel left out of the conversations because of my voice" ($P < 0.001$), "My voice problem causes me to lose income" ($P < 0.001$), "I feel like I have to strain to produce voice" ($P = 0.001$), "My voice problem upsets me." ($P = 0.005$), "My voice makes

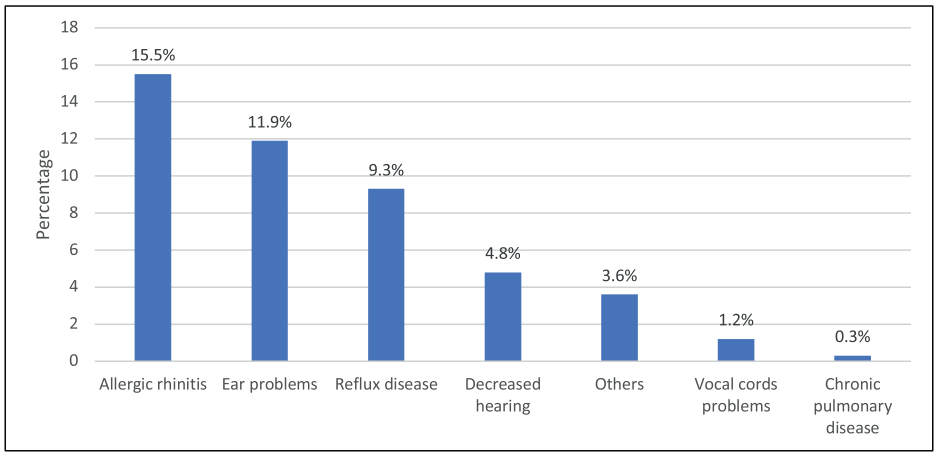

FIGURE 1. Associated chronic diseases.

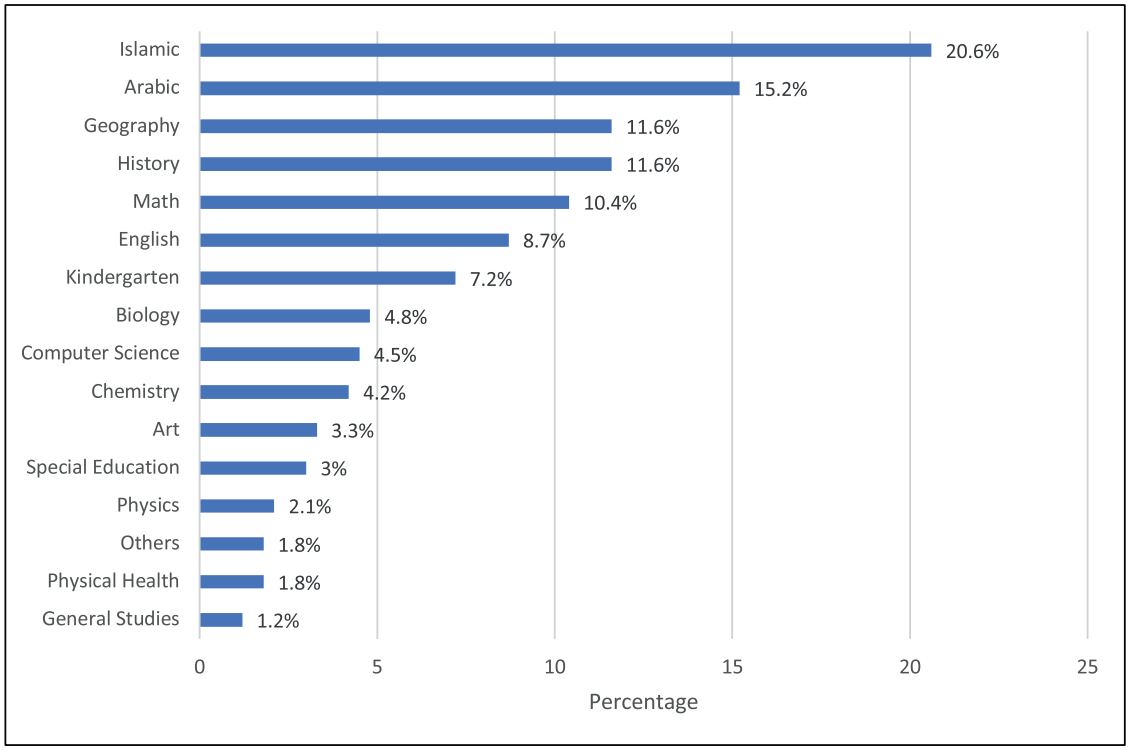

FIGURE 2. Specialty of the teacher.

me feel handicapped" ($P < 0.001$), and "People ask, 'what is wrong with your voice'" ($P < 0.001$).

- **VHI-10 results**

Teachers' classrooms exhibited a comparable interruption in teaching hours before COVID-19 and during the pandemic, with a minor drop during the pandemic (Figure 5). The mean VHI-10 score during the pandemic (T = 6.519; p0.001) was statistically substantially lower than the mean VHI-10 score before the epidemic (Figure 6). There were no significant differences in the mean post VHI-10 score when comparing workload between distance and regular teaching during the pandemic, regardless of age, gender, school-level training, years of experience, currently teaching distance learning, the number of students in a class, use of accessory during distance learning, or comparison of workload between distance and regular teaching during the pandemic (Table 4).

DISCUSSION

- **VHI-10 results and comparison with prior literature**

This study sought to determine the effect of online teaching on the vocal health of Saudi teachers during the COVID-19 pandemic. There were limited studies that discussed the spectrum of vocal problems among teachers during this crisis, specifically in Saudi Arabia. The findings of this study are necessary to foreshadow the current vocal

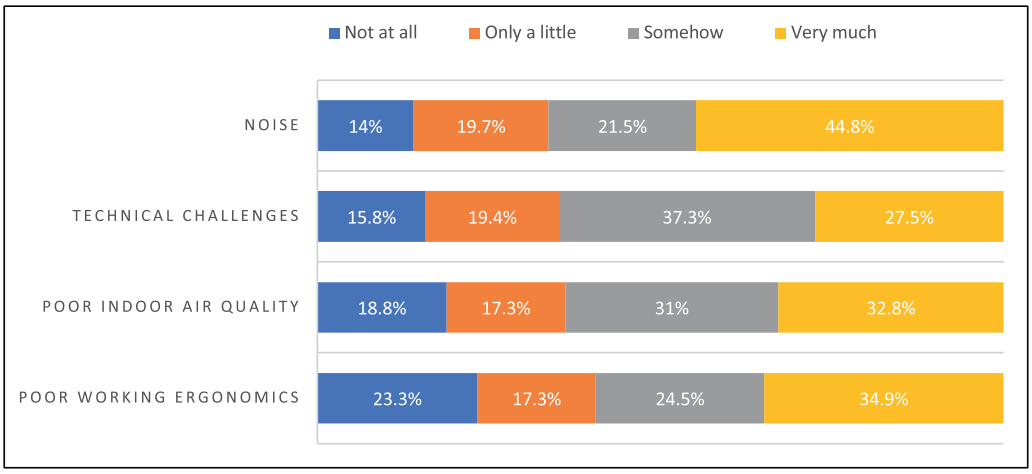

FIGURE 3. Disturbing factors of teaching.

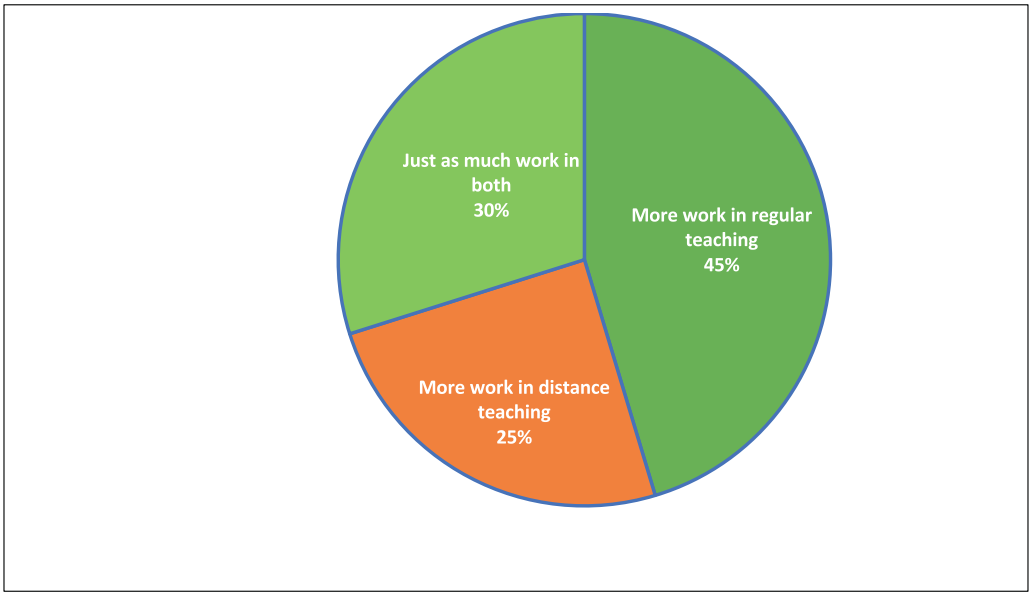

FIGURE 4. Comparison of workload between distance and regular teaching.

health of teachers during online teaching and whether this method has positively or negatively impacted the vocal health of the teachers.

The aggregate VHI-10 score of teachers was lower during the pandemic (p0.001), according to our findings utilizing the VHI-10 questionnaire. This suggests that throughout the crisis, teachers' voice problems diminished. The findings were consistent with those of Patjas et al,[18] who found that remote teaching had a mean VHI-10 score of 4.58, which was much lower than classroom instruction (mean: 7.88). These are also in line with the findings of Besser et al.[19] Mudaugh et al[20] Disagreed with these findings, claiming that voice singing teachers preferred in-person instruction over online instruction, indicating that virtual voice instruction is insufficient to substitute in-person instruction. However, one may ask that the previous study was about voice singing education that is different from general education which could be the turning point. Moreover, according to the VHI-10 questionnaire, we found various statements that negatively affected vocal health before and during the COVID-19 pandemic. For instance, "My voice difficulties restrict my personal and social life," "I feel left out of the conversations because of my voice," "My voice problem causes me to lose income," "I feel like I have to strain to produce voice," "My voice problem upsets me," "My voice makes me feel handicapped," and "People ask, "what's wrong with your voice," which warrant further investigations.

- **Factors associated with phono trauma**

During the pandemic, the vocal disorder was not significantly different between males and females. This finding is not consistent with Abdel-Hamid et al.[21] Accordingly, they documented that one of the risk factors for vocal disorders was the female gender. They further added that vocal disorders had negatively affected teachers' physical and emotional conditions with similar findings as discussed by Van Houtte and colleagues.[22] Other related characteristics of the teachers were also not observed to have a relevant

TABLE 3.
Comparison of Voice Health Problem Before and During COVID-19 Pandemic (n=335)

VHI Questionnaire	Before COVID-19N (%)	During COVID-19N (%)	*P*-value*
My voice makes it difficult for people to hear me			
Never	95 (28.4%)	126 (37.6%)	0.109
Almost never	70 (20.9%)	66 (19.7%)	
Sometimes	84 (25.1%)	71 (21.2%)	
Almost always	79 (23.6%)	62 (18.5%)	
Always	07 (02.1%)	10 (03.0%)	
People have difficulty understanding me in a noisy room.			
Never	86 (25.7%)	109 (32.5%)	0.540
Almost never	61 (18.2%)	20 (06.0%)	
Sometimes	107 (31.9%)	107 (31.9%)	
Almost always	40 (11.9%0	65 (19.4%)	
Always	41 (12.2%)	34 (10.1%)	
My voice difficulties restrict my personal and social life			
Never	99 (29.6%)	126 (37.6%)	**0.002**†
Almost never	61 (18.2%)	79 (23.6%)	
Sometimes	136 (40.6%)	88 (26.3%)	
Almost always	36 (10.7%)	42 (12.5%)	
Always	03 (0.90%)	0	
I feel left out of the conversations because of my voice			
Never	75 (22.4%)	119 (35.5%)	**<0.001**†
Almost never	88 (26.3%)	66 (19.7%)	
Sometimes	96 (28.7%)	88 (26.3%)	
Almost always	40 (11.9%)	40 (11.9%)	
Always	36 (10.7%)	22 (06.6%)	
My voice problem causes me to lose income			
Never	99 (29.6%)	106 (31.6%)	**<0.001**†
Almost never	76 (22.7%)	93 (27.8%)	
Sometimes	50 (14.9%)	55 (16.4%)	
Almost always	60 (17.9%)	49 (14.6%)	
Always	50 (14.9%)	32 (09.6%)	
I feel like I have to strain to produce voice			
Never	68 (20.3%)	103 (30.7%)	**0.001**†
Almost never	57 (17.0%)	54 (16.1%)	
Sometimes	122 (36.4%)	114 (34.0%)	
Almost always	63 (18.8%)	46 (13.7%)	
Always	25 (07.5%)	18 (05.4%)	
The clarity of my voice is unpredictable			
Never	87 (26.0%)	110 (32.8%)	0.777
Almost never	54 (16.1%)	21 (06.3%)	
Sometimes	114 (34.0%)	121 (36.1%)	
Almost always	56 (16.7%)	48 (14.3%)	
Always	24 (07.2%)	35 (10.4%)	
My voice problem upsets me			
Never	89 (26.6%)	99 (29.6%)	**0.005**†
Almost never	43 (12.8%)	52 (15.5%)	
Sometimes	95 (28.4%)	115 (34.3%)	
Almost always	70 (20.9%)	37 (11.0%)	
Always	38 (11.3%)	32 (09.6%)	
My voice makes me feel handicapped			
Never	69 (20.6%)	108 (32.2%)	**<0.001**†
Almost never	70 (20.9%)	70 (20.9%)	
Sometimes	131 (39.1%)	92 (27.5%)	
Almost always	48 (14.3%)	48 (14.3%)	
Always	17 (05.1%)	17 (05.1%)	
People ask, "what's wrong with your voice"			
Never	86 (25.7%)	130 (38.8%)	**<0.001**†
Almost never	63 (18.8%)	57 (17.0%)	
Sometimes	100 (29.9%)	56 (16.7%)	
Almost always	43 (12.8%)	39 (11.6%)	
Always	43 (12.8%)	53 (15.8%)	

* *P*-value has been calculated using Wilcoxon signed-rank test.
† significant at $p<0.05$ level.

TABLE 4.
Association Between Vocal Voice Score During Pandemic According to Voice Handicap Index − 10 (VHI-10) Questionnaires in Regard to the Teachers' Academic Status and Other Related Characteristics (n=335)

Study Variables	VHI-10Score (40)Mean ± SD	Z/H-test	*P*-value
Age group †			
22-29 yrs	15.6 ± 5.64	H=4.176	0.243
30-39 yrs	15.2 ± 6.00		
40-49 yrs	14.1 ± 6.51		
50-59 yrs	13.7 ± 6.17		
Gender ‡			
Male	14.7 ± 5.76	Z=0.386	0.700
Female	14.4 ± 6.37		
School level of teaching †			
Primary school	13.9 ± 6.47	H=4.653	0.199
Secondary school	14.4 ± 6.47		
Senior high school	14.7 ± 5.53		
Higher education	17.0 ± 6.51		
Years of experience as a teacher†			
≤10 yrs	14.5 ± 6.30	H=0.133	0.936
11-20 yrs	14.4 ± 6.58		
>20 yrs	14.4 ± 6.58		
Are you *currently* teaching in distance or regular teaching? †			
Distance teaching	14.1 ± 6.49	H=0.926	0.629
Regular teaching	14.5 ± 5.88		
Both	14.9 ± 6.21		
How many students per class do you usually teach?†			
<20	13.3 ± 5.28	H=2.916	0.405
20-30	14.9 ± 6.67		
31-40	14.4 ± 5.97		
>40	14.4 ± 7.03		
Use of accessory (ie, earphone, microphone) during distance learning ‡			
Yes	15.1 ± 6.13	Z=0.759	0.448
No	14.4 ± 5.64		
Comparison of workload between distance and regular teaching †			
More work in regular teaching	14.3 ± 6.03	H=1.222	0.543
More work in distance teaching	15.0 ± 6.69		
Just as much work in both	14.2 ± 6.19		
Disturbing factors at school*,†			
Noise	14.4 ± 6.35	Z=0.050	0.960
Technical challenges	14.3 ± 6.34	Z=0.737	0.461
Poor indoor air quality	14.5 ± 6.34	Z=0.314	0.753
Poor working ergonomics	14.5 ± 6.37	Z=0.118	0.906

* Variable with multiple response answers.
† *P*-value has been calculated using Kruskal Wallis H-test.
‡ *P*-value has been calculated using Mann Whitney Z-test.

relationship with voice handicap index-10 during the pandemic including age, school-level training, years of experience, currently teaching distance learning, the number of students in a class, use of accessories during distance learning, comparison of workload between distance and regular teaching and the disturbing factors at school. More study is necessary to assess the impact of the voice handicap index-10 during the pandemic on the instructors' fundamental features. Working at a private school, increased vocal usage, utilizing the voice at a high intensity, problems with the voice in online classes, vocal habits, and vocal symptoms were all linked to poor voice quality in a study done in Brazil.[23] Vocal issues have been associated with psychological stress and associated chronic illness in Finland,[18] including allergic rhinitis, chronic pulmonary disease, and reflux disease. In our analysis, the most prevalent related disorders of teachers were allergic rhinitis (15.5%), ear difficulties (11.9%), and reflux disease (9.3%), all of which were stated by Nemr et al.[24]

- **Teachers' practices during online teaching**

During the current pandemic, the prevalence of teachers who were teaching online was 45.7%, 29% were teaching in-

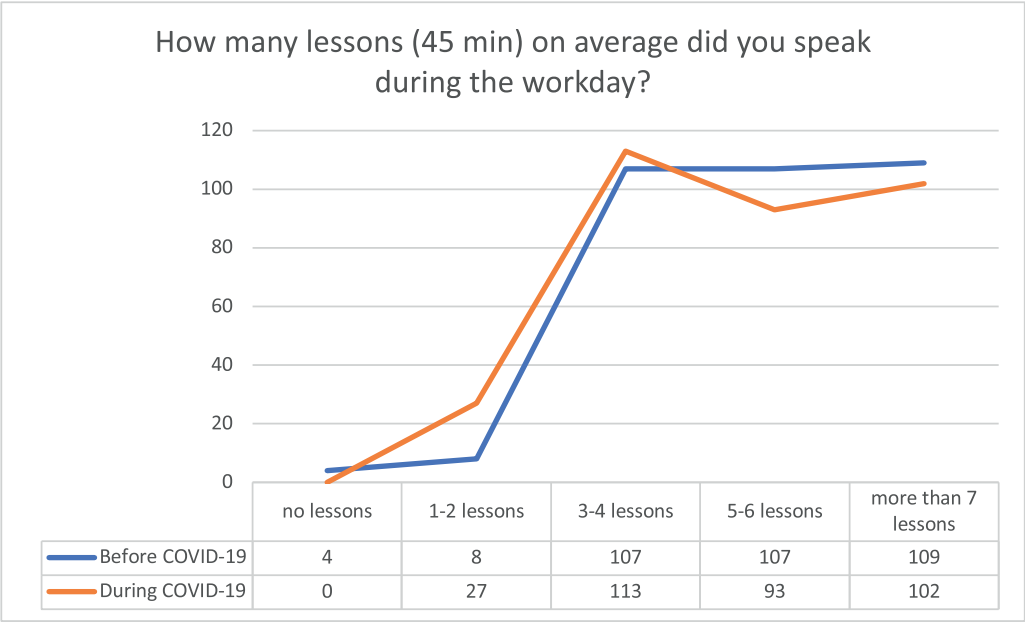

FIGURE 5. Comparison of lessons taught on average between distance and regular teaching.

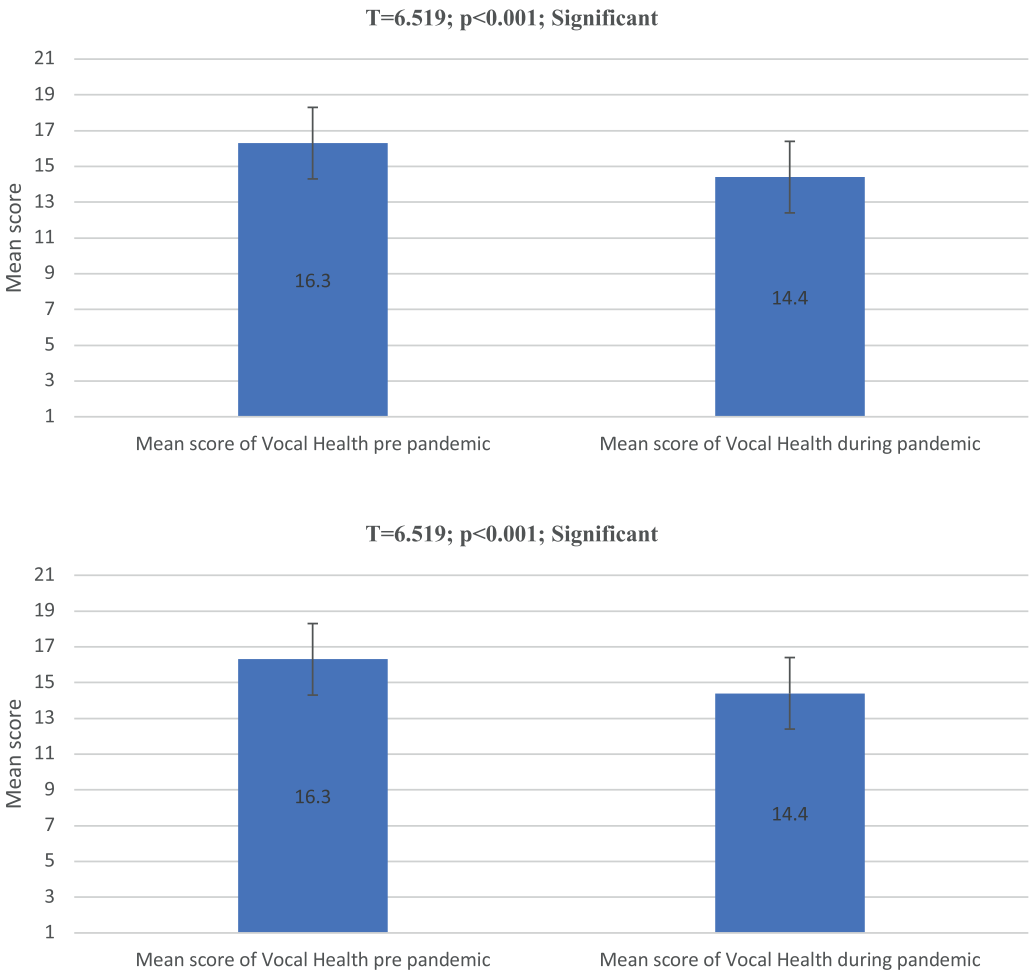

FIGURE 6. Comparison of mean score of vocal health and teaching status before and during pandemic according to Voice Handicap Index – 10 (VHI-10) questionnaires.

person classes and 25.4% were teaching blend methods. About 45% of teachers perceived more workload in regular teaching than distance teaching. The most frequently used accessories during online teaching were earphones and microphones (49.3%). In a study published by Besser et al,[19] The usage of earphones/microphones by 33.5% of teachers during synchronized online teaching was consistent with our findings. Similarly, Nemr et al,[24] documented that schoolteacher that used headphones for online classes experienced symptoms including dry throat and hoarseness after class. Incidentally, Patjas et al,[18] accounted that background noise was the most disturbing factor for a teacher in both classroom and distance teaching, adding that the experienced poor indoor air quality at school negatively influenced vocal health. The results are also true in our study, about 45% of the teachers indicated noise as the most disturbing factor in the class, followed by poor ergonomics (34.9%) and poor indoor quality (32.8%). These factors affected the vocal health of teachers.

LIMITATION

The study's findings must be considered in light of the study's limitations. The first is a communication gap, as the survey was sent in Arabic and had to be translated for statistical analysis and paper writing. The second limitation is that owing to the COVID-19 pandemic, the questionnaire was distributed via internet connections; nonetheless, in-person completion of the questionnaire would be preferred if any extra explanation were necessary.

CONCLUSION

When compared to traditional in-person teaching, online education has a good influence on voice health among Saudi teachers. Female primary school teachers who now undertake online teaching, as well as those who perceive greater work at distant learning, are more likely to have vocal issues than men. Furthermore, loudness, technical obstacles, and poor working ergonomics in the classroom all contribute to teachers' vocal disorders. Online education appears to be the ideal answer during a pandemic; nevertheless, constant monitoring is essential to protect the voice and deliver good teaching and learning.

DATA AVAILABILITY STATEMENT

The data sets generated and analyzed during the current study are available from the corresponding author on reasonable request.

LEARNING OUTCOMES

As a result of this research, participants will be able to relate the COVID-19 pandemic to its impact on the vocal health of Saudi teachers when teaching online.

Acknowledgments

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