A comparative and correlative study of the Voice-Related Quality of Life (V-RQOL) and the Voice Activity and Participation Profile (VAPP) for voice-related quality of life among teachers with and without voice disorders

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Abstract
The aim of this study was to investigate the difference and correlation between the Voice-Related Quality of Life (V-RQOL) and the Voice Activity and Participation Profile (VAPP) among teachers. The participants were 672 teachers (218 males and 454 females, male-to-female ratio = 0.48:1) whose vocal cords were examined using a Strobolaryngoscope. Questionnaire results were obtained for both the V-RQOL and the VAPP.

Of the 672 participants, 322 teachers had voice disorders while 350 teachers did not. The most common voice complaint was hoarseness (n=250), and the most common throat complaint was foreign body sensation (n=129) in teachers with voice disorders. Chronic laryngitis (n=162, 50.3%), vocal cord polyps (n=92, 28.6%), and vocal cord nodules (n=43, 13.4%) were the most frequent diagnoses in teachers with voice disorders. Significant differences were seen on the V-RQOL and the VAPP scores between teachers with and without voice disorders, and between female and male teachers. Differences were also observed among teachers from different grades, and among different types of voice-related diseases. Moderate-to-strong correlations were observed between the VAPP total score and those for all the subscales of the VAPP and between the VAPP total score and the V-RQOL score (P < .001).

Teachers with voice disorders have a significantly poorer voice-related quality of life than those without voice disorders, as do female teachers compared with male teachers. Different groups of voice disorders have different effects on teachers’ voice-related quality of life, and primary school teachers suffer from a poorer voice-related quality of life than do high school teachers. A moderate-to-strong correlation was found between the results of the V-RQOL and the VAPP scores.

Abbreviations: SDs = standard deviations, VAPP = Voice Activity and Participation Profile, VHI = Voice Handicap Index, V-RQOL = Voice-Related Quality of Life.

Keywords: teacher, voice activity and participation profile, voice disorder, voice-related quality of life

1. Introduction
The voice is the essential instrument people use to express thoughts and sensations. With the development of society and the continuous progress of medicine, the communication between people becomes more important. Therefore, voice disorders may harm people’s ability to communicate, their emotional and economic functioning, and then their basic quality of life. Regarding professional voice users, such as teachers, singers, and lawyers, the importance of the voice is self-evident, and professional voice users’ quality of life and capability of performing their occupation can be significantly negatively affected by voice-related diseases.[1–4] Objective voice evaluation, including imaging technique and acoustic parameters, may not be capable of showing people’s daily living experiences or functional participation in activities.[5,6] There are several subjective voice-related quality of life instruments designed to capture the condition of people’s voice disorders and reflect how the dysphonia they experience impacts their daily lives; these instruments include the Voice Handicap Index (VHI).[7] the Voice-Related Quality of Life (V-RQOL)[8] and the Voice Activity and Participation Profile (VAPP).[9] Multiple researchers have demonstrated the outcomes of their use of these scales to evaluate individuals’ voice-related quality of life in varying categories, yet many of these studies either lack a large quantity of participants or cover various measurements. Besides that, no research has used the VAPP to measure teachers’ voice-related quality of life in China, and no research has sought to compare and correlate the outcomes between the V-RQOL and the VAPP scores across the world.

In view of these facts, the purpose of this study is to compare the differences in voice-related quality-of-life between teachers...
with and without voice disorders and between female and male teachers in China with various measurements. Differences are likewise compared among distinct types of voice disorders and among teachers from varying grades. Furthermore, we aim to explore the correlation between the V-RQOL and the VAPP scores. This is the first study to evaluate the differences and correlations of the V-RQOL and the VAPP among teachers so far, and the first to use the VAPP as a measurement tool in Chinese teachers.

2. Methods

2.1. Participants

This study was conducted from December 2017 to June 2018 in the outpatient section of the West China Hospital of Sichuan University, China. All participants were working teachers from primary or high schools, and informed written consent was acquired from all participants. The inclusion criteria were as follows: age, 22 to 60 years; no history of treatment for voice disorders; and no history of neurological disease, former laryngeal disease, cervical trauma, or laryngeal surgical operation that might influence vocal qualities.

2.2. Self-assessment

The recruited participants’ personal information, general status, and medical-related histories were recorded, together with information about former voice or throat complaints. Voice complaints included hoarseness, a weak or tired voice, loss of voice control or range, and difficulty with high- or low-pitched tones and were compiled on a checklist. Throat complaints included sore or dry throat and foreign body sensation. Voice-related quality of life was assessed via the Chinese-language versions of the V-RQOL and the Mandarin (simplified) Chinese version of the VAPP. The V-RQOL is a 10-item questionnaire that measures the influence of voice disorders on quality of life. Each item is valued from 1 to 5 (from 1 = not a problem to 5 = worst problem possible). Replies are summed up to calculate the total score (0–50), and with an algorithm used for summary scores. Therefore, the total scores range from 0 to 100, where 0 is poor and 100 is optimal. The VAPP has 28 queries across 5 sections, with each query valued from 1 to 10. The 5 sections include self-perceived severity, job, daily communication, social communication, and emotion. The maximal total score of the questionnaire is 280; the higher the score is, the more severe the damage to one’s voice-related quality of life.

2.3. Strobolaryngoscopy

All recruited participants underwent Strobolaryngoscopy by the same experienced manipulator using a 4.9-mm strobolaryngoscope (Olympus Medical Systems Corp., Tokyo, Japan). Participants were then divided into group with voice disorders and group without voice disorders following the laryngoscope results.

2.4. Statistical analysis

All data were analyzed using SPSS Statistics 21.0 (SPSS, Inc., Chicago, IL). Means and standard deviations (SDs) were calculated for continuous variables, and frequencies were calculated for categorical variables. The distribution of the measurement data was tested for normality with the Kolmogorov–Smirnov one-sample test; when the distribution of the measurements was not normal, the differences between subgroups were compared using nonparametric Mann–Whitney U tests, and the Kruskal–Wallis ANOVA test was used to make comparison among multiple groups. Spearman correlation coefficients were calculated to further evaluate the correlation between the V-RQOL and the VAPP scores. Statistical significance was set at P < .05 for all tests.

3. Results

A total of 672 teachers with a mean age of 40.81 ± 8.60 years (range, 22–59 years) was included in this study (218 men, 454 women; male-to-female ratio = 0.48:1). There were 322 (47.9% of total) teachers with voice disorders compared with 350 (52.1% of total) teachers without voice disorders. No significant difference was observed in age between the 2 groups (P > .05). The average age of the group with voice disorders, which included 87 men (27.02%) and 235 women (72.98%), was 41.43 ± 8.37 years (range, 22–58 years). The diagnoses were as follows: chronic laryngitis (n = 162), polyps and nodules (n = 135), sulcus vocalis (n = 10), Reinke edema of the vocal cords (n = 9), vocal cord cysts (n = 3), and vocal cord leukoplakia (n = 3). The average age of the group without voice disorders, which included 131 men and 219 women, was 40.25 ± 8.77 years (range, 22–59 years).

3.1. Self-reported symptoms

The symptoms self-reported by teachers with voice disorders are shown in Table 1. Hoarseness was the most frequently reported voice symptoms, whereas foreign body sensation was the most frequently reported throat symptom.

3.2. Comparison of the V-RQOL and the VAPP scores

The means and SDs of scores from the V-RQOL and the VAPP for teachers with and without voice disorders and for female and male teachers are shown in Tables 2 and 3. As expected, teachers with voice disorders had significantly lower scores on the V-RQOL and higher total and subscales scores on the VAPP than those of teachers without voice disorders (P < .05). As shown in Table 3, female teachers had significantly higher total and subscale scores on the VAPP and significantly lower scores on the V-RQOL than males did (P < .05). The differences between V-RQOL and VAPP scores in regard to types of voice disorder are shown in Figures 1 and 2. Reinke edema of the vocal cords had the highest VAPP total scores and the lowest V-RQOL scores, whereas vocal cord cyst had the lowest VAPP total scores and the highest V-RQOL scores. The significant differences between the V-RQOL and VAPP scores in regard to different grades taught by the participating teachers with voice disorders are shown in Table 4 (P < .05). Teachers in primary school presented with lower V-RQOL and higher VAPP total scores, as shown in Figures 3 and 4.

3.3. Analysis of the correlation between results of the V-RQOL and the VAPP

As shown in Table 5, moderate-to-strong correlations were observed between the total and the subscale scores for each section including self-perceived severity and effect on job, daily communication, social communication, and effect on emotion of the VAPP and scores for the V-RQOL (P < .05). The highest correlation coefficients were found between the VAPP total scores and the VAPP daily communication subscale scores (r = 0.946),
### Table 1
Self-reported symptoms in the group with voice disorders.

| Symptoms           | Number of teachers | Percentage of total |
|--------------------|--------------------|--------------------|
| Hoarseness         | 250                | 77.64%             |
| Tired voice        | 20                 | 6.21%              |
| Loss of voice control and range | 13   | 4.04%              |
| Difficulty with high-or-low tones | 10  | 3.11%              |

| Symptoms           | Group with voice disorders (n=350) | Group without voice disorders (n=322) |
|--------------------|----------------------------------|----------------------------------|
| Hoarseness         | 129                              | 40.06%                           |
| Tired voice        | 78                               | 24.22%                           |
| Loss of voice control and range | 68    | 21.12%                           |

SD = standard deviation, VAPP = the Voice Activity and Participation Profile, VRQOL = the Voice-Related Quality of Life.

### Table 2
Statistic measures of the VRQOL and VAPP scores among teachers with and without voice disorders.

| Measures           | Group with voice disorders (n=350) | Group without voice disorders (n=322) | P     |
|--------------------|----------------------------------|----------------------------------|------|
| V-RQOL             | 74.29±20.68                      | 86.28±13.56                      | <.001|
| VAPP total         | 106.09±73.166                    | 72.58±73.76                      | <.001|
| VAPP severity      | 5.27±2.61                        | 4.26±2.79                        | <.001|
| VAPP job           | 15.57±10.95                      | 10.53±9.81                       | <.001|
| VAPP daily communication | 46.37±32.96                   | 30.84±27.90                      | <.001|
| VAPP social communication | 13.76±12.151           | 8.29±9.69                        | <.001|
| VAPP emotion       | 27.75±42.755                     | 16.54±16.92                      | <.001|

SD = standard deviation, VAPP = the Voice Activity and Participation Profile, VRQOL = the Voice-Related Quality of Life.

### Table 3
Statistic measures of the VRQOL and VAPP scores among male and female teachers.

| Measures           | Males (n=295)       | Females (n=322)      | P     |
|--------------------|--------------------|----------------------|------|
| V-RQOL             | 84.41±16.81        | 78.68±18.76          | <.001|
| VAPP total         | 72.00±82.75        | 96.63±70.16          | <.001|
| VAPP severity      | 4.00±2.91          | 5.11±2.60            | <.001|
| VAPP job           | 10.41±10.17        | 14.16±10.69          | <.001|
| VAPP daily communication | 10.10±8.99        | 42.21±31.76          | <.001|
| VAPP social communication | 8.55±10.21       | 12.05±11.58          | <.001|
| VAPP emotion       | 15.96±17.42        | 24.77±37.03          | <.001|

SD = standard deviation, VAPP = the Voice Activity and Participation Profile, VRQOL = the Voice-Related Quality of Life.

Figure 1. Comparison of the VRQOL scores in different voice disorders.

Figure 2. Comparison of the VAPP scores in different voice disorders.
followed by the VAPP total scores and the VAPP social communication subscale scores ($r = 0.900$). Significant correlations were found between the V-RQOL and VAPP total scores ($r = -0.753$), and the scatter plot of the V-RQOL and the VAPP scores was shown in Figure 5.

4. Discussion

The voice is the main tool of teachers, so dysphonia can affect their professional performance and daily life, even lead to psychological problems and social difficulties. Self-assessment instruments are helpful for the diagnosis and treatment of voice disorders in clinical practice.

The V-RQOL has been established and widely used as a reliable and responsive clinical tool for the assessment of patients with dysphonia, with higher scores indicating a better quality of life.[8] Large quantities of research studies have used it as an important tool to make voice-related assessment among multiple individuals, or between patients receiving related therapies.

The VAPP, proposed by Ma and Yiu,[9] has shown to be a reliable and valid instrument to measure the voice-related quality of life in patients, and has been translated into multiple languages, such as versions of Spanish,[10] Persian,[11] Italian,[12] and Finnish.[13] The Mandarin (Simplified) Chinese version of the VAPP, we used in our study, was translated recently and was determined to have with high internal consistency, high Cronbach alpha coefficient, and high test–retest reliability.[14]

Although this questionnaire has proved to be a reliable and valid instrument for the evaluation of voice-related quality of life in Chinese-speaking individuals and useful for screening people with and without voice disorders, it has hardly been used to evaluate Chinese individuals, considering the short period of time since it has been translated. The purpose of the present study was to investigate the differences and correlation between the 2 commonly used instruments V-RQOL and VAPP scores among categories of teachers. In the present study, the mean scores of the V-RQOL scores were 74.29 in the group with voice disorders and 86.28 in the group without, which is similar to that in previous studies.[15,16] On the contrary, the mean total scores of the VAPP were 106.09 regarding the voice disorder group and 72.58 regarding the normal group. The results of both the V-RQOL and the VAPP suggest that teachers with voice disorders have worse voice-related quality of life than do those without. This reminds us that we must pay more attention to the voice hygiene of the professional voice users, reduce the incidence of voice diseases among them, and be concerned about the psychological health of teachers with voice diseases.

We also noticed that female teachers appear to be suffered more often from voice-related diseases (56.76%) than male teachers do (39.91%). Moreover, female teachers had significantly lower...
VRQOL scores and higher VAPP scores than male teachers, suggesting that female teachers possessed a poorer voice-related quality of life than males did. Although the quantity of female teachers was larger as we expected, the different scales scores may be associated with physiological differences, considering the shorter vocal cords and higher fundamental voice frequencies in females. In addition, female teachers tend to use their voices more than male teachers do and are more probably adjust their voice use more due to situational demands, according to the previous studies. A higher vocal load would contribute to more extensive vocal damage and more physical discomfort. In addition, males are less likely to report their symptoms and discomfort under some circumstances.

In the present study, the most common voice complaint was hoarseness ($n=250$), followed by tired voice ($n=20$), whereas the most common throat complaints were foreign body sensation ($n=129$), sore throat ($n=78$) and dry throat ($n=68$) in teachers with voice disorders, which is consistent with the results of previous studies, suggesting that patients with the above-mentioned symptoms should be considered to be associated with their potential voice problems. According to the strobolaryngoscope results in our findings, among the 322 participants ($47.9\%$ of the total), the correlations between V-RQOL and VAPP subscales are presented in Table 5.

### Table 5: Coefficients of correlation between V-RQOL and VAPP subscales among teachers with voice disorders.

|         | V-RQOL  | VAPP total | VAPP severity | VAPP job | VAPP daily communication | VAPP social communication | VAPP emotion |
|---------|---------|------------|---------------|----------|--------------------------|---------------------------|--------------|
| V-RQOL  | 1       | -0.753     | -0.555        | -0.629   | -0.709                   | -0.697                    | -0.485       |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP total | -0.753 | 1          | 0.710         | 0.844    | 0.946                    | 0.900                     | 0.546        |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP severity | -0.555 | 0.710 | 1 | 0.676 | 0.654 | 0.582 | 0.387 |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP job | -0.629 | 0.844 | 0.676 | 1 | 0.779 | 0.703 | 0.458 |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP daily communication | -0.709 | 0.946 | 0.654 | 0.779 | 1 | 0.831 | 0.493 |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP social communication | -0.697 | 0.900 | 0.582 | 0.703 | 0.831 | 1 | 0.500 |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |
| VAPP emotion | -0.485 | 0.546 | 0.387 | 0.458 | 0.493 | 0.500 | 1 |
| Sig. (2-tailed) | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ | $P<.001$ |

SD = standard deviation, VAPP = the Voice Activity and Participation Profile, VROQL = the Voice-Related Quality of Life.

Figure 5. The scatter plot of the V-RQOL and the VAPP scores. The Pearson correlation coefficient was –0.753.
of total) with voice disorders, the majority diagnosis was chronic laryngitis (n = 162, 30.3 %), followed by vocal cord polyps (n = 92, 28.6 %) and vocal cord nodules (n = 43, 13.4 %). Moreover, individuals with different types of voice disorders presented with different degree of voice-related quality-of-life damage. Reinke edema, which usually involves the full length of the vocal cords, more likely to occur on both sides, and severely affects vocal cord vibration, presented the worst quality of life in both the V-RQOL and VAPP scores among all types of different voice disorders in our study. By contrast, the vocal cord cyst, commonly occurring on a single side and usually of limited size, showed a homologously significantly better quality of life.

Chen et al and Alva et al proposed that grade levels have no significant relationship with the occurrence of teachers’ voice disorders in their studies of over 100 participants.[20,21] However, by comparing the scores results among different grades, we noticed that teachers from primary school had higher VAPP total and subscales scores and lower V-RQOL scores than teachers did from high school in the group of individuals with voice disorders. We assume the reasons for that is because students in primary schools and of younger ages are more likely to perform noisily and are more difficult to manage behaviorally, which means that their teachers have to control those students harder during the school time; thus, primary teachers have to raise up their volume, and voice abuse is more likely to occur. Therefore, there is no doubt that would increase the teacher’s voice burden and lead to voice diseases.

There are many correlational studies on different assessment instruments demonstrated their associations between different evaluation scales,[15,22,23] however, this study is the first to assess the correlation between the V-RQOL and the VAPP scores. Significantly moderate-to-strong correlations were observed between the VAPP total score and each subscale, suggesting that a voice disorder accurately reflects patient voice-related activity and participation in aspects of severity, job, daily communication, social communication, and emotion. The strongest correlation was observed between VAPP total scores and VAPP daily communication (r = 0.946), followed by the correlation between VAPP total scores and VAPP social communication (r = 0.900) or VAPP job (r = 0.844), suggesting that the above aspects are more easily affected by voice disorders homologously, especially among teachers. These findings follow a clear and logical pattern, as communication is the primary function of the voice, and the voice is specially used as a job-related tool in all enrolled participants as working teachers in the present study. In addition, we noticed a moderate correlation between the VAPP total scores and VAPP emotions (r = 0.546), which is obviously weaker than that in other subscales, suggesting that participants’ voice-related emotions are less likely to affect their general activity and participation. We propose that this result might be because Chinese individuals tend to act more impassively in their daily lives and are both less likely to express their emotions to others and less inclined to let their emotion be easily affected by other factors. In addition, a significantly strong correlation was presented between the V-RQOL and the total VAPP scores, which suggests that the 2 instruments are based on similar concepts for measuring voice-related quality of life, and both prove valid and reliable in voice-related evaluations. Considering that the V-RQOL and the VAPP are highly correlated, the results of studies using the V-RQOL are likely to be comparable to those using the VHI, and vice versa, especially in those studies with large samples.

We also admit that there are still some limitations in our research. As the V-RQOL and the VAPP scales are subjective measurements, the results could only reflect the individuals’ feelings and might be less reliable in participants with anxious or aphatic attitude. Future research may combine these subjective scales with other objective examinations, for example, acoustic parameters or vocal fold vibration assessment, to make evaluation.

5. Conclusion
In our study, we discovered that teachers with voice disorders possessed a poorer voice-related quality of life than did those without and that the voice-related quality of life of female teachers compared with that of male teachers was more seriously damaged. Distinct detrimental voice-related quality of life were also found regarding different types of voice disorders and regarding different grades. Thus, more attention should be paid to the quality of life in those individuals. The V-RQOL and the VAPP were significantly correlated among teachers with voice disorders; thus, both scales provide clinicians with baseline information that is applicable to diverse voice disorders and that can be used as local normative data.

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