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A visual analog scale for patient-reported voice outcomes: The VAS voice

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Abstract

Objectives: Although patient-reported outcome measures (PROMs) can be useful for assessing quality of life, they can be complex and cognitively burdensome. In this study, we prospectively evaluated a simple patient-reported voice assessment measure on a visual analog scale (VAS voice) and compared it with the Voice Handicap Index (VHI-10).

Study design: Prospective survey.

Methods: An abbreviated voice measure was designed by a team of otolaryngologists, speech pathologists, and patients that consisted of four VAS questions related to (a) a global question of voice disturbance, (b) physical function of voice, (c) functional issues, and (d) emotional handicap. All English-speaking patients presenting to an academic laryngology clinic for a voice complaint were included. Internal consistency and validity were assessed with comparison to the VHI-10.

Results: A total of 209 patients were enrolled. Ninety-two percent of patients reported understanding the survey. The four-item VAS survey was highly correlated with VHI-10 score (Pearson correlation .81, $P < .0001$), and the Cronbach's alpha between all four VAS questions was .94. Age, gender, and diagnosis were not associated with either the global VAS or VHI-10 tool.

Conclusion: Reducing the complexity of instruments assessing voice-related quality of life is feasible, and the VAS voice correlated with existing measures. Simplified assessments may offer advantages compared to more cumbersome PROMs.

Level of Evidence: 2c

KEYWORDS
dysphonia, hoarseness, outcomes, patient-reported outcome measures, visual analog scale, voice

1 | INTRODUCTION

Patient-reported outcome measures (PROMs) are validated questionnaires filled out by patients to score their symptoms or health status.[1] Over the past 30 years, many PROMs have been used to assess voice

disorders.[2-7] In addition to objective and clinician-reported outcome measures, these patient-reported assessments have proven helpful both in terms of clinical decision-making and also evaluation of interventions. Several recent reviews of these measures, however, demonstrate that of the patient-reported voice measures published, there were considerable deficiencies in terms of validity and interpretability, as well as rigorous development according to international standards.[8,9] Additionally, PROMs can be time consuming and burdensome for patients; significant effort has been put into research on questionnaires that achieve reliable outcome measures with decreased patient burden.[10,11] Indeed, the length of surveys given to patients is closely correlated to completion rate, leading some authors to suggest that a single item (rather than multiple item) survey might be preferable.[12,13] These impediments and others have led to inconsistency in the use of PROMs both in clinical practice and in otolaryngology research.

The object of this study was to investigate a shortened questionnaire for the assessment of voice, and to compare this against an existing PROM routinely given out in laryngology offices. Our hypothesis was that a shortened questionnaire would not be inferior to longer measures; specifically, that a shortened questionnaire would correlate well with the Voice Handicap Index (VHI-10), and that measures of reliability for this shortened questionnaire would be high. Furthermore, we hypothesized that a shortened subscore analysis for voice would not reveal significant differences between the longer and shorter surveys.

2 | METHODS

Approval of this study was obtained through the hospital's Institutional Review Board. We included all patients presenting for a voice complaint at our tertiary care voice and swallowing center in a large metropolitan area. Patients included were any patients presenting with a voice complaint (rather than airway or swallow), and those excluded included children (less than 18 years old), non-English speakers, and patients with mental handicaps. Patients were enrolled after the standard visit (which included baseline PROM, history, and physical), and only after explicit consent was obtained from the attending provider.

A brief survey (VAS voice) consisting of four items was composed based on input from patient interviews, two laryngologists, and a speech language pathologist. This included four questions on a visual analog scale (VAS), a well-accepted method in social and behavioral science to measure subjective experience (eg, pain level).[14] The four questions were designed to approximate a global assessment of voice, as well as an emotional, functional, and physical question. Appendix S1 shows the instrument, which consisted of each of the four items (VAS1: "How much does your voice bother you?"; VAS2: "Does your voice problem make you feel upset?"; VAS3: "Does your voice problem make it difficult to participate in your normal functions?"; and VAS4: "Does your voice problem cause strain, discomfort, or increased effort to speak?") listed above a 10 cm line, from the left ("not at all") to right ("worst possible") with tick marks. Ten patients were given a preliminary version survey to determine comprehensibility, and all 10 patients

demonstrated good understanding; however, scores were biased toward areas with tick marks, so these were removed for the final version. The overall score of the VAS voice was the summed score of each of the four items, with a total score possible from 0.0 to 40.0.

Before this consultation with an attending laryngologist with or without a speech language pathologist, all patients had been asked to fill out a standard PROM for voice, the VHI-10. This is a validated and well-accepted measure of voice handicap consisting of 10 questions, which are generally divided into subscores including physical, functional, and emotional domains related to voice handicap.[4] The total score possible is 0 to 40. Patients were also asked whether they understood the survey.

Data were collected on paper forms and compiled using Microsoft Excel (Microsoft, Redmond, Washington). Analysis was done with SAS statistical software (Version 9.4, Cary, North Carolina). For exploring internal consistency, Cronbach's alpha was used, which represents the degree to which items within a scale are inter-correlated with one another. Factor analysis was utilized to discern how many constructs were provided by both the VHI-10 and the VAS voice. The mean instrument score provided by the VAS voice was tested on varying diagnostic groups to help discriminate among groups of patients, according to the levels of symptom severity. We used the Student's t test or ANOVA (analysis of variance) for significance testing. Age and gender were also explored. Patient characteristics were regressed against both the VHI-10 and VAS scores, and correlation statistics were performed using Pearson product-moment correlation.

3 | RESULTS

All 209 patients filled out the four-item VAS survey, and 205 completed the VHI-10. The average age was 57 years old (range: 20-92), and the majority of patients were female (60.1%). Age and gender were not associated with scores on either the global VAS or VHI-10 tool. Measures of comprehensibility were favorable. The majority (92.3%) of patients understood the survey, with 79.5% indicating "Agree" and 12.8% indicating "Somewhat agree" to the statement "I understood the questions in this survey." Approximately 4.1% indicated "Somewhat disagree" and 0.5% indicated "Disagree" to this question.

Both the VAS and the VHI-10 had high Cronbach's alpha (.935 and .928, respectively) suggesting that the items on each survey are internally consistent. Each of the questions on the VAS voice was highly correlated with one another, with coefficients ranging from .72 to .84. Table 1 demonstrates the summed VHI-10 and VAS scores by diagnosis. The VHI-10 and the VAS survey mean scores were not significantly different when comparing all diagnoses together, nor were they different when looking at individual diagnoses. Figure 1 plots the VHI-10 against the four-item VAS survey. These were highly correlated with a Pearson correlation coefficient of .81 ($P < .0001$). All of the individual questions on the VAS survey correlated highly with the VHI-10, with the first question ("How much does your voice bother you?") showing the strongest individual correlation (.772, $P < .0001$).

TABLE 1 Overall and diagnosis specific scores show no significant differences. Both scales are on a 0 to 40 range

	Summed VHI-10		Summed VAS		
	Mean	SD	Mean	SD	P value
Benign lesion	13.9	9.8	14.7	10.9	.692
Functional	13.8	10.7	16.5	13.1	.532
Malignant lesion	17.2	14.6	15.7	15.6	.773
Neurologic	17.1	10.7	18.5	13.3	.816
Other	15.1	12.1	17.9	13.4	.294
Paralysis	18.3	10.8	18.5	11.8	.937
Stenosis	19.1	9.8	17.8	7.0	.743
All diagnoses	15.7	11.1	16.8	12.3	.356

Abbreviations: VAS, visual analog scale; VHI-10, Voice Handicap Index.
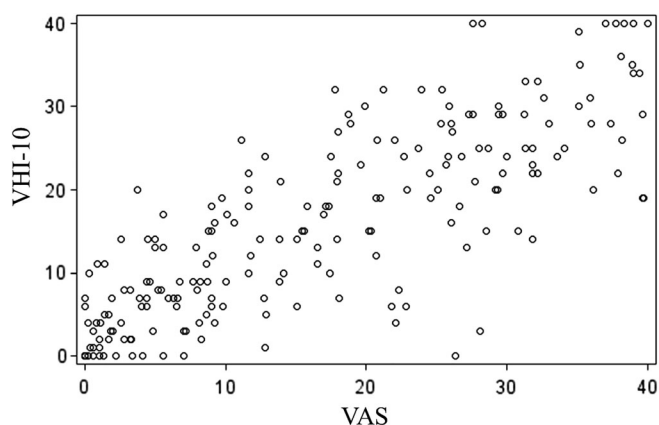
FIGURE 1 Plot of Voice Handicap Index (VHI-10) vs visual analog scale (VAS voice)

TABLE 2 Correlation of subscores (all P < .0001)

	VHI/ emotional	VHI/ functional	VHI/ physical
VAS2/emotional	0.761	0.630	0.591
VAS3/functional	0.705	0.697	0.629
VAS4/physical	0.617	0.640	0.729

Abbreviations: VAS, visual analog scale; VHI-10, Voice Handicap Index.

Principal component analysis demonstrated that only one construct was being measured by the VAS voice, which accounted for 83.8% of the total variance in the data. This factor was also most highly correlated with the first VAS question. Likewise, the VHI-10 demonstrated only one underlying construct; forcing a three construct model on the data did not demonstrate factor loadings consistent with physical, functional, and emotional factors.

Subscore analysis was then done on the functional, emotional, and physical aspects of each survey. Table 2 shows high correlations between all subscores. The emotional subscores from the VHI-10 was most highly correlated with the emotional subscore from the VAS voice, and likewise the physical subscores from each survey correlated most highly. Interestingly, the functional subscore on the VAS score more highly correlated with the emotional subscore of the VHI-10, although the differences in correlation coefficients between functional and emotional scores were very similar (.705 vs .697).

4 | DISCUSSION

Assessments of voice include three main areas: acoustic measures relating to voice signal; perceptual evaluation of voice, which includes tools like the Grade-Roughness-Breathiness-Asthenia-Strain (GRBAS) scale and Consensus of Auditory Perceptual Evaluation of Voice (CAPE-V) tool; and PROMs. Although acoustic measures have arguable general validity and reliability, perceptual and patient-reported outcomes tend to be more useful to clinicians.[15,16] In recent years, particular attention has been given to patient-reported outcomes (referred to variably as PROMs or PRO measures) in clinical trial design, device development, and routine medical care.[1,17-20] These may be general measures of quality of life (eg, SF-36 and EQ-5D),[21,22] disease-specific measures of utility,[23,24] or other disease-specific measure designed to capture quality of life or disability. Otolaryngology, which tends to see a large percentage of quality-of-life complaints particularly suited to patient-centric assessment, has likewise had an explosion of PROMs across many different subspecialties and topics, including voice.[8,9,25-34]

The intention of these patient-centric measures is to capture the patient experience; however, the implementation of these measures remains burdensome for most otolaryngologists and patients. Therefore, considerations prior to using PROMs should include logistical concerns (eg, how to comprehensively capture, record, and store data; how to work surveys into clinic flow) and practical issues (eg, how will the clinician use the PROM for decision-making).[35] From the patient's perspective, a primary issue concerns the burden of filling out surveys, which can be multiple on any given visit.[36-38] For instance, a patient presenting with a throat complaint may be asked to complete a VHI-10 for voice, an Eating Assessment Tool 10 (EAT-10) for dysphagia, and a Reflux Symptoms Index as an assessment of nonspecific laryngeal irritation. Indeed, there has been significant effort devoted to implementing Item Response Theory and computer adaptive testing, in which questions asked of patients are based on previous question responses, in order to significantly shorten PROMs without a resulting decrease in data quality.[10,11,39,40] Acceptability by patients remains a significant issue for more than just length, however; unless patients believe that their responses have utility, they are unlikely to respond appropriately to them.[35,36]

This research aimed to see if a simple, shortened questionnaire of four questions would correlate with a standard measurement of voice handicap, the VHI-10. Our data indicate that there is a close correlation between the VAS voice and the VHI-10. Although the VHI-10 and our four-item survey asked different questions, this question raises the question of how simple our PROMs can become. Indeed, just one question ("How much does your voice bother you?") was

simultaneously highly correlated with the VHI-10, most strongly associated with the underlying construct measuring voice decrement, and much simpler than the VHI-10. Additionally, we were unable to conclude if there is value to adding the three subscore questions, as these did not reveal any different constructs being measured. Although a high Cronbach's alpha between all four VAS scores could be interpreted as high reliability of the four-item survey, another interpretation is that this survey is merely asking the same question repeatedly, as perceived by the patient; in essence, the PROM may be redundant.[41] It is possible that the constructs of physical, functional, and emotional subscores may not reflect the underlying sentiments of patients. A critical review of the original VHI score did not justify a three-factor construct for understanding voice handicap,[42] nor does the data in this study. Efforts are ongoing to implement and validate future iterations of this VAS question, with only a single question asked: "How much does your voice bother you?" When considering the simplicity of such an approach, less may be more.

We chose to use a VAS for assessment, as it is simple, quick, has ratio properties (rather than ordinal or Likert scales), and is sensitive to small changes.[14,43,44] Certainly, there are negative aspects of VAS; different patients may interpret the scale differently, with or without written anchors, and the translation of a feeling into a linear format may be difficult for some patients.[45] The ordinal rating scale, as is used in the VHI-10, also has negative aspects. Central tendency bias is a robust finding in Likert-type scales wherein participants choose values toward the center of the scale, and respondent fatigue can be particular taxing with long surveys.[46] Another common issue seen in our clinics is "straightlining," where patients circle a single value for all 10 questions. Indeed, 12.2% of patients in this survey straightlined the VHI-10 for all 10 items, and 33.7% had at least one string of five identical rankings, which may reflect some degree straightlining. It is impossible to know whether this reflects the true assessment of the patient, their impatience, or their misunderstanding of the choice task.

This research brings several issues and limitations to light. It has been suggested that the administration of PROMs may be more a process of *creation* of patient opinion about their health state than a process of *revelation*—that is, PROMs can change how patients think about their condition.[47] It is therefore incumbent upon clinicians to be quite thoughtful about the selection of survey instruments. As has been noted by many previous authors,[8,9,42] PROMs currently used in laryngology are not necessarily optimal, either from a practical or psychometric perspective; they are not always correlated with objective measures and are designed to provide complementary information to standard clinical assessment.[48] Furthermore, there are significant patient and physician factors that hinder the usefulness of PROMs, related to survey administration, impatience, and other underlying biases. A limitation of the current measure relates to the timing of the VAS scale; in our study, this test was given after the standard patient encounter, which may have shaped patient opinions and answers. Finally, it remains unclear how much we can simplify these outcome measures and still have a meaningful metric. Test-retest reliability, which is a critical measure in development of such tools and was explicitly not studied herein, can be difficult to measure given the dynamic nature of voice complaints, which may vary over a short period of time. Clinicians using PROMs in all areas of otolaryngology, and medicine in general, are encouraged to consider the validity and reliability of this data prior to accepting and using a measure.

5 | CONCLUSION

Reducing the complexity of instruments assessing voice-related quality of life is feasible, and the VAS voice correlated with existing measures. Simplified assessments may offer advantages compared to more cumbersome PROMs. More research should be done on the usefulness of subscales and the psychometric properties that underpin current PRO instruments.

CONFLICT OF INTEREST

None.

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