

The voice handicap index as a tool for assessment of the biopsychosocial impact of voice problems

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Abstract. *The voice handicap index as a tool for assessment of the biopsychosocial impact of voice problems.*
Background: Objective measurements do not evaluate the biopsychosocial impact of a voice disorder. The Voice Handicap Index (VHI) measures the influence of voice problems on a patient's quality of life.
Objective: To investigate if the VHI can monitor biopsychosocial impact of voice disorders and to provide a frame of reference for use of the VHI in general ENT practice.
Methods: VHI scores and subscores were analysed in 272 controls, 237 patients with initial voice complaints ("new patients") and 92 patients before and after microsurgery ("operated patients").
Results: The VHI scores of the controls were not normally distributed (Kolmogorov-Smirnov test: $<.001$). The total VHI scores for the 5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles were, respectively, 0.0, 0.0, 2.0, 6.0, 12.0, 23.0 and 32.8. In the controls, there was not a significant effect of gender on either VHI totals or subscores ($p = 0.060$ - 0.858). In the "new patients" group, males scored significantly higher on the functional subscore ($p = 0.004$). There was a very weak negative correlation between age and VHI totals and subscores in controls (correlation coefficient: -0.092 to -0.187). There was a significant difference in VHI totals and subscores between subjects with and without voice complaints ($p < 0.001$). In the patient group, VHI scores of professional voice users (PVUs) were not significantly different from those of non-PVUs ($p = 0.112$ - 0.753). In controls, a significantly higher score was found for PVUs in the P domain of the VHI ($p = 0.017$). After microsurgical treatment, 82.0% of patients had a lower total VHI score, and 93.3% reported an improvement in voice. In the patient group, the median postoperative VHI score was almost halved.
Conclusion: Gender and profession did not have a significant influence on the total VHI score. There was a weak tendency for VHI to decrease with age. The VHI is a useful instrument for quantifying the biopsychosocial impact of a voice disorder, and is able to monitor changes in self-perception of voice handicap after treatment.

Introduction

The voice is a multidimensional entity that can express emotions, artistic feelings and verbal communication. For many professions, a robust voice is an absolute necessity. Voice impairments can have an adverse effect on the physical, emotional and functional domains of a patient's quality of life.¹⁻³ George Engel^{4,5} stressed that clinicians should attend simultaneously to the biological, psychological and social dimensions of a health problem. His biopsychosocial model of health explains why some individuals experienced health problems as illness, while others regarded their condition as simply one of the problems

of daily life.^{4,5} Subjective assessments are better than objective voice measurements in reflecting the impact of a voice disorder on an individual's life. Quality of life measurements reflect the patient's experiences and recognise the centrality of the patient's vision. Several aspects are involved in determining the biopsychosocial impact of a voice problem, such as identifying the patient's level of function in daily and professional life, and calculating the emotional effects of the disorder. A negative biopsychosocial impact results in a more negative influence on quality of life. Several methods and scales have been developed to quantify the biopsychosocial impact of voice disorders, e.g. the

measurements of Smith *et al.*,⁶ the "voice-related quality of life" (V-RQOL) scale,⁷ the "Voice Disability Index",⁸ the "Therapy Outcome Measures",⁹ the "Voice Outcome Survey (FOX)"¹⁰ and the "Activity and Participation Profile (VAPP)".¹¹ The most frequently used inventory is the Voice Handicap Index (VHI), developed by Jacobson *et al.*¹²

When diagnosing or treating patients with voice problems, measurement of the biopsychosocial impact of the voice problem is an indispensable instrument for monitoring therapy effectiveness. The aim of this study was to investigate if the biopsychosocial impact of voice problems and the effectiveness of treatment

can be assessed using the VHI inventory, and to provide a frame of reference for use of the VHI in general ENT practice.

Materials and methods

Subjects

Control subjects were quasi-randomly recruited from the Dutch general population in order to investigate how VHI scores behave in a normal population. The control group consisted of 272 subjects, 183 females (67.3%) and 88 males (32.4%). In one case gender was not indicated. Distribution, gender difference, and age-dependency of the VHI scores were examined. The scores of subjects with vocally demanding professions were compared to the scores of non-professional voice users. Patient subjects consisted of “new patients” who were visiting a general ENT clinic with voice complaints for the first time (Bernhoven Hospital Veghel, the Netherlands), and “operated patients” who underwent phonomicrosurgical treatment for benign vocal fold lesions (University Hospital of Leuven, Belgium and Bernhoven Hospital Veghel, the Netherlands). Subjects younger than 17 and older than 65 were excluded. The “new patients” group consisted of 237 subjects, 177 females (74.7%) and 60 males (25.3%). The “operated patients” group consisted of 92 subjects. The time period in which the data were collected was from 2001 to 2005.

VHI measurement of the biopsychosocial impact of voice problems

All subjects were asked to fill out the Voice Handicap Index. In this

study, the Dutch translation of the VHI was used.¹³ The VHI consists of 30 variables, equally divided between three domains: functional (F), physical (P), and emotional (E). Each variable is scored on a five-point scale (0-4), varying from “never” to “always”. The scores are expressed in subscores (0-40) and a total score (0-120).

The control subjects were also asked whether they had voice problems at the moment of the test and/or in the past year, and if they used their voice intensively in their profession. The operated patients filled out a VHI questionnaire prior to surgical treatment, and two weeks after phonomicrosurgery. It was also registered whether the voice had subjectively improved after treatment.

Statistical analysis

The data were analyzed using the statistical program SPSS 12.0. For discrete outcome variables the Pearson Chi-Square test was used. A one-sample 2-tailed Kolmogorov-Smirnov test was applied in order to determine if continuous outcome variables were distributed normally. For continuous outcome variables that were not normally distributed, the Mann-Whitney U test and non-parametric calculation of correlation (Spearman) were used. The significance level was set at $p < 0.05$.

Results

Frame of reference for use of the VHI

In the subjects from the general population the median age was 38.5 years, with an inter-quartile range of 27.0 to 49.0. In the control group, neither the total VHI scores nor the subscores were nor-

mally distributed (Kolmogorov-Smirnov test: $p < .001$) (Figure 1). Table 1 summarizes the median scores and the 5th, 10th, 25th, 75th, 90th, and 95th percentiles.

The VHI total score, and the F, E, and P subscores of the male controls were compared to those of the female controls. None of the scores exhibited a significant difference by gender ($p = 0.858$, 0.110 , 0.276 , and 0.060 respectively). In the “new patients” group, the males scored significantly higher than the females on the functional subscore (VHI-F: median males = 11, median females = 7; $p = 0.004$). For the VHI totals and the other subscores (VHI-E, VHI-P) no significant gender-influence was found ($p =$ respectively 0.185 , 0.129 and 0.744). In the control group, a weak negative correlation was found between age and the VHI totals and subscores (correlation coefficient: -0.092 to -0.187).

In the control group, 96 subjects indicated they use their voice extensively in their profession (35.3%). Their VHI totals and subscores were compared to the scores of subjects without vocally demanding professions. There was no significant difference in either the VHI totals or the F and E subscores ($p = 0.184$, 0.862 and 0.889 , respectively), while the subjects with vocally demanding professions had a significantly higher score in the P domain ($p = 0.017$). In the “new patients” group (NP), 111 subjects had a vocally demanding profession (41.6%). There was no significant difference in either the VHI totals or subscores between this group and the NP non-professional voice users ($p = 0.112$ to 0.753).

The biopsychosocial impact of voice problems and the VHI as

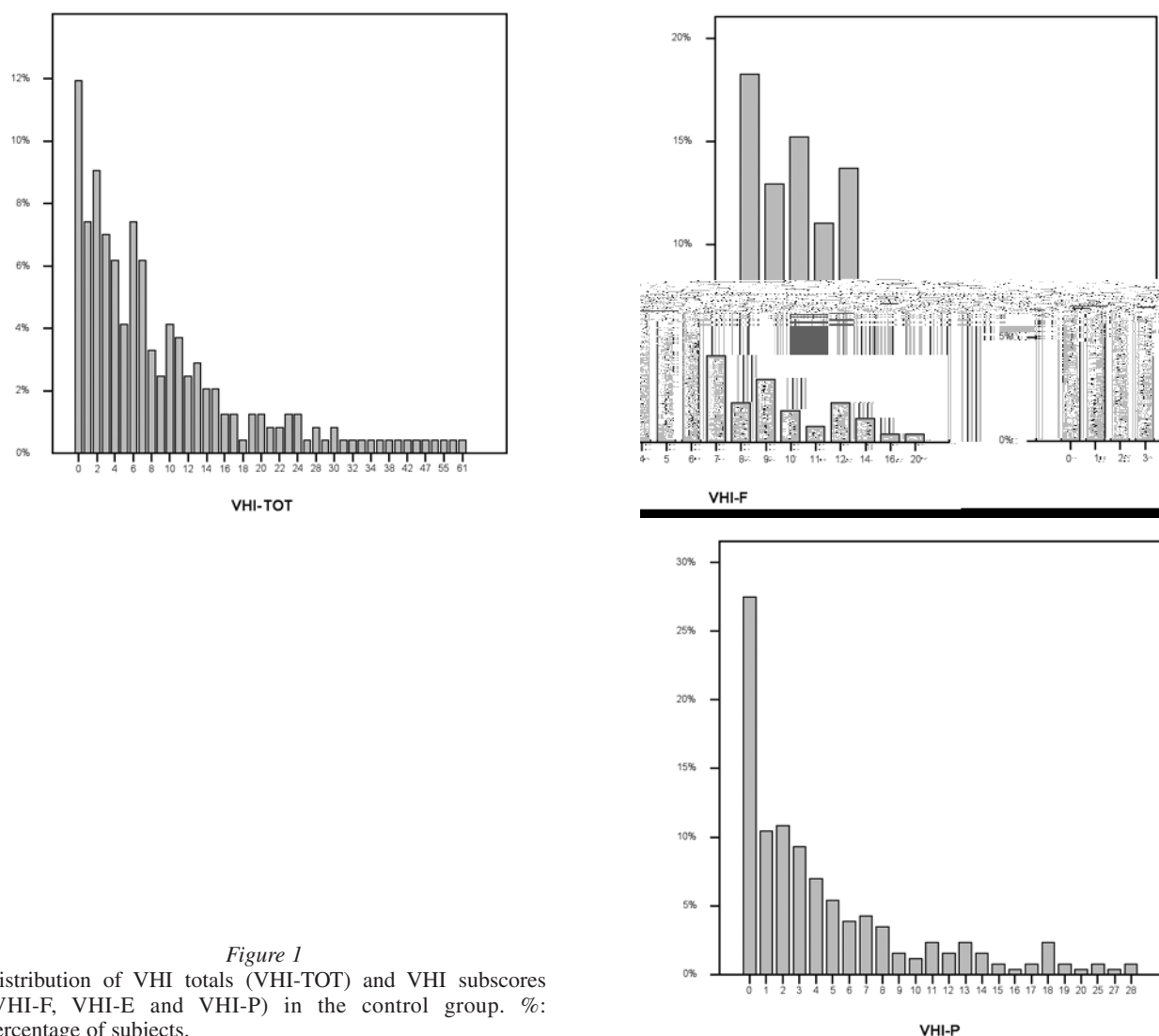


Figure 1

Distribution of VHI totals (VHI-TOT) and VHI subscores (VHI-F, VHI-E and VHI-P) in the control group. %: percentage of subjects.

result of treatment

To investigate if the VHI can determine the biopsychosocial impact of voice problems, the control group was divided into two groups: subjects who did not report voice problems at the moment of the test or in the past year, and subjects who did experience voice problems (Table 2). There was a significant difference between the VHI scores of these two groups ($p < 0.001$). There was also a significant difference between the scores of the “new patients” and the controls without

Table 1
Medians and percentiles of the VHI totals (VHI-tot) and VHI subscores (VHI-F, VHI-E, VHI-P) of the control group. Number of subjects = 243

	Percentiles						
	5	10	25	50	75	90	95
VHI-tot	0.0	0.0	2.0	6.0	12.0	23.0	32.8
VHI-F	0.0	0.0	1.0	3.0	5.0	7.6	10.0
VHI-E	0.0	0.0	0.0	0.0	2.0	5.6	8.8
VHI-P	0.0	0.0	0.0	3.0	6.0	13.0	17.8

voice complaints ($p < 0.001$, Table 2).

The VHI questionnaire was filled out by a group of 92 operated patients with benign vocal fold

lesions before, and two weeks after, phonosurgery. Table 3 shows that 82.0% of patients had a lower VHI total score after treatment, 14.0% had a higher VHI

Table 2

VHI totals and subscores for controls with (C) and without (NC) voice complaints at the moment of the test or within the past year. VHI scores of the “new patients” group (NP). IQR: inter-quartile range, n: number of subjects

		n	VHI tot (IQR)	VHI-F (IQR)	VHI-E (IQR)	VHI-P (IQR)
Controls	C	68 (25.8%)	14.0 (7.0-27.0)	5.0 (3.0-7.0)	1.0 (0.0-6.0)	7.0 (4.0-14.0)
	NC	196 (74.2%)	4.0 (1.5-9.0)	2.0 (1.0-4.0)	0.0 (0.0-2.0)	2.0 (0.0-4.5)
NP		237	36.0 (23.0-48.5)	8.0 (4.5-13.0)	9.0 (4.0-14.0)	18.0 (13.0-23.0)

Table 3

Percentage of patients with a respectively unchanged, lower, or higher VHI total after phonomicrosurgery, and their subjective impression of improvement

Total VHI Post-versus preoperative score	Percent	Improvement (%)	
		No	Yes
Unchanged	4.0	50.0	50.0
Lower	82.0	6.7	93.3
Higher	14.0	69.2	30.8

Table 4

Quantification of the change in VHI after treatment. VHIpost: postoperative VHI score, VHIpre: preoperative VHI score

VHI score	(VHIpost/VHIpre) × 100	
	No improvement	Improvement
Total	108	54
F	126	58
E	164	53
P	99	55

total score, and in 4.0% of the cases the VHI totals remained unchanged. In the group that exhibited a lower VHI after micro-surgical treatment, 93% also reported an improvement in their voice. In the group that exhibited a higher VHI after treatment, 69% reported that there was no improvement in their voice. In patients in whom the VHI was unaltered after surgery, 50% reported that there was no improvement in their voice.

Table 4 shows the quantification of the VHI changes after surgery. In patients that did not report an improvement in their voice after surgery, the median postoperative VHI total score was slightly increased (i.e. 108% of the median preoperative VHI total score). In contrast, in patients that did report an improvement in their voice after treatment, the median postoperative VHI total score was 54% of the median preoperative VHI total. This was also reflected

in the subscores, where the median postoperative VHI scores in the functional, emotional, and physical subdomains were 58%, 53%, and 55% of the preoperative scores, respectively.

Discussion

Voice disorders affect multiple aspects of a patient's life, including emotional, physical, and functional. Patients with similar voice disorders can experience different levels of handicap severity. There is a need for voice health-care providers and investigators to quantify the influence of vocal dysfunction on quality of life. The VHI is one standardized method that allows practitioners to identify the effects of a voice disorder. It is designed to rate the subjective biopsychosocial impact of voice problems, independent of the diagnosis. To provide a frame of reference for use of the VHI in general ENT practice, we investigated the distribution of the VHI in a normal population and the influence of gender, age, and profession on VHI scores. To exclude professionally inactive subjects, age limits were put at 17 and 65 years.

In the control group, the VHI was not normally distributed, which confirms our expectations. In a normal population the majority of subjects do not have voice problems, which would be reflected by low VHI scores. In developing the VHI, Jacobson *et al.*¹² asked subjects to self-rate the severity of their voice problem as “mild”, “moderate”, or “severe”. Subjects describing their voice as “normal”, or rating their voice disorder as “mild”, had a mean VHI total of 33.7. Those who rated their voice disorder as “moderate”

showed a mean VHI total of 44.8, and subjects who rated their voice disorder as “severe” had a mean VHI total of 61.4. In general, a VHI total of 0 to 30 is considered a low score, i.e. the handicap associated with the voice disorder is minimal. A score from 31 to 60 reflects a moderate handicap, and a VHI total from 61 to 120 is considered a severe handicap. In the current study, the controls without voice complaints have a median VHI total of 6.0. This may mean that subjects experience some handicap, but do not consider it a problem.

Kooijman¹⁴ found that males and females respond differently to experiencing voice problems. In his study, 41.3 percent of females sought help and underwent examination and treatment for their voice problems, versus 27.8 percent of the males. In our study, the “new patients” group was 74.7% female and 25.3% male. In a previous study by Corney,¹⁵ equal proportions of males and females sought help for physical problems associated with a voice disorder, but females were more likely to seek help for the associated psychosocial problems, such as distress and related consequences. Females also sought help at an earlier stage of the disorder compared to males. This could suggest that males would have lower VHI scores than females, but in control subjects in our study, no significant difference in VHI scores was obtained between males and females. In the “new patients” group, males scored significantly higher than females in the functional sub-domain. The other subscores, and the VHI totals, were not significantly different. This is in accordance with the findings of

Kooijman,¹⁴ which did not indicate a significant gender-difference in VHI scores.

It is generally accepted that voice capacity decreases with age. Hodge *et al.*¹⁶ and Baker *et al.*¹⁷ demonstrated that voice intensity is decreased in elderly speakers. It could be, therefore, that aging comes with greater development of voice problems and higher VHI scores. The results of the current study, however, are not in accordance with this assumption. On the contrary, in the control group, there is a weak negative correlation between age and VHI scores. This agrees with the results of Kooijman,¹⁸ who studied teachers, and found that subjects late in their professional careers did not have more voice complaints than those subjects just beginning their teaching career. In fact, Kooijman¹⁸ found fewer complaints in subjects further along in their careers. This would indicate that with increasing age, subjects acquire coping strategies for their voice problems, resulting in fewer complaints and lower VHI scores.

In the current study, there were not significant differences in VHI total scores between subjects with vocally demanding professions and non-professional voice users. Although in the control group, the vocally demanding professions did score significantly higher in the P domain ($p = 0.017$) of the VHI. An explanation for why the VHI did not differentiate between vocally and non-vocally demanding professions could be that the VHI was designed as a general questionnaire and is not specific enough to detect profession-related voice problems. For instance, the VHI contains only one question that refers to professional consequences of a

voice disorder. Rosen *et al.*¹⁹ compared the VHI scores of a group of singers with the VHI scores of a group of non-singers, and found significantly lower VHI scores amongst the singers. This may reflect that, as a group, singers are more sensitive to smaller voice changes and therefore seek medical attention earlier. It is reasonable to assume that the level of vocal demands dictated by a patient's lifestyle and occupation, would strongly influence VHI score. Data presented by Behrman *et al.*²⁰ suggest that, on average, this is true. Routine professional voice users (e.g. a clerical worker who reports “average” telephone use in a quiet office without substantial vocal demands) had significantly lower VHI scores than those with higher vocal demands. However, the range of scores between the two groups overlapped considerably, such that a substantial number of patients with routine vocal demands perceived themselves as having a relatively severe vocal handicap, and many individuals with a higher level of vocal demands did not perceive their voice problems to be particularly limiting. Two factors likely influence these findings. First, the ability to adapt to, and compensate for, voice disorders is highly individual and, to a certain degree, independent of vocal use. Second, reliance on patient reports and occupation to identify the level of vocal demands is inexact and contributes to measurement error.

The VHI scores of subjects without voice complaints are significantly lower than the scores of subjects who do have voice complaints, showing that the VHI is able to monitor biopsychosocial impact of voice problems. The

results of this study also indicate that the VHI is sensitive to changes in voice handicap after treatment. Ninety-three percent of operated patients reported an improvement in their voices two weeks after microsurgery, and in that same group the post-treatment VHI was nearly halved. It is interesting to note that for the purposes of monitoring treatment outcome, the absolute VHI score may not be as important as the percent change in the score. For instance, a VHI score of 100 prior to treatment, and a subsequent VHI score of 50 after treatment, represents a significant change in the patient's perception of his or her voice handicap. In our study, the relatively high post-treatment VHI scores could be due to the fact that phonosurgery for benign vocal cord lesions does not solve all of the functional inadequacies. In a study by Rosen *et al.*,²¹ the VHI detected changes after treatment for all of the voice disorders studied, regardless of the type of treatment, including surgery, medical therapy, and voice therapy.

Conclusion

This study demonstrates that the VHI is a useful instrument to quantify the subjective perception of the biopsychosocial impact of a voice disorder. However, it is a general questionnaire that is not specific enough to detect profession-related voice problems. VHI scores are not significantly different between males and

females, and tend to decrease with age. The VHI is a useful patient-based assessment tool to monitor the changes in self-perception of a voice handicap after treatment.

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