

Correlation Between Talkativeness, Vocal Loudness and the Voice Handicap Index

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ABSTRACT

Background: The aim of this study is to examine the correlation between self-rated talkativeness and self-rated vocal loudness and to assess significant differences in individual patient-reported and objective voice characteristics for patients with low, normal, and high self-rated talkativeness.

Methods: For this study, the voice clinic prospectively collected data from September 2019 to November 2021 from patients with mucosal and muscle tension disorders on one end and muscle deconditioning disorders on the other end, as these are voice pathologies in which self-rated talkativeness and self-rated vocal loudness are suspected to play a role. In this study, 221 patients were included. The dataset contained patient responses on self-rating scales of talkativeness and vocal loudness and both individual patient-reported and objective voice characteristics determined by the medical staff. The scores of the self-rating scales of talkativeness and vocal loudness were compared. Subsequently, the self-rated score of talkativeness was plotted against the individual patient-reported and objective voice characteristics. Patient demographics were used as an overlay to seek additional insight.

Results: First, a significant positive correlation between the self-rating score of talkativeness and the self-rating score of vocal loudness was observed. Secondly, the only voice characteristic that was significantly higher with increasing self-rated talkativeness was the voice handicap index. No statistically significant difference was seen for all other parameters.

Conclusion: Assessing talkativeness by a self-rating scale can help create a profile of patients in a voice clinic. The high degree of self-rated talkativeness correlates well with increased loudness of speech. The patient-reported perception of voice complaints measured by the voice handicap index is significantly higher in patients with high self-rated talkativeness. The other individual patient-reported and objective voice characteristics do not differ significantly for patients with normal to high self-reported talkativeness.

Keywords: Talkativeness, vocal loudness, voice characteristics, voice clinic, voice disorders

Introduction

Talkativeness and vocal loudness are 2 phenomena directly related to voice use and tend to reflect individual personality.¹ Excessive voice use may be the result of a person's occupation, living circumstances, and personality, i.e., personality traits such as extroversion, hyperactivity, and impulsivity.²⁻⁷ Talkativeness and vocal loudness are patient-reported variables best assessed by the patients themselves.

Certain voice disorders affecting the mucosal tissues of the vocal folds are believed to arise from excessive use of the voice.

The hypothesis is that excessive voice use leads to an abundance of vibrational stress on the vocal folds. Consequently, this vibrational stress has the potential to harm the mucosal tissue, potentially leading to the development of vocal polyps and the formation of vocal nodules. Therefore, individuals who naturally lean towards using their voice excessively are potentially more prone to vibrational damage.⁸ This is supported by literature where we find that high talkativeness and loudness correlate with benign vocal cord lesions such as vocal cord nodules, vocal cord polyps, ectasias and hemorrhages.^{1,9} Consequently, as talkativeness and vocal loudness are related with individual personality, several studies observed

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correlations between vocal cord noduli and personality traits such as being extrovert.^{2,4,8,5,10}

At the other end of the spectrum there is also an assumption that individuals who speak less, might experience a weakening of their vocal muscles, leading to an elevated risk of disorders related to muscle deterioration due to the lack of activity in the thyroarytenoid muscles. This can result in thin and bowed vocal folds. Conditions arising from muscle deconditioning encompass issues such as reduced volume due to air leakage through bowed vocal folds, as well as vocal fatigue syndrome caused by exertion while speaking with bowed vocal folds.^{8,11}

If vocal overuse and vocal underuse are risk factors for certain laryngeal disorders, evaluating voice characteristics correlating with vocal overuse and vocal underuse could be valuable for assessing laryngeal pathology.⁸ Trying to assess a patient's tendency to overuse, or underuse, his or her voice is therefore important and currently underutilized in the diagnostic work-up of voice pathology. Robert W. Bastian introduced multiple years ago a pair of 7-point Likert scales where he asks patients to rate their innate degrees of talkativeness and loudness, respectively. We find this self-rating scales of talkativeness and vocal loudness of added value in daily practice and hence wish to draw renewed attention to these scales by applying them for assessment of talkativeness and vocal loudness. This study seeks to determine the correlation between self-rated talkativeness and self-rated vocal loudness and to find significant differences in individual patient-reported and objective voice characteristics for patients with low to higher self-rated talkativeness.

Methods

Study Design and Patient Population

This study was conducted using prospectively collected data from September 2019 to November 2021 in the voice clinic of a supraregional non-university hospital. All patients presenting with dysphonia in this specialized voice clinic were evaluated according to a predefined protocol by an otorhinolaryngologist with specialized training in laryngology and phoniatic surgery

and a speech-language pathologist with a special degree in voice pathology.¹²

A standardized assessment of patients consulting our voice clinic consisted of the following components: patient demographics, patient self-rated talkativeness and patient self-rated loudness scores, patient reported outcomes including a patient reported voice analysis, i.e., voice handicap index (VHI) with different subscales (functional, physical, and emotional), an objective voice analysis i.e., acoustic voice quality index (AVQI) and dysphonia severity index (DSI), and a patient-reported perceptual auditory analysis i.e., a vocal capability battery including Grade Roughness Breathiness Asthenia Strain (GRBAS). These questionnaires and voice analyses were followed by a clinical examination including videolaryngostroboscopy. Diagnoses were categorized into main categories according to the classification adapted from Laryngopedia (see appendix).¹³ A treatment plan was established. These parameters were gathered in a database over the past years.

In this retrospective study, we limited our study population to patients with a diagnosis of voice pathologies in which talkativeness and vocal loudness are suspected to play a role, i.e., mucosal voice disorders and muscle tension disorders with suspected vocal overuse on one end, and muscle deconditioning disorders with vocal underuse on the other end. Other main diagnostic voice pathologies were excluded, for example neurologic, inflammatory, tumoral, mucous glandular pathology, trauma, ... A total of 221 individuals were included in this study, of which each patient was assigned to 1 of the 3 (mucosal, muscle tension, and muscle deconditioning disorders) diagnostic subgroups.

An informed consent of all patients was obtained following a detailed explanation of the data we were going to collect and the setup of the database. The study was approved by the Ethics Committee of AZ Delta hospital Roeselare-Menentorhout. (Approval no: B1172023000002; date: 10/03/2023) and conducted in accordance with the ethical principles for medical research involving human subjects outlined in the Declaration of Helsinki. Informed consent was obtained from the patients who agreed to take part in the study.

Main Points

- Self-rated talkativeness and self-rated vocal loudness are 2 phenomena directly related to voice use and tend to reflect individual personality traits.
- To assess talkativeness and vocal loudness, 7-point Likert self-rating scales developed by Robert W. Bastian can be used.
- These 2 self-rating scales have great potential but are still very little used and have not yet been compared or plotted against well-known individual patient-reported and objective voice characteristics.
- The results of our study suggest that self-rated talkativeness correlates well with loudness of speech and that the patient-reported perception of voice complaints measured by the voice handicap index is significantly higher scored in patients with high self-rated talkativeness.
- In this manner self-rated talkativeness and vocal loudness can have an impact on differentiating voice pathology and are therefore of added value to guide clinical suspicion.

Outcome Parameters

To assess talkativeness and vocal loudness, 7-point Likert scales, a pair of self-rating scales developed by Robert W. Bastian, were used.^{8,14} Our patient population was divided into 3 groups of talkativeness using this self-rating scale, i.e. vocal underdoers, normal voice users and vocal overdoers. A score of 1 out of 7 represented a quiet untalkative person, a score of 4 out of 7 represented an averagely talkative person, and a score of 7 out of 7 represented an extremely talkative person. The vocal underdoers were defined as a group scoring speech activity (talkativeness) of 1 or 2. The normal voice users had a speech activity of 3, 4 or 5. The vocal overdoers had a speech activity of 6 or 7. To score vocal loudness for each patient, the same 7-point Likert scale was used, where 1 represents markedly soft speaking volume, 4 represents average speaking volume, and 7 represents very loud speaking volume.⁸

In addition to self-rated talkativeness and self-rated vocal loudness, patient demographics (age, sex and occupation)

and individual patient-reported and objective voice characteristics were analyzed. Voice handicap index is a self-reported outcome parameter. The VHI questionnaire evaluates an individual's perception of the handicap degree caused by a voice disorder in 3 subscales: functional, physical, and emotional. The functional subscale reflects statements describing the impact of a person's voice disorder on their daily activities. The physical subscale represents self-perception of laryngeal discomfort and voice output characteristics. The emotional subscale represents a person's affective response to a voice disorder. This scale ranges from 0 to 120, with a cut-off for abnormal values set of ≥ 20 . Each subscale is scored from 0 to 40. Higher scores indicating a larger impact of the voice problem on patient's health status.¹⁵ A total VHI score below 20 means the voice causes no restrictions. A total VHI score from 20 to 40 means the voice causes some impairments, while a total VHI score between 40 and 60 means the voice causes significant impairments. A total VHI score higher than 60 means the voice problem takes the form of a disability. Dysphonia severity index is an objective voice quality index for vocal performance by assessing various types of phonations. This index ranges from -5 (bad voice) to +5 (good voice), where values beyond this range are possible. Dysphonia severity index is considered aberrant when the threshold value is < 1.6 .^{16,17} Acoustic voice quality index is a clinical method to quantify dysphonia severity by assessing continuous speech, thereby limiting its evaluation to comfortable production of vocals and phrases. This index ranges from 0 to 10. Voices above the AVQI threshold of 2.95 were indicated as impaired.¹⁸ An auditory-perceptual evaluation method is the GRBAS scale of the Japan Society of Logopedics and Phoniatrics, which gives subjective scores of 0, 1, 2, or 3 for the grade of hoarseness, roughness, breathiness, asthenia, and strain, where 0 is normal, 1 is a slight degree, 2 is a medium degree, and 3 is a high degree. Cutoffs for abnormal scores were set at $G \geq 1$ and/or $R \geq 1$ and/or $B \geq 1$ and/or $A \geq 1$ and/or $S \geq 1$.¹⁹

First, we examined the correlation between self-rated talkativeness and self-rated vocal loudness. Secondly, we searched for significant differences in individual patient-reported and objective voice characteristics in patients with low to higher self-rated talkativeness. A comparison of each characteristic was made between the normal voice users and the vocal overdoers. The group of vocal underdoers was omitted as this group only consisted of 3 patients.

Each individual patient-reported and objective voice characteristic has been depicted in a box-whisker plot, providing graphical representation of the minimum, the first quartile, the median (the second quartile), the third quartile, and the maximum.

Statistics

Data were analyzed with SPSS Statistics version 27 (IBM SPSS Corp.; Armonk, NY, USA). To check for normality, a Shapiro-Wilk test was used. To determine whether significant differences ($P < .05$) occurred parametric tests, by unpaired *t*-test, and non-parametric tests, by Mann-Whitney *U*-test, were performed.

To check the correlation between self-rated talkativeness and self-rated vocal loudness a Spearman's rank correlation

coefficient was used (significance, $P < .05$). A Shapiro-Wilk test was used to determine the normality of the DSI. Due to 9 outliers, the normal voice users and the vocal overdoers were not normally distributed. After elimination of these outliers the groups were normally distributed and parametric testing was continued.

For the parameters DSI, AVQI, total VHI and P-VHI parametric tests (by unpaired *t*-test) were used. For the parameters GRBAS, E-VHI and F-VHI non-parametric tests (by Mann-Whitney *U*-test) were used. A *P*-value for significance of .05 has been applied.

Results

Demographics and Self-Rated Talkativeness

A total of 221 individuals were included in this study. The studied population was represented by mucosal disorders (61.3%), muscle tension disorders (23.0%) and muscle deconditioning disorders (15.7%). Within the mucosal disease group, the largest proportion suffered from vocal cord nodules (29.0%). Vocal cord polyps (20.4%) were second most common in this subgroup. Among the muscle deconditioning disorders, the most frequent diagnosis was presbyphonia (9.0%). Note that due to the presence of patients with double diagnosis, the total amount of diagnoses was 235.

This patient population consisted of a small study group of vocal underdoers (1.4%). A fairly balanced distribution was seen between normal voice users (46.4%) and vocal overdoers (52.3%). The vocal overdoers and normal voice users, were mostly women (retrospectively 80.0 % vs. 74.5%). The vocal underdoers consisted of a very small group of men ($n = 3$). Vocal overdoers were younger (median age 38 years) compared to normal voice users (median age 50 years). The normal voice users consisted mainly of professional voice users (38.2%) and non-vocal nonprofessionals (35.3%). The vocal overdoers consisted mostly of professional voice users (53.9%) followed by non-vocal professionals (16.5%) (Table 1). Within our patient population demographics between normal voice users and vocal overdoers are rather similar for age, sex, and profession. In both groups, the majority consisted of professional voice users, of which the highest relative amount is among the vocal overdoers.

Correlation Between Self-Rated Talkativeness and Self-Rated Vocal Loudness

The vocal overdoers had a higher mean self-rated loudness (5.3) than the normal voice users (4.3). When examining the correlation between self-rated talkativeness and self-rated vocal loudness, a Spearman's rho positive rank coefficient of 0.488 was observed. This indicates a moderate correlation of 0.000 which was significant ($P < 0.01$). This positive correlation was confirmed in a scatter plot (Figure 1).

Differences in Individual Patient Reported and Objective Voice Characteristics for Patients with Normal to High Self-Rated Talkativeness

A comparison of individual patient-reported and objective voice characteristics between the normal voice users and the vocal overdoers was made (Table 2).

Table 1. Demographics According to Self-Rated Talkativeness

Group	Vocal Underdoers	Normal Voice Users	Vocal Overdoers
Talkativeness (score out of 7)	1-2	3-5	6-7
Number N (%)	3 (1.4)	102 (46.4)	115 (52.3)
Men	3 (100)	26 (25.5)	23 (20.0)
Women	0 (0)	76 (74.5)	92 (80.0)
Age (years)			
Mean (SD)	74.3 (11.9)	50.2 (21.0)	38.6 (15.4)
Median	69.0	48.0	35.0
Minimum	66	18	18
Maximum	88	91	79
Profession N (%)			
Non-vocal non-professional	3 (100)	36 (35.3)	12 (10.4)
Non-vocal professional		12 (11.8)	19 (16.5)
voice user		39 (38.2)	62 (53.9)
Elite vocal performer		6 (5.9)	8 (7.0)
Vocal student		9 (8.8)	14 (12.2)
Non-vocal student			

Individual Patient-Reported Voice Characteristics

The mean VHI value of the normal voice users (35.0) was lower than the mean VHI value of the vocal overdoers (42.1) with a strong significant mean difference of -7.06 and $P=.007$ ($P<.01$) (Figure 2). We conducted an additional statistical analysis to assess whether the observed significant difference extended across all Voice Handicap Index (VHI) subscales. Both the Physical-VHI (P-VHI) and Emotional-VHI (E-VHI) scores were markedly lower in normal voice users compared to vocal overdoers, with P -values of $.001$ ($P<.05$) and $.033$ ($P>.05$), respectively. Conversely, no significant difference was noted in the Functional-VHI (F-VHI) between normal voice users and vocal overdoers, as indicated by a P -value of $.465$ ($P>.05$).

Table 2. Objective and Individual Patient Reported Voice Characteristics According to Self-Rated Talkativeness

Classification	Normal Voice Users (7-Point Likert Scale: 3-5)	Vocal Overdoers (7-Point Likert Scale: 6-7)
Individual patient reported voice characteristics		
VHI		
Mean (SD)	35.0 (17.6)	42.1 (19.8)
Median	33.5	41.0
$P=.007^{**}$		
Grade (GRBAS)		
Mean (SD)	1.1 (0.6)	1.1 (0.7)
Median	1.0	1.0
$P=.963$		
Roughness (GRBAS)		
Mean (SD)	0.8 (0.7)	0.9 (0.7)
Median	1.0	1.0
$P=.502$		
Breathiness (GRBAS)		
Mean (SD)	0.8 (0.7)	0.9 (0.70)
Median	1.0	1.0
$P=.111$		
Asthenia (GRBAS)		
Mean (SD)	0.5 (0.8)	0.4 (0.6)
Median	0.0	0.0
$P=.241$		
Strain (GRBAS)		
Mean (SD)	0.7 (0.7)	0.9 (0.7)
Median	1.0	1.0
$P=.092$		
Objective voice characteristics		
DSI*		
Mean (SD)	1.8 (2.6)	2.3 (2.1)
Median	1.7	2.5
$P=.098$		
AVQI		
Mean (SD)	4.3 (1.6)	3.9 (1.4)
Median	4.0	3.8
$P=.070$		

*Outliers from the DSI were eliminated.**Statistically significant $P<.05$.

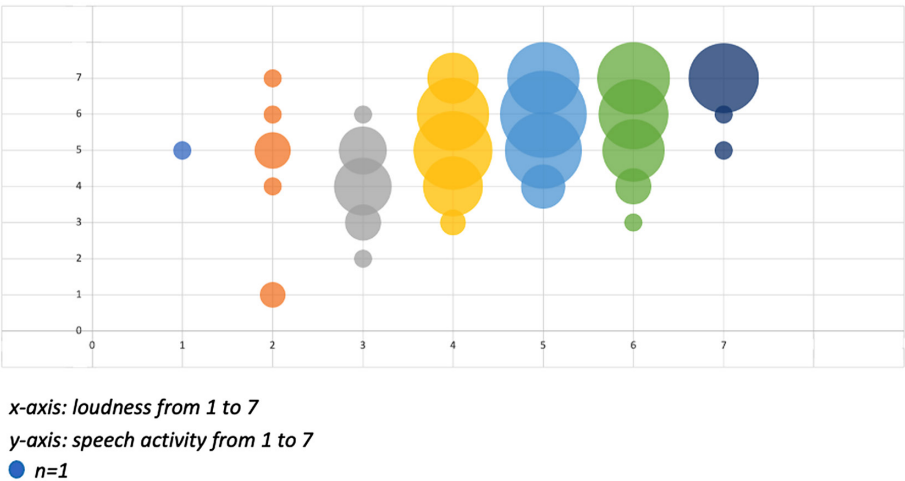


Figure 1. Scatter plot: correlation between self-rated talkativeness and self-rated loudness.

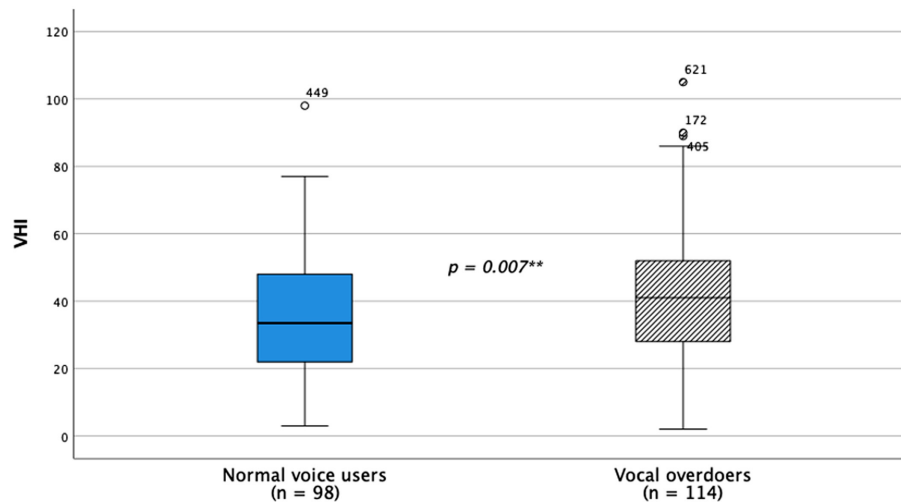


Figure 2. Box plot VHI.

Concerning the perceptual auditory analysis, all mean values were rather similar between the normal voice users and the vocal overdoers with a non-significant mean difference for Grade, Roughness, Breathiness, Asthenia and Strain of - 0,01; - 0,06; - 0,15; 0,16 and - 0,17 respectively. *P*-values were respectively .963 ($P > .05$), .502 ($P > .05$), .111 ($P > .05$), .241 ($P > .05$) and .092 ($P > .05$).

Objective voice characteristics

The mean DSI value of the normal voice users (1.8) was lower than the mean DSI value of the vocal overdoers (2.3) with a non-significant mean difference of - 0.55 and $P = .098$ ($P > .05$). The mean AVQI value of the normal voice users (4.3) was higher than the mean AVQI value of the vocal overdoers (3.9). There was a non-significant mean difference of 0.4 and $P = .070$ ($P > .05$).

Discussion

Self-rated talkativeness and vocal loudness are 2 phenomena directly related to voice use and tend to reflect individual personality. Extensive literature search shows that to date, only Robert W. Bastian is reporting data considering talkativeness and vocal loudness. He uses the aforementioned 7-point Likert scales to quantify talkativeness and vocal loudness, and emphasizes the importance of these parameters on voice pathology. In 2016, Robert W. Bastian reported a positive correlation between self-rated talkativeness and self-rated loudness in a retrospective study. Hitherto these parameters were not described nor used in clinical practice. In our study we could confirm this relation and validated this correlation in another independent cohort.⁸

From the same research by Robert W. Bastian statistic evidence was found that mucosal lesions are strongly associated with a high self-rated talkativeness and that laryngeal deconditioning disorders were associated with a low self-rated talkativeness.⁸ In our study, we did not focus on the correlation between self-rated talkativeness and vocal loudness on different types of voice pathology. Our research investigates whether these not so known self-reporting talkativeness and vocal loudness scores correlate with other well-known individual

patient-reported and objective voice characteristics. A comparison of individual patient reported voice characteristics and objective voice characteristics between the normal voice users and the vocal overdoers shows a statistically significant difference in individual patient reported perception of voice quality by the VHI questionnaire. Whereas the normal voice users indicate a mild self-reported voice impairment, the vocal overdoers subjectively score their voice problem as significant. However, none of the other voice characteristics differ statistically significantly. Evaluating Grade, Roughness, Breathiness, Asthenia and Strain rated from 0 to 3, did not show a difference between both groups. Dysphonia severity index does not reach the cut-off of < 1.6 for both groups, according to this parameter both groups are considered to have a normal to good voice as the values are closer to the upper margin. In contrast, both groups reach the cut-off of the AVQI-index of ≥ 2.95 , indicating a pathological voice. Only a small and non-significant difference between the 2 groups can be seen for this parameter, with a higher score among the normal voice users indicating a poorer voice quality. We can conclude in this study that patient reported perception of voice complaints measured by the Voice Handicap Index is significantly higher scored in patients with high self-rated talkativeness. The other individual patient-reported and objective voice characteristics do not differ significantly for patients with normal to high self-reported talkativeness

In this manner self-rated talkativeness and self-rated vocal loudness can have an impact on differentiating voice pathology and are therefore of added value to guide clinical suspicion. We are rating talkativeness and loudness in the outpatient voice clinic as it can directly relate not only to the diagnosis but also to the treatment.

Hence, we also recommend clinicians to use this 7 point Likert scale in clinical practice. Since both scores correlate very well, one score will suffice. We suggest using more specifically the self-rated talkativeness scale. Our experience is that this score is easier to report by the patients. Voice specialists will find benefit both in better understanding the pathogenesis and finding the correct diagnosis and tailor the treatment. Vocal overdoers tend to have more vibration induced mucosal

disorders so the clinician can suspect these lesions and focus more specifically both in listening and looking more closely for particular small lesions on the mucosal surface. In addition, it will help to direct the treatment as in vocal overdoers speech therapy will be indicated alone or in addition to surgery and will be directed towards lifestyle management and behavioral treatment. At the other end of the spectrum vocal underdoers will consist of voice building before turning to the option of surgery.

We identified a heightened Voice Handicap Index (VHI) among individuals who excessively use their voice compared to those with regular voice usage. We hypothesize multiple factors contributing to this discrepancy. First, the vocal overdoers group comprises a larger proportion of women. Generally, women exhibit greater sensitivity to the impact of mucosal disorders, leading to more frequent visits to a voice clinic for consultation. Secondly, individuals with an inclination towards talkativeness are likely to be more perturbed by suboptimal voice quality, resulting in elevated VHI scores in their reports. The statistic subanalysis, assessing emotional, physical, and functional dimensions of speech perception, substantiated these observations. We observed a statistically significant disparity in emotional and physical Voice Handicap Index (VHI) scores. This indicates that the emotional impact on talkative patients is most pronounced as well as the self-perception of their voice impairment comparing to less talkative patients. In contrary there is less impact of their voice disorder on their daily activities. The functional aspect does not contribute as significantly to overall annoyance, as indicated by the questionnaires.

In contrast to what we expected, except for the VHI, we did not find a statistical difference for the other parameters. For the subjective perceptual auditory analysis (GRBAS) this may in part be because the GRBAS scale is less granular (score only from 0 to 3). For the objective parameters (DSI and AVQI) the absence of statistical difference may point towards the fact that vocal overdoers are more impacted by their voice quality purely on a subjective basis. The absence of a difference in GRBAS also points towards the fact the voice quality is only perceived worse by the patients and not as such evaluated by the medical staff.

These results should be interpreted with caution as there are several limitations of our study, including its retrospective nature and the relative small sample size (although consecutive patients). In addition, some data are missing (14 patients had a double diagnosis meaning 221 individuals were included in the study, but 235 diagnoses were assigned). Finally, because of low numbers vocal underdoers were excluded and no control group was used.

Further research is needed and planned as the data collection by the voice clinic in our center is continuously ongoing. We believe that an enlarged sample size could reveal further insights or more statistically significant correlations.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: This study was approved by Ethics Committee of AZ Delta hospital Roeselare-Menen-Torhout. (Approval no: B1172023000002; date: 10/03/2023).

Informed Consent: Informed consent was obtained from the patients who agreed to take part in the study.

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Author Contributions: Concept – K.D., M.R.; Data collection – K.D., M.R., J.E.; Data cleaning – A.C.; Analysis and interpretation – E.V., A.C.; Literature search – E.V., A.C.; Writing manuscript – E.V., A.C.; Critical review – K.D., M.R.

Declaration of Interests: K.D., M.R. and J.E. work for the department of laryngology where they apply these scales of self-rated talkativeness and self-rated vocal loudness to assess their patients in the voice clinic. The other authors have no conflict of interest to declare.

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Appendix

Appendix: Main Diagnostic Categories

Neurological	Dystonia Paralysis Paresis <ul style="list-style-type: none">• Thyroarytenoid muscle• Lateral cricoarytenoid muscle• Posterior cricoarytenoid muscle• Interarytenoid muscle• Thyroarytenoid muscle + lateral cricoarytenoid muscle• Thyroarytenoid muscle + lateral cricoarytenoid muscle + posterior cricoarytenoid muscle• Parkinson's disease associated Tremor Other
Mucosal	Nodules Polyp Epidermoid cyst Granuloma Leukoplakia Smoker's polyps Sulcus Other
Laryngitis (inflammatory)	Bacterial Fungal Viral Laryngopharyngeal reflux Other
Muscular	Atrophy Presbyphonia Voice fatigue syndrome Other
Non-organic	Hypokinetic breathy dysphonia Muscle tension dysphonia Puberphonia Psychogenic Other
Tumour	Benign Malignant Other
Mucous gland pathology	Laryngocele Mucous retention cyst/mucocele Saccular cyst Other
Other	Ankylosis Autoimmune Endocrine Foreign Body Other
Trauma	Internal External Other