Epidemiological Patterns and Treatment Outcomes in a Private Practice Community Voice Clinic

Zoë Thijs, M.S.[a]

Kristie Knickerbocker, M.S.[b]

Christopher R. Watts, Ph.D.[a]

[a] Texas Christian University, Fort Worth, USA

[b] a tempo Voice Center, Fort Worth, USA

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ABSTRACT

Objectives: Voice therapy is administered by speech-language pathologists in multiple practice settings, including private practice community voice clinics. However, the evidence for diagnosis patterns and voice treatment outcomes in community voice clinics is very limited. The purpose of this study was to extend knowledge from a previous investigation by assessing the epidemiological patterns of patient referrals to a private practice community voice clinic across a 4 year period (50 months) and to measure the effectiveness of treatment outcomes for patients who were followed up with voice therapy in that setting.

Study Design: Retrospective case series

Methods: Consecutive patient records from November 2014 through January 2019 were reviewed. Patients were grouped into 7 categories of distinctive diagnoses. Descriptive data for each group were extracted to determine epidemiological patterns of disorder diagnosis, voice handicap, voice quality severity, age, and gender. For patients who completed at least 3 treatment sessions, pre- and post-treatment measurements of two assessments, the Voice Handicap Index (VHI) and the Acoustic Voice Quality Index (AVQI), were extracted and compared using a MANOVA.

Results: Records from 454 consecutive patient referrals over a 50-month time period were reviewed. The most frequent diagnoses were multifactorial etiologies or those with only a few cases, categorized collectively as an "other" diagnosis category. Diagnoses of non-specific dysphonia and mid-membranous lesions were also common. CAPE-V scores were not different among disorders, however, group differences were found for VHI and AVQI. Treatment data were available for 292 patients, with 48 of those patients completing at least 3 treatment sessions and with data for pre- and post-therapy VHI and AVQI. A mixed MANOVA showed a significant effect of treatment (Wilks' Lamba=0.42, $F[2]=27.58$, $p<0.001$, $\eta_p^2=0.58$), where both AVQI and VHI improved significantly across the pre-to-post treatment measurements.

Conclusion: Patient characteristics and diagnosis patterns across a 50 month period were similar when compared to a previous study that investigated epidemiological patterns in this clinic across 28 months. Voice therapy administered in this community voice clinic to patients

with varied diagnoses was found to be effective based on changes in VHI and AVQI measurements.

KEYWORDS

Voice therapy – private practice voice clinic – effectiveness – voice quality – perceived voice handicap

INTRODUCTION

Voice therapy is often implemented as a primary treatment approach for voice disorders and can, in some cases, change subsequent recommendations for medical management [1,2]. While the majority of evidence reporting voice treatment outcomes and epidemiological data for patient populations with voice impairments has been from laryngologist-led clinics typically associated with academic medical centers [3,4], a substantial number of speech-language pathologists (SLP) who are voice clinicians see patients in community voice clinics that are not led by a physician [5]. For example, as of the year 2020 more than 8,600 SLP's identify 'voice" as one of their clinical specialty areas, with over 550 of these professionals working in non-academic community settings such as private offices or speech clinics [6].

Regardless of practice setting, a commonly used tool for assessing the outcomes of voice therapy is the Voice Handicap Index (VHI) [7]. As a patient-reported outcome measure, the VHI represents a primary tool used to measure treatment outcomes in patients receiving voice therapy [8,9]. The VHI consists of 30 questions divided over 3 domains (emotional, physical, and functional subscales) [7]. All items are scored on a Likert-scale ranging from 0-never to 4-always, resulting in a score between 0 and 120. Higher scores on the VHI reflect a greater perceived vocal handicap [7]. The VHI's clinical utility is supported by robust psychometric properties compared to other patient-reported quality of life instruments [10]. Moreover, the administration of the VHI is standardized which has allowed for comparisons of scores across a large body of clinical research [9,11-14].

Acoustic assessments of vocal function are also a standard component of a comprehensive voice evaluation and have been shown to be sensitive to treatment change in populations with voice impairments [15,16]. One example is the Acoustic Voice Quality Index (AVQI), a multiparametric acoustic measure that is both strongly related to perceptions of voice quality (e.g., perceived severity of dysphonia) and sensitive to treatment outcomes [16]. The AVQI can be used with the computer program Praat [17] and combines multiple cepstral, spectral, and time-based measurements applied to continuous speech and sustained vowel recordings. AVQI analysis produces a single metric that falls within a continuum of 1 to 10, where higher numbers are associated with greater dysphonic severity [18,19]. The use of the

AVQI as a diagnostic tool and as a measure of clinical outcomes is supported by a large and growing body of evidence across multilinguistic patient populations [20-22].

It stands to reason that a large population of patients with voice disorders is evaluated and treated in community voice clinic settings. Unfortunately, we know very little about the demographics and characteristics of the populations referred to private practice clinics, and even less about the outcomes of the voice therapy administered to patients treated in these settings. Our knowledge of epidemiological patterns in different clinical practice sites is important for at least three reasons: (a) for benchmarking referral patterns and caseload characteristics that will inform what practices the clinician will need to utilize in their professional role (i.e., what evaluation tools and skills are needed, what treatment approaches should the clinician be competent in, etc.?); (b) for monitoring trends in incidence and prevalence of voice disorders over time in specific practice settings and communities (i.e., disease surveillance); and (c) to provide evidence of epidemiological patterns that can inform future studies seeking to identify risk factors for voice disorders in different populations (i.e., is gender represented disproportionately, is there a large percentage of certain professions represented across clinical settings?). In a recent study, we addressed this problem by reporting epidemiological data from 216 patients evaluated in a private practice community voice clinic across a 28-month period [5]. That study found that patient demographics and diagnosis distributions in a private practice clinic led by an SLP were similar to specialty voice clinics led by laryngologists. It was concluded that the competencies needed by SLP's in a private clinic would be the same as SLP's working in specialty voice centers. This is critical knowledge, as it should inform the educational and experiential needs of clinicians considering voice/vocology as a specialty area, regardless of practice setting.

The purpose of this study was to extend our previous research using the following research questions: (1) what are the epidemiological patterns in a private practice community voice clinic including a large sample of patients evaluated across 50 consecutive months; and (2) what are voice treatment outcomes as measured by the VHI and AVQI tools for patients treated in the same private practice setting. For the second research question, we hypothesize that treatment outcomes after at least three voice therapy sessions will show measurable and

significant decreases in VHI and AVQI scores, and thus show that voice therapy intervention can result in positive outcomes in a private practice setting.

METHODOLOGY

This study was a continuation of our previous retrospective investigation of diagnosis and referral patterns to a private practice community voice clinic [5]. The study was approved by the Texas Christian University Institutional Review Board. Epidemiological data from all patients receiving a voice evaluation across 50 consecutive months were collected (28 months from earlier study, 22 additional months for new data set) from patient charts in a single clinical practice. The data represented patients referred to a single community voice clinic, which was led by a licensed and certified SLP (2nd author, KK) with a background in vocal performance and 7 years of clinical experience centered on vocology. All patients referred to the clinic were included in the sample, regardless of age and diagnosis.

All patient referrals to the voice clinic were from either (a) community otolaryngology practices, (b) community SLPs, or (c) self-referrals. Data extracted for this investigation represent information obtained during a specialty voice evaluation by the SLP, along with records from the patients' otolaryngologist. Previous or subsequent otolaryngology examination was completed for each patient prior to the development of any voice treatment plan. Medical diagnoses were established via the otolaryngology and specialty voice clinical evaluations. Laryngeal imaging via videostroboscopy was completed by either a referring otolaryngologist or the SLP. The International Classification of Diseases, 10th Revision (ICD-10) was utilized for guidance on diagnosis codes, consistent with previous studies [5,23].

Within this overall sample, we also identified patient charts that represented those who underwent an initial evaluation and received at least 3 sessions of voice therapy in the clinic, and for whom pre-treatment and post-treatment data were available to evaluate treatment outcomes in this private practice community voice clinic. When a voice treatment plan was developed for a patient who would be served by the clinic, voice therapy was personalized for each patient and was based on their diagnosis and needs. Treatment plans consisted of one or more of the following domains: voice production physiology education, vocal wellness education (i.e., vocal hygiene), and a combination of Resonant Voice Therapy, semi-occluded vocal tract exercises, Stretch-and-Flow and/or Vocal Function Exercises. All patients were treated individually and in-

person during weekly therapy sessions. If needed, adjacent medical management was sought. Patients were discharged after typically 3-5 therapy sessions if they met one of the following criteria: (a) the patient no longer demonstrated vocal impairment, and/or (b) voice therapy goals were met; and/or (c) the patient was able to apply new vocal behaviors confidently and independently to their satisfaction.

The following data were extracted from the charts by the treating SLP (2nd author, KK) for all patients: (a) voice disorder diagnosis, (b) age, (c) gender, (d) auditory perceptual ratings of voice quality, (e) AVQI scores, and (f) VHI scores. The auditory perceptual ratings of voice quality were performed by the SLP using the Consensus Auditory Perceptual Evaluation of Voice-scale (CAPE-V) [24]. The disorder diagnoses were stratified into different categories, using a similar approach as our previously published study [5]. This resulted in 8 distinct groups of diagnoses: (1) atrophy or bowing, (2) mid-membranous lesions [MML], (3) muscle tension dysphonia [MTD], (4) non-specific dysphonia [NSD], (5) patients who are transgender, (6) vocal cord dysfunction [VCD], (7) vocal fold immobility [paresis or paralysis – VFI], and (8) an "Other" category consisting of etiologies that represented less than 5 patients, patients with multifactorial diagnoses, patients diagnosed with "acute laryngitis", or patients with no divergent voice quality. For the subgroup of patients for whom pre-treatment and post-treatment data were available, we chose to use pre-treatment and post-treatment measurements of VHI and AVQI as the outcome measures in this study, as these metrics can be validly compared within and across patients. Therefore, the post-treatment measurements for VHI and AVQI were extracted from the patient files as well for these patients.

We applied multivariate analyses of variance (MANOVA) to the VHI, CAPE-V, and AVQI scores for the entire data set with diagnosis group (etiology) as the main factor. MANOVA analysis was selected because it allowed for the inclusion of variance associated with all three dependent variables in one statistical test, and in doing so served to protect against Type 1 error for any follow-up tests to the MANOVA [25]. For all statistical analyses, a significance level of $\alpha=0.05$ was set. To examine the epidemiological patterns of all patients referred to the clinic, we merged data sets from the 22-month cohort (new data) with the 28-month cohort (previously published data). A single data set representing patients evaluated in the voice clinic across 50 consecutive months was derived. Descriptive analyses were then applied to this pooled

data set, containing all patients, to describe the following epidemiological patterns: (a) diagnosis category frequency, (b) age distribution, (c) gender distribution. For statistically significant main effects, post-hoc testing utilized the Fisher least square difference test in a pairwise manner.

To determine the outcome of voice treatment, we only considered the patients for whom pre-treatment and post-treatment data were available. A multivariate analysis of variance (MANOVA) was also applied to this data, with diagnosis group (etiology) and measurement period (pre-treatment vs. post-treatment) as factors. Pairwise testing using the Fisher least square difference test for statistically significant main effects was used for post-hoc testing. For all inferential analyses, outliers outside 1.5x the interquartile range were removed, as defined by the statistical program (IBM SPSS, v. 25).

RESULTS

Research Question 1: Characteristics of the whole patient population

Of the reported 454 patients that were referred to the community voice clinic for initial evaluation, 225 cases were presented in our previous data set [5], and 229 cases were reported for the first time. As no significant differences between the groups were found, the groups were pooled together. An overview of the diagnoses and patient characteristics of the 454 patients can be found in Figure 1 and Table 1. The most prevalent disorder diagnosis across the sample was "Other" (25.3%) followed by non-specific dysphonia (24.7%) and mid-membranous lesions (15.4%). More females (67.4%) were seen in the clinic compared to males (32.6%). Moreover, Table 1 shows that the sample contained more patients in older age groups compared to younger age groups. The most common diagnoses in females were the "Other" category and non-specific dysphonia (both 16.7%), followed by mid-membranous lesions (12.3%). In males, the "Other" diagnosis and non-specific dysphonia were the most prevalent, at 8.6% and 7.9% respectively. Patients who are transgender were the third most prevalent category (5.2%) for the male gender in this clinical practice. Table 2 shows the average age, CAPE-V overall severity score, as well as the average VHI and AVQI score for each diagnosis group in the full sample. The atrophy and bowing group were most prevalent in older patients, whereas patients who are transgender were the youngest. CAPE-V scores were similar across all groups. The AVQI value for vocal cord dysfunction appeared to be higher (indicating worse voice quality) than the other groups.

The CAPE-V, VHI, and AVQI scores of the patient sample at the initial evaluation were compared using a MANOVA with diagnosis group as a between-subject factor and the three measurements as separate variables in the statistical model. Twenty data points in the VHI data set were identified as outliers and removed along with 6 data points from the AVQI data. The analysis showed a significant effect for diagnosis group (Wilks' Lambda=0.842, $F[21]=2.78$, $p<0.001$). Significant group differences were found for VHI ($F[7]=4.20$, $p<0.001$), and AVQI ($F[7]=3.21$, $p=0.003$), but not for CAPE-V score ($F[7]=1.05$, $p=0.39$). Post-hoc tests revealed that for VHI, patients with mid-membranous lesions scored significantly higher than patients with non-specific dysphonia ($p<0.001$), patients who are transgender ($p=0.011$), and the "other" diagnosis group ($p=0.002$). Patients with vocal fold immobility also scored significantly higher than patients with non-specific dysphonia ($p<0.001$), patients who are transgender ($p=0.036$), and the 'Other' diagnosis group ($p=0.020$). Patients with atrophy or bowing showed significantly higher VHI scores than the non-specific dysphonia group ($p=0.026$). For AVQI, patients with vocal fold immobility scored significantly higher than mid-membranous lesions ($p=0.014$), non-specific dysphonia ($p=0.002$), patients who are transgender ($p=0.001$) and patients with muscle tension dysphonia ($p=0.005$). Patients with atrophy or bowing also had higher AVQI scores than patients who are transgender ($p=0.007$) and patients with muscle tension dysphonia ($p=0.022$). The 'Other' category also had significantly higher scores than patients who are transgender ($p=0.018$).

INSERT FIGURE 1

INSERT TABLES 1-2

Research question 2: voice treatment outcomes

Across the entire data set, 292 patients were referred for and did attend at least one voice therapy session. Criteria for treatment outcome analysis (completed a minimum of 3 treatment sessions, and pre- and post-treatment data were available for VHI and AVQI) were met for 54 of these cases (12%). Patients with vocal cord dysfunction and those who were transgender were not included in the analysis as dysphonia was not their main complaint. Those with muscle tension dysphonia (i.e., non-phonotraumatic dysphonia) were collapsed into the 'Other' group due to insufficient numbers. Six cases were identified as outliers and removed from the analysis.

Therefore, forty-seven patients were included in the analysis. An overview of the average scores for AVQI and VHI pre- and post-treatment can be found in Table 6. The pre-treatment scores for both VHI and AVQI appeared to be numerically higher than the post-treatment scores. The mid-membranous lesions group showed the highest VHI and AVQI score, whereas non-specific dysphonia showed the lowest scores.

The differences between the pre- and post-treatment values for the disorder diagnosis groups were calculated using a 2 x 5 Mixed MANOVA design with measurement time (pre-treatment vs. post-treatment) and diagnosis group as the factors where VHI and AVQI scores were variables in the statistical model. There was only a significant effect of time, i.e. pre-treatment measurements vs. post-treatment measurements (Wilks' Lamba=0.42, F[2]=27.58, $p<0.001$, $\eta_p^2=0.58$). No significant effect of group (Wilks' Lamba=0.68, F[10]=1.73, p=0.09, $\eta_p^2=0.18$) was found. No interaction effect between diagnosis group and time was found (Wilks' Lamba=0.80, F[10]=0.93, p=0.51, $\eta_p^2=0.10$). The within-subject analyses showed that pre-treatment VHI scores were significantly higher than the post-treatment VHI scores (F[1]=35.02, $p<0.001$, $\eta_p^2=0.46$), and the pre-treatment AVQI scores were significantly higher than the post-treatment AVQI scores as well (F[1]=31.01, $p<0.001$, $\eta_p^2=0.43$) when collapsing across all diagnosis groups. That is, across all 47 patients the average VHI and AVQI scores decreased, indicating an improvement in perceived handicap and acoustic indices of voice quality.

INSERT TABLE 2

INSERT FIGURES 2-3

DISCUSSION

The purpose of this study was to further investigate diagnosis and referral patterns in a private practice community voice clinic led by an SLP, as well as describing treatment outcomes after at least three voice therapy sessions. We compiled data from a group of 454 patients seen across a consecutive 50-month period. We analyzed the epidemiological characteristics of this group and also treatment outcomes for a subgroup of patients who received at least 3 sessions of voice therapy. Our main findings were as follows: (1) Across all 454 patients evaluated in the voice clinic, 2/3 were females; (2) 50% of all disorder diagnoses were represented by the 'Other' category (within this category the most common diagnosis was acute laryngitis) and the non-specific dysphonia category; (3) The disorder diagnoses of mid-membranous lesions, vocal fold

immobility, and atrophy/bowing had the largest negative effects on VHI and AVQI scores; (4) Of 48 patients included in the pre-post treatment analyses, there was a significant treatment effect on measurements of VHI and AVQI, suggesting positive treatment outcomes on measures of voice handicap and acoustic measures of voice quality. However, voice therapy did not result in the same degree of improvement for these VHI or AVQI measures across the different diagnosis groups.

The current study was a continuation of a previously published investigation that reported the diagnosis and referral patterns in a private practice community voice clinic. While some minor differences were observed (most noticeably an increase in the percentage of NSD and "Other" cases), the diagnosis patterns were largely the same in the new group of 229 patients compared to the same measurements from our previously reported data set of 225 patients. The epidemiological patterns of gender, age and VHI scores, and CAPE-V ratings were also similar in the two cohorts and no significant differences were present between the data sets. The sample reported in this study, which combines both groups of data, therefore did not appear to have changed over time. Moreover, the overall demographic characteristics of our current sample were largely similar to what has been reported in the literature. The current sample found that 67% of the patients evaluated in the voice clinic were female. Previous studies have reported very similar percentages, ranging between 60% and 70% [26-31]. These gender differences have been explained previously as due to dissimilarities in laryngeal anatomy between males and females, where anatomical and resulting physiological differences put females at a greater risk for specific voice disorders [3,29-31]. Moreover, our sample showed similar age distributions as previous studies: over half of the patients in our sample were over 50 years old [26,29,30]. However, some studies have reported noticeably younger populations [27,28], possibly because of differences in the clinic settings from which epidemiological data were collected.

The current study found that the 'Other' category (25.33%) and non-specific dysphonia (24.66%) were the most prevalent disorders, followed by mid-membranous lesions (15.4%) and vocal fold immobility (14.54%), which is in accordance with our previously published report from approximately one-half of the current data set [5]. As the 'Other' category in the current study included multidimensional diagnoses (patients with multiple diagnoses, diagnoses with less than five cases, etc.) it is difficult to directly compare this category with previous literature.

However, the three most prevalent diagnoses besides the 'Other' category were very similar to what has been reported in published studies. Vocal fold nodules are often found to be one of the most prevalent diagnoses within a sample in a voice clinic. Reported percentages of patients presenting with vocal fold nodules have ranged between 10%-23% [26-30], which is comparable to the 15% we found in the current sample, although we also included other mid-membranous lesions, such as vocal fold cysts and polyps, in this group. Secondly, vocal fold immobility (vocal fold paralysis or paresis) has been reported to occur in 8% to 24% of patient populations [26-31], which is also comparable to our findings (14.45%).

Non-specific dysphonia, defined in this study as patients without observable laryngeal impairment or obvious functional components such as muscle tension dysphonia, was the diagnosis in 24.66% of the cases. While the terminology within the literature differs, percentages between 8% and 12% have been reported previously for similar diagnosis categories. Some studies found a markedly higher prevalence of muscle tension dysphonia than the current study [26,28,29]. The discrepancy between the current study and previously reported literature for non-specific dysphonia and muscle tension dysphonia may stem from differences in definitions and methodology. For patients diagnosed with atrophy, vocal cord dysfunction, muscle tension dysphonia, and patients who are transgender the prevalence was low, which is consistent with the literature [27,29,31]. It is important to note that all of the previously published literature reported data from academic medical centers or clinics led by ENTs. Our findings continue to support the supposition that clinical populations in an SLP-led private practice voice clinic are similar to patient populations in physician-led voice clinics. The results of our study did differ from data reported from insurance claims. Those studies have found acute laryngitis to be the most prevalent disorder diagnosis (42%-54%), followed by non-specific dysphonia (22%-31%) [32,33].

The current study found a significant positive effect of treatment for patients attending a private practice voice clinic. No significant differences were found among the diverse diagnoses. Therefore, the current study does not support the notion that the effect of therapy on voice disorders was dependent on the disorder type. However, our study sample included in the pre-treatment and post-treatment comparison was small: forty-seven participants divided over 6 groups of diagnoses. Studies with larger samples could provide a more representative indication

of therapy outcomes across diagnosis groups. Another possible explanation is within-group variability. The 'Other' group contained patients with multiple diagnoses as well as diagnoses with low prevalence. It is possible these different pathologies reacted differently to therapy and thus minimalized the effect of therapy within the group. Similarly, the mid-membranous lesions group contained patients with nodules, cysts, and polyps. Ogawa et al. [34] described the differential effects of treatment for patients with vocal fold polyps, nodules, and cysts. More specifically, cysts would not respond well to voice therapy [34]. Therefore, combining cysts with more manageable MML may have impacted the therapy outcome in this study.

The outcome of therapy was measured with the VHI and AVQI. We chose VHI as a treatment outcome measure in this study because this tool measures the patient's perception of their own voice problem and its ubiquitous use in diagnostic and treatment studies across the vocology and laryngology literature. Pre-to-post treatment changes of 18 points or greater in VHI scores are considered a meaningful treatment response for perceived vocal handicap [7]. Rosen et al. [35] and Bouwers et al. [36] found lower VHI scores after treatment in patient populations, and there were similar degrees of improvement in VHI scores across the two studies. However, both studies took place in an academic voice center and had surgery as one of the treatment options [35,36]. In the present study, post-treatment VHI scores for patients with mid-membranous lesions, vocal fold immobility, and atrophy or bowing all improved beyond the 18-point threshold. This finding supported our assumption that treatment administered by a clinician experienced in treating voice disorders in a private practice community voice clinic can be effective for reducing vocal handicap. The three diagnosis categories that did not improve by 18 VHI points or more included non-specific dysphonia, muscle tension dysphonia, and the 'Other' category. Although VHI treatment changes in patients within both of those diagnosis groups were statistically significant, the failure of those changes to reach the 18 point threshold may be due to (a) the non-specificity of the underlying impairment for the NSD group, which presented a barrier for developing targeted treatment plans that addressed a specific physiological imbalance, (b) the small number of patients with muscle tension dysphonia in the sample, and (c) the heterogeneity of patients within the 'Other' group, which included those with acute laryngitis, chronic cough, and vocal cord dysfunction among several other diagnoses.

The results of our investigation indicated that voice therapy significantly decreased AVQI measurements, indicating improvement, when comparing pre- and post-treatment values. AVQI has previously shown to be an effective tool for measuring acoustic indices of voice quality that change secondary to voice therapy [16]. The positive change in AVQI measures from our study aligns with findings from Chhetri and Gautam [37], who also found improvement in acoustic voice measures secondary to treatment. Meerschman et al. [38] also found improved AVQI scores, although the reported degree of improvement was not statistically significant in their traditional voice therapy group. In other trials with more specific therapy approaches, AVQI is often used as an outcome measure and has been shown to be sensitive to improved vocal function after voice therapy [9,39,40].

Interestingly, when using a cut-off score of 2.95 for the AVQI to distinguish normal from disordered voice quality [16], not all groups had an objective "normal" voice at voice treatment discharge. Patients in the diagnosis groups with vocal fold immobility, mid-membranous lesions, and atrophy or bowing still manifested acoustic measures above the AVQI threshold of normal. It is important to note that this threshold value has been validated in a Dutch-speaking population only, whereas the population evaluated in the clinic of this study were English speaking and the vast majority spoke English as a first language. The deviation of the patient's voices from normal at discharge could be explained by multiple factors. Firstly, vocal fold immobility, mid-membranous lesions, and atrophy or bowing are all three organic pathologies of the vocal folds. For these etiologies, voice treatment alone may not be sufficient to restore normal voice quality in a number of patients, who may need further medical treatment [41,42]. Ogawa et al. [34] have found mixed results for voice therapy in people with benign vocal fold lesions. In patients with vocal fold immobility, the effect of voice therapy as a primary treatment remains unclear [42]. For vocal fold bowing and/or atrophy, voice therapy by itself might only be effective in mild cases [43].

Secondly, dysphonic voice quality at discharge could be explained by the different criteria set for discharge when developing individualized voice treatment plans for specific patients. Normal voice quality is not the primary goal for the patient or voice therapist. Gillespie and Gartner-Schmidt [44] found that the 5 most important criteria for the discharge of a patient treated for a voice disorder were (a) independently using the new voice, (b) being able to

function in daily life with their new voice, (c) being able to differentiate the good from the bad voice as well as (d) taking responsibility for their voice, and (e) a better sounding voice than pre-therapy. Those authors suggested that for discharge, the patient's ability to generalize their skills to daily life is considered to be more important than acoustic outcomes [44]. Similar goals were reflected in the discharge criteria for many of the 52 patient sample receiving voice therapy in the current study, and could therefore further explain why AVQI scores for some patients were above the normal threshold.

Most studies that investigate therapy outcomes or effectiveness either focus on a specific population and/or a specific therapy technique within a fixed time frame and a controlled setting [1]. While this methodology is ideal to determine the effectiveness of therapy in these populations or with those techniques, it does not reflect typical speech-language pathology practice patterns. Multiple authors have recognized that SLPs use multiple direct voice therapy techniques in practice to accommodate a patient's needs [45-47]. The value of the current study is, therefore, that it looked at voice therapy outcomes in an ecologically valid manner. The patients were treated using an individualized treatment plan that often comprised multiple voice therapy techniques, which is reflective of real-world clinical practice. The current study provides support for the notion that voice therapy is effective, even when multiple therapy techniques are employed, and when those specific combinations of techniques are different for each patient. Our findings thus suggest that voice therapy can be effective in a private practice community voice clinic led by an SLP.

It is important to note that a substantial number of the patients evaluated in the discussed private practice community voice clinic did not undergo voice therapy. There are several barriers to the implementation of voice therapy in treatment-seeking populations: the patient may not want to participate in treatment because he/she did not understand the purpose of therapy; the patient might believe that behaviors targeted in voice therapy will not translate to daily life; the patient may perceive the exercises targeted in therapy are strange or hard; or because the patient wants to wait to see if the voice impairment will spontaneously recover [48]. Van Leer and Connor [49] have concluded that voice therapy requires substantial resources of the patient, including motivation, self-regulation, and the ability to form a productive relationship with the

therapist. Moreover, insurance coverage and travel requirements have also been reported as patient barriers to participation in voice therapy [50].

The current retrospective study design presented a number of limitations that must be considered. Firstly, treatment plans were individualized based on the patient's needs and goals, and as such the specific therapeutic approaches used were not identical from patient to patient. While this reflects real-world clinical practice, it did not allow us to compare one treatment approach or technique to another. We were unable to determine if voice treatment outcome was influenced by medical or surgical treatment, as not all patient records available in the private practice clinic had surgical notes if the patient previously underwent surgical intervention. Moreover, the data for this study was gathered by the SLP who treated the patients. This could bias the findings of the study, as the therapist was not blinded for the diagnosis of the participant. Another limitation is that voice therapy outcome data were available for only 292 patients, of which only 48 could be included in the treatment outcomes analysis. A reason for this is that post-therapy acoustic and VHI data were not always collected at the moment of therapy discharge for each patient seen in this clinic. This resulted in a limited sample size for that part of the analysis. To address the limitations noted above, future research can utilize a prospective methodology to better control for factors that influence data collection and treatment outcomes.

CONCLUSION

The current study aimed to investigate the epidemiological patterns as well as the effectiveness of voice therapy for patients referred to a private practice community voice clinic. The patient characteristics and diagnosis patterns found in the current study were comparable to previously reported data from a smaller sample of the same population. Across the whole sample, diagnoses in the 'Other' category, mid-membranous lesions, and non-specific dysphonia were the most common. The different diagnoses presented with diverse VHI and AVQI ratings, although the CAPE-V ratings were similar across diagnoses. For 48 patients who received at least three sessions of voice therapy, measures of VHI and AVQI improved significantly at post-treatment, although the degree of improvement was not the same for all disorder diagnosis categories. Collectively, the results of this study indicated that voice therapy in a community private practice voice clinic is effective for improving acoustic voice measures and self-perceived voice handicap.

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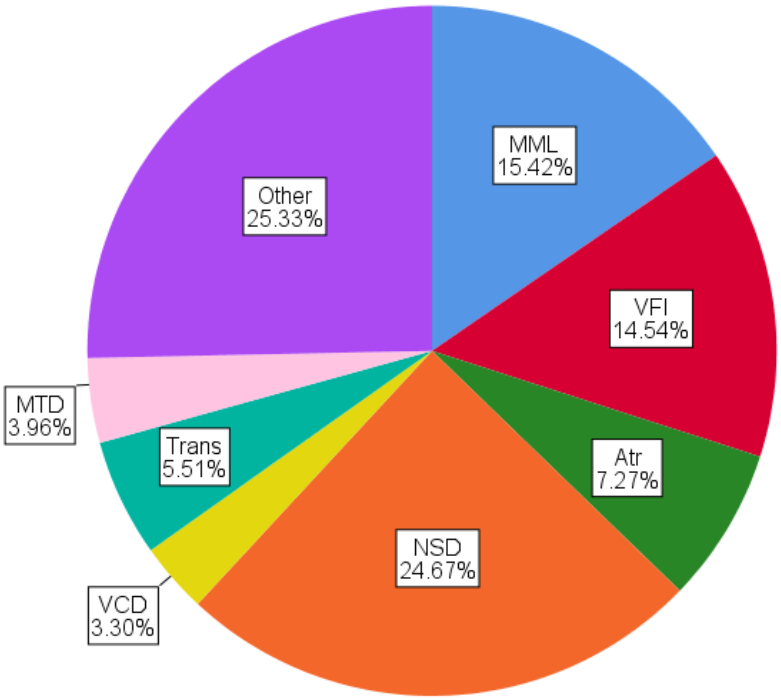
Figure 1

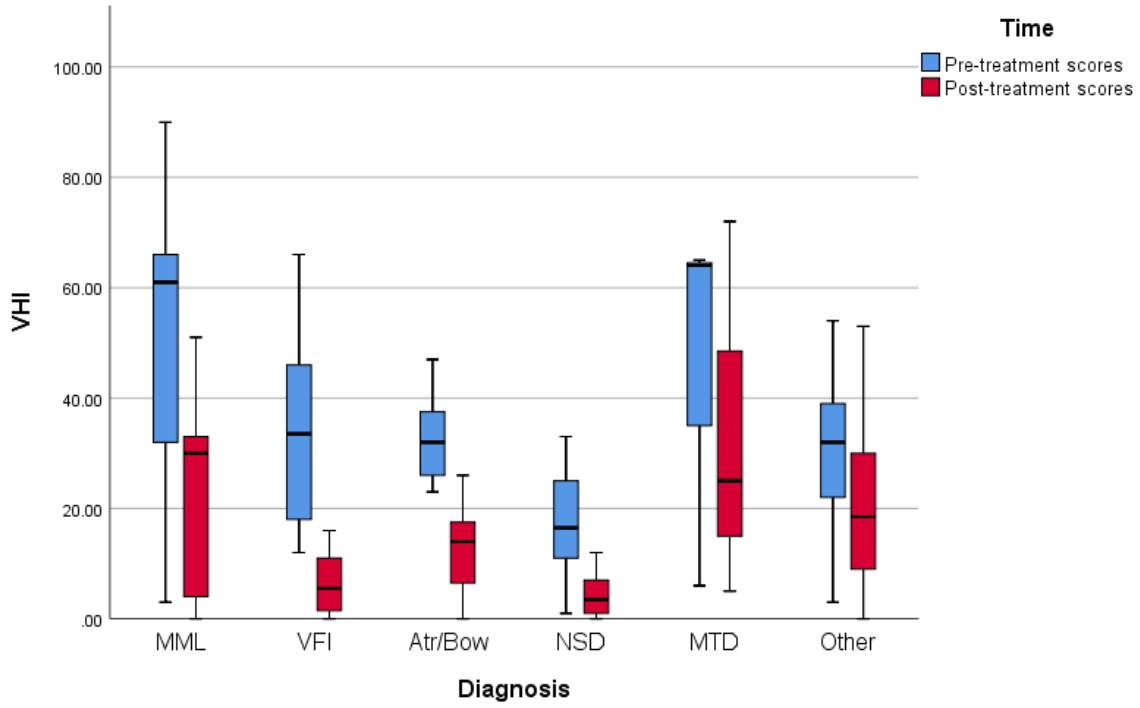
Pie chart describing the prevalence of each diagnosis across the whole sample.



Note. MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia, VCD = vocal cord dysfunction, Trans = patient who is transgender, MTD = muscle tension dysphonia.

Figure 2

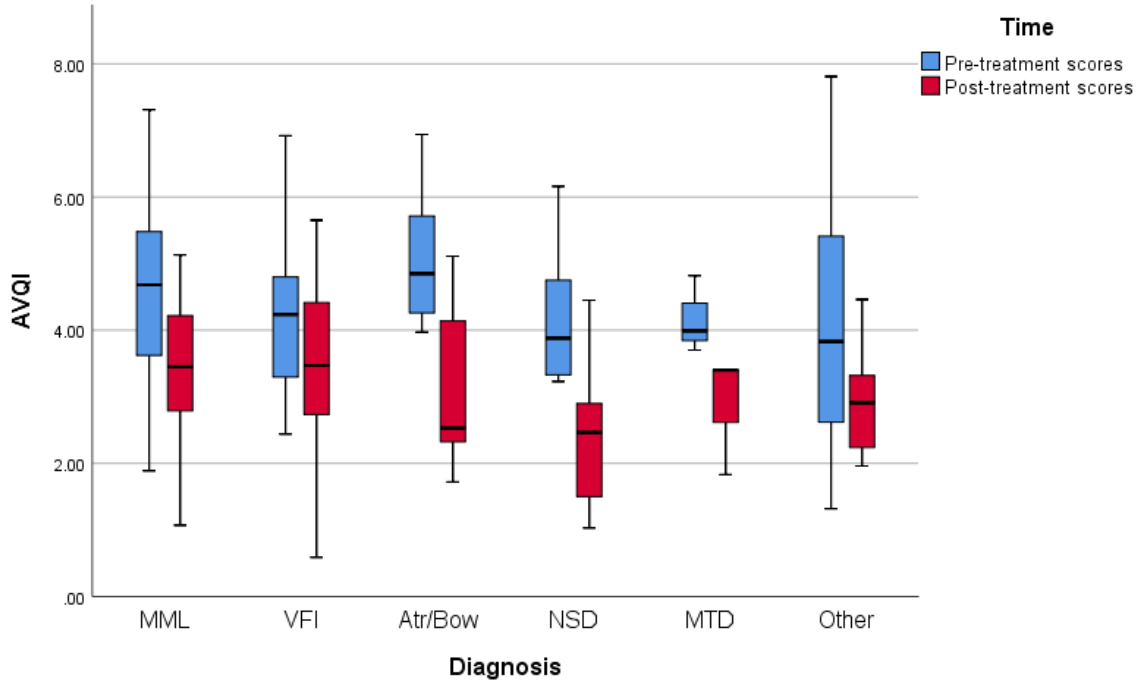
Boxplots of the VHI scores pre and post-therapy. The scores pre-therapy are represented by the left, blue boxplots, while the post-therapy scores are the right, red boxplots. The upper line of the colored box represents the third quartile (percentile 75), the middle line represents the median, while the lower line represents the first quartile (percentile 25). The ends of the whiskers designate the minimum and maximum values within 1.5x the interquartile range.



Note. VHI = Voice Handicap Index, MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia, VCD = vocal cord dysfunction, Trans = patient who is transgender, MTD = muscle tension dysphonia.

Figure 3

Boxplots of the AVQI scores pre and post-therapy. The scores pre-therapy are represented by the left, blue boxplots, while the post-therapy scores are the right, red boxplots. The upper line of the colored box represents the third quartile (percentile 75), the middle line represents the median, while the lower line represents the first quartile (percentile 25). The ends of the whiskers designate the minimum and maximum values within 1.5x the interquartile range.



Note. AVQI = Voice Handicap Index, MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia, VCD = vocal cord dysfunction, Trans = patient who is transgender, MTD = muscle tension dysphonia.

Table 1
Cross-tabulation of disorder diagnosis, age categories, and gender of the whole sample.

Diagnosis	**Gender**	**<20**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥70**	***Total***
MML	**Male**	1 (0.2%)	0 (0%)	2 (0.4%)	5 (1.1%)	2 (0.4%)	2 (0.4%)	2 (0.4%)	*14 (3.1%)*
	Female	4 (0.9%)	9 (2.0%)	14 (3.1%)	15 (3.3%)	10 (2.2%)	3 (0.7%)	1 (0.2%)	*56 (12.3%)*
	Total	*5 (0.11%)*	*9 (2.0%)*	*16 (3.5%)*	*20 (4.4%)*	*12 (2.6%)*	*5 (0.11%)*	*3 (0.7%)*	***70 (15.4%)***
VFI	**Male**	1 (0.2%)	1 (0.2%)	0 (0%)	4 (0.9%)	0 (0%)	4 (0.9%)	5 (1.1%)	*15 (3.3%)*
	Female	2 (0.4%)	1 (0.2%)	2 (0.4%)	9 (2.0%)	11 (2.4%)	11 (2.4%)	15 (3.3%)	*51 (11.2%)*
	Total	*3 (0.7%)*	*2 (0.4%)*	*2 (0.4%)*	*13 (2.9%)*	*11 (2.4%)*	*15 (3.3%)*	*20 (4.4%)*	***66 (14.5%)***
Atr	**Male**	0 (0%)	0 (0%)	0 (0%)	1 (0.2%)	1 (0.2%)	5 (1.1%)	8 (1.8%)	*15 (3.3%)*
	Female	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (1.3%)	12 (2.6%)	*18 (4.0%)*
	Total	*0 (0%)*	*0 (0%)*	*0 (0%)*	*1 (0.2%)*	*1 (0.02%)*	*11 (2.4%)*	*20 (4.4%)*	***33 (7.3%)***
NSD	**Male**	1 (0.2%)	4 (0.9%)	2 (0.4%)	7 (1.5%)	3 (0.7%)	10 (2.2%)	9 (1.9%)	*36 (7.9%)*
	Female	3 (0.7%)	9 (2.0%)	6 (1.3%)	8 (1.8%)	22 (4.8%)	14 (3.1%)	14 (3.1%)	*76 (16.7%)*
	Total	*4 (0.9%)*	*13 (2.9%)*	*8 (1.8%)*	*15 (3.3%)*	*25 (5.5%)*	*28 (6.1%)*	*23 (5.1%)*	***112 (24.7%)***
VCD	**Male**	0 (0%)	0 (0%)	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	1 (0.2%)	*3 (0.7%)*
	Female	5 (1.1%)	0 (0%)	2 (0.4%)	3 (0.7%)	1 (0.2%)	1 (0.2%)	0 (0%)	*12 (2.6%)*
	Total	*5 (1.1%)*	*0 (0%)*	*3 (0.7%)*	*4 (0.9%)*	*1 (0.2%)*	*1 (0.2%)*	*1 (0.2%)*	***15 (3.3%)***
Trans	**Male**	7 (1.5%)	8 (1.8%)	7 (1.5%)	1 (0.2%)	1 (0.2%)	0 (0%)	0 (0%)	*24 (5.3%)*
	Female	0 (0%)	0 (0%)	1 (0.2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	*1 (0.2%)*
	Total	*7 (1.5%)*	*8 (1.8%)*	*8 (1.8%)*	*1 (0.2%)*	*1 (0.2%)*	*0 (0.0%)*	*0 (0%)*	***25 (5.5%)***
MTD	**Male**	0 (0%)	0 (0%)	1 (0.2%)	0 (0%)	0 (0%)	1 (0.2%)	0 (0%)	*2 (0.4%)*
	Female	2 (0.4%)	2 (0.4%)	1 (0.2%)	5 (1.1%)	1 (0.2%)	2 (0.4%)	3 (0.7%)	*16 (3.5%)*
	Total	*2 (0.4%)*	*2 (0.4%)*	*2 (0.4%)*	*5 (1.1%)*	*1 (0.2%)*	*3 (0.7%)*	*3 (0.7%)*	***18 (4.0%)***
Other	**Male**	2 (0.4%)	3 (0.7%)	4 (0.9%)	5 (1.1%)	11 (2.4%)	7 (1.5%)	7 (1.5%)	*39 (8.6%)*
	Female	2 (0.4%)	2 (0.4%)	4 (0.9%)	9 (2.0%)	12 (2.6%)	27 (5.9%)	20 (4.4%)	*76 (16.7%)*
	Total	*4 (0.9%)*	*5 (1.1%)*	*8 (1.8%)*	*14 (3.1%)*	*23 (5.1%)*	*34 (7.5%)*	*27 (5.9%)*	***115 (25.3%)***
Total	***Male***	*12 (2.6%)*	*16 (3.5%)*	*17 (3.7%)*	*24 (5.3%)*	*18 (4.0%)*	*29 (6.4%)*	*32 (7.0%)*	***148 (32.6%)***
	Female	*18 (4.0%)*	*23 (5.1%)*	*30 (6.6%)*	*49 (10.8%)*	*57 (12.6%)*	*64 (14.1%)*	*65 (14.3%)*	***306 (67.4%)***
	Total	***30 (6.6%)***	***39 (8.6%)***	***47 (10.4%)***	***73 (16.08%)***	***75 (16.5%)***	***93 (20.5%)***	***97 (21.4%)***	**454 (100%)**

Note. MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia, VCD = vocal cord dysfunction, Trans = patient who is transgender, MTD = muscle tension dysphonia.

Table 2

Means and standard deviations of quantitative variables for each diagnosis group. Age is reported in years. VHI scores range between 0 (no perceived handicap) to 120 (maximal perceived handicap). CAPE-V scores range between 0 (no deviation from normal) to 100 (maximal deviation from normal). AVQI score range from 0 (good voice quality) to 10 (bad voice quality).

	Age	**VHI**	**CAPE-V**	**AVQI**
MML	42.76 (14.71)	39.20 (27.37)	50.44 (25.03)	3.90 (1.68)
VFI	58.74 (16.25)	36.64 (23.11)	50.94 (26.65)	4.72 (2.00)
Atr/Bow	74.57 (8.12)	33.07 (15.39)	49.00 (23.18)	4.50 (1.57)
NSD	54.30 (18.82)	22.72 (16.65)	41.22 (25.98)	3.76 (1.60)
VCD	31.50 (24.75)	39.00 (16.97)	46.50 (45.96)	5.20 (0.22)
Trans	28.29 (10.12)	24.18 (21.53)	52.41 (35.85)	3.00 (1.10)
MTD	45.55 (14.46)	34.30 (22.43)	41.00 (27.04)	2.99 (0.97)
Other	57.93 (16.36)	27.94 (20.92)	45.20 (29.88)	4.13 (2.09)
Total	*52.46 (19.40)*	*30.45 (21.98)*	*46.58 (27.42)*	*4.04 (1.81)*

Note. MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia, VCD = vocal cord dysfunction, Trans = patient who is transgender, MTD = muscle tension dysphonia.

Table 3

Means and standard deviations for pre- and post-therapy scores for each group included in the analysis. VHI scores range between 0 (no perceived handicap) to 120 (maximal perceived handicap). AVQI score range from 0 (good voice quality) to 10 (bad voice quality).

Diagnosis	**n**	**Pre VHI**	**Post VHI**	**Pre AVQI**	**Post AVQI**
ML	9	49.78 (28.91)	21.89 (19.10)	4.60 (1.74)	3.43 (1.29)
VFI	8	34.12 (18.61)	6.50 (5.73)	4.25 (1.38)	3.44 (1.61)
Atr/Bow	7	32.71 (8.98)	12.57 (8.83)	5.10 (1.11)	3.18 (1.28)
NSD	10	20.60 (18.61)	4.70 (3.92)	4.06 (1.48)	2.43 (1.14)
MTD	3	45.00 (33.78)	34.00 (34.40)	4.17 (0.58)	2.88 (0.91)
Other	10	30.20 (14.20)	21.00 (16.17)	4.28 (2.27)	2.96 (0.81)
Total	*47*	*33.89 (21.55)*	*14.81 (16.17)*	*4.40 (1.60)*	*3.05 (1.20)*

Note. MML = mid-membranous lesion, VFI = vocal fold immobility, Atr/Bow = atrophy or bowing, NSD = non-specific dysphonia.