Development of an Electronic Documentation System for Voice Therapy: A New Teaching and Clinical Research Tool

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Abstract

Although research on the outcomes of the treatment of voice disorders is widely discussed, there is a lack of information regarding the specifics of the methods and tasks undertaken during the therapy sessions. One reason may be a lack of a clear, standardized method of documentation for the voice therapy. Therefore, this article discusses the development of a new electronic documentation system for voice therapy. The goals of this documentation system are to create a user-friendly, flexible system that implements the standard terminology and structure proposed in the recent voice therapy taxonomy (Van Stan, Roy, Awan, Stemple, & Hillman, 2015). This documentation system stores all the information from the therapy session in a local database, which is accessible for analysis within or between patients. This allows large-scale datasets to be compiled for future clinical research. This documentation system includes definitions for all terminology and includes hierarchies, which are not required, but can be followed for additional structure. This documentation system can be used as a teaching tool, with the ability to accommodate the needs of both the novice and expert clinician.

Much of the current research on the treatment of voice disorders focuses on the outcome of voice therapy. However, unless discussing a new voice-specific therapy method, the details of voice therapy are often not explicitly addressed. Without documentation of the methodologies and

tasks undertaken in an outcome study, it is difficult to clearly state which elements of voice therapy may have contributed to any changes in vocal function. This not only poses difficulty in terms of research repeatability, but clinically, this hinders the ability of expert and novice clinicians alike to effectively utilize and learn from evidence-based practice.
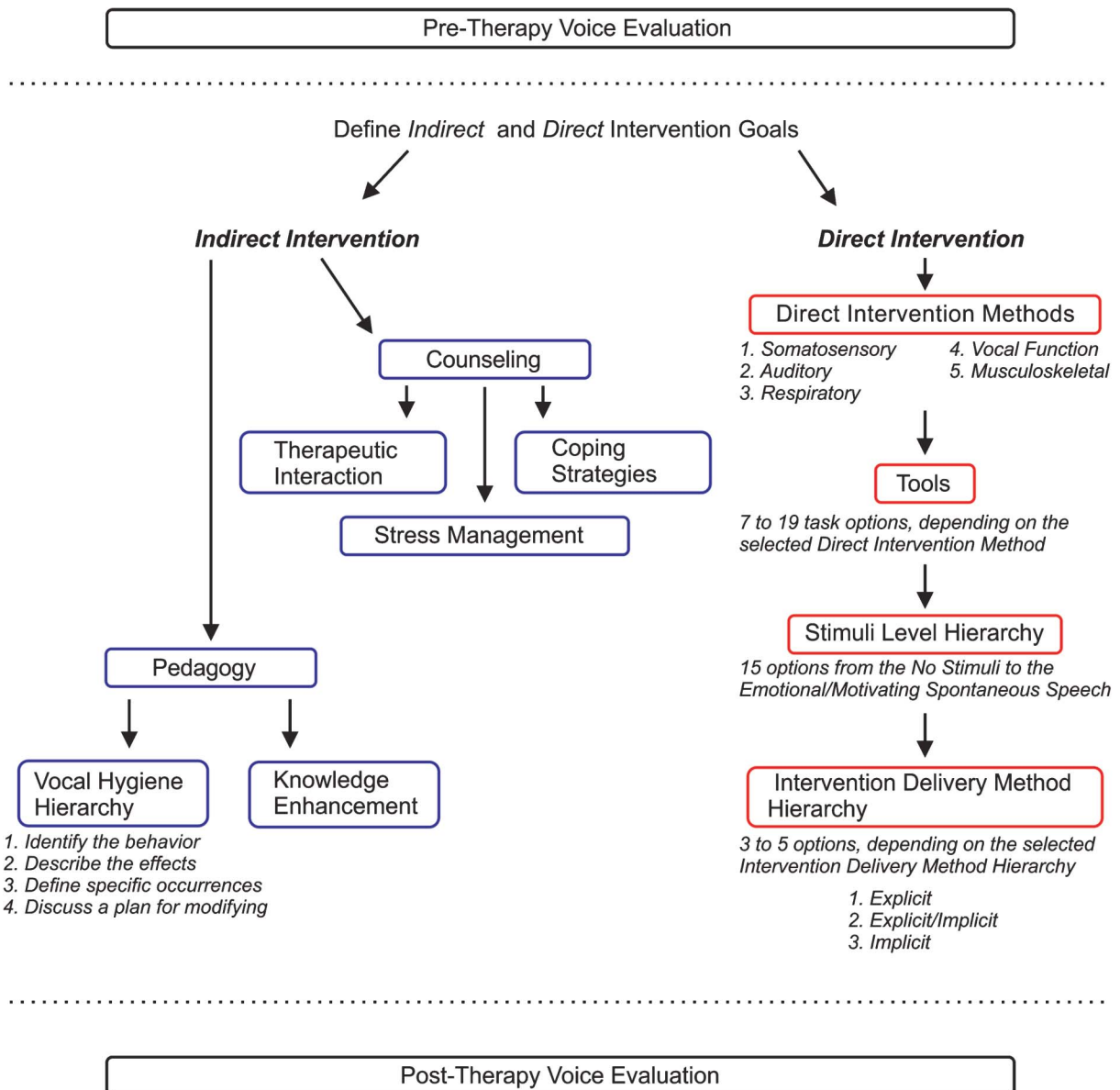
One possible explanation for the lack of details regarding voice therapy in many of the current articles is a lack of a standardized documentation system for voice therapy. Thus, the aim of our current project was to design an easy-to-use and flexible voice therapy documentation system. The goals of this documentation system were three-fold: (1) to allow the user to document the contents of every voice therapy session, (2) to provide a venue to compile information about the contents of therapy sessions across multiple patients into a central location, and (3) to provide adequate information to allow the documentation system to be used as a teaching tool for novice clinicians.

This paper delineates the development of this new voice therapy documentation system. After initial development, the documentation system terminology was adjusted to be consistent with the recently proposed taxonomy and unification of the voice therapy nomenclature (Van Stan, Roy, Awan, Stemple, & Hillman, 2015). All items listed below in italics (*sample*) are consistent with the definitions in the proposed voice taxonomy (see Van Stan et al., 2015 for all definitions). Portions of the documentation system that were not related to the voice taxonomy or not discussed in the voice taxonomy paper are clearly indicated with text that is italicized and underlined (*sample*). The first iteration of this documentation system was a paper version, which was piloted by a licensed speech-language pathologist (SLP) with three individuals with voice disorders. Following the pilot study, the paper version was refined and converted into an electronic version. This article discusses the development of the paper documentation system, a case-series utilizing the paper documentation system, a qualitative evaluation of the initial system, explanation of refinements to the electronic documentation system, utility of the documentation system, and future directions.

Development of the Documentation System

The original version of the documentation system included a pre- and post-therapy voice evaluation based on the recently proposed standards for a voice evaluation (Awan et al., 2015). Although the nature of this article precludes a detailed discussion of voice evaluations, the system is designed to be compatible with both pre- and post-therapy evaluations. The overall structure of the documentation system is outlined in Figure 1, including both *Direct Intervention* and *Indirect Intervention.*

Figure 1. *Documentation System Flow Chart. Boxes between the dotted lines are included in the documentation system.*

Pre-Therapy Voice Evaluation

Define *Indirect* and *Direct* Intervention Goals

Indirect Intervention

Counseling

Therapeutic Interaction

Coping Strategies

Stress Management

Pedagogy

Vocal Hygiene Hierarchy

Knowledge Enhancement

1. Identify the behavior
2. Describe the effects
3. Define specific occurrences
4. Discuss a plan for modifying

Direct Intervention

Direct Intervention Methods

1. Somatosensory   4. Vocal Function
2. Auditory   5. Musculoskeletal
3. Respiratory

Tools

7 to 19 task options, depending on the selected Direct Intervention Method

Stimuli Level Hierarchy

15 options from the No Stimuli to the Emotional/Motivating Spontaneous Speech

Intervention Delivery Method Hierarchy

3 to 5 options, depending on the selected Intervention Delivery Method Hierarchy

1. Explicit
2. Explicit/Implicit
3. Implicit

Post-Therapy Voice Evaluation

Indirect Intervention

Documentation of *Indirect Intervention* is structured to provide the opportunity to record information regarding both *Pedagogy* and *Counseling. Pedagogy* includes (1) *Vocal Hygiene* and (2) *Knowledge Enhancement. Counseling* includes (1) *Therapeutic Interaction,* (2) *Stress Management,* and (3) *Coping Strategies.* Based on the guidelines proposed by Stemple, Glaze, and Gerdeman (2000), a <u>*Vocal Hygiene Hierarchy*</u> is included. The clinician is not obligated to follow or use the hierarchy; however the documentation system provides space to record the following if desired: (1) identify the aberrant behavior, (2) describe the effects of the behavior, (3) define specific

65

occurrences of the behavior, and (4) discuss a plan for modifying the behavior, eliminating the behavior, or modifying the environment (Stemple et al., 2000).

Direct Intervention

Documentation of *Direct Intervention* includes the selection of goals, the modality or modalities implemented to target the goal (i.e., *Direct Intervention Method*), the specific *Tool* used, the level of stimuli (e.g., two-syllable words, phrases), and the *Intervention Delivery Method.* In the remainder of this article, the <u>Task</u> will indicate a combination of the selected *Direct Intervention Method, Tool, <u>Stimuli Level</u>*, and *Intervention Delivery Method.* All *Direct Intervention Methods, Tools,* and *Intervention Delivery Methods* are consistent with the terminology and definitions proposed by Van Stan et al. (2015). However, at all points in the documentation system, there is always an option to choose <u>Other</u>, allowing full autonomy on the part of the clinician.

The five *Direct Intervention Methods* in the documentation system are: *Somatosensory, Auditory, Respiratory, Vocal Function, and Musculoskeletal.* Each *Direct Intervention Method* is comprised of descriptive categories (see Van Stan et al., 2015 for full details). For example, the *Somatosensory* method includes the descriptive categories *Discrimination, Nociception,* and *Visual Processing.* Each descriptive category contains suggested *Tools.* For example, the *Discrimination* category includes *Videos, Drawings*, and *Mirror Use.* It should be noted that some *Tools* belong in more than one category or under more than one *Direct Intervention Method.* For example, *Pitch Changes* is a *Tool* that is categorized under the *Direct Intervention Methods* of *Auditory* and *Vocal Function.*

Following the selection of the *Direct Intervention Method(s)* and *Tool(s),* the clinician documents the stimuli level from the <u>Stimuli Level Hierarchy</u>, which ranges from "no stimuli" to "emotionally/motivating spontaneous speech." The clinician is not required to follow the <u>Stimuli Level Hierarchy</u>, and can use any level of stimuli at any time. Therefore, methods of voice therapy which do not use a hierarchy and focus more on conversational speech (e.g., Gartner-Schmidt et al., 2015) can still be documented with this system. The clinician then selects the *Intervention Delivery Method*, which encompasses the structure with which the clinician chooses to deliver the intervention *Tool* (Van Stan et al., 2015). The documentation system orders the 11 *Intervention Delivery Methods* into an <u>Intervention Delivery Method Hierarchy</u>, which moves from extrinsic clinician-applied methods, to a combined extrinsic/intrinsic approach, to intrinsic, patient-applied methods. Similar to the <u>Stimuli Level Hierarchy</u>, the clinician is not obligated to follow the suggested hierarchy and can use any *Intervention Delivery Methods* at any point.

Case Series: Piloting the Initial Paper Documentation System

A certified SLP and two graduate student interns piloted the paper version of this documentation system with three patients Pt1, Pt2, and Pt3 (all female, M=25 years old). All three patients were seen in the Boston University Academic Speech, Language, and Hearing Center from Fall 2014 to Spring 2015. Two patients (Pt1 and Pt3) had diagnoses of muscle tension dysphonia and one patient (Pt2) had a diagnosis of vocal fold nodules; all diagnoses were made by a laryngologist prior to the start of therapy. The clinician used the paper documentation system for 6 weeks of voice therapy. Voice evaluations were completed before and after 6 weeks of voice therapy. Patient Pt2 did not return after Week 4, and therefore results from her therapy sessions only represent the first 4 weeks of therapy.

Following an initial pre-therapy voice evaluation, the clinician defined *Indirect* and *Direct Intervention* <u>Goals</u> for the patient. In this initial iteration of the documentation system, the clinician selected from a relevant list of goals, ordering the goals in manner that was individualized to appropriately fit the patient. The clinician first provided *Knowledge Enhancement* and appropriate *Counseling* to the patient. Next the clinician addressed the *Indirect Intervention* goals by following the <u>Vocal Hygiene Hierarchy</u>. Following the completion of all *Indirect Intervention* goals, the clinician

66

selected the *Direct Intervention Method(s), Tools,* and <u>*Stimuli Level*</u> for each *Direct Intervention* goal. Next, the clinician followed an initial version of the <u>*Intervention Delivery Method Hierarchy*</u> that included five items: (1) *Teaching*, (2) M*odeling*, (3) A*ugmented Feedback*, (4) S*elf-Evaluation*, and (5) S*elf-Correction*. The <u>*Intervention Delivery Method Hierarchy*</u> was later expanded to encompass all *Intervention Delivery Methods* outlined in Van Stan et al. (2015). At each level of the <u>*Intervention Delivery Methods Hierarchy*</u>, the clinician marked each attempt as correct or incorrect, providing a record of the patient's performance on the given <u>*Task*</u>. Advancement through the <u>*Intervention Delivery Method Hierarchy*</u> was standardized based on client performance.

Following the completion of the pilot testing, the documentation of which <u>*Task*</u>s were completed during the *Direct Intervention* portion of the therapy sessions was compiled from the paper documentation system and patients' charts. *Indirect Intervention* was also targeted and documented for all individuals, but those results are not discussed in the current article. The clinician focused on maintaining appropriate voice quality for Pt1, Pt2, and Pt3. Therapy sessions with Pt2 also focused on adequate respiratory support and appropriate posture. For Pt1, the clinician chose the *Direct Intervention Methods* of *Somatosensory, Auditory,* and *Vocal Function* to target vocal quality, utilizing the *Tools* of *Tactile*, *Placement*, *Intensity Changes,* and *Glottal Stops.* For Pt2 the clinician selected the *Direct Intervention Methods* of *Somatosensory* and *Vocal Function* to target vocal quality, employing the *Tools* of *Tactile*, *Easy Onset,* and *Glottal Stops.* For Pt3 the clinician used all five *Direct Intervention Methods* to target vocal quality, breath support, and posture, with the T*ools* of *Tactile, Pitch Changes, Abdominal Breathing, Held Voice,* and *Body Posture* (See Table 1).

Table 1. Summary of Direct Intervention Methods and *Tools* Used With Each of the Three Patients.

	Pt1	Pt2	Pt3
Direct Intervention Method			
Somatosensory	1) Tactile 2) Placement 3) **Intensity Changes**	1) Tactile	1) Tactile
Auditory	1) **Intensity Changes**	1) **Pitch Changes**	
Respiratory		1) Abdominal Breathing 2) Held Voice	
Vocal Function	1) Glottal Stop	1) **Pitch Changes**	1) Glottal Stop 2) Easy Onset
Musculoskeletal		1) Body Posture	

*Tools that are **bolded** are categorized under more than one Direct Intervention Method.*

Motivation for Electronic Format

The initial documentation system involved the use of a substantial amount of paper, providing multiple opportunities for confusion and/or for loss of documents. This became apparent in the piloting of the documentation system and resulted in the necessity to corroborate some information recorded using the documentation system with the notes written in the patients' charts. Due to this time-consuming redundancy, we sought to implement an electronic documentation system that automatically saves all relevant therapy information. Additionally, the original documentation system did not have clear links to definitions and instructions, resulting in the clinician mislabeling or misunderstanding of some elements of the documentation system. As
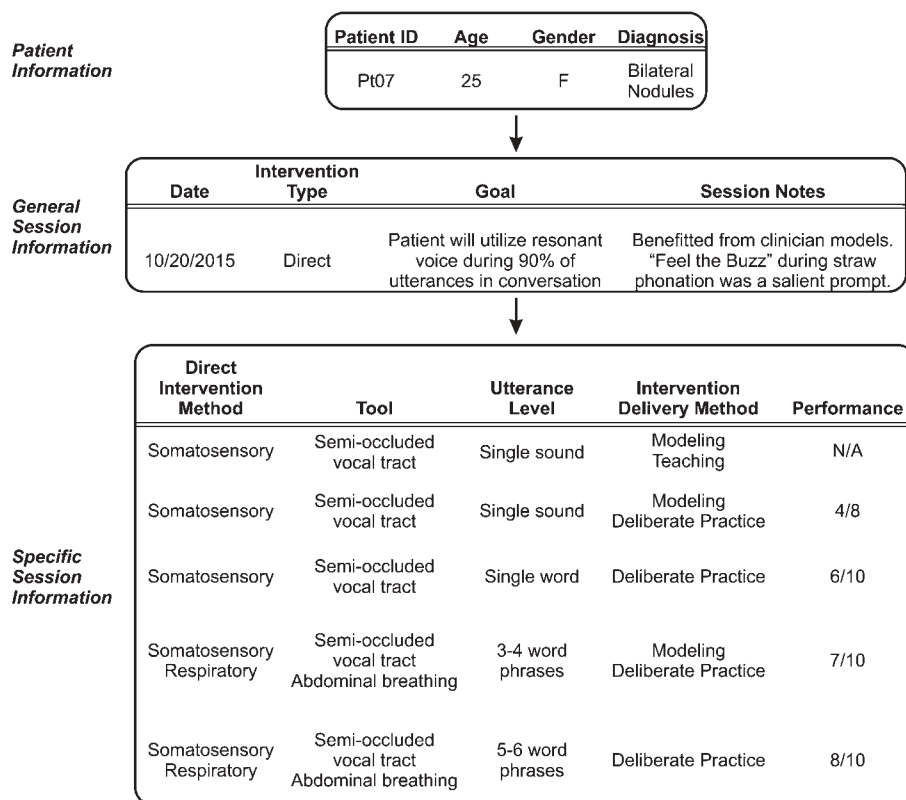
67

discussed below, the current electronic version provides definitions and instructions for all aspects of documentation system which can be accessed through a "Help" menu.

Development of the Electronic Documentation System

The electronic documentation system (developed in Javascript, HTML, CSS, and SQL on the Cordova/PhoneGap platform) is a mobile application optimized for Windows Phone and both Apple and Android phones and tablets. The application targets a mobile platform in order to enable clinicians to document during sessions without interfering with patient interaction. To ensure patient confidentiality, all patient data is anonymized by the use of a patient ID rather than name or other identifying information. In addition, therapy activities are stored on the local device used during therapy; that is, no data is automatically electronically shared. If the clinician chooses to share the information, the database may be exported via email in order to enable further analysis on a larger scale.

When beginning a therapy session with a new patient, the clinician is guided to enter the patient's basic information such as de-identified patient ID, age, gender, and diagnosis, which are then stored in the database (See Figure 2). Determination of the patient ID is at the discretion of the treating clinician, thereby allowing the patient information to be found easily by the clinician and reducing the loss of confidentiality to an outside source.
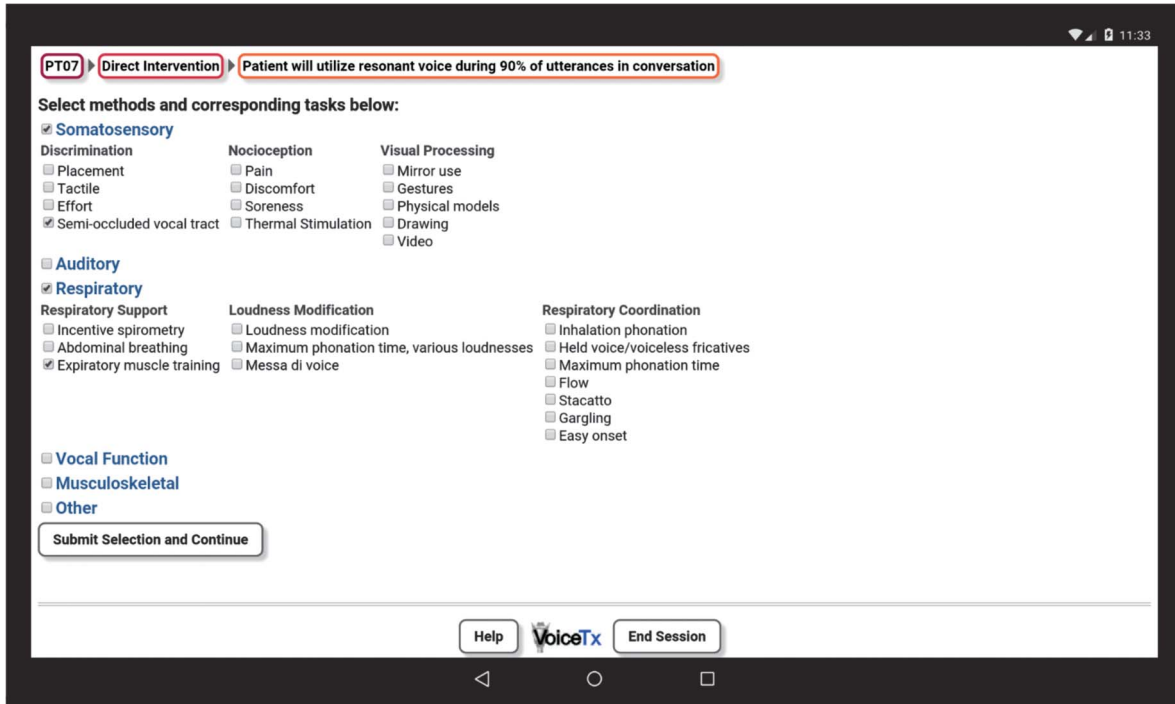
Figure 2. Schematic of the Information Included in the End-of-Session Report.

Patient Information

Patient ID	Age	Gender	Diagnosis
Pt07	25	F	Bilateral Nodules

General Session Information

Date	Intervention Type	Goal	Session Notes
10/20/2015	Direct	Patient will utilize resonant voice during 90% of utterances in conversation	Benefitted from clinician models. "Feel the Buzz" during straw phonation was a salient prompt.

Specific Session Information

Direct Intervention Method	Tool	Utterance Level	Intervention Delivery Method	Performance
Somatosensory	Semi-occluded vocal tract	Single sound	Modeling Teaching	N/A
Somatosensory	Semi-occluded vocal tract	Single sound	Modeling Deliberate Practice	4/8
Somatosensory	Semi-occluded vocal tract	Single word	Deliberate Practice	6/10
Somatosensory Respiratory	Semi-occluded vocal tract Abdominal breathing	3-4 word phrases	Modeling Deliberate Practice	7/10
Somatosensory Respiratory	Semi-occluded vocal tract Abdominal breathing	5-6 word phrases	Deliberate Practice	8/10

The clinician then creates *Direct Intervention* and *Indirect Intervention* goals. The device use stores all goals and makes them available for future use. Following goal selection, the clinician
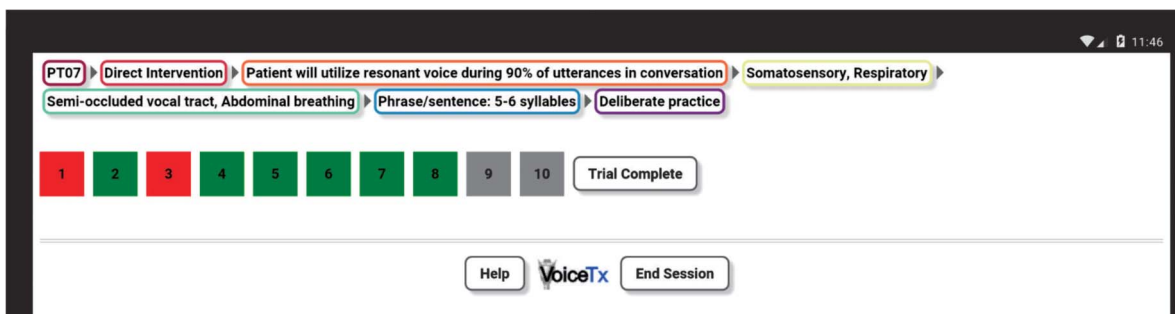
68

selects the desired *Direct Intervention Method(s), Tool(s)* (See Figure 3), stimuli level, and *Intervention Delivery Method(s).*

Figure 3. Sample Selection of Intervention Delivery Methods and Tools on the Electronic Documentation System.

As with the goals, the clinician may enter unique *Tools,* stimuli levels, or *Intervention Delivery Methods,* which are added to the database and stored for future use. During the course of therapy, all *Tasks*, performance on a given *Task* (See Figure 4), and decisions made about how to move through therapy are saved in the database. At the end of each session, the clinician may choose to export all the notes from the session, which can be used to compile the office clinical report (see Figure 2). All information is saved in the database, linked to the patient's ID, allowing the entire saved database to be accessed by the clinician at any point.

Figure 4. Sample Tracking of Performance on the Electronic Documentation System.

69

Transition from Paper Documentation System to Electronic Format

The initial paper documentation system required structure in order to guide the clinician through the documentation system. Although this structure was necessary to implement the paper version of the system, there was limited flexibility, thus leading to some clinician non-compliance through error. Therefore, the electronic format gives clinicians complete autonomy and flexibility when using the documentation system, avoiding any potential disruption to quality care. However, although clinicians are no longer forced to follow a structure or hierarchy, these hierarchies (i.e., _Vocal Hygiene Hierarchy_, _Intervention Delivery Method Hierarchy_, and the _Stimuli Level Hierarchy_) are still available for reference in the documentation system.

These hierarchies may provide particular benefits to new clinicians. During the initial stages of learning how to provide quality voice therapy, having a clear structure can assist new clinicians with learning how to scaffold a therapy session. The use of a hierarchy as a teaching tool has been examined in other domains of speech-language therapy, for example the Clinician Directed Hierarchy (Duthie, 2008; Duthie & Montgomery, 2013). The Clinician Directed Hierarchy was designed as a training tool to guide students through intervention, assisting the student in determining the appropriate support and therapies for a specific patient (Duthie, 2008). Students who used the Clinician Directed Hierarchy and received feedback from their supervising clinicians had greater improvements in clinical competency skills than students who solely received feedback without access to the Clinician Directed Hierarchy (Duthie & Montgomery, 2013). As new clinicians become more knowledgeable and skilled in providing voice therapy, using the structure and suggested hierarchy could be discontinued if desired.

Utility of the Documentation System: Teaching Tool

It is an issue of great importance to ensure that speech-language pathology graduate students develop competencies in a variety of areas, allowing them to adapt to have sufficient knowledge and competency to effectively provide therapeutic services after graduation. The field of speech-language pathology is continually changing and evolving, posing challenges for the clinical teacher to ensure their student clinicians gain the appropriate competencies (Anderson, 2001; Brumfitt, Hoben, Enderby, & Goddard, 2001). Additionally, in specialized areas such as voice disorders there are other barriers, such as minimal access to voice patients, lack of advanced clinical instrumentation, lack of access to expert voice clinicians, and lack of funding for instrumentation and expert faculty (Teten, DeVeney, & Friehe, 2013). To ensure students were knowledgeable in the area of voice disorders, Teten and colleagues proposed a competency checklist for voice disorders, with each item on the checklist associated with one or more American Speech-Language-Hearing Association (ASHA) Knowledge and Skill Acquisition standards (Council for Clinical Certification in Audiology and Speech-Language Pathology of the American Speech-Language-Hearing Association, 2013; see Teten et al., 2013 for full voice checklist). We propose that use of the documentation system will assist the novice clinician in achieving and tracking many of these proposed competencies. Below are four examples of how use of this type of documentation system could directly contribute to helping the new clinician achieve competencies in multiple areas of voice therapy. This is not meant to be a comprehensive list of the clinical teaching possibilities, but it is rather meant to provide a window into how this documentation system could be used as a teaching tool. All competencies below are taken from the proposed voice checklist (Teten et al., 2013).

1. **Plans and implements a treatment program to address the individual needs of the patient and communication styles of family members based on the results of a comprehensive assessment and patient and/or family consultation.**

After completion of the voice evaluation, the proposed documentation system provides the clinician with space to document goals for _Indirect Intervention_ and _Direct Intervention_. Documentation of goals based on the results of a voice evaluation will encourage the graduate student clinicians to

70

critically examine and synthesize all information obtained during the voice evaluation, as well as to incorporate the needs of the patient. Additionally, the electronic documentation system saves all the goals in a central location. This can provide an opportunity for the expert clinician to input a list of goals, providing a model of the appropriate format and scope of goals.

As the student clinician moves through the treatment program, he or she will record his or her decision-making progress during therapy, providing ample concrete data points for the supervisor to provide feedback. As session data are always available for review, this could provide a continuous learning process regarding the implementation of a treatment program, rather than just a discrete session.

2. **Assists patient with developing and adhering to a plan for managing vocal hygiene.**

The _Vocal Hygiene Hierarchy_ will help to guide novice clinicians through developing a plan to manage vocal hygiene. The structure of the hierarchy will guide the clinician to address four major portions of vocal hygiene, (1) identify the aberrant behavior, (2) describe the effects of the behavior, (3) define specific occurrences of the behavior, and (4) discuss a plan for modifying the behavior, eliminating the behavior, or modifying the environment (Stemple et al., 2000). Additionally, each step of the _Vocal Hygiene Hierarchy_ is documented, allowing for further discussion between the novice and expert clinician regarding decisions made in targeting vocal hygiene.

3. **Displays flexibility in selecting appropriate facilitating voice techniques when assessing the patient's stimulability for improved voice quality at the time of the initial evaluation and during ongoing treatment.**

Mastery of this competency requires not only knowledge of how to use particular therapy techniques, but a deep understanding of the theory and motivation behind it. While navigating the documentation system, novice clinicians cannot simply choose a familiar tool to use in therapy. Instead they must first decide which subsystem (i.e., _Direct Intervention Method,_ such as Auditory) they want to focus on, then decide what _Tool_ is the most appropriate to try, and what stimuli level to attempt first. Additionally, they must think critically about how to structure the session in terms of what _Intervention Delivery Methods_ and _Tools_ to use and how much feedback or cueing to provide (i.e., _Intervention Delivery Method_). Additionally, the documentation system provides a concrete way to document success or lack of success for a given task. Although this type of data collection has been acknowledged an important part of therapy (ASHA, 2008), it is often difficult to manage in a session, especially for new clinicians (Epstein, 2008).

The proposed system has the potential to assist novice clinicians not only with documentation, but also with prompt critical thinking about which elements could be changed or continued in the next steps of therapy to make the sessions most effective.

4. **Writes evaluation, therapy, and referral reports that adequately explain the nature of the patient's voice disorder and treatment for the patient and the family.**

The concrete information collected from the documentation system during a therapy session will provide graduate student clinicians with information about which _Tasks_ they have completed and how successful they were for the patient. This will not only allow for clear post-hoc discussion of therapy choices by the supervisor and the student clinician, but provide a structure for detailed report writing.

Utility of the Documentation System: Clinical Research

An additional benefit of the documentation system is the compilation of a large dataset for further analyses. The information for an individual patient is connected to the goals targeted and how these goals are connected to the selected Direct Intervention Method(s), Tools, stimuli, and

71

Intervention Delivery Method. Large-scale data collection and analysis will help to inform further clinical research, as has been explored in other clinical domains. For example, Des Roches and colleagues (2014) examined the effectiveness of an iPad-based therapy for individuals with aphasia. Due to the nature of the data collection, the authors were able to examine large-scale trends and note the effectiveness of specific therapy tasks for individuals with particular cognitive profiles. This enables the development of therapy tasks that are more effectively tailored for an individual depending on their initial presentation.

The ability to track the effectiveness of particular tasks and interventions is essential for answering many additional research questions. For example: Are specific Direct Intervention Methods more effective for targeting certain goals? Do individuals with certain diagnoses respond better to certain Tools? Does a patient's success with learning one Tool have any bearing on how successful he or she is with mastering another Tool? Are certain Tools taught more effectively at certain levels of the Intervention Delivery Method Hierarchy? These questions, as well as many more, can begin to be answered if we use a system that clearly documents what happens during therapy and how successful it was for the patient.

Conclusion

This paper discusses the development of an electronic application that allows for the documentation of voice therapy. The documentation system uses the common terminology proposed in a recent voice taxonomy publication (Van Stan et al., 2015) and has potential benefits for both clinical research and teaching. Future directions will include piloting the electronic version and continued refinement of the system for increased usability and flexibility. Individuals who are interested in viewing the electronic documentation system can email either Elizabeth Heller Murray (ehmurray@bu.edu) or Cara Stepp (cstepp@bu.edu). We invite any feedback on the documentation system in terms of its ease of use, utility for teaching and clinical research, as well as any suggestions and comments that will assist with improvements.

Acknowledgements

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