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VOCAL HEALTH PRESERVATION FOR TEACHERS OF MUSIC:
A LITERATURE REVIEW

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An Independent Study Submitted in Partial Fulfillment of the Requirements for the Degree of
MASTER OF SCIENCE

Department of Communication Sciences and Disorders
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Vocal Health Preservation for Teachers of Music: A Literature Review

Music education students may receive some limited education in vocal health and hygiene during their undergraduate studies. For instance, future music educators at Millikin University specializing in vocal music education may receive a single class in vocal pedagogy during their educational curriculum before they enter the professional field, while those who specialize in instrumental music education may not receive any courses addressing vocal health at all (Millikin University, 2019). The National Association for Music Educators (NAfME) is the governing body which oversees standards for certification of music teachers, but these standards do not specifically include stipulations regarding collegiate plans of study or education on vocal health (NAfME, 2019). One can conclude based on this, that no standard of education for music teachers exists to control whether they receive vocal health education or the quality of that information. Further, current research findings regarding the high prevalence of voice complaints among teachers suggests that any vocal health information music teachers are receiving is inadequate for the prevention of voice disorders.

Since there appears to be no standard of education regarding vocal health for music teachers of all specialties, the dissemination of pertinent and current information on vocal health to music teachers is crucial. Such continuing education will give music educators to have the opportunity to be informed self-advocates for preservation of their voices. This review will examine the risk/incidence of voice disorders among teachers, various vocal hygiene strategies and their efficacy, when and why professionals should be encouraged to seek help for voice complaints, and where help could most effectively be sought. The author hopes that this review will identify general trends in the literature that may serve as guiding principles for music educators in preserving vocal health or seeking help if concerns about vocal health arise.

Teachers are At an Increased Risk for Voice Disorders

Most existing research studies do not separate out music educators as a distinct sub-population of teachers. Further, studies to establish the prevalence of voice disorders in teachers appear to have a wide range of sample sizes and vary in criteria for establishing the presence or absence of a voice disorder. Some concluded there was a voice disorder based on perceptual data via surveys while others incorporated acoustic voice analyses or took videostroboscopic imaging. Studies also varied in their definition of voice disorders (i.e., diagnosed via a speech-language pathologist or otolaryngologist versus self-report of symptoms). That said, while the prevalence of voice problems in each study varies across researchers and their diverse methodologies, nearly all studies concluded that teachers were at an elevated risk for either voice disorders or symptoms thereof. Despite diverse methodologies, trends confirm that teachers are 2-3 times more likely to develop voice disorders than the general populous (Martins, Pereira, Hidalgo, Tavares, 2014).

Notably, a study by Roy, Merrill, Thibeault, Parsa, Gray, and Smith (2004), interviewed over 1,000 teachers in the United States and found that nearly 60% reported they experienced vocal dysfunction that interfered with their ability to communicate (Roy, et al., 2004). Similarly, a survey of 304 teachers in Dublin, Ireland concluded that 80% reported prior or current voice symptoms such as the feeling of fatigue, a dry throat, and loss of high range (Munier & Kinsella, 2008).

Music Teachers

Szymanowski, Streitl Borst, and Sataloff (2014) indicated few studies have examined singing and performing arts teachers but suggested that both sub-populations are at a greater risk for voice disorders than general education teachers (Szymanowski et al., 2014). Specifically,

Doherty (2011) cites an unpublished doctoral dissertation in her literature review, which compared voice complaints among general education teachers, vocal music teachers, and instrumental music teachers. This research discovered that the majority of vocal music teachers and nearly half of instrumental music educators reported speaking and singing problems (Doherty, 2011). Likewise, another study found that when forty-four K-12 music teachers were surveyed, many indicated current (63.6%) or past (88.6%) voice problems. Further, vocal music teachers reported high vocal demands; indicating on average that they used their speaking and singing voices 90 percent of their teaching day (Solberg & Duax, 2000).

In support of the assertion that music teachers have high vocal load, a Polish study conducted on 425 full-time teachers and 83 non-teachers, all women, found that music and sports teachers reported more frequent voice symptoms than other teachers (Sliwinska-Kowalska, 2006) although it is hard to say how classroom conditions compare between Poland and the United States. However, despite the potential variables between teaching conditions in Poland versus the United States, Morrow & Connor identify a general trend in research which suggests music teachers may be “presenting in voice clinics at more than four times the rate of other teachers” (Morrow & Connor, 2011a, p. 441).

Risk Factors

Potential risk factors for voice disorders fall into three major categories: (1) personal factors, (2) environmental factors, and (3) occupational factors. Personal factors include gender, age, either a family or personal history of voice disorders, illness, allergies, lifestyle, poor vocal hygiene, hormones, drying medications, stress/anxiety, and vocal activities outside of work (Assunção, 2012; Hunter, Tanner & Smith, 2011; Koojiman et al., 2006; Martins, Periera, Hidalgo & Tavares, 2014; Morawska & Niebudek-Bogusz, 2017; Roy, et al., 2004;

Szymanowski, 2014; Verdolini & Ramig, 2001; Vilkman, 2000; Vincent, 2009). In particular, being a woman and predisposition to allergies, illnesses that affected the upper respiratory system, or acid reflux were commonly mentioned risk factors.

Environmental-related factors identified by the literature included acoustics, general ergonomic factors, noisy work environments, and poor air quality (Cantor Cutiva, Vogel & Burdorf, 2013; Martins, Periera, Hidalgo & Tavares, 2014; Morawska & Niebudek-Bogusz, 2017; Szymanowski, 2014; Titze, 1997; Vilkman, 2000; Vincent, 2009).

Occupational-related factors identified by the literature included large class sizes, younger students, high vocal load/high number of teaching hours, lack of rest/recovery time, and poor vocal training (Doherty, 2011; Morawska & Niebudek-Bogusz, 2017; Munier & Kinsella, 2008; Szymanowski, 2014; Titze, 1997; Thibeault, 2004; Vilkman, 2000; Vincent, 2009).

Prolonged vocal use is the occupational-related factor most reinforced by the literature, with an emphasis on sustained loud/high intensity, effortful speech (Cantor Cutiva, Vogel & Burdorf, 2013; Szymanowski, 2014; Titze, 1997). The tendency to engage in high-intensity voice use may be motivated by personal factors like physical tension or stress, but undoubtedly also linked to environmental and occupational demands that challenge professionals to speak in unfavorable acoustic environments or project their voices to large numbers of students, respectively.

Therefore, prolonged use of effortful and high amplitude speech may be a risk factor that falls in all three categories.

It is notable that a survey disseminated by Kooijman et al. (2006) confirmed personal risk factors of physical condition, stress, and lack of appropriate voice training. However, contrary to other research findings, his survey responses did not indicate that their vocal load (number of teaching hours) and work-related environmental factors contributed as risk factors for voice

disorders (Kooijman et al., 2006). There also seems to be conflicting findings about whether physical education teachers are at a greater risk for voice disorders. In particular, a 2012 systematic review of 23 cross-sectional studies found that classroom noise, being a physical education teacher, and speaking loudly habitually were consistently identified as factors linked to potential occurrence of voice disorders for teachers (Cantor Cutiva, Vogel & Burdorf, 2013). However, a large cross-sectional study by Thibeault, Merrill, Roy, Gray & Smith, (2004) which interviewed 1,243 teachers, found that while teachers of vocal music, drama, and other performing arts were at a greater risk for developing voice disorders than other teachers, physical education teachers were not. This finding is contrary to those of previous smaller-scale studies, and the authors posit that their results may be due to the physical education teachers' use of amplification systems as well as breaks from intense vocal activity throughout the day (Thibeault, Merrill, Roy, Gray & Smith, 2004).

Risks that researchers believe could put music teachers at higher risk than other teachers include increased vocal load, augmented by before/after school rehearsals or performances and necessity of singing for/with students, fewer opportunities for vocal rest or recovery, increased necessity for loud speech (often speaking over instruments or large groups of people), high likelihood of teaching in challenging environments, the likelihood of teaching larger classes (with large band/orchestra/choir), and the likelihood that music teachers are also vocal performers outside of school (Doherty, 2011; Morrow & Connor, 2010b; Thibeault, 2004; Vincent, 2009). Specifically, one study compared the vocal load between 5 general elementary education teachers and 7 elementary music teachers found that the music teachers had substantially higher vocal loads in phonation time and intensity (Morrow & Connor, 2010b). It is important to note that while researchers tend to agree that music educators are at a greater risk

than general education teachers for voice disorders, additional research is needed to confirm the role each hypothesized factors play in music teachers' increased overall risk for disorders.

What is a voice disorder?

There are multiple definitions and classification systems for voice disorders. The American Speech and Hearing Association (ASHA) partially defines voice disorders as a voice which does not meet an individual's daily needs, and problems that may be classified into functional or organic categories. ASHA describes organic voice disorders as those that would include structural changes such as nodules or polyps, and functional voice disorders as those which are not organic or caused by a structural/physical change, but rather "result from improper or inefficient use of the vocal mechanism when the physical structure is normal (e.g., vocal fatigue; muscle tension dysphonia or aphonia; diplophonia; ventricular phonation)" (ASHA, 2019a). Many voice disorders may have both functional and organic components. That is, structural changes that result in or are the result of inefficient functional voice use.

Wicklund (2010) proposes two ways of categorizing voice disorders: In the first, disorders can be separated into three major categories: (1) Functional, (2) Neurologic, and (3) Organic. The second separates disorders into five categories: (1) Structural changes of the vocal folds (including nodules, polyps, lesions/hemorrhage, etc.), (2) Neurogenic voice disorders, (3) Systemic disease's effect on the larynx and voice, (4) Disorders of voice use (e.g., those with a functional basis like increased muscle tension during phonation.), and (5) Idiopathic voice disorders (Wicklund, 2010). For the purposes of this paper, it is simplest to adhere to ASHA's classification system, while acknowledging that teachers may not be necessarily using their

voices improperly or inefficiently, but they may experience disorders due to a number of factors, as previously mentioned.

“Dysphonic” is the term applied to a disordered voice and the following are common gradual or sudden perceptual changes in voice quality, sensation, or function identified by researchers and:

- roughness,
- breathiness,
- strained quality,
- tense or harsh,
- strangled quality,
- abnormal pitch (too high, too low, pitch breaks, decreased range),
- abnormal loudness/volume,
- abnormal or decreased resonance (hypernasal, hyponasal, etc.),
- loss of voice,
- phonation breaks,
- weak voice,
- gurgly/wet sounding voice,
- hoarse voice,
- pulsed voice (vocal fry register, or creaks or pulses in sound),
- shrill voice,
- shaky voice,
- increased vocal effort associated with speaking,
- decreased vocal endurance or onset of fatigue with prolonged voice use,
- variable vocal quality throughout the day or during speaking,
- running out of breath quickly,
- persistent coughing/throat clearing,
- Perceived persistent dryness,
- and excessive throat or laryngeal tension/pain/tenderness (ASHA, 2019b; McBroom, 2017; Sliwinska-Kowalska, 2006; Wicklund, 2010).

A voice disorder can negatively impact teachers’ quality of work and students’ learning.

If a teacher is unable to effectively voice information to their classroom, their students’ learning will be affected (Vilkman, 2004). This can have many iterations: A teacher may be experiencing chronic fatigue and therefore speak more softly in an effort to save their voice, meaning the students in the back rows don’t hear as much of the content; a teacher may not be able to manage their class to maintain focus of rowdy kids if their voice is diminished; or a teacher may

lose their voice entirely and take days off of work to recover, at which point students are not receiving the volume or quality of information they might otherwise have received if their teacher had been able to remain vocally healthy. Because of this, preventative practices may protect music teachers' vocal health and longevity.

Introduction to Prevention

Prevention of voice disorders is a complicated matter. One researcher, Vilkman, suggested looking at prevention in the context of the Principles of Occupational Safety and Health, which includes acknowledging and addressing risks, adapting environment, and implementing hygiene practices (Vilkman, 2004). The only way to effectively follow and adhere to such principles, however, is to stay informed. Being informed is partially about being aware of what constitutes vocally “abusive” behaviors and when you are engaging in them. Educators might be surprised what these behaviors include, and how often they are in a position where they engage in them. A longitudinal study conducted on 55 teachers-in-training revealed that indirect treatment, which involved education on vocal mechanics, hygiene, and proper versus harmful voice use, helped teachers maintain a healthy voice and potentially prevent disorders when compared to participants who did not receive this indirect treatment (Duffy & Hazlett, 2004). Another study done by Bovo, Galceran, Petruccelli, and Hatzopoulos (2007) found that participation in a voice disorders prevention program, which involved vocal hygiene, a group voice therapy session, and home exercises helped 20 full-time teachers make a positive impact on their voice. Their participants journaled when they engaged in vocally abusive behaviors to supplement self-awareness during their prevention program, and the participants were able to partially maintain improvements after 12 months. So, while Bovo et al.'s (2007) study suggests it

is not enough to just be informed, information and awareness may contribute to improvement and maintenance of one's vocal health.

Returning to Vilkmán's (2004) proposal of looking at prevention through the Principles of Occupational Safety and Health, the following sections will address classroom adaptation, hygiene practices, and managing other risks via vocal strategies, as well as methods of dealing with fatigue, stress, and sickness.

Classroom adaptation. Herndon, Sundarrajan, Sivasankar, & Huber (2017), conducted a study which found participants (12 teachers) reported increased perception of tiredness and effort after being subjected to a 1-hour task of reading in noise (although no significant changes in respiratory volume and cepstral peak prominence were observed). Based on this study, it can be deduced that the researchers' experimental conditions may approximate classroom conditions, and the perception of fatigue could preempt physiological changes. Amplification and vocal breaks may be viable options to reduce teachers', and in particular, music teachers' vocal loading during the work week (Thibeault et al., 2004). Similarly, Bovo et al.'s (2007) suggests that efforts to prevent voice problems should address classroom acoustics and the use of voice amplification systems in the classroom as well as the implementation of voice care programs for student teachers.

Vilkmán (2004) noted that vocal ergonomics, or shaping the environment to enable efficient vocal use, is a valid consideration which requires additional research. He also noted that making environmental adaptations that protect vocal health of teachers is also likely to positively impact students' learning, and vice-versa, suggests that the factors causing vocal health of teachers to suffer are also negatively impacting the learning environment (Vilkmán, 2004). It is possible that short-term vocal recovery takes place with short periods of vocal rest. Titze (2007)

suggests putting more of the vocal burden on students will allow teachers more break that will potentially “save” their voice. For example, teachers may ask students to engage in small or large group discussion rather than lecturing to the entire class. ASHA (2019) recommends the following for improving classroom acoustics:

- adding carpets or rugs to the floor
- using rubber caps on chair/table legs
- putting drapes or cloth on windows and walls
- placing sound panels on ceilings or walls
- landscaping with trees around school buildings reduce outside noise
- maintaining classroom lighting

As previously mentioned, amplification may be another strategy for reducing vocal load. A 2001 study, conducted in Iceland, found that lower fundamental frequency and intensity were used by 5 teachers with amplification systems (Jonsdottir, Rantala, Laukkanen, Vilkmán, 2001). In another study, voice amplification led to significant vocal improvement in 117 full-time teachers experiencing dysphonia (Roy, et al., 2002). Further, a review of literature on voice disorder treatment identified a trend in the efficacy of voice amplification in supplement to direct voice therapy to reduce reported impact of voice symptoms on teachers’ quality of life (Ziegler, Gillespie, & Verdolini Abbott, 2010). Research has documented a risk of dysphonia for teachers with limited technical resources and equipment (Assunção, Bassi, de Medeiros, de Souza Rodrigues, & Gama, 2012); thus, it might follow that making amplification available to teachers could reduce this risk.

A study completed by Morrow and Connor found “significant decreases in both vocal intensity and vocal load” with the use of amplification, and “in addition to reducing vocal intensity, music teachers also used their voices less” with some individual variability (Morrow, Connor, 2011a, p.444). Another study on 37 elementary music teachers concluded that

amplification alone was not sufficient to improve perceived voice health, however, the research concluded that it may be helpful when combined with regular practice of vocal function exercises (Vincent, 2009). This was admittedly a small-sample study on one specific amplification system, but a valid takeaway here is that one cannot expect amplification to be sufficient by itself, so it is of paramount importance for music teachers to utilize good voice production technique whether or not they are amplified. Finally, while more research is needed overall for efficacy on prevention, investigating the use of amplification in the classroom could reasonably be a great preventative measure in combination with other practices.

Some thought should be given to various factors before implementing an amplification system in order to choose the most effective system for the teacher and space. Doherty (2011) raised the point that “classroom size, voice use, student needs, and funding are just a few of the considerations that need to be made” before buying an amplification system (Doherty, 2011, p. 46). She also suggests consulting the district audiologist and school administrator to help with these considerations. Controlling any of these variables may impact the efficacy of any amplification system implemented in a classroom (Doherty, 2011).

Hygiene. The easiest way to conceptualize vocal hygiene is to think about it in terms of lifestyle factors that can potentially affect the voice including, but not limited to, sleep, diet, and exercise. Several studies have indicated that vocal hygiene is an important component of successful voice therapy for people with voice disorders. For instance, Roy et al. (2002) found that a group of 15 full-time teachers experiencing dysphonia could at least avoid worsening of their conditions through instituting vocal hygiene practices. While there were likely inconsistent degrees of compliance across participants, additional research should be done to investigate the extent to which hygiene programs can be helpful and with which type(s) of voice disorders (Roy,

et al., 2002). Results from a study done by Wingate, Brown, Shrivastav, Davenport & Sapienza (2007) on a small cohort of voice professionals with either lesions and/or dysphonia, suggest that a combination of expiratory muscle strength training (EMST) and voice therapy, including vocal hygiene, resulted in reduced symptoms. These results indicate the possibility that vocal hygiene practices might facilitate vocal maintenance and even symptom resolution when paired with other forms of direct voice and breathing exercise.

Sataloff (2017) acknowledges that vocal hygiene is integral to effective therapy and discusses how good voice hygiene practices include avoidance of throat clearing, whispering, grunting, yelling/screaming, noisy environments, and excessive talking. Sataloff also mentions the importance of adequate sleep, moderation of drying caffeine intake, good hydration through water consumption and environmental humidification, if necessary. A cross-sectional study done in Brazil reported a correlation between teachers who engaged in regular exercise (3+ times a week) and reduced prevalence of dysphonia. They felt this may be due to reduction in stress as it relates to ease of phonation, however did mention the limitation that they did not assess the specific exercise practices for these teachers (Assunção, 2009). In her review, Doherty also discusses the importance of paying attention to diet (specifically avoiding spicy food and alcohol consumption that contribute to reflux), staying hydrated, and warming up to prepare the voice for strenuous use (Doherty, 2011). Wicklund also recommends avoiding foods associated with reflux, dehydrating alcohol/caffeine, and long exposure to dry or cold air (Wicklund, 2010).

Interestingly, Erickson DiRenzo, Taylor, & Thibeault (2016) point out that we do not have any way to adequately measure the effects of moderate changes in hydration on the voice, so recommendations of water consumption may or may not make any difference to vocal hygiene. They also debunk the idea that steam inhalation would make a difference to vocal fold

hydration, though they admit that environmental humidity may help some individuals' vocal function. However, a study by Sliwinska-Kowalska (2006) reported that dry throat, exacerbated by indoor air quality and poor water consumption, could lead to excessive coughing, which would be phonotraumatic. Therefore, humidifiers and proper hydration could be indicated as preventative measures, depending on the individual and their environmental or health circumstances.

Wicklund's recommends the use of nasal strips to avoid mouth breathing, healthy diet/exercise/rest, addressing any hearing concerns, and avoiding coughing/sneezing/throat clearing and allergens pollutants and irritants such as smoke/dust/fumes/insecticides. She suggests that individuals can use either "silent cough" wherein one would inhale and then forcibly blow air through the open vocal folds, or "huff and swallow" wherein one would complete a silent cough and then subsequently swallow, to avoid coughing (Wicklund, 2010). Reduction of chalk dust through use of dry-erase markers or air purifiers may also help reduce allergens. In support of the effects of rest on the voice, Sataloff (2017) cited a survey of 56 classical singers in which 82% of reported reduced breath support and 36% reported reduced vocal endurance when they were lacking sleep (Sataloff, 2017).

Managing sickness/stress/fatigue. One study exposed 87 teachers to a 2-hour reading exercise, meant to approximate the vocal demands of an average teacher's day, and then measured the perceived fatigue and timing/trajjectory of fatigue recovery. They found that the teachers consistently perceived vocal fatigue. The researchers determine, by way of imaging and self-report, that it took, 4-6 hours on average for the muscles to recover 90% and about 12-18 hours to recover fully. These patterns of recovery were consistent with chronic skin wounds with the authors suggesting that additional vocal loading could exceed vocal fold tissue's capacity to

recover on the timeline noted (Hunter & Titze, 2009). This is particularly important for music teachers to understand, as they may have a greater than average vocal load. For the purposes of managing fatigue, careful management of vocal rest time is pertinent to allow for the healing process to catch up to the amount of potential damage done over the course of a day.

Sataloff (2017) discusses fatigue of the voice in the context of exercise physiology; he suggests that some fatigue is unavoidable/expected in the process of training the voice to build strength and endurance, so complete avoidance is unnecessary (Sataloff, 2017). However, while Sandage and Hoch (2018) agree with Sataloff, they recommend careful management of fatigue to increase muscle fatigue resistance and avoid injury and hypothesize that use of a warm-up and cool-down may help reduce unnecessary fatigue. Sataloff posits that a cool-down can be useful after strenuous voice activity and before fatigue is experienced to help the laryngeal muscles return to homeostasis and facilitate faster muscle recovery from fatigue (Sataloff, 2017).

Upper respiratory illness is a risk factor for voice disorders that may be unavoidable. There is a dearth of literature available that discusses management of upper respiratory sickness from the perspective of voice preservation. However, Sataloff (2017) gives several points of advice, including;

- Do not try to sound the same as you do when you're not sick, but rather accept that your voice will be a bit different.
- Try not to clear your throat a lot, which will exacerbate irritation and may cause laryngitis.
- If you have a cough, take non-narcotic cough suppressants.
- Consider utilizing the "silent cough" method which involves using abdominal pressure to push a burst of air through the vocal folds to clear mucus. This is similar to making a forceful /h/. (Sataloff, 2017, p. 784)

In the case of laryngitis, Sataloff recommends vocal rest, drinking plenty of water, steam inhalation (via hot shower or humidifier), and avoiding irritants such as smoke or allergens if possible (Sataloff, 2017, p. 296-298). For management of allergies and acid reflux, consultation with a doctor is recommended with a word of caution about the drying nature of antihistamine medications (Sataloff, 2017). Wicklund further recommends canceling performances if it hurts to sing (Wicklund, 2010).

Wicklund (2010) also acknowledges stress management as a component of prevention of voice disorders, as continuous stress can have negative effects on the muscular system, which can potentially leave the voice vulnerable to injury. It stands to reason that stress can manifest as muscular tension in the body, which can then affect the voice. Managing stress is a tricky and individual affair, but exercise can be a great component as indicated in Assunção's 2009 study.

Voice Rest. As a music educator, this author has received variable advice on how and when to use voice rest. Part of this may be due to the fact that clinical practice is changing based on recent research findings, and part of this may be due to an elaborate game of music educator telephone. Either way, Sataloff recommends the following; Absolute voice rest, which is complete silence, is not advisable for more than 1 week, which is on the extreme end. Vocalists should be aware that excessive voice rest could cause atrophy and leave a voice prone to further injury/weakness (Sataloff, 2017).

Relative voice rest involves only using the voice when unavoidable and with good support/technique, warming up the voice gently before use, avoiding unfavorable environments for voicing (see advice on environmental modifications to make the classroom a less vocally-abusive environment), and continuing to make healthy lifestyle choices like consuming water, getting appropriate amounts of sleep, and making healthy dietary choices. Sataloff (2017)

advises against cancelling voice lessons when on relative voice rest; however, due to the risks, Sataloff suggests vocal rest should be supervised by a speech-language pathologist (SLP) and adds that it is important to resume using the voice carefully and with good technique after rest (Sataloff, 2017).

Finally, Sandage and Hoch (2018) suggest the implications of detraining or loss of muscle training should be considered for professional voice users as 2 weeks of reduced vocal activity can decrease endurance gained through prior maintenance. Therefore, it is not only important to take care when coming back from periods of vocal rest, but also to continue singing over breaks from school/teaching and to come back slowly from vocal rest with the understanding that building endurance is a process.

Vocal Strategies. The practice of a warm-up and/or cool-down were mentioned as good practices for the management of fatigue, but in a job with high vocal load, they may act as daily preventative practices. The question remains, what does a good warm-up or cool-down look like? Stemple (2005) advises that exercises which treat the voice holistically by simultaneously working on respiration, phonation, and resonance are ideal for both prevention of disorders and rehabilitation of the voice. He suggests the use of voice therapy programs that treat the voice holistically and have been researched for efficacy in therapy, such as vocal function exercises (VFE), resonant voice therapy and (RVT) (Stemple, 2005). Sandage and Hoch (2018) advise that “repeated engagement of muscle groups during the course of vocal warm-up likely trains the muscles to have more efficient delivery of muscle fuel and faster recovery, as has been found with limb skeletal muscles” (Sandage & Hoch, 2018, p #). Sataloff (2017), and Sandage and Hoch (2018) agree that a warm-up has the potential to increase blood flow to the vocal muscles and may play an important role in injury prevention, though more research is needed. They

further recommend that a warm-up should not be longer than 10-15 minutes for those who are going to engage in strenuous vocal activity, such as a full day of vocal exercise, as anything longer than this could cause fatigue (Sataloff, 2017; Sandage & Hoch, 2018). Likewise, daily practice of upward and downward glides on sustained vowels (in one's comfortable range, depending on voice type/register) combined with the use of amplification in the classroom resulted in perceived gains in vocal health among a small sample of elementary music teachers (Vincent, 2009).

Sandage and Hoch (2018) suggest a "cool-down" period would include forward resonance exercises derived from RVT exercise. They admit that "little empirical evidence is available to guide our understanding of the role and application of cool-down routines for vocal function" but it is hypothesized that the cool-down may help the voice return back to homeostasis after high-intensity use (Sandage & Hoch, 2018, p#). Verdolini, Li, Branski, Rosen, Grillo, Steinhauer, & Hebda (2012), completed a small-sample study on 9 vocalists, which found that some limited RV exercises may help attenuate some inflammation. Further research is required to confirm these findings and to determine the appropriate cool-down dosage and elements (Verdolini et al., 2012).

Aside from warm-ups and cool-downs, it is important to build and maintain healthy voice production technique, as skill acquisition of good singing and voice technique is important for injury prevention (Sataloff, 2017). One study monitoring the voices of 7 physical education student teachers across a semester of teaching, revealed that most of the participants experienced fatigue into the middle of the semester. However, one participant who was a singer with prior formal voice training did not experience vocal changes throughout the semester, supporting the hypothesis that vocal training can be preventative (Grillo & Fugowski, 2011).

Sataloff advises that good vocal skills include good posture, as poor posture can affect the voice in multiple ways by affecting the respiratory system as well as laryngeal position (Sataloff, 2017). A 2008 study on 133 teachers with voice disorders found that a vocal training program that addressed breathing, relaxation, resonance and function (with carryover exercises) reduced symptoms and improved their mean maximum phonation time (Niebudek-Bogusz, et al., 2008). This finding supports the idea that proper vocal technique may be a viable preventative measure to assist in preservation and maintenance of the voice. Another 2002 study in Iceland found increased fundamental frequency and intensity of 5 teachers over the course of a day, with or without the use of amplification. The researchers hypothesized that this increase may not signify fatigue, but rather be a sign of vocal adaptation to loading (Jonsdottir, Laukkanen, & Vilkmann, 2002). These findings may support that vocal longevity may be facilitated by careful repeated training/vocal loading exercises, treating the voice like other muscles we work at the gym. More research should be done to ensure these results are generalizable to the teacher population as a whole; and ideally, some of this research should be conducted in the U.S. to confirm these results are specific to American-English speaking teachers as well.

Minimization of use is another vocal strategy for preservation of the voice, and teachers can think about minimization of use as a component of healthy technique. Some tips for reducing vocal use based on Doherty (2011) include:

- Avoiding unnecessary repetition
- Using non-verbal communication, such as visual cues, to get the class's attention,
- Conducting or using gestures to communicate musical expression
- Beginning and ending class with a non-speaking routine
- Writing information down and using visual aids

- Using recorded music or other technologies to vary instruction
- Make a conscious effort not to sing or talk over students
- Videotaping rehearsals and classes to better understand one's own vocal use patterns,
- As previously discussed, utilizing amplification

Teachers can self-advocate for rest periods by educating administrators/those responsible for scheduling classes for music teachers on the importance of periods of short vocal breaks during the school day to allow vocal tissue to rest/recover (Morrow & Connor, 2011a).

When to Seek Help

Determining when to seek help can be a difficult thing, as we cannot always identify when symptoms are serious or when imaging is needed (e.g. "Sudden onset laryngitis/hoarseness may suggest a vocal cord hemorrhage") (McBroom, 2017, p. 34). Some voice issues could be addressed with voice rest and/or circumlaryngeal massage and/or steroid medications, while others cannot, but it is not always possible to discriminate which voice issues are truly serious simply via self-perception (McBroom, 2017). Knowing this, it is good for occupational voice users, as a high-risk population, to have a voice care team to help monitor their vocal health.

Occupational voice users also have access to some key tools for perceptual self-assessment. The Voice Handicap Index (VHI) was developed and researched/normed by Jacobson et. al to measure psychosocial impacts of voice disorders. Norms were developed on 63 voice patients to produce a 30-question survey with which one can determine the extent of voice handicap and its functional, physical, and/or emotional effects (Jacobson, et al., 1997). This measure may be used by teachers who rely primarily on a functional speaking voice but are not specifically worried about the quality of their singing voice.

A modified version is available for singers as well, the Singing Voice Handicap Index (sVHI), which may be more appropriate for vocal music teachers, or those general music educators who also sing professionally outside of their teaching requirements. This version was researched and normed by Cohen et al. (2007) on 241 singers, with a mixture of healthy and dysphonic voices, and was judged to be a reliable and valid questionnaire for self-assessment of voice handicap for the singing population.

The VHI is a valuable asset to the diagnostic process, however due to the fact that no one symptom is, by itself, enough to diagnose a voice disorder, the process of diagnosing a voice disorder falls under the purview of a laryngologist and/or speech-language pathologist, depending on the nature of the disorder. Thus, these professionals should be part of every occupational voice user's vocal health care team. Should a music educator have symptoms that are persistent beyond an expected period of time (generally 2-3 weeks), or should they experience multiple symptoms, imaging of the vocal folds might be necessary to confirm whether or not there are abnormalities of the vocal mechanism (Doherty, 2011; Eastern Carolina ENT, 2019; National Institute on Deafness and Other Communication Disorders, 2019). A stroboscopy is necessary to confirm the status of the vocal folds, as without the imagery provided by a scope, we lack enough information to make an accurate diagnosis (Wicklund, 2017).

Further, a systematic review of voice therapy programs found insufficient evidence for improved self-perceived vocal function following direct voice training, indirect voice training, or a combination thereof (Ruotsalainen, Sellman, Leto, Jauhiainen, & Verbeek, 2008). Self-perception may not be the most accurate monitoring system, which is another reason to have a voice care team help monitor one's vocal health, as they can examine vocal acoustics as well as conduct endoscopic evaluations. Meanwhile, randomized controlled trials examining various

voice prevention and intervention measures are necessary to continue improving clinical voice care. It would be very valuable for teachers to participate in these studies as the opportunity is afforded to do so. Such participation may help occupational voice users and vocal health professionals continue to learn about important variables in vocal maintenance and preservation of vocal health. A subsequent 2009 review of 6 randomized controlled studies conducted by Ruotsalainen, Sellman, Leto, Jauhiainen, & Verbeek concluded that research literature does support effectiveness of a combination of direct and indirect voice therapy for teachers with voice problems. None of the studies they looked at evaluated direct treatment alone, and the one study that evaluated indirect treatment alone found that it was insufficient (Ruotsalainen, Sellman, Leto, Jauhiainen, Verbeek, 2009).

How to Seek Help and Who From

Voice care and assessment should ideally be provided by an interdisciplinary team including a physician (specifically, an otolaryngologist/laryngologist), a speech-language pathologist (SLP), and a singing-voice specialist (SVS), some of which are also SLPs. Likewise, depending on the individual needs of the patient, many other professionals can be part of this team, including a singer's current voice teacher, acting voice specialist (i.e., voice coach, drama voice teacher, or voice consultant), nurse, physician's assistant, voice scientist and other consultants. Many members of the team will work with, or be contracted by, otolaryngologists/laryngologists at voice clinics or university medical centers in large metropolitan areas (Wicklund, 2010; Sataloff, 2017; & McBroom, 2017). Ideally, occupational voice professionals would establish care with a voice team prior to experiencing any vocal health concerns (McBroom, 2017).

A laryngologist is necessary, as they are the ones who can diagnose medical conditions and recommend medical procedures (Doherty, 2011). A licensed SLP can provide treatment for functional voice disorders by working with patients on vocal behavior. The SLP specifically works on identifying and empowering patients to modify vocal behaviors and other factors that contribute to pathology (Sataloff, 2017, p. 295, 771).

A SVS is a voice teacher with expertise in rehabilitating the injured singing voice. SVS is not a regulated field with specifications for certification, licensure, or educational background. Thus, it is important to explore the background and expertise of an SVS before working with one; however, training from these professionals may facilitate healthy changes to the singing (Sataloff, 2017,; Wicklund, 2010). A SVS should supplement standard voice therapy, conducted by an SLP, with singing exercises (Sataloff, 2017).

Conclusion

Research confirms that teachers are occupational voice users at a high risk for voice disorders or symptoms thereof, and music teachers are a subgroup of teachers that has an even higher incidence of voice disorders. Overall, the vocal load of teaching, and especially of teaching music, is likely excessive to the capacity of the voice, but there are several preventative things professionals can do to reduce the risk, including;

1. Environmental modifications
2. Voice amplification
3. Vocal hygiene practices
4. Healthy technique (including warm-up, and cool-down)
5. Breaks/minimization of use

Further, being informed about these things is a good step toward vocal health maintenance. To care for their voice, it is important for occupational voice users to know when, where, and how to seek help, and to get connected with an interdisciplinary team of vocal health professionals before they experience vocal health concerns in order to get the proper care they need.

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