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Health Promotion and Injury Prevention Education for Student Singers

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INTRODUCTION

THE LATIN *MAXIM SCIENTIA POTENTIA EST* (knowledge is power) deserves renewed consideration from educators involved in the training of singers. The connection between professional singing and occupation-related voice problems has been well established,¹ and evidence suggests voice problems in professional singers may commence as early as the singer's tenure as a student.² In fact, as many as 56.5% of student singers report a current voice problem.³ That figure, however, may actually underestimate the true extent of voice problems in student singers, as demonstrated by clinically significant laryngoscopic findings among asymptomatic singing students.⁴ Whereas some student singers are unaware of laryngeal or vocal changes, other student singers are rather troubled by a vocal impairment, leading some to express serious mental health concerns as a result.⁵ Such students may forego singing-related opportunities, and some even abandon performing altogether.⁶ Clearly, one important aim in the training of student singers is to promote their vocal health and prevent injury to enhance academic and professional success.

HEALTH PROMOTION IN SCHOOLS

In response to the potential threat health problems pose to academic and later professional success in all domains, the World Health Organization (WHO) Division of Health Promotion, Education, and Communication launched an initiative called the Health Promotion in Schools.⁷ The WHO Global School Health Promotion Initiative emerged in response to the Ottawa Charter for Health Promotion in 1986, the recommendations of the WHO Expert Committee on Comprehensive School Health Education and Promotion in 1995, and the Jakarta Declaration of the Fourth International Conference on Health Promotion in 1997.⁸ Specifically, the WHO Expert Committee reviewed research from developed and developing countries and found a preponderance of evidence indicating that the creation of school-based programs promoting health and reducing health risks in schools leads to improved educational outcomes. An effort has been made to increase the number of *health promoting schools*, that is, schools that strive to prevent health problems among students by changing the conditions that affect risk. One mechanism by which health promotion and injury prevention can be accomplished is with the establish-

ment of curricula. Coursework should not only focus on developing students' understanding of factors that affect health, but should also instill skills to help students navigate situations that potentially threaten health. Paramount to achieving this goal is a joint effort among health professionals, school personnel, parents, students, and the community at large.

In 2004, professionals in performing arts medicine and music set out to address the challenge set forth by the WHO. These individuals collaborated to develop a set of initial recommendations addressing health promotion and injury prevention specifically in schools of music at the university level.⁹ Four recommendations were established by the Health Promotion in Schools of Music Project (HPSM):

- (1) schools of music should adopt a framework to become a health promoting school;
- (2) music students should enroll in an undergraduate occupational health course that addresses injury prevention;
- (3) music students should receive education during ensemble-based instructions about music-related hearing loss; and
- (4) music students should receive assistance in seeking out health care resources.

The remaining focus of this article is the HPSM's second recommendation—the development of an occupational health course—with specific suggestions for research-based content built around two complementary conceptual frameworks. In addition, data from the limited number of previously published studies as well as a recently completed study will be presented, providing preliminary evidence about potential benefits of occupational health courses for student singers.

FRAMEWORK FOR INJURY PREVENTION

Many phonogenic injuries are preventable. Some data imply individuals with healthy voices generally may have greater knowledge about voice care than individuals with dysphonic voices.¹⁰ Stated differently, education about vocal health should help reduce the risk of injury.

Ideally, educational efforts are not developed in a vacuum, but rather depend on some cohesive framework. The Haddon Matrix developed by Dr. William Haddon, Jr., a pioneer in the field of injury epidemiol-

ogy, may be useful.¹¹ The Haddon Matrix is based on an epidemiological model that emphasizes interactions across host (an individual who may sustain an injury), agent/vehicle of injury (the mechanism of energy transfer that results in physical injury), and environment (physical and sociocultural context in which an injury occurs) in injury genesis. Haddon further makes a useful distinction between the moment when an actual injury occurs versus pre- and postinjury event phases. This distinction makes it possible to address factors that may lead to an injury and factors that influence outcomes, independently from the actual energy transfer event.

Haddon's additional contribution to the field of injury prevention is a complementary framework, Haddon's 10 Strategies (Table 1).¹² This framework consists of a series of countermeasures, or actions that can prevent, or mitigate, the effects of injury (e.g., reduce the amount of hazardous exposure). Such countermeasures provide specific targets for intervention. An example for voice might be to teach student singers about the relationship between vocal load and phonotrauma. Once a singer understands how voice use may increase vocal fold impact stress and, ultimately, result in phonotrauma, the singer might identify ways to reduce vocal load, for example, by vocally "marking" during blocking rehearsals. In sum, the suggestion is that education targeting injury control in student singers should: (1) review factors leading to injury; (2) encourage student singers to adopt behaviors that avert injury or, at least, reduce its risk; and (3) provide student singers with strategies for adaptively responding to injury if and when it occurs.

VOCAL HEALTH PROMOTION AND INJURY PREVENTION

The Situation in Student Singers

Many student singers report symptoms of vocal attrition.¹³ Voice-related impairments are undoubtedly the result of a constellation of factors identified in Haddon's model. Among other things, student singers are faced with considerable vocal demands, including practice, private voice lessons, rehearsals, and performances, at times for both solo and ensemble singing.¹⁴ On top of substantial vocal load from singing-related activities, student singers report heavy voice use from nonsinging employment, large amounts of nonessential voice use

TABLE 1. List of Haddon's 10 Strategies.

Countermeasures	Samples
1. Prevent the creation of the hazard in the first place.	<ul style="list-style-type: none"> • Obtain a baseline laryngeal evaluation. • Complete an adequate vocal warm-up.
2. Reduce the amount of hazard brought into being.	<ul style="list-style-type: none"> • Limit nonessential voice use on performance days. • Only sing full out when required.
3. Prevent the release of hazard that already exists.	<ul style="list-style-type: none"> • Avoid singing with inflamed vocal folds (e.g., allergies). • Release emotional energy without vocal constriction.
4. Modify the rate of spatial distribution of release of the hazard from its source.	<ul style="list-style-type: none"> • Allow adequate recovery time between performances. • Distribute difficult passages throughout practice.
5. Separate in time or space the hazard and that which is to be protected.	<ul style="list-style-type: none"> • Schedule performances around menstrual cycle. • Avoid smoky environments.
6. Separate the hazard and that which is to be protected by interposition of a material barrier.	<ul style="list-style-type: none"> • Use amplification in spaces with poor acoustics. • Wear a mask when dusting, set building, mowing, etc.
7. Modify basic relevant qualities of the hazard.	<ul style="list-style-type: none"> • Transpose songs to a more suitable key. • Selectively perform belt voice for embellishment.
8. Make what is to be protected more resilient to damage from the hazard.	<ul style="list-style-type: none"> • Optimize vocal fold tissue health with adequate hydration. • Continue to train the voice throughout the lifespan.
9. Begin to counter the damage already done by the environmental hazard.	<ul style="list-style-type: none"> • Receive prompt medical attention for persistent vocal issues. • Execute vocal cool-downs to promote recovery.
10. Stabilize, repair, and rehabilitate the object of damage.	<ul style="list-style-type: none"> • Undergo vocal rehabilitation with a speech pathologist. • Cease all voice use after a sudden, dramatic voice change.

(excessive talking at social gatherings), and loud talking.¹⁵ Furthermore, certain behaviors not typically considered “vocal” in lay terms reportedly may lead to injury, such as frequent throat clearing.¹⁶ Student singers also report lifestyle choices that may further impact the condition of the vocal fold tissue such as late night eating, consumption of caffeinated and alcoholic beverages, and smoking.¹⁷ Interestingly, evidence reveals that student singers who had taken voice lessons did not demonstrate a difference in any of the concerning issues compared to singers who had not received voice lessons.¹⁸

The Situation in Professional Singers

Also professional singers complain of symptoms of vocal attrition similar to those reported by student singers.¹⁹ According to one report, 21% of singing teachers who responded to a nationally-based survey

reported a current voice problem, and 64% reported a voice problem at some time in the past.²⁰ Of those, only 56% with a current problem had sought treatment for it, and 83% with a past problem had sought treatment. Regrettably, singing teachers with a voice problem rarely enrolled in voice therapy, despite its appropriateness in many cases.²¹ Even more alarming, one study found that attendees at a conference on contemporary commercial music were less likely to seek out treatment for their voice than for a general medical issue. Lack of or insufficient medical coverage was identified as a significant barrier to seeking treatment.²²

Undoubtedly, similar risk mechanisms exist for professional as for student singers. Despite their presumably long-term occupational engagement, evidence suggests many professional singers are poorly informed about the vocal mechanism,²³ although they *report* a corpus of

knowledge.²⁴ Although data indicate professional singers generally show greater knowledge than amateur singers regarding vocal anatomy and physiology, vocal hygiene, and vocal pathologies, professional singers still remain relatively uninformed.²⁵ On some topics—for instance, on the role of the speech pathologist—professional and amateur singers do not demonstrate a difference in knowledge: both groups exhibit remarkably little.²⁶ Professional singers who also teach voice lessons appear to be more knowledgeable than professional singers with no teaching responsibilities.²⁷

Student Singers and Occupational Health Education

The foregoing data imply efforts should be made to increase singers' knowledge about their vocal mechanisms and injury. One could argue a good venue for such education might be the private voice lesson. Unfortunately, that option may be insufficient. Although singing training presumably benefits vocal *function*,²⁸ training does not necessarily obviate voice problems.²⁹ In particular, evidence suggests that private study may not affect *lifestyle choices* affecting voice.³⁰

Broadus-Lawrence and colleagues conducted a study to investigate the effects of systematic education on injury prevention outside the context of the private voice lesson.³¹ Eleven undergraduate students with less than two years of formal voice instruction attended four weekly one-hour lectures addressing vocal hygiene only. Results from pre- and postinstruction surveys demonstrated that while subjects believed they had greater knowledge, *appreciated* the new knowledge, and would recommend the course to a fellow singer, only trends were evident in the data indicating any positive change in student singers' vocal health-related behaviors.

More encouraging results were shown in a study by Barton and Feinberg.³² Twenty-six freshman music majors with an equal representation of instrumentalists and vocalists attended an eight-week course on injury prevention and health promotion on a weekly basis, as an adjunct to a required seminar during their first semester of study. This additional course component was taught by an occupational therapist with a background as a musician. Subjects were evaluated at three time points including preinstruction, immediately postinstruction, and six weeks after the final class. Results demonstrated

a statistically significant increase in knowledge at each follow-up compared to baseline. Furthermore, a self-assessment questionnaire on the student's current use of injury prevention strategies indicated a statistically significant improvement at the six-week postinstruction time point compared to baseline.

More recently, a previously unpublished study conducted at Emory University, described here in some detail, provides further evidence for the potential usefulness of a course on vocal health promotion and injury prevention for student singers. This cross-sectional study examined the degree to which different groups exhibited knowledge on questions that targeted an array of voice-related issues. The hypothesis was that a group of nine students who completed a three-credit seminar entitled "The Singing Voice: How It Works" would demonstrate more knowledge than two groups of students who did not complete the seminar, and as much knowledge as a group of medical professionals who specialize in voice care. Three of the students enrolled in the seminar were in their last undergraduate semester of a bachelor of music in voice degree. The remaining six students were completing a master of music degree in choral conducting. All of the seminar students had prior singing training. The seminar met twice weekly over 14 weeks; each meeting lasted 1.5 hours. The seminar was taught using a multidisciplinary approach to instruction including a singer/singing teacher, laryngologist, physiologist, and psychologist. The seminar was administered through lectures, self-directed learning through reading and independent research, cadaveric laboratory dissection of the human larynx, endoscopic imaging laboratory of the larynx, and a vocal acoustics and aerodynamics laboratory. The seminar was designed to help students develop accurate knowledge about the anatomy and physiology of the singing voice throughout the lifespan, and about vocal health and injury prevention in ensemble and solo singing. Seminar goals were numerous. Specific goals were for students to be able to define the detailed anatomy of the larynx as it relates to voice production, describe the physiology of healthy voice production in singing and speaking, apply knowledge of the anatomy and physiology of the vocal tract to acoustic and aerodynamic events, apply knowledge of the anatomy and physiology of the body to singing training, utilize correct terminology in discussing the body and singing

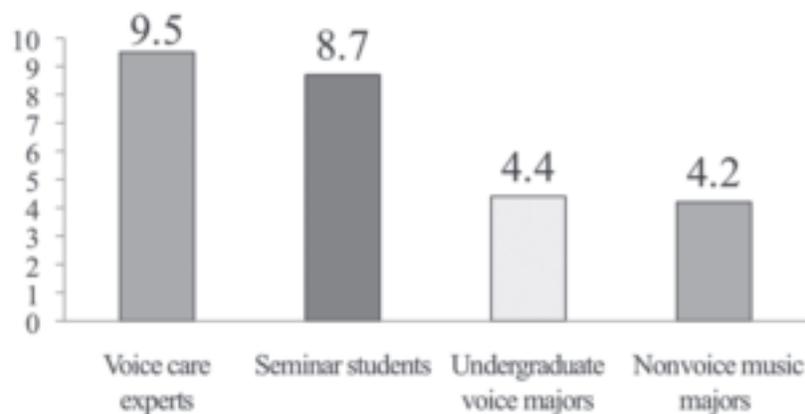


Figure 1. Chart of mean scores on test by group membership.

techniques, demonstrate knowledge of acoustics as applied to the singing instrument and hearing, develop a working knowledge of and informed opinion about differing breath management philosophies, demonstrate knowledge of accepted resonance balancing in Western classical singing, demonstrate the ability to classify voice types, unify the male and female singing voice across vocal registers, be familiar with the health and care of the singing voice, and utilize knowledge to identify and correct vocal technique.

The students enrolled in the seminar were given a ten-item multiple choice test to complete in class at the conclusion of the semester. The maximum score for the assessment was ten points. The content of the test questions was based on information derived from literature in the areas of anatomy and physiology of the voice, voice disorders, and treatment of voice disorders (Appendix A). To decrease the potential that students in the seminar would be influenced by the possibility that their performance on the assessment tool would have an impact on their overall class evaluation, seminar students were informed that their participation in the study had no bearing on their final grade, the assessment tool was administered without any identifying information, and, finally, the assessment tool was collected and placed in a sealed envelope to be scored later. Seminar students were contacted through telephone and electronic correspondence one year later, at which time they were asked to complete a separate questionnaire that assessed the impact of the knowledge gained from the seminar on a variety of voice-related issues. The impact questionnaire consisted of seven questions, each

with a five-point Likert-based response format. Seminar students were also asked to provide any comments on how they thought the seminar might have had an impact (Appendix B).

Scores on the first assessment tool were compared with scores obtained from groups who were administered the same tool, including a group of voice care experts (laryngologists and medical speech pathologists) and two groups of students who did not receive the intervention—a group of nonvoice music majors and a group of undergraduate voice majors. A one-way between-subjects analysis of variance (ANOVA) was performed on test scores as a function of group membership (seminar students, voice care experts, nonvoice music majors, and undergraduate voice majors) using IBM SPSS Statistics Version 18 for Windows (IBM Corporation, Somers, New York). The assumption of normality was met for all levels of group membership except voice care experts. All other assumptions were met. The results did not change after performing a non-parametric Kruskal-Wallis test, $\chi^2(3, N = 44) = 29.08$, $p < .001$. Therefore, results from the standard ANOVA are reported.

A statistically significant difference was shown for voice knowledge among the levels of group membership, $F(3, 40) = 32.298$, $p < .001$, $\eta^2 = .708$. To assess the pattern of differences in voice knowledge across the levels of group membership, *post hoc* pairwise comparisons of assessment scores were performed using Bonferroni adjustment. Data and results are presented in Figure 1 and Tables 2 and 3. Voice care experts ($M = 9.50$, $SE = .548$) exhibited significantly higher scores than nonvoice

TABLE 2. Descriptive statistics of scores on test by group membership.

	Voice care experts	Seminar students	Undergraduate voice majors	Nonvoice music majors
Mean scores (SD)	9.50 (0.54)	8.67 (1.00)	4.44 (2.09)	4.22 (1.20)
Range in scores	9–10	7–10	0–9	2–6

TABLE 3. Results of *post hoc* pairwise comparisons of mean scores on test using Bonferroni adjustment.

Groups		Mean difference	p value
Seminar students	Voice care experts	-0.83	1.000
	Undergraduate voice majors	4.22	.000*
	Nonvoice music majors	4.44	.000*
Voice care experts	Undergraduate voice majors	5.06	.000*
	Nonvoice music majors	5.28	.000*
Undergraduate voice majors	Nonvoice music majors	.22	1.000

* Significant results at $p < 0.05$

music majors ($M = 4.22$, $SE = .516$) and undergraduate voice majors ($M = 4.44$, $SE = .365$), $p < .001$. Seminar students ($M = 8.67$, $SE = .516$) demonstrated significantly higher test scores than nonvoice music majors and undergraduate voice majors, $p < .001$. Knowledge scores did not differ across voice care experts and seminar students (voice care experts vs. seminar students, $p = 1.000$; nonvoice music majors vs. undergraduate voice majors, $p = 1.000$).

The results of the impact questionnaire were analyzed descriptively, and the data are presented in Table 4. Two seminar students were lost to follow-up and, as such, the

results of the impact questionnaire were based on the seven students who responded. Data analysis revealed six domains in which a majority of the seminar students provided an impact rating of three or greater (moderate, large, or as large as it can be): (1) problem solving voice issues during practice ($n = 5$, 71%), (2) problem solving voice issues during rehearsal ($n = 4$, 57%), (3) seeking out medical attention ($n = 6$, 86%), (4) teaching voice/singing ($n = 6$, 86%), (5) vocally irritating behaviors ($n = 6$, 86%), and (6) lifestyle choices ($n = 5$, 71%). In addition, verbatim comments from seminar students on how they believed the seminar had influenced them are provided in Table 5.

TABLE 4. Number of responses and cumulative percent from seminar students on impact survey by question.

Rating	Q1A #, %	Q1B #, %	Q1C #, %	Q2 #, %	Q3 #, %	Q4 #, %	Q5 #, %	Q6 #, %	Q7 #, %
No impact	1; 14.3	1; 14.3	3; 42.9	1; 14.3	1; 14.3	2; 28.6	3; 42.9		1; 14.3
Minimal	1; 28.6	2; 42.9	2; 71.4			3; 71.4	1; 57.1	1; 14.3	1; 28.6
Moderate	1; 42.9	1; 57.1	1; 85.7	1; 28.6	2; 42.9	2; 100	1; 71.4	5; 85.7	3; 71.4
Large	3; 85.7	2; 85.7	1; 100	4; 85.7	2; 71.4		2; 100	1; 100	1; 85.7
Largest	1; 100	1; 100		1; 100	2; 100				1; 100

TABLE 5. Verbatim comments from students who completed the seminar.

“A lot of topics in this class had been explained to me in voice lessons, but the class gave me a more concrete understanding of the physiology and also gave me a means of explaining vocal issues and techniques to other people.”

“MUS 547 gave me a knowledge and understanding of the singing voice that has allowed me to better diagnose and solve singing issues, as well as to promote general healthy singing, both in solo singing and choral singing. I finished with a greater knowledge of various vocal problems, both technical and physiological. I am able to negotiate problems with my own voice in choral rehearsals and voice lessons and implement a variety of techniques to solve them, such as placement, vowel, and breath support. I also pay more attention to vocal issues in the choirs I direct, and am able to make technical suggestions to improve the quality of the sound from the choir.”

“The most valuable thing I got out of the class is the anatomy and physiology of the larynx. It helps me to understand what goes on and what causes certain undesirable characteristics. It also has helped me diagnose and help my singers overcome them.”

“I very much enjoyed learning about the physiological aspect of singing since this is often overlooked in voice lessons. The insights from Dr. XX and other physicians were great.”

“I now have a much more thorough understanding of how the voice works mechanically. I have a much more complete vocabulary to use in speaking with students about their instrument and I can understand why various problems arise in singing because of the physical mechanics of the voice. I know what health habits affect the voice and can advise my student in how to maintain a healthy voice.”

DISCUSSION

Unlike nonvoice music majors, singing students may be at a distinct disadvantage in terms of developing an occupation-related injury because they cannot see the majority of their instrument. Moreover, the association between a current voice disorder and the report of a past voice disorder suggests that vocalists who have sustained injury may be susceptible to injury in the future.³³ Furthermore, insurance coverage poses an obstacle to pursuing management of voice problems. Student singers report voice problems that limit the capability of their mechanism despite receiving private voice instruction from presumably knowledgeable teachers.³⁴ As prior research has shown, professional singers desire under-

standing about the vocal mechanism.³⁵ Accordingly, a priority should be given to incorporating courses on vocal health promotion and injury prevention into the curriculum of training programs, consistent with recommendations of the Health Promotion in Schools of Music Project.³⁶

Overall, thus far sparse findings from research on vocal health promotion and injury prevention education reveal that singing students who gain exposure to key information do demonstrate increased knowledge that positively affects behavior.³⁷ Furthermore, in the study conducted at Emory University, the poor test performance of undergraduate voice majors who have not taken an occupational health course provides evidence that these singers' knowledge about their mechanism is limited. This finding is further emphasized by the lack of a statistically significant difference between the mean scores of undergraduate voice majors and nonvoice music majors, suggesting that undergraduate voice majors may not gain exposure to information specific to their instrument.

As with other research,³⁸ the students in the study at Emory reported that information presented in the seminar positively influenced their vocal hygiene practice, voice production, and treatment seeking behavior. Individual comments suggest that the seminar students began to limit behaviors that can result in vocal fold injury, such as throat clearing, and adopted behaviors that promote optimal tissue health, such as drinking more water. Seminar students reported that exposure to their new knowledge translated into changes in vocal production by rating a moderate or greater impact of the seminar with problem solving voice issues during practice and rehearsal. Specifically, individual comments revealed seminar students believed they implemented the newly acquired knowledge during practice and rehearsal to aid in breathing more effectively, navigating vocal registers more smoothly, and producing voice more efficiently.

Students who completed the Emory seminar and also teach voice further reported the information they received influenced the manner in which they provide voice instruction. This finding demonstrates the potential indirect benefit translated to student singers in private lessons. However, based on participants' reports, everyday conversation was little affected by the seminar.

Perhaps the seminar students did not feel their speaking voice posed a problem and accordingly felt no need to alter it. Alternatively, student singers may require more information on how use of the speaking voice can affect the singing voice.

Another finding was that a majority of students indicated the seminar had at least a moderate impact on their treatment seeking behavior from medical professionals. The implication is that seminar students became more conscientious about accessing clinical care for any voice changes. One hopes that the strategy of early detection will limit the progression of a vocal impairment into a disability or handicap, and keep student and professional singers from scaling back singing engagements, or, in more extreme cases, leaving the profession altogether. Despite the inclusion of information in the seminar about the role of and services offered by a speech pathologist, the seminar students did not report a great impact from gaining this particular information. This finding is consistent with previous data indicating few singing teachers seek voice rehabilitation for voice problems.³⁹ The barriers to seeking voice therapy should be explored further as some research revealed professional singers expressed interest in learning more about the speech pathologist.⁴⁰

FUTURE RESEARCH

The promotion of vocal health and prevention of vocal injury among singers is critical. An occupational health course such as the ones described in this report seems to satisfy one of the recommendations of the Health Promotion in Schools of Music project,⁴¹ namely, injury prevention education. However, more research is necessary to better understand how voice educators can serve the health needs of singing students. Of critical importance is to continue investigations on short- and long-term benefits of improved knowledge for injury prevention, on managing preexisting disease processes, on parameters of voice production, and on aspects of performance that may be affected. Well designed randomized control trials that follow singing students beyond graduation are crucial.

NOTES

1. B. Fritzell, ["Work-Related Voice Problems. Teachers, Social Workers, Lawyers and Priests Should Receive Preventive Voice Training"], *Läkartidningen* 93, no. 14 (1996); I. R.

- Titze, J. Lemke, and D. Montequin, "Populations in the U.S. Workforce Who Rely on Voice as a Primary Tool of Trade: A Preliminary Report," *Journal of Voice* 11, no. 3 (September 1997); H. Galloway and A. Berry, "A Survey of Communicative Disorders in College Vocal Performers and Pedagogy Majors," *Journal of Music Therapy* 18, no. 1 (Spring 1981).
2. Galloway and Berry; S. Sapir, "Vocal Attrition in Voice Students: Survey Findings," *Journal of Voice* 7, no. 1 (March 1993); S. Sapir, B. Mathers-Schmidt, and G. W. Larson, "Singers' and Non-Singers' Vocal Health, Vocal Behaviours, and Attitudes Towards Voice and Singing: Indirect Findings from a Questionnaire," *International Journal of Communication Disorders* 31, no. 2 (April 1996); E. S. Tepe et al., "A Pilot Survey of Vocal Health in Young Singers," *Journal of Voice* 16, no. 2 (June 2002).
3. Galloway and Berry.
4. D. S. Lundy et al., "Incidence of Abnormal Laryngeal Findings in Asymptomatic Singing Students," *Otolaryngology—Head and Neck Surgery* 121, no. 1 (July 1999).
5. Sapir.
6. Sapir, Mathers-Schmidt, and Larson.
7. World Health Organization, "WHO's Global School Health Initiative: Health-Promoting Schools" (Geneva: World Health Organization, 1998).
8. *Ibid.*
9. K. S. Chesky, W. J. Dawson, and R. Manchester, "Health Promotion in Schools of Music: Initial Recommendations for Schools of Music," *Medical Problems of Performing Artists* 21, no. 3 (September 2006).
10. H. M. Fletcher, M. J. Drinnan, and P. N. Carding, "Voice Care Knowledge among Clinicians and People with Health Voices or Dysphonia," *Journal of Voice* 21, no. 1 (June 2007).
11. C. W. Runyan, "Introduction: Back to the Future—Revisiting Haddon's Conceptualization of Injury Epidemiology and Prevention," *Epidemiologic Reviews* 25, no. 1 (August 2003).
12. *Ibid.*; W. Haddon, Jr., "Energy Damage and the Ten Countermeasure Strategies," *Journal of Trauma* 13, no. 4 (April 1973).
13. Sapir, Mathers-Schmidt, and Larson.
14. Lundy et al.; Joanna Zimmer-Nowicka and Henryka Januszewska-Stańczyk, "Incidence and Predisposing Factors of Common Upper Respiratory Tract Infections in Vocal Students During Their Professional Training," *Journal of Voice* 25, no. 4 (July 2011).
15. Sapir; Sapir, Mathers-Schmidt, and Larson; Lundy et al.; Zimmer-Nowicka and Januszewska-Stańczyk.

16. Sapir; Sapir, Mathers-Schmidt, and Larson; Lundy et al.
17. Sapir; Sapir, Mathers-Schmidt, and Larson; Lundy et al., Zimmer-Nowicka and Januszewska-Stańczyk.
18. Tepe et al.
19. N. Eller et al., "Health and Lifestyle Characteristics of Professional Singers and Instrumentalists," *Occupational Medicine (London)* 42, no. 2 (May 1992); M. K. Miller and K. Verdolini, "Frequency and Risk Factors for Voice Problems in Teachers of Singing and Control Subjects," *Journal of Voice* 9, no. 4 (December 1995); D. J. Phylant, J. Oates, and K. M. Greenwood, "Self-Reported Voice Problems among Three Groups of Professional Singers," *Journal of Voice* 13, no. 4 (December 1999).
20. Miller and Verdoli.
21. Ibid.
22. M. Gilman et al., "Performer's Attitudes Toward Seeking Health Care for Voice Issues: Understanding the Barriers," *Journal of Voice* 23, no. 2 (March 2009).
23. G. Kovacic and A. Budanovac, "Knowledge About Voice Care among Professional, Semiprofessional, and Amateur Choral Singers," *Journal of Singing* 60, no. 1 (September/October 2003); C. Braun-Janzen and L. Zeine, "Singers' Interest and Knowledge Levels of Vocal Function and Dysfunction: Survey Findings," *Journal of Voice* 23, no. 4 (July 2009).
24. J. L. LoVetri and E. M. Weekly, "Contemporary Commercial Music (CCM) Survey: Who's Teaching What in Nonclassical Music," *Journal of Voice* 17, no. 2 (June 2003); Braun-Janzen and Zeine.
25. Kovacic and Budanovac; Braun-Janzen and Zeine.
26. Braun-Janzen and Zeine.
27. Ibid.
28. A. P. Mendes et al., "Effects of Vocal Training on the Acoustic Parameters of the Singing Voice," *Journal of Voice* 17, no. 4 (December 2003); A. P. Mendes et al., "Effects of Vocal Training on Respiratory Kinematics During Singing Tasks," *Folia Phoniatica et Logopaedica* 58, no. 5 (September 2006).
29. Galloway and Berry; Sapir; Sapir, Mathers-Schmidt, and Larson; Lundy et al.; Tepe et al.
30. Tepe et al.
31. P. L. Broaddus-Lawrence et al., "The Effects of Preventive Vocal Hygiene Education on the Vocal Hygiene Habits and Perceptual Vocal Characteristics of Training Singers," *Journal of Voice* 14, no. 1 (March 2000).
32. R. Barton and J. R. Feinberg, "Effectiveness of an Educational Program in Health Promotion and Injury Prevention for Freshman Music Majors," *Medical Problems of Performing Artists* 23, no. 2 (June 2008).
33. Miller and Verdolini.
34. Galloway and Berry; Sapir; Sapir, Mathers-Schmidt, and Larson; Tepe et al.
35. Braun-Janzen and Zeine.
36. Chesky, Dawson, and Manchester.
37. Barton and Feinberg.
38. Ibid.
39. Miller and Verdolini.
40. Braun-Janzen and Zeine.
41. Chesky, Dawson, and Manchester.

APPENDIX A

Assessment Tool

Instructions: Please answer all the questions by circling the best choice for each question.

1. Which of the following muscles is primarily responsible for high-pitched singing?
 - a. Thyroarytenoid
 - b. **Cricothyroid**
 - c. Interarytenoid
 - d. Lateral cricoarytenoid
2. Which of the following muscles primarily controls pitch during chest voice singing?
 - a. Lateral cricoarytenoid
 - b. **Thyroarytenoid**
 - c. Cricothyroid
 - d. Interarytenoid
3. Which of the following is the primary determinant of vocal loudness?
 - a. Laryngeal muscle force
 - b. **Subglottal pressure**
 - c. Supraglottal air force
 - d. Pulmonary tension
4. Vocal fold vibration occurs primarily in which of the following layers?
 - a. Pharyngeal
 - b. Muscular
 - c. **Mucosal**
 - d. Ligamentous
5. Which of the following is the primary determinant of pitch?
 - a. Formant frequency
 - b. Harmonic partial
 - c. Vocal amplitude
 - d. **Fundamental frequency**

- 6. Excessive voice use typically leads to injury to which of the following?
 - a. **Vocal mucosa**
 - b. Vocalis muscle
 - c. Vocal ligament
 - d. Vocal resonator
- 7. With increases in pitch, which of the following changes in vocal fold configurations occurs?
 - a. **Lengthening and thinning**
 - b. Shortening and thinning
 - c. Lengthening and thickening
 - d. Shortening and thickening
- 8. The vocal folds are encased by which of the following structures?
 - a. Cricoid cartilage
 - b. Hyoid bone
 - c. **Thyroid cartilage**
 - d. Supraglottis
- 9. Formant frequencies are determined by which of the following structures?
 - a. Sound source
 - b. Pulmonary actuator
 - c. Environmental acoustics
 - d. **Resonator tract**
- 10. In singing, volume and pitch control are best facilitated by which of the following?
 - a. Low chin posture
 - b. Increased laryngeal tension
 - c. **Abdominal breath support**
 - d. Posterior tongue base position

APPENDIX B
Impact Survey

- 1 = None, no impact
- 2 = Minimal
- 3 = Moderate
- 4 = Large
- 5 = Impact is as “large as it can be”

My enrollment in MUS 547 (The Singing Voice: How It Works) had how much of an impact on:

How much of an impact?

- | | |
|--|-----------|
| 1. Problem solving voice issues during: | |
| a. Practice? | 1 2 3 4 5 |
| b. Rehearsal? | 1 2 3 4 5 |
| c. Performance? | 1 2 3 4 5 |
| 2. Seeking medical attention? | 1 2 3 4 5 |
| 3. Teaching voice/singing? | 1 2 3 4 5 |
| 4. Everyday conversation? | 1 2 3 4 5 |
| 5. Receiving voice therapy with an SLP? | 1 2 3 4 5 |
| 6. Producing vocally irritating behaviors such as throat clearing, coughing, etc? | 1 2 3 4 5 |
| 7. Considering lifestyle choices such as smoking, hydration, caffeine intake, etc? | 1 2 3 4 5 |

Comment on how your enrollment in MUS 547 (The Singing Voice: How It Works) had an impact on problem solving voice issues.

Michael M. Johns III, MD, is a graduate of Johns Hopkins School of Medicine. He completed his residency in otolaryngology at the University of Michigan and trained as a research fellow through a National Institute of Health program. He then pursued a fellowship in laryngology and care of the professional voice at the Vanderbilt Voice Center at Vanderbilt University. Dr. Johns was awarded the highest honors during his academic career, including membership in Phi Beta Kappa and Alpha Omega Alpha medical honor society. He is the director of the Emory Voice Center at Emory University, pursuing research, teaching, and clinical care, with a specific interest in geriatric laryngology and the aging voice.

Singing voice specialist and speech-language pathologist, **Aaron Ziegler, MA, CCC-SLP**, earned a BFA in theater from the University of Michigan, where he studied voice with George Shirley, and an MA from Northwestern University in Speech-Language Pathology. He is currently pursuing his PhD at the University of Pittsburgh under Dr. Katherine Verdolini Abbott, after recently completing his clinical fellowship at the Emory Voice Center. Concurrently, he is providing care at the University of Pittsburgh Medical Center as part of the voice and swallowing centers. He has also worked as a voice trainer in his private studio, as a performing arts teacher in Hong Kong and Bangkok, and as adjunct faculty at Columbia College Chicago.

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