

Vocal Hygiene Habits and Vocal Handicap Among Conservatory Students of Classical Singing

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Summary: Objectives. This study sought to assess classical singing students' compliance with vocal hygiene practices identified in the literature and to explore the relationship between self-reported vocal hygiene practice and self-reported singing voice handicap in this population. The primary hypothesis was that increased attention to commonly recommended vocal hygiene practices would correlate with reduced singing voice handicap.

Study Design. This is a cross-sectional, survey-based study.

Methods. An anonymous survey assessing demographics, attention to 11 common vocal hygiene recommendations in both performance and nonperformance periods, and the Singing Voice Handicap Index 10 (SVHI-10) was distributed to classical singing teachers to be administered to their students at two major schools of music.

Results. Of the 215 surveys distributed, 108 were returned (50.2%), of which 4 were incomplete and discarded from analysis. Conservatory students of classical singing reported a moderate degree of vocal handicap (mean SVHI-10, 12; range, 0–29). Singers reported considering all 11 vocal hygiene factors more frequently when preparing for performances than when not preparing for performances. Of these, significant correlations with increased handicap were identified for consideration of stress reduction in nonperformance ($P = 0.01$) and performance periods ($P = 0.02$) and with decreased handicap for consideration of singing voice use in performance periods alone ($P = 0.02$).

Conclusions. Conservatory students of classical singing report more assiduous attention to vocal hygiene practices when preparing for performances and report moderate degrees of vocal handicap overall. These students may have elevated risk for dysphonia and voice disorders which is not effectively addressed through common vocal hygiene recommendations alone.

Key Words: Vocal hygiene–Vocal handicap–Voice handicap–Singer–Dysphonia.

INTRODUCTION

Vocal pedagogues, speech language pathologists, and laryngologists routinely recommend vocal hygiene practices such as moderation in amount and type of voice use, reducing stress, avoidance of phonotraumatic behaviors such as screaming or talking over crowds, and improved hydration and humidification, to improve performance and ensure vocal longevity.^{1–3} Some objective evidence supports these recommendations—for instance, there are some studies that link improved laryngeal hydration to improved voice quality,⁴ and vocal rest has also been linked to improved vocal health.⁵ Other recommendations, such as the use of antacid medications, are more general and stem from current understanding of causes of many vocal fold pathologies.³ Classical singing students routinely receive these recommendations from teachers, speech-language pathologists, and laryngologists hoping that they can avoid vocal problems through preventative lifestyle modifications.^{2,6} However, the effectiveness of these practices in preventing vocal dysfunction among singers remains uncertain.

Conservatory students of classical singing develop vocal hygiene habits that affect the rest of their careers. The

musical, academic, and social demands of the conservatory environment necessitate frequent voice use, placing these students at increased risk of voice problems. Students participate in ensembles of varying sizes, from large choral groups to duos; perform roles in operas; work intensively on vocal technique, style, diction, and stage movement through one-on-one coachings and master classes; and study music history, theory, and language and lyric diction. In addition to the requirements of their degrees, singers often hold positions at local religious institutions as chorus members or music directors, teach singing, take outside auditions, and seek additional performance opportunities outside the conservatory. For each of these activities, there is a corresponding investment of practice and study time, and students are often learning how best to practice while working out challenging technical problems. As a result, singers may be more sensitive to dysphonia and vocal dysfunction than non-singers, and many report anxiety related to the proper functioning of their voices. Surveys have suggested that as much as 87% of classical singing students suffer from at least one symptom of vocal attrition (hoarseness, reduced pitch range, vocal fatigue, tightness or pressure in the throat, throat discomfort, dryness in the throat, and throat pain) because of “vocally abusive behaviors,” such as speaking quickly, speaking at too low a pitch, and dominating conversations in social situations.⁷ The higher prevalence of vocal problems in preprofessional singers has previously been observed in musical theater singers on matriculation into training programs.⁸ Additionally, current literature on preprofessional classical singers suggests that these students have a low compliance with commonly recommended vocal hygiene

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¹At the time this work was conducted.

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practices.⁶ This population also tends to seek information about vocal health not from medical professionals but from their primary voice instructors.⁹ The increased risk of voice problems, combined with the reluctance to seek professional medical attention, indicates a need for a better understanding of development and prevention of dysphonia among singing students to reduce the incidence of vocal attrition in this population.

This study sought to assess classical singing students' compliance with vocal hygiene practices identified in the literature and to explore the relationship between self-reported vocal hygiene practice and self-reported vocal health in this population.

METHODS

A survey assessing demographics, risk factors for voice problems, vocal hygiene practices, and singing voice handicap¹⁰ was created and distributed to students at the Eastman School of Music in Rochester, New York, and the Peabody Institute in Baltimore, Maryland (Appendix A). Subjects were selected for feasibility and representation of two major conservatory voice programs. Vocal pedagogues at each institution agreed to distribute surveys to their students and collected the surveys in sealed envelopes. The survey was completed and returned anonymously, so that neither the vocal pedagogues nor research team could identify respondents. The study was approved by the Institutional Review Board of the Johns Hopkins Medical Institutions.

Primary outcome measures included vocal hygiene recommendation adherence in both performance and nonperformance periods, assessed using a vocal hygiene index developed by the study team and level of vocal handicap as measured by the Singing Voice Handicap Index-10 (SVHI-10).¹⁰ Secondary outcome measures included information on length of training, vocal health history, and primary goals for singing.

The vocal hygiene index was developed by consulting existing studies describing vocal hygiene recommendations and asking respondents to rate how often they considered each of 11 common vocal hygiene recommendations on a Likert scale from 0 to 4, with 0 being "never" and 4 being "always," in a fashion that mimicked the scale used in the SVHI-10. Vocal hygiene and vocal health factors assessed included amount and duration of speaking and singing voice use, noisy environments, water intake, diet, amount and/or quality of sleep, amount and/or type of physical exercise, caffeine intake, stress reduction, gastroesophageal reflux disease/reflux effects and prevention, and medication effects.^{1,3,6,11} The index was repeated for the periods leading up to performances and periods not leading up to performances (questions 15 and 16, Appendix A). Possible scores ranged from 0 (if a respondent "never" considered any of the 11 vocal hygiene factors) to 44 (if a respondent "always" considered each of the 11 vocal hygiene factors).

Statistical analysis was performed using Stata13 (Stata-Corp Inc., College Station, Texas). Overall scores for each vocal hygiene index were calculated, and the difference

between a nonperformance period and a performance period assessed by subtracting the nonperformance period numerical score from the performance period score. A paired *t* test was completed for each individual category and overall score between nonperformance and performance periods. Similarly, a paired *t* test was also completed to compare the overall scores for gender and age categories. Multiple linear regression models using model selection methods were used to assess whether consideration of individual vocal hygiene and vocal health factors were predicative of SVHI-10 score. Variance inflation factors (VIF) were calculated, and backward selection modeling was performed to judge the validity of the analysis.

RESULTS

One hundred twenty-five surveys were mailed to the Eastman School of Music, and 63 (50%) were returned in the mail. Four (6%) were discarded from analysis because of failure to complete one or more indices. Ninety surveys were delivered to teachers at the Peabody Institute, of which 45 (50%) were returned completed and none discarded. Characteristics of the respondents are summarized in Table 1. Mean vocal hygiene index scores were higher for performance periods than

TABLE 1.
Characteristics of the Study Population

Characteristic	n = 104
Mean age (range)	22 (17 to 63)
Female, n (%)	69 (66)
Mean years of training (standard deviation [SD]); n = 102	7.6 (3.9)
Vocal health history	
Current smoker, n (%)	2 (1.9)
Former smoker, n (%)	10 (9.6)
Prior voice problem (n = 103), n (%)	25 (24)
History of reflux (n = 101), n (%)	9 (8.9)
Singing goals	
Solo performance, n (%)	84 (81)
Solo performance + education, n (%)	4 (3.8)
Education (university or grade school), n (%)	4 (3.8)
Personal enjoyment, n (%)	12 (12)
Mean total hygiene scores	
Performance period (SD, range)*	29 (7.8, 10 to 44)
Nonperformance period (SD, range)*	23 (7.3, 5 to 40)
Difference (performance period, nonperformance period; SD, range)	6.3 (5.0, -7 to 21)
Mean SVHI-10 (SD, range)†	12 (6.1, 0 to 29)

* Values range from 0 to 44, where 0 = never consider any vocal hygiene practice and 44 = always consider all practices.

† Values range from 0 to 40.

TABLE 2.
Differences Between Consideration of Hygiene Factors in Nonperformance and Performance Periods

Predictor	Difference (95% Confidence Interval)	P Value
Speaking voice	1.07 (0.87–1.26)	0.00001
Singing voice	0.68 (0.51–0.85)	0.00001
Environment	0.68 (0.50–0.86)	0.00001
Water intake	0.59 (0.45–0.72)	0.00001
Diet	0.45 (0.26–0.64)	0.00001
Sleep	0.46 (0.28–0.64)	0.00001
Exercise	0.23 (0.08–0.38)	0.0037
Caffeine	0.63 (0.41–0.86)	0.00001
Stress reduction	0.63 (0.43–0.82)	0.00001
Reflux	0.30 (0.16–0.44)	0.0001
Medication	0.52 (0.34–0.70)	0.00001
Overall score	6.27 (5.30–7.23)	0.00001

nonperformance periods (29 ± 0.8 vs 23 ± 0.7 , $P = 0.00001$), indicating that students considered vocal hygiene factors more often when preparing for a performance. Table 2 presents the differences between consideration of each individual vocal health and hygiene factor in performance and nonperformance periods. These scores varied widely for both periods, however, as evidenced by the broad ranges and large standard deviation of responses. No scores (either hygiene or SVHI-10) differed significantly between gender, age groups (<21 years and ≥ 21 years), or with length of training. Of the 104 survey respondents, 41 (39%) had an SVHI-10 score >14, indicating possible vocal problems.¹⁰ Four (3.8%) had scores >21.5, the mean value for dysphonic singers in the original validation study.¹⁰

Multiple linear regression models using vocal hygiene factors from questions 15 and 16 (Appendix A) with SVHI-10 as the outcome show that consideration of stress reduction ($P = 0.01$) correlates significantly with increased voice handicap in nonperformance periods, whereas consideration of singing voice use ($P = 0.02$) in performance periods correlates significantly with reduced vocal handicap, and

consideration of stress reduction ($P = 0.02$) in performance periods continues to predict increased vocal handicap (Table 3). Collinearity does not appear to exist in either model based on the variance inflation factors (mean VIF, 1.64 for nonperformance and 1.71 for performance periods), further suggesting the significance of these correlations. Additionally, models built using the backward selection method result in the same significant predictors in each model, with the predictors in performance periods becoming even more significant ($P = 0.007$ for stress reduction, $P = 0.006$ for singing voice use).

DISCUSSION

Conservatory students of classical singing in this cross-sectional study report a moderately elevated degree of vocal handicap and devote more time to consideration of 11 common vocal hygiene factors when preparing for performances than in periods when they are not preparing for performances. Overall attention to vocal hygiene factors does not appear to correlate with voice handicap as measured by the SVHI-10, except that greater consideration of stress reduction in both performance and nonperformance periods correlates significantly with increased vocal handicap and greater consideration of singing voice use in performance periods correlates significantly with decreased vocal handicap.

To validate the results of this analysis, VIFs for each linear regression were calculated. A set of covariates that are highly correlated may experience the phenomenon of multicollinearity, where the set appear to be significantly related to an outcome as a group but insignificant as individual covariates. VIF is a commonly used measure of multicollinearity because it quantifies the increase in variance because of the multiple correlations among the covariates. A mean VIF value of 1.0 indicates little to no influence in coefficient estimates from multicollinearity, whereas a value >10 suggests high multicollinearity. Our models demonstrated mean VIF values of 1.64 and 1.71, indicating a very low probability of multicollinearity and suggesting the validity of this model.

TABLE 3.
Regression Coefficients for SVHI-10 Scores in Nonperformance and Performance Periods

Predictor	Nonperformance Coefficient (Q15)	P Value	Performance Coefficient (Q16)	P Value
Speaking voice	0.79	0.305	-1.28	0.121
Singing voice	-0.97	0.228	-2.55	0.018
Environment	0.85	0.195	0.64	0.253
Water intake	-0.60	0.444	-0.59	0.580
Diet	-0.16	0.810	0.92	0.239
Sleep	-0.23	0.761	-0.29	0.756
Exercise	0.10	0.876	-0.01	0.985
Caffeine	-0.28	0.570	-0.08	0.875
Stress reduction	1.49	0.010	1.43	0.022
Reflux	0.16	0.783	0.29	0.543
Medication	-0.91	0.099	-0.37	0.452

Bold indicates statistical significance ($P=0.05$).

Further validation was achieved with the use of the backward selection method to model the data. The backward selection method is one of many methods used for regression model building. It starts with a full model including all possible predictors and deletes insignificant variables one by one until only significant variables remain. The backward selection method model generated from our data identified the same significant predictors (singing voice use and stress reduction) as the linear regression models, a strong indication of the significance of these variables.

The correlation of frequent consideration of “stress reduction” with increased vocal handicap suggests that singers who experience higher levels of stress (academic, musical, social, or other) may be more prone to vocal handicap than those who experience less. It is especially interesting that this particular consideration represents the only significant vocal hygiene practice in this study to demonstrate a significant effect on reported vocal handicap in both nonperformance preparation and performance preparation periods. Given the high level of musical and academic performance expected of conservatory students, an awareness of feelings of stress should not be surprising, but the correlation identified here suggests that the effects of stress represent the most significant contribution to the elevated level of vocal handicap reported in this study, regardless of observance of commonly recommended vocal hygiene practices such as reducing voice use, hydration, or avoiding certain foods. Furthermore, it cannot be ruled out that those who are more attentive to vocal hygiene may also be more sensitive to changes in voice, which would result in higher scores for both hygiene and handicap.

Alternatively, this finding may suggest that singers’ attitudes toward stress may be more important than stress itself. Those who are more attentive to “stress reduction” may feel the effects of stress more acutely, causing increased anxiety about voice and potentially introducing unnecessary tension into speech and singing. Large population-based studies examining the link between attitudes about stress and all-cause mortality have demonstrated that the belief that stress is harmful may actually increase risk of death. This suggests that there may be negative physiological consequences that arise from the perception of stress as harmful, which may in part explain the elevation in vocal handicap.¹² It has also been demonstrated that individuals who are trained to “reappraise” their physiological stress response as “functional and adaptive” in turn demonstrate improved physical stress response.¹³

This finding is consistent with prior studies, which have found that vocal hygiene practices are less effective than voice therapy as preventative or rehabilitative treatment for phonotrauma.¹⁴ It has also been shown that vocal hygiene education for singing students does not effectively produce changes in potentially phonotraumatic behaviors.^{2,6} A recent study using self-reported vocal hygiene and handicap data and objective measurements of vocal performance in eight master’s level singing students found that both the male and the female singers with the highest perturbation values reported

adherence to common hygiene practices such as adequate hydration and limiting voice use.¹⁵ Our findings further suggest that conservatory students of classical singing may have elevated risk for dysphonia and voice disorders which is not effectively addressed through adherence to common vocal hygiene recommendations alone.

Several other factors may account for these findings. Some of the elevation in vocal handicap index score may be related to history of prior vocal problems, with 24% of those surveyed reporting prior vocal health problems and an additional 9% reporting difficulty with reflux. Furthermore, conservatory students of classical singing may be more attuned to fluctuations in voice because students of classical singing work to change their vocal technique and address ingrained habits in speaking and singing voice use, which may in the short term lead to increased awareness and distress related to voice. Finally, most students at the conservatory level are still in the formative stages of their professional careers, and the effects of their continued vigilance on vocal health remain to be seen as they move into professional careers in music.

This study has several important limitations. First, some survey questions were ambiguous and resulted in poor data. For example, when singers were asked what they considered a performance preparation period, the survey was intended to ask them for a number of days or weeks, but many respondents simply circled “Days” or “Weeks” without providing an exact numerical value. The variety of responses to this question made it impossible to assess the relationship between length of time spent preparing for performance and vocal handicap scores. In addition, typographic errors resulted in incorrect numbering of the vocal hygiene indices, which has been corrected for clarity in the included version. These errors did not appear to significantly impact participant responses.

The vocal hygiene indices that we developed addressed how often singers reported considering factors of vocal health and hygiene but could not assess their actual practices. This assessment remains a goal for future studies. Finally, although SVHI-10 score may predict vocal fold pathology,¹⁰ no objective assessments could be performed. The prevalence of clinically significant dysphonia and/or vocal fold pathology in this population remains to be studied. Additionally, recent evidence has suggested that voice handicap indices may be poor predictors of actual vocal fold pathology as identified by clinicians,¹⁶ suggesting that the perceived handicap may be related to problems with vocal technique, rather than physiological health of the vocal folds themselves as maintained through hygiene practices.

CONCLUSIONS

These data suggest that the benefits of preventive vocal hygiene practice in this population may currently be overstated. Despite their reported attentiveness to vocal hygiene factors, these singers demonstrate high levels of perceived handicap. It is reasonable to conclude that lack of adherence to vocal hygiene recommendations may play only a small part in

increasing risk for vocal problems among conservatory students of classical singing. Helping students of classical singing to develop more effective strategies for managing and reappraising stress—such as those reported by Jamieson et al¹³—may prove more effective in reducing vocal attrition and improving vocal health in this population than vocal hygiene education.

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APPENDIX A

Vocal hygiene and voice handicap survey.

Thank you for your participation! Please note that your completion of this survey or questionnaire will serve as your consent to participate in this research study. If you do not wish to participate, please return the survey blank.

- For how many years have you been training as a singer?

- What is your gender? _____
- What is your age? _____
- What is your primary focus as a singer? (Please choose the most accurate answer.)
 - Performance (solo)
 - Performance (choral)
 - Music education (in schools)
 - Vocal pedagogy (teaching privately or in a university)
 - Personal enjoyment (non-professional)
- Have you ever sought medical treatment for a voice problem? _____ (y/n)
- Have you been diagnosed with a vocal fold pathology? If so, please specify. _____
- If yes, have you done speech or voice therapy?
 - Yes
 - No
- If yes, for how long? _____ (circle: months or years)
- Have you been diagnosed with GERD or any type of reflux disease before? _____ (y/n)
- Do you currently smoke?
 - No
 - Once a month
 - Once a week
 - Once a day
 - Less than 1 pack a day
 - 1-2 packs a day
 - More than 2 packs a day
- Have you ever smoked?
 - Yes
 - No
- If yes, for how long? _____ (month or years)
- When did you quit? _____ (mo/yr)
- The following questions refer to periods directly leading up to a performance. When you have a performance coming up, what period of time constitutes a “performance preparation period” for you? _____ (circle one: days or weeks)

15. Please rate the following on a scale of 0–4, where:

0 = Never 1 = Almost Never 2 = Sometimes 3 = Almost Always 4 = Always

How often do you consider the following factors of Vocal Health and hygiene when you are not preparing for a performance?¹

Amount and duration of speaking voice use	0	1	2	3	4
Amount and duration of singing voice use	0	1	2	3	4
Noisy environments	0	1	2	3	4
Water intake	0	1	2	3	4
Diet	0	1	2	3	4
Amount and/or quality of sleep	0	1	2	3	4
Amount and/or type of physical exercise	0	1	2	3	4
Caffeine intake	0	1	2	3	4
Stress reduction	0	1	2	3	4
GERD/reflux effects and prevention	0	1	2	3	4
Medication effects	0	1	2	3	4

16. Based on your answer from Question 14, how often do you consider the following factors of Vocal Health and hygiene when you are preparing for a performance?²

Amount and duration of speaking voice use	0	1	2	3	4
Amount and duration of singing voice use	0	1	2	3	4
Noisy environments	0	1	2	3	4
Water intake	0	1	2	3	4
Diet	0	1	2	3	4
Amount and/or quality of sleep	0	1	2	3	4
Amount and/or type of physical exercise	0	1	2	3	4
Caffeine intake	0	1	2	3	4
Stress reduction	0	1	2	3	4
GERD/reflux effects and prevention	0	1	2	3	4
Medication effects	0	1	2	3	4

The Singing Voice Handicap Index-10³

¹Adapted from Barnes-Burroughs K and Rodriguez MC. "The teaching performer: a survey of assets versus choices in voice use." *J Voice*. 2012 Sep; 26(5):642-55.<http://dx.doi.org/10.1016/j.jvoice.2011.10.005>. Epub 2012 Feb 17.

²Ibid.

³Cohen SM, Statham M, Rosen CA, Zullo T. "Development and validation of the Singing Voice Handicap-10." *Laryngoscope*. 2009 Sep; 119 (9):1864–9.