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Vocal warm-up practices and perceptions in vocalists: a pilot survey

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VOCAL WARM-UP PRACTICES AND PERCEPTIONS IN VOCALISTS:
A PILOT SURVEY

A Thesis

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Masters of Arts

in

The Department of Communication Disorders

by

Allison Kimberly Gish
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ABSTRACT

Vocal warm-up exercises are believed to contribute to the prevention of vocal fold injury in professional voice users. Professional singers and students of singing consider a regular vocal warm-up regimen essential. There is conflicting information in the vocal pedagogy literature about the most effective and widely used vocal warm-up exercises and the optimal frequency and duration of vocal warm-up sessions. The goal of this current study was to investigate the characteristics of vocal warm-up regimens in the singing community using a survey. One hundred seventeen participants completed the survey. Participants included voice students from undergraduate, masters, and doctoral music programs and professional singers. All participants reported using vocal warm-up prior to singing. Vocal cool-down was used following singing in 22.2% of the participants. The majority of participants (78.6%) used warm-up sessions of 5-20 minutes in duration. Despite using vocal warm-up, 25.6% of participants reported experiencing voice problems. The investigation of gender and education on frequency and duration of vocal warm-up sessions revealed that females warmed up significantly more frequently than males. There was no significant difference in duration of warm-up sessions between males and females. However, females tended to employ longer warm-up sessions than males. Education of the participants did not appear to have any significant effect on the vocal warm-up practices. The most commonly used singing warm-up exercises were ascending/descending 5-note scales, ascending/descending octave scales, legato arpeggios, and glissandi. Findings suggested a belief among singers that warming up improves voice quality and assists in prevention of vocal injury. Future studies are planned to investigate the effect of voice classification and singing styles on vocal warm-up practices.

1 INTRODUCTION

Vocal warm-up exercises are believed to contribute to the prevention of vocal fold injury in professional voice users. For professional singers and students of singing, a regular vocal warm-up regimen is considered essential (Miller, 1990; Goldberg, 2007). Despite the wide and longstanding use of vocal warm-up in the singing community, relatively little is known about how vocal warm-up impacts the physiologic characteristics of the vocal folds and affects the acoustic parameters of the voice. Furthermore, there is conflicting information in the vocal pedagogy literature about the most effective and widely used vocal warm-up exercises and the optimal frequency and duration of vocal warm-up sessions.

Given that the laryngeal and respiratory muscles function in the same way as other skeletal muscles (Saxon & Schneider, 1995), it is necessary to briefly review the purposes and effects of warm-up on the skeletal muscles. According to Woods et al. (2007), there are two main functions for warm-up. Warm-up should “improve a muscle’s dynamics” in order to reduce the risk of injury. Warm-up should also prepare the athlete for the demands of exercise. Specifically, warm-up improves muscle function by reducing viscous resistance in the muscles, resulting in smoother contractions (Bishop, 2003; Woods, Bishop, & Jones, 2007). Warm-up also increases muscle temperature, thereby increasing blood flow to active tissues (Bishop, 2003; Woods, Bishop, & Jones, 2007). Muscles that have been warmed-up require greater stretching and force to induce tearing, thereby reducing the risk of muscle injury (Safran, Seaber, & Garrett, 1988).

Study of laryngeal muscle function is possible using laryngeal electromyography (EMG), a technique in which muscle activity is measured via electrodes inserted into the muscle (Heman-

Ackah & Barr, 2006). However, laryngeal EMG must be performed by physician and requires that subjects receive local anesthesia (Heman-Ackah & Barr, 2006). As a result, previous studies have employed indirect measures of laryngeal function in order to study the effects of vocal warm-up on the vocal folds. Elliot et al. (1993) investigated the effect of vocal warm-up on phonation threshold pressure (PTP), which the authors defined as “the lowest subglottal pressure capable of bringing the vocal folds to oscillation.” This pilot study sought to determine if vocal warm-up would induce a lowering of PTP in a group of amateur singers. Each subject’s singing voice was recorded and PTP was measured before and after a vocal warm-up designed and implemented by a professional singing instructor. This 30-minute warm-up commenced with a descending melodic pattern on the syllable [mu:] in the middle of each participant’s pitch range. The remainder of the warm-up procedure was not explicitly stated, but was described as “various exercises involving pitch changes, different vowels, and different degrees of vocal loudness, consistently avoiding extremely loud singing.” All but one participant reported that the warm-up was successful in that “voice timbre [was] better, that it was easier to sing, particularly at high pitches, and that the voice appeared as a more obedient instrument.” This study found that the effect of vocal warm-up on PTP varied considerably between participants, increasing with pitch in some participants, decreasing in others, and remaining essentially unaffected by pitch in other participants.

A more recent study conducted by Motel et al. (2002) investigated the effect of vocal warm-up on PTP in soprano singers at high pitch, as well as, its effect on vocal range. The authors of this study hypothesized that vocal warm-up would increase maximum and minimum fundamental frequencies (F_0) and PTP. Maximum F_0 , minimum F_0 , and PTP measurements were collected from each participant before and after two conditions: a 10-minute vocal warm-up on

Day 1 and a 10-minute period of vocal rest on Day 2. The vocal warm-up protocol was designed by a professional singing instructor, and each participant was provided with an audio recording of the exercises for review prior to the experiment. The vocal warm-up consisted of five exercises: (1) descending stepwise scales spanning one octave on the syllable /zi/ in legato style; (2) ascending and descending stepwise scales spanning one fifth on the syllable /zi/ in legato style; (3) ascending major triads on the syllable /i/ in staccato style; (4) descending, stepwise thirds on the syllables /trioioi/ spanning one half-octave; and (5) allegro ascending and descending scales spanning one octave on a text of /vi/. Although all participants reported positive effects following the vocal warm-up, the degree to which the participants felt “warmed-up” varied considerably, suggesting this warm-up protocol did not provide equal exercise and equal benefits to the participants. The study found that PTP increased at high pitches in six of the nine participants studied, while maximum and minimum F_0 did not change significantly. This finding is significant because increased PTP is typically associated with the increased phonatory effort, suggesting that vocal warm-up produces different effects than previously thought.

Milbrath et al. (2003) further examined the effect of vocal warm-up on PTP in eight female non-singers who presented with complaints of vocal fatigue. The effect of vocal warm-up on perceived phonatory effort (PPE) was also examined. PTP and PPE data was collected before and after two “vocal-preparation” conditions: (1) 20 minutes of vocal rest and general relaxation and (2) 15-20 vocal warm-up regimen designed by the researchers. This warm-up regimen consisted of stretches targeting the arms, chest, back, mandible, and tongue, followed by deep breathing while seated with a well-aligned posture. Next, resonance was targeted as the participants sustained pitches for 1-2 seconds, while focusing on “feeling the upper lip or nose

buzz.” Finally, the participants performed vocal function exercises consisting of ascending and descending pitch glides on the syllable /nol/. Following the vocal-preparation conditions, PTP and PPE was measured following a one-hour vocal loading task (loud reading) and again following a 30-minute vocal recovery period. The study failed to find significant differences between PTP and PPE measurements following each of the conditions. The authors concluded that PTP and PPE are not adequately sensitive for measuring changes in vocal function in people who experience chronic vocal fatigue.

In the above-mentioned studies, the researchers utilized PTP as a means of measuring change effected by vocal warm-up. Amir et al. (2005) instead investigated the effect of vocal warm-up on the acoustic parameters of the voice in twenty young, female singers. Frequency and amplitude perturbation and noise indices, singer’s formant, and accuracy of pitch production were measured before and after vocal warm-up. Each subject was instructed to warm-up using her personal warm-up routine. Some subjects completed their warm-ups with the assistance of a professional voice teacher, while others completed their warm-ups independently. All participants utilized different vocal exercises encompassing “voice productions and placement at different pitches, registers, and amplitude levels using a variety of syllables sung in different pitches,” and warm-ups ranged from 7 to 23 minutes in duration. Most warm-up protocols also included muscle relaxation and breathing exercise components. The rationale for this approach was that vocal warm-up is highly personal to the individual, addressing her particular vocal needs, and that a standardized routine may not have been adequate for every participant. The study found that vocal warm-up reduced frequency perturbation and amplitude perturbation measures, increased singer’s formant amplitudes, and improved noise-to-harmonic ratio (NHR). Pitch accuracy was not affected. Interestingly, these effects were more pronounced in mezzo-

soprano singers, than in soprano singers. The results support the use of acoustic measurement as a tool for investigating the effects of vocal warm-up.

Although singers consistently report that vocal warm-up improves voice quality, previous research has failed to identify how vocal warm-up affects the voice (Elliott, Sundberg & Gramming, 1995; Motel, Fisher, & Leydon, 2002; Milbrath & Solomon, 2003; Amir, Amir, & Michaeli, 2005). Studies investigating the effect of vocal warm-up on PTP have yielded conflicting results, while studying the effect of vocal warm-up on acoustic parameters of the voice appears promising. A significant limitation of previous studies is that the warm-up regimens employed varied considerably between the studies. Some studies utilized standardized warm-up protocols (Elliott, Sundberg & Gramming, 1995; Motel, Fisher, & Leydon, 2002), while others allowed participants to utilize a personalized warm-up routine (Amir, Amir, & Michaeli, 2005). Furthermore, the duration of warm-up protocols utilized in previous studies varied considerably, ranging between 7 and 30 minutes. This lack of consistency may be one of the factors contributing to conflicting results between studies.

Literature Review

Currently, no vocal warm-up regimen exists, which is universally used among singers. This lack of consistency leads to widely-varied warm-up regimens. Miller (1990) wrote “What takes place among singers during the warm-up process may be amazingly diverse, and the results of varying value.” In order to study the effects of vocal warm-up on vocal fold health, it is essential to first determine the most commonly used vocal warm-up exercises employed in singers’ warm-up regimens. In addition, it is vital to establish the average duration and frequency of vocal warm-up sessions in singers, and how vocal warm-up is perceived in the prevention of vocal injury in singers. Furthermore, one needs to determine the frequency of vocal difficulties

experienced by singers who use/do not use warm-up exercises. Answers to these questions will determine the most widely used and most effective vocal warm-up regimens in preventing vocal fold injury in singers.

In conducting a study of vocal warm-up practices in singers, it is first imperative to investigate vocal warm-up as described in vocal pedagogy literature. Goldberg (2007) listed the basic categories of vocal warm-up exercises for singers: (1) Stretching and relaxation exercises for “both body and voice”; (2) Breathing exercises to encourage deep, low breathing; (3) Concentration exercises, using deep breathing, to focus the singer’s mind; and (4) Singing exercises, or vocalises, that prepare the vocal mechanism for “the various physical mental, vocal, and musical tasks that the singer will encounter in the repertory.”

Miller (1990; 1996) cited the importance of preparing the larynx for strenuous activity and for assessing the status of one’s laryngeal function prior to singing, particularly prior to performance. Like previous pedagogues (Coffin, 1989), he also cautioned against warm-up regimens of excessive length (i.e. longer than 30 minutes). He advocated a “graduated program” for vocal warm-up, beginning with light physical exercises and stretching, followed by gentle, brief vocal onsets and offsets in a comfortable vocal range for the singer. He called this technique “attack and release.” Following attack and release, the singer would progress to humming and vocalizing on syllables with nasal/vowel sequences. Gradually, the singer would progress to vocalises targeting agility, utilizing ascending and descending melodic patterns. Miller emphasized that “heavy vocalization should never form part of the warm-up series,” and that the purpose of vocal warm-up is not to target technical problems, but rather, to prepare the voice for more extensive technical work.

The vocalise, in particular, has been the subject of several historical texts on vocal technique and training. Manuel Garcia, a nineteenth-century pedagogue who blended traditional *bel canto* singing technique with scientific research, defined the vocalise as “[singing] on vowels” (Garcia, 1847, 1872). He elaborated that to vocalize is “to perform with the voice, on all the vowels” over the entire pitch range of the voice, at all musical tempi, and utilizing a number of musical styles (e.g. *legato*, *staccato*, etc.). He divided vocalises into four basic categories through which singing students should progress: (1) *portamento*: “[leading] from one tone to another by passing through all of the possible intermediate tones”; (2) *legato* vocalization: “to pass from one tone to another...without interrupting the flow of sound”; (3) *marcato* vocalization: “to make [tones] distinct...by supporting each of them separately without detaching them or stopping them”; and (4) *staccato* vocalization: to “[attack] tones individually by a stroke of the glottis which detaches them from one another.” Thus, Garcia’s method included hundreds of vocalises designed to train the singer to sing effortlessly in all musical contexts and in all parts of his/her vocal range.

Like Garcia, Francesco Lamperti, another 19th century vocal pedagogue, agreed that vocalises should encompass a full range of musical styles (Coffin, 1989). Unlike Garcia, he believed that singers should only vocalize in the middle part of their vocal range, avoiding the two highest and two lowest pitches of his/her vocal range. Additionally, he advocated for emotional expression as part of the vocalise, for “singing must be subordinate to art.”

Historically, singers were instructed to complete vocalises on pure Italian vowels (i.e. /a, i, e, o, u/), and the practice of vocalizing primarily on these vowels is still common (Gregg & Scherer, 2007). The use of nasal consonants in the vocalise, particularly the practice of humming, was discouraged by many pedagogues, and was described by Marchesi, another 19th

century vocal pedagogue, as being detrimental to the developing singer (Coffin, 1989). More recently, Miller (1996a) described humming as a technique which increases awareness of breath management, encourages relaxed laryngeal function, and improves vocal resonance. Gregg (1996) further described the effect of humming on the voice. Humming on the consonant /m/ increases the strength of F_0 in the acoustic spectrum resulting in increased “carrying power” of the voice with decreased muscular effort.

Nix (1999), like earlier pedagogues, discouraged the overuse of nasals in vocalizing, citing the belief that the technique promotes a chronically lowered velum and undesirable nasality in the singing voice. Instead, Nix encouraged the use of lip trills as a means of promoting improved vocal resonance. The lip trill, also referred to as lip flutter, is an exercise in which the vocal folds and the lips are set into vibration simultaneously. Tongue trills are similar, except that it is the tongue rather than the lips which are set into vibration, as in the Italian rolled /r/. Titze explained that it is commonly believed among teachers of singing that lip and tongue trills remind the singer to be conscious of the vibrations in the lips and front of the mouth during singing and that they serve to relax the orofacial musculature. The technique is also believed to prepare the respiratory system for strenuous singing with minimal laryngeal effort. Titze then described the scientific basis behind the technique. In performing a lip or tongue trill, both the lips/tongue and the vocal folds share a common energy source: the airstream. In order to maintain vibration of both the lips/tongue and the vocal folds, the singer must “learn how to budget pressures appropriately.” Thus, lip and tongue trills tax the respiratory system without inducing vocal fatigue, given that increased vocal tract pressure tends to abduct the vocal folds (Titze, 1996).

Similar to humming, lip trills, and tongue trills, phonation through flow resistant straws during vocal warm-up can be used to warm up the respiratory muscles without fatiguing the laryngeal musculature (Titze, Finnegan, Laukkanen, & Jaiswal, 2002). Titze et al. investigated the effect of this technique on two singers by measuring aerodynamic and electroglottograph (EGG) parameters. The researchers found that lung pressure was increased in both participants, and that the exercise promoted small-amplitude vibration of the vocal folds. These findings were supported by a later study in which Titze et al. (2005) investigated the effects of semi-occluded vocal tract exercises on aerodynamic parameters using a computer model.

Titze (2002a; 2005) described a suggested protocol for implementing straw phonation in vocal warm-up, in which the singer performs pitch glides through the straw openings of various diameters. The rationale for this protocol was that the greatest effects of the exercise were produced when phonating through the most constricted opening. Thus, the exercise progresses from the smallest diameter opening to the largest diameter opening. The singer would begin with a small diameter straw, such as a coffee stirring straw, progressing to a larger diameter drinking straw. Following straw phonation, the singer would perform pitch glides on the voiced bilabial fricative /β/, followed by lip/tongue trills, progressing to nasal consonants /m/ or /n/, and finally to pitch glides on the vowel /u/ or /i/.

Sabol et al. (1995) investigated the use of vocal function exercises as a component in singers' warm-up regimens. Vocal function exercises are defined as “a series of voice manipulations that are designed to strengthen the laryngeal musculature and to facilitate efficient vocal fold vibration,” and are designed to “[give] the laryngeal and respiratory muscles a refined, sustained isometric workout at a very soft dynamic level.” Vocal function exercises differ from traditional vocal warm-up regimens in that the singer is not concerned with vocal quality during

the exercises, but, rather, with coordination of the laryngeal and respiratory muscles. In this four-week study, participants completed the following vocal function exercises twice daily in addition to their usual vocal exercise regimens: (1) sustained syllable /i/ on a comfortable pitch for as long as possible; (2) ascending pitch glide from lowest to highest possible pitches on the syllable /o/; (3) descending pitch glide from highest to lowest possible pitches on the syllable /o/; and (4) sustained the musical notes C4 D4, E4, F4, and G4 for as long as possible, on the syllable /o/ (one octave lower for males). The study revealed significant positive changes in the participants' vocal parameters following the four-week trial. Specifically, airflow rates were decreased and maximum phonation time increased, suggesting improved glottal efficiency. Furthermore, the participants reported increased awareness of tension in the laryngeal and facial musculature, resulting in more productive vocal practice sessions following the vocal function exercises.

McHenry et al. (2008) investigated general aerobic exercise as a component in vocal warm-up regimens. Ten male and ten female singer-actors completed a vocal warm-up under two conditions: (1) 20-minute vocal warm-up consisting of relaxation, breathing, and simple vocalises; and (2) 5 minutes of aerobic exercise at moderate intensity, followed by a 20-minute vocal warm-up. Acoustic measurements and PTP were measured immediately before and after each condition. For the male participants, there were no significant differences in acoustic and aerodynamic parameters between the two warm-up conditions. For the female participants, there was a greater reduction in PTP measurements when vocal warm-up was preceded by general aerobic exercise; however, acoustic parameters did not vary significantly between the two conditions. The researchers partially attributed the differences in male and female participants to the fact that the male participants were more physically fit than the female participants. It was

concluded that general aerobic exercise as a component of a vocal warm-up regimen may be beneficial in women of average fitness.

This review of vocal pedagogy and speech-language pathology literature revealed several reasons why singers are encouraged to complete vocal warm-up exercises prior to extended periods of singing: (1) To prepare the larynx for strenuous activity (Miller 1990; 1996); (2) To prepare the respiratory muscles for strenuous activity (Titze, 2002; 2005); (3) To improve glottal efficiency prior to singing (Sabol, 1995); (4) To assess vocal status prior to singing (Miller 1990; 1996); (5) To mentally prepare the singer for the musical and technical demands of singing (Goldberg, 2007; Miller, 1996a).

Purpose of Current Study

Given the wide variability of vocal warm-up regimens in singers, studies investigating the effects of vocal warm-up on vocal fold health and injury prevention have yielded conflicting results (Elliott, Sundberg & Gramming, 1995; Motel, Fisher, & Leydon, 2002; Milbrath & Solomon, 2003; Amir, Amir, & Michaeli, 2005). Furthermore, studies investigating the physiological effects of vocal warm-up on the voice are scarce. As a result, the mechanisms by which vocal warm-up affects the physiologic, acoustic, and aerodynamic parameters of the voice are still not fully understood, and the effectiveness of vocal warm-up in the prevention of vocal fold injury has not been determined. By studying the characteristics of vocal warm-up regimens in the singing community, it will be possible to design a warm-up regimen which can be used in future studies investigating the effect of vocal warm-up on the voice. The purpose of this study is: (1) To determine duration and frequency of vocal warm-up sessions in singers; (2) To examine the differences in vocal warm-up regimens in singers from varying sociodemographic groups with varying degrees of singing training; (3) To determine the most frequently used vocal

warm-up exercises in the singing community; (4) To examine singers' perceptions of the role of vocal warm-up in the prevention of vocal fold injury; and (5) To obtain preliminary data on the occurrence of vocal fold injury in singers who use/do not use a vocal warm-up regimen.

2 METHOD

Participants

Following LSU-IRB approval of the study, adult vocalists were recruited. Participants were recruited via email to complete a web-based questionnaire. Undergraduate students, graduate students, and professional singers were targeted for the study. Additional participants were recruited from the researcher's social network of professional singers. Participants were excluded if they had received less than 1 year of formal singing instruction at the time of completing the survey.

Materials and Procedure

Materials required for this study were as follows: (1) a letter to potential participants, describing the study and requesting their participation; (2) a consent statement provided to participants prior to completion of the survey; and (3) a web-based questionnaire administered to the participants.

Each participant was asked to complete a web-based questionnaire developed by the investigator. Members of the voice faculties at 136 universities in the United States and Canada were contacted via email to briefly describe the study, provide a hyperlink to the web-based questionnaire, and to request participation in the web-based questionnaire. Additionally, each voice instructor contacted was asked to forward the letter to vocal performance majors in his or her department. This recruitment letter was also sent to all members of the Southern Region of the National Association of Teachers of Singing, which is comprised of professional singers and voice instructors from Louisiana, Arkansas, and Mississippi. Additional participants were recruited from the investigator's social network of professional singers via an announcement

posted on her Facebook page. This announcement included the recruitment letter described above and a hyperlink to the web-based questionnaire.

Description of the Questionnaire

The questionnaire used in this study (Appendix B) was developed using Survey Monkey, a web-based survey application. The cryptographic protocol SSL (Secure Sockets Layer) was utilized to ensure the security of all data collected. The questionnaire consisted of a combination of closed- and open-set questions. The majority of the questions had a closed set of responses; however, for some questions, the participants were able to include written explanations of responses (e.g. if participants selected the option “other,” they were encouraged to explain this response). The questionnaire addressed characteristics of vocal warm-up in singers, including whether singers consistently use a warm-up regimen, frequency of warm-up sessions, average length of warm-up sessions, and types of exercises/tasks utilized during a typical warm-up session. For the question concerning types of exercises/tasks utilized in typical vocal warm-up sessions, an extensive list of exercises described in vocal pedagogy and speech-language pathology literature were provided, and participants selected all exercises they utilize in their warm-up regimens (See Appendix C for list of singing exercises).

In order to examine differences in vocal warm-up regimens in singers with varying degrees of formal training, questions concerning the length of time the singer has been enrolled in formal voice/singing lessons were included. Questions to determine the presence, frequency, and duration of current and past voice problems were also included so that preliminary data on the effect of vocal warm-up on vocal fold injury prevention could be obtained. Additionally, specific voice-related questions were asked to reveal behavioral and medical factors which may

contribute to voice problems. In the section that follows, topics/questions that were covered in the questionnaire are outlined:

1. Sociodemographic characteristics: (a) age, (b) gender, (c) current education level (e.g. freshman, first-year masters candidate, third-year doctoral candidate), (d) outside occupation(s), and (e) number of years enrolled in formal voice instruction.
2. Vocal warm-up regimen characteristics: (a) use of a vocal warm-up regimen, (b) frequency of vocal warm-up sessions, (c) duration of vocal warm-up sessions, (d) types of exercises/tasks utilized during a typical vocal warm-up session, and (e) use of a vocal cool-down following singing.
3. Perceptions about vocal warm-up: (a) beliefs about the necessity and importance of vocal warm-up, (b) beliefs about the role of warm-up in the prevention of vocal fold injury, and (c) perception of if/how vocal warm-up affects the voice.
4. Daily vocal use (type and frequency): (a) solo singing, (b) choral singing, (c) speaking, (d) loud talking, and (e) shouting/screaming.
5. Risks associated with voice disorders: (a) smoking, (b) alcohol consumption, (c) caffeine consumption, (d) dehydration, and (e) occupational-related risks (e.g. working in noisy and/or smoky environment).
6. History of voice problems: (a) presence of voice problems within the past year, (b) frequency of voice problems within the past year, and (c) duration of problematic voice episodes within the past year.
7. Medical conditions associated with voice disorders (presence, type, and frequency): (a) presence of gastroesophageal reflux symptoms.

Data Analysis

Analyses were descriptive in nature. Vocal warm-up characteristics (i.e. type, duration, and frequency) of all participants are presented. Vocal warm-up characteristics are compared across genders, ages, education levels, and singing experience of participants. Sociodemographic factors (i.e. gender and educational classification) and medical factors (presence of reported voice problems) that might impact vocal warm-up characteristics were analyzed using the Mantel-Haenszel chi-squared test for linear association. A $p < 0.05$ was considered of both statistical and explanatory significance.

3 RESULTS

Sociodemographic Characteristics of Participants

One hundred eighty-eight people participated in the study, and 117 (62.2%) of the respondents completed the questionnaire. For data analysis purposes, the 117 complete responses were utilized. Sociodemographic characteristics of the participants are as follows (Figures 1-5): Forty-six (39.3%) of the participants were between the ages of 18 and 30, 21 (17.9%) were between 31 and 40, and 50 (42.7%) were 41 years of age or older (Figure 1). Thirty-six (30.8%) of the participants were male and 81 (69.2%) were female (Figure 2). Sixty-five (55.6%) of the participants resided in the Southern region of the United States, 16 (13.7%) in the Midwest, 16 (13.7%) in the West, 15 (12.8%) in the Northeast, and 5 (4.3%) resided outside of the United States (Figure 3). Twenty-eight (23.9%) of the participants were undergraduate students, 29 (24.8%) were masters students, 13 (11.1%) were doctoral students, 9 (7.7%) had completed an undergraduate degree and were not currently students, 7 (6.0%) had completed a masters degree and were not currently students, and 31 (26.5%) had completed a doctoral degree (Figure 4). Seventy-four (63.2%) of the participants had received more than 10 years of formal voice instruction, 34 (29.1%) had received 5-10 years of formal voice instruction, and 9 (7.7%) had received 1-4 years to formal voice instruction (Figure 5).

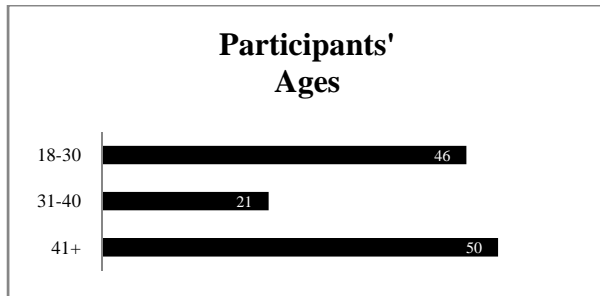


Figure 1: Distribution of Participants' Ages (n: 117)

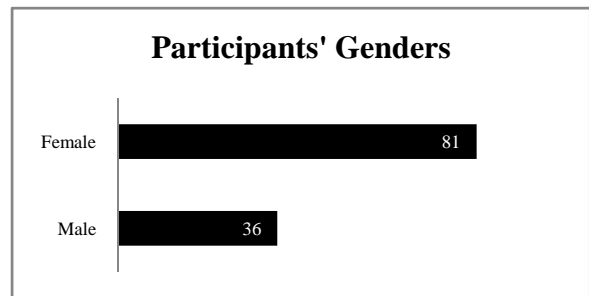


Figure 2: Distribution of Participants' Genders (n: 117)

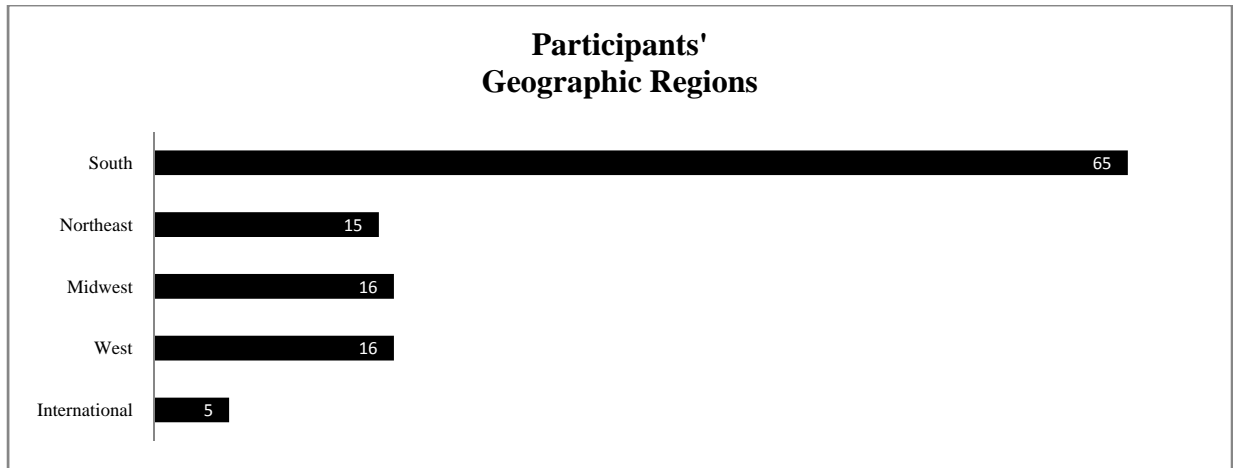


Figure 3: Participants' Geographic Regions (n: 117)

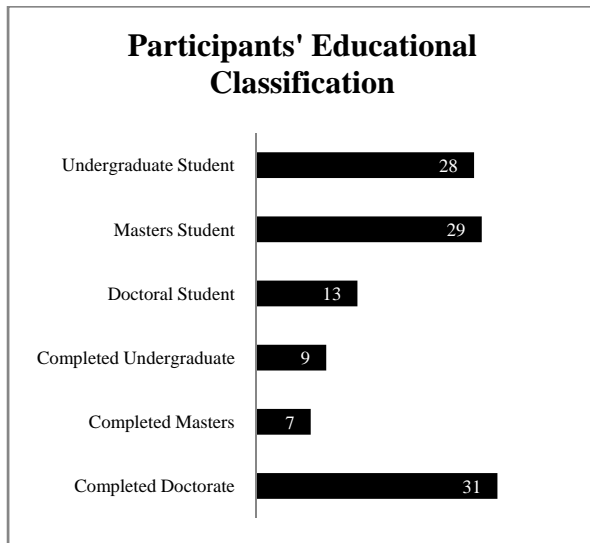


Figure 4: Distribution of Participants' Educational Classifications (n: 117)

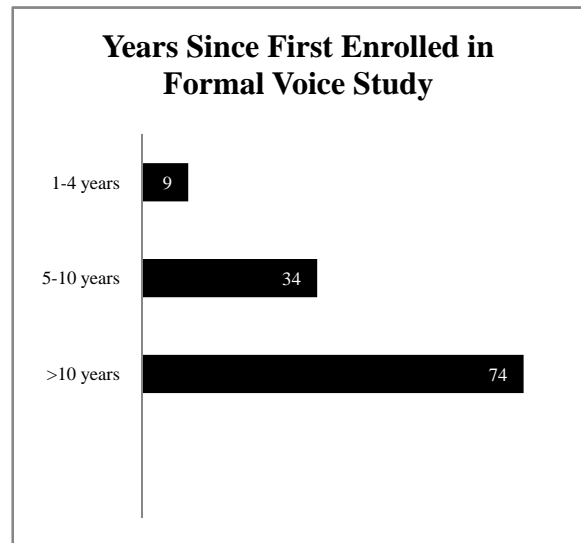


Figure 5: Distribution of Participants' Years Enrolled in Formal Voice Study (n: 117)

Frequency and Duration of Vocal Warm-Up

All participants (n: 117) reported that they currently complete a vocal warm-up prior to singing. Distribution of reported **frequency** of using vocal warm-up (Figure 6) was as follows: 63 (53.8%) answered “always,” 41 (35.0%) answered “usually,” 11 (9.4%) answered “sometimes,” and 2 (1.8%) answered “rarely.” Distribution of participants' typical warm-up **duration** (Figure 7) was as follows: 14 (12.0%) warm up for less than 5 minutes, 37 (31.6%) warm up for 5-10 minutes, 29 (24.8%) warm up for 10-15 minutes, 26 (22.2%) warm up for 15-

20 minutes, 6 (5.1%) warm up for 20-25 minutes, 4 (3.4%) warm up for 25-30 minutes, and 1 (0.9%) warms up for more than 30 minutes. Participants were asked to indicate which **vocal activities they use a vocal warm-up prior to participating** (Figure 8). More participants indicated completion of a vocal warm-up prior to solo singing activities than ensemble singing (e.g. choir performance) or speaking activities. For solo singing activities, vocal warm-up completion ranged from 75.2% (private voice lessons) to 89.7% (brief solo singing appearance). For ensemble singing activities, warm-up completion ranged from 29.1% (opera chorus participation) to 61.5% (choir concert participation). For extended periods of speaking, completion ranged from 10.3% (general speaking activities) to 17.9% (teaching a class or theater rehearsal participation). Thirty-eight (32.5%) participants reported warming up prior to teaching voice lessons, which was classified as a speaking activity in the questionnaire.

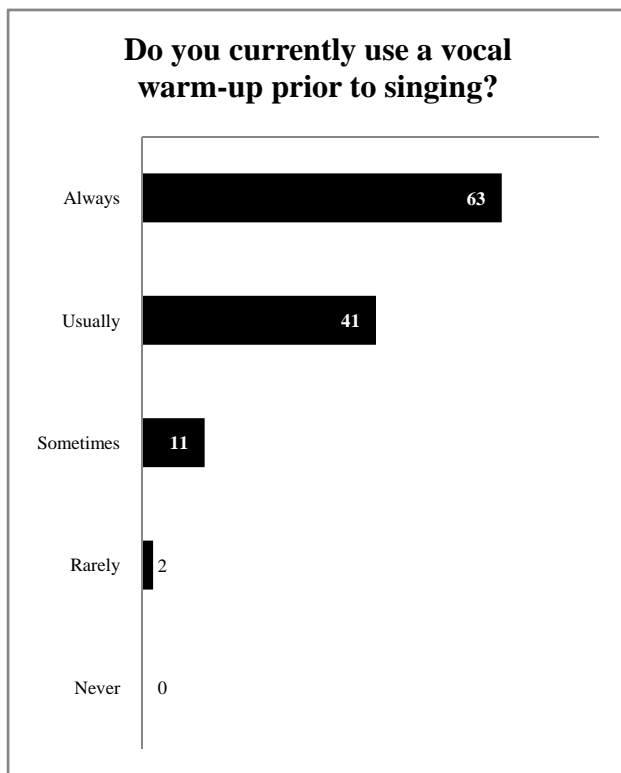


Figure 6: Frequency of Vocal Warm-Up (n: 117)

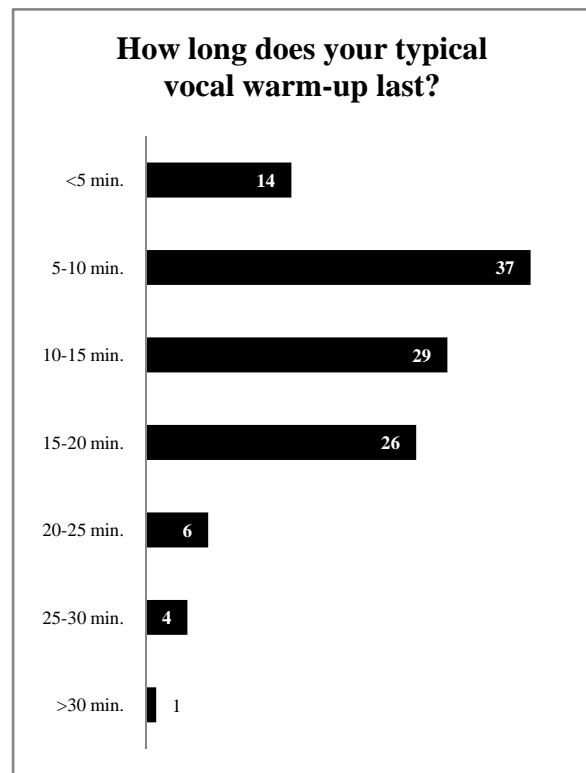


Figure 7: Duration of Vocal Warm-Up (n: 117)

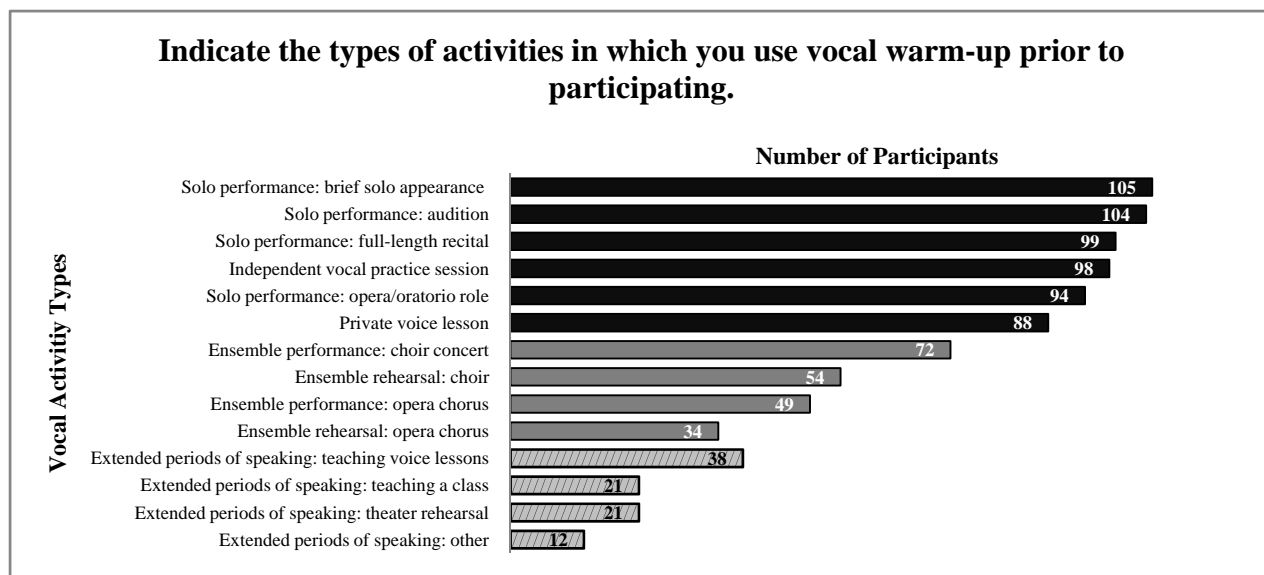


Figure 8: Distribution of Vocal Activities in Which Participants Warm Up Prior to Participating (n: 117)

Effects of Age, Gender, Educational Classification and Singing Experience on Frequency and Duration of Vocal Warm-Up

The frequency and duration of participants’ vocal warm-up regimens were further examined in the following participant sub-groups: **age** (i.e. participants aged 18-30, 31-40, and 41 and older), **gender** (i.e. male and female), **educational classification** (i.e. student and non-student), and **singing experience** (i.e. 1-4 years since first voice lesson, 5-10 years since first voice lesson, and more than 10 years since first lesson).

Age

For participants aged 18-30 (n: 46), distribution of reported **frequency** of using vocal warm-up (Figure 9) was as follows: 20 (43.5%) answered “always,” 18 (39.1%) answered “usually,” and 8 (17.4%) answered “sometimes.” For participants aged 31-40 (n: 21), distribution of reported frequency of using vocal warm-up was as follows: 12 (57.1%) answered “always,” 7 (33.3%) answered “usually,” 1 (4.8%) answered “sometimes,” and 1 (4.8%) answered “rarely.” For participants aged 41 and older (n: 50), distribution of reported frequency

of using vocal warm-up was as follows: 31 (62.0%) answered “always,” 16 (32.0%) answered “usually,” 2 (4.0%) answered “sometimes,” and 1 (2.0%) answered “rarely.”

For participants aged 18-30 (n: 46), distribution of typical warm-up **duration** (Figure 10) was as follows: 8 (17.4%) warm up for less than 5 minutes, 14 (30.4%) warm up for 5-10 minutes, 10 (21.7%) warm up for 10-15 minutes, 11 (23.9%) warm up for 15-20 minutes, and 3 (5.1%) warm up for 20-25 minutes. For participants aged 31-40 (n: 21), distribution of typical warm-up duration was as follows: 2 (9.5%) warm up for less than 5 minutes, 8 (38.1%) warm up for 5-10 minutes, 5 (23.8%) warm up for 10-15 minutes, 5 (23.8%) warm up for 15-20 minutes, and 1 (4.8%) warms up for 20-25 minutes. For participants aged 41+ (n: 50), distribution of typical warm-up duration was as follows: 4 (8.0%) warm up for less than 5 minutes, 15 (30.0%) warm up for 5-10 minutes, 14 (28.0%) warm up for 10-15 minutes, 10 (20.0%) warm up for 15-20 minutes, 2 (4.0%) warm up for 20-25 minutes, 4 (8.0%) warm up for 25-30 minutes, and 1 (2.0%) warms up for more than 30 minutes.

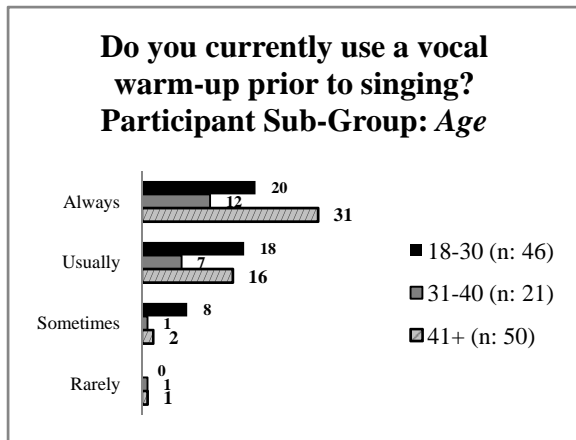


Figure 9: Frequency of Vocal Warm-Up in Age Sub-Groups

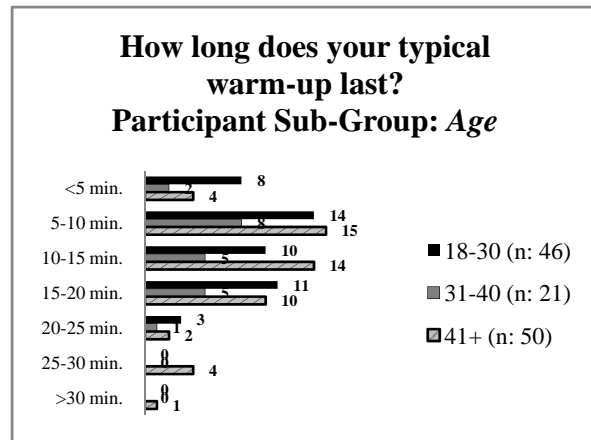


Figure 10: Duration of Vocal Warm-Up in Age Sub-Groups

Gender

For male participants (n: 36), distribution of reported **frequency** of using vocal warm-up (Figure 11) was as follows: 12 (33.3%) answered “always,” 17 (47.2%) answered “usually,” 6

(16.7%) answered “sometimes,” and 1 (2.8%) answered “rarely.” For female participants (n: 81), distribution of reported frequency of using vocal warm-up was as follows: 51 (63.0%) answered “always,” 24 (29.6%) answered “usually,” 5 (6.2%) answered “sometimes,” and 1 (1.2%) answered “rarely.” The relationship between gender and warm-up frequency was significant with females using warm-up more than males ($p=0.0032$).

For male participants (n: 36), distribution of typical warm-up **duration** (Figure 12) was as follows: 6 (16.7%) warm up for less than 5 minutes, 10 (27.8%) warm up for 5-10 minutes, 11 (30.6%) warm up for 10-15 minutes, 8 (22.2%) warm up for 15-20 minutes, and 1 (5.1%) warms up for 20-25 minutes. For female participants (n: 81), distribution of typical warm-up duration was as follows: 8 (9.9%) warm up for less than 5 minutes, 27 (33.3%) warm up for 5-10 minutes, 18 (22.2%) warm up for 10-15 minutes, 18 (22.2%) warm up for 15-20 minutes, 5 (6.2%) warm up for 20-25 minutes, 4 (4.9%) warm up for 25-30 minutes, and 1 (1.2%) warms up for more than 30 minutes. The relationship between gender and warm-up duration was not statistically significant ($p=0.1820$).

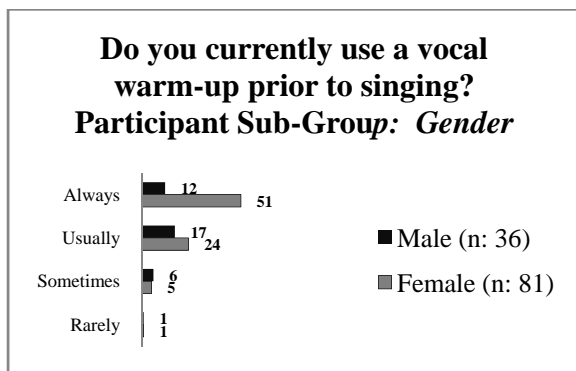


Figure 11: Frequency of Vocal Warm-Up in Gender Sub-Groups

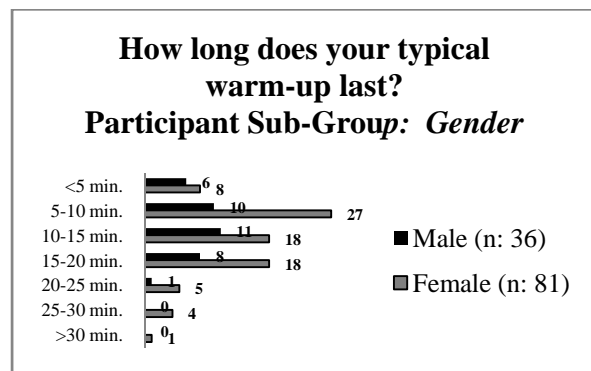


Figure 12: Duration of Vocal Warm-Up in Gender Sub-Groups

Educational Classification

For non-student participants (n: 47), distribution of reported **frequency** of using vocal warm-up was as follows: 27 (57.5%) answered “always,” 16 (34.0%) answered “usually,” 2

(4.3%) answered “sometimes,” and 2 (4.3%) answered “rarely.” For student participants (n: 70), distribution of reported frequency of using vocal warm-up (Figure 13) was as follows: 36 (51.4%) answered “always,” 25 (35.7%) answered “usually,” and 9 (12.9%) answered “sometimes.” The relationship between participants’ educational classification and warm-up frequency was not statistically significant ($p=0.6585$).

For non-student participants (n: 47), distribution of typical warm-up **duration** was as follows: 4 (8.5%) warm up for less than 5 minutes, 15 (31.9%) warm up for 5-10 minutes, 10 (21.3%) warm up for 10-15 minutes, 13 (27.7%) warm up for 15-20 minutes, 2 (4.3%) warm up for 20-25 minutes, 2 (4.3%) warm up for 25-30 minutes, and 1 (2.1%) warms up for more than 30 minutes. For student participants (n: 70), distribution of typical warm-up duration (Figure 14) was as follows: 10 (14.3%) warm up for less than 5 minutes, 22 (31.4%) warm up for 5-10 minutes, 19 (27.1%) warm up for 10-15 minutes, 7 (10.0%) warm up for 15-20 minutes, 4 (5.7%) warm up for 20-25 minutes, and 2 (2.9%) warm up for 25-30 minutes. The relationship between participants’ educational classification and warm-up duration was not statistically significant ($p=0.0984$).

For undergraduate participants (n: 28), distribution of reported **frequency** of using vocal warm-up was as follows: 13 (46.4%) answered “always,” 10 (35.7%) answered “usually,” and 5 (17.9%) answered “sometimes.” For masters participants (n: 29), distribution of reported frequency of using vocal warm-up was as follows: 15 (51.7%) answered “always,” 10 (34.5%) answered “usually,” and 4 (13.8%) answered “sometimes.” For doctoral participants (n: 13), distribution of reported frequency of using vocal warm-up was as follows: 8 (61.5%) answered “always,” and 5 (38.5%) answered “usually.”

For undergraduate participants (n: 28), distribution of typical warm-up **duration** was as follows: 7 (25.0%) warm up for less than 5 minutes, 8 (28.6%) warm up for 5-10 minutes, 6 (21.4%) warm up for 10-15 minutes, and 1 (3.6%) warms up for 20-25 minutes. For masters participants (n: 29), distribution of typical warm-up duration was as follows: 3 (10.3%) warm up for less than 5 minutes, 9 (31.0%) warm up for 5-10 minutes, 8 (27.6%) warm up for 10-15 minutes, 4 (13.8%) warm up for 15-20 minutes, 3 (10.3%) warm up for 20-25 minutes, and 2 (6.9%) warm up for 25-30 minutes. For doctoral participants (n: 13), distribution of typical warm-up duration was as follows: 5 (38.5%) warm up for 5-10 minutes, 5 (38.5%) warm up for 10-15 minutes, and 3 (23.1%) warm up for 15-20 minutes.

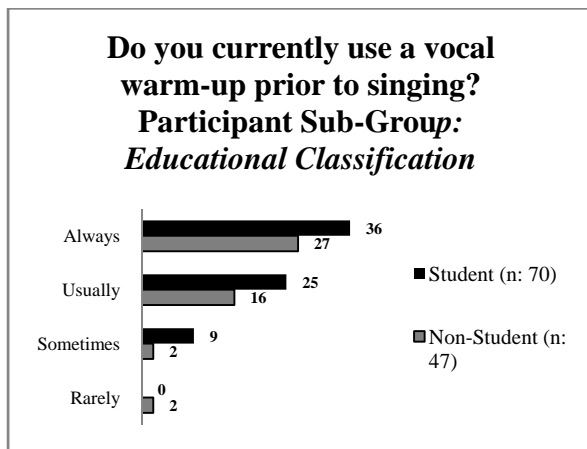


Figure 13: Frequency of Vocal Warm-Up in Educational Classification Sub-Groups

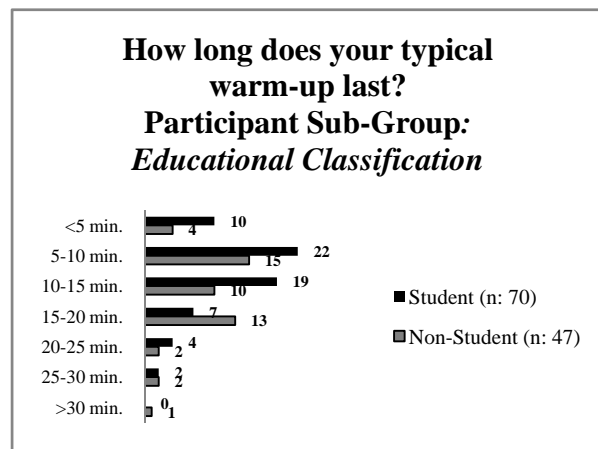


Figure 14: Duration of Vocal Warm-Up in Educational Classification Sub-Groups

Singing Experience

For participants for whom 1-4 years had passed since their first voice lesson (n: 9), distribution of reported **frequency** of using vocal warm-up (Figure 15) was as follows: 3 (33.3%) answered “always,” 4 (44.4%) answered “usually,” and 2 (22.2%) answered “sometimes.” For participants for whom 5-10 years had passed since their first voice lesson (n: 34), distribution of reported frequency of using vocal warm-up was as follows: 17 (50.0%)

answered “always,” 11 (32.4%) answered “usually,” 5 (14.7%) answered “sometimes,” and 1 (2.9%) answered “rarely.” For participants for whom more than 10 years had passed since their first voice lesson (n: 74), distribution of reported frequency of using vocal warm-up was as follows: 43 (58.1%) answered “always,” 26 (35.1%) answered “usually,” 4 (5.4%) answered “sometimes,” and 1 (1.4%) answered “rarely.”

For participants for whom 1-4 years had passed since their first voice lesson (n: 9), distribution of typical warm-up **duration** (Figure 16) was as follows: 2 (22.2%) warm up for less than 5 minutes, 3 (33.3%) warm up for 5-10 minutes, 1 (11.1%) warms up for 10-15 minutes, and 1 (11.1%) warms up for 15-20 minutes. For participants for whom 5-10 years had passed since their first voice lesson (n: 34), distribution of typical warm-up duration was as follows: 5 (14.7%) warm up for less than 5 minutes, 10 (29.4%) warm up for 5-10 minutes, 9 (26.5%) warm up for 10-15 minutes, 9 (26.5%) warm up for 15-20 minutes, and 1 (2.9%) warms up for 20-25 minutes. For participants for whom more than 10 years had passed since their first voice lesson (n: 74), distribution of typical warm-up duration was as follows: 7 (9.5%) warm up for less than 5 minutes, 25 (33.8%) warm up for 5-10 minutes, 17 (23.0%) warm up for 10-15 minutes, 16 (21.6%) warm up for 15-20 minutes, 4 (5.4%) warm up for 20-25 minutes, 4 (5.4%) warm up for 25-30 minutes, and 1 (1.4%) warms up for more than 30 minutes.

Types of Vocal Warm-Up Exercises

Participants were asked to describe the **types of non-singing exercises** used during a typical vocal warm-up session (Figure 17). The most commonly used non-singing exercises were stretching and alignment exercises. Seventy-two participants (61.5%) reported using stretching exercises for the head/neck/shoulder muscles, 64 (54.7%) reported using breathing exercises, and 59 (50.4%) reported using postural alignment and general stretching exercises,

respectively. Relaxation exercises were also commonly used, with 54 participants (46.1%) using head/neck/shoulder relaxation exercises, 39 (33.3%) using mental relaxation tasks, and 28 (23.9%) using general muscle relaxation exercises. The least commonly used non-singing warm-up tasks were general aerobic exercise (25 respondents, 21.4%) and laryngeal massage (16 participants, 13.7%). Nine participants (7.7%) reported that they do not use non-singing tasks as part of their vocal warm-up regimens.

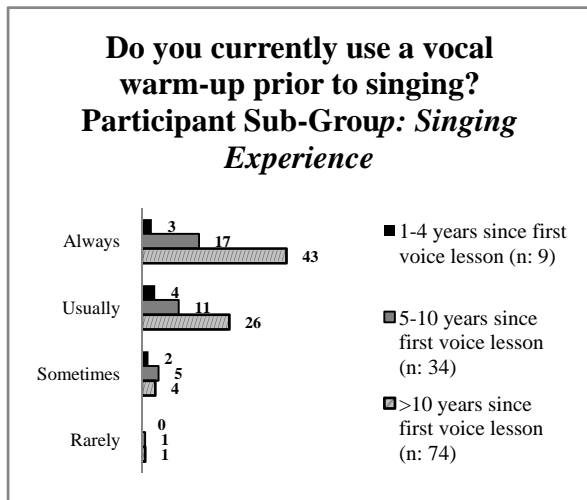


Figure 15: Frequency of Vocal Warm-Up in Singing Experience Sub-Groups

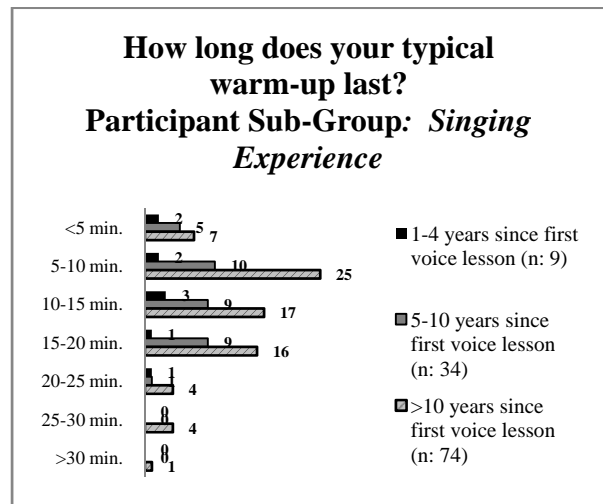


Figure 16: Duration of Vocal Warm-Up in Singing Experience Sub-Groups

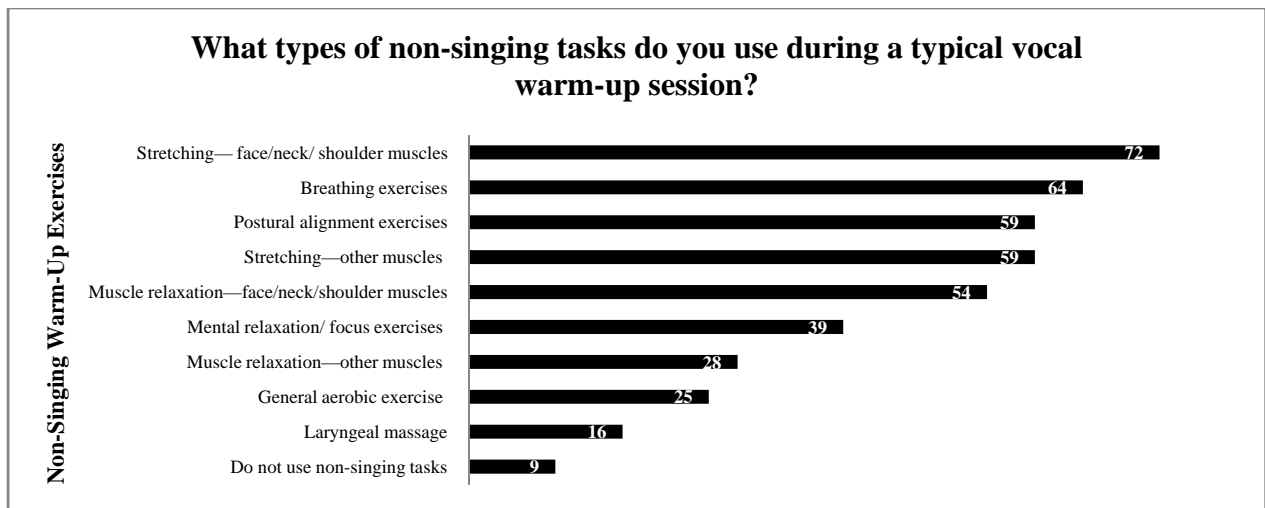


Figure 17: Distribution of Non-Singing Warm-Up Exercises (n: 117)

The next part of the questionnaire asked participants to describe the **types of singing exercises** used (Table 1) as part of their vocal warm-up regimens. Thirteen exercises described in the vocal pedagogy literature were included in the questionnaire (Appendix B). For each exercise, participants were asked how often they use the exercise and on what vowel(s) or voiced consonants they typically sing the exercise. For all singing exercises represented in the questionnaire, the vowels and voiced consonants on which the participants typically sing the exercise varied tremendously, ranging from single vowels to alternating vowels, words, and phrases. The most commonly used singing exercise was the ascending/descending five-note scale sung at a rapid tempo; 112 (95.7%) participants reported using the exercise. Other commonly used singing exercises included the ascending/descending octave scale sung at a rapid tempo (108, 92.3%), the ascending/descending arpeggio sung *legato* (104, 88.9%) and the *glissando* (104, 88.9%). The least commonly used singing exercise was the chromatic scale, used by only 52 participants (44.4%). Other less commonly used singing exercises were the *messa di voce* sung at a high pitch (61, 52.1%), the ascending/descending octave scale sung at a slow tempo (64, 54.7%), and the *messa di voce* sung at a low pitch (67, 57.3%).

For each singing exercise represented in the questionnaire, participants were also asked to rate the perceived difficulty of the exercise on a scale of 1 to 5, with 1 being the least difficult and 5 being the most difficult (Table 2). Participants were also given the option “I do not use this exercise” if they did not use the exercise as part of their warm-up regimen. The singing warm-up exercise rated as the least difficult by participants was the ascending/descending 5-note scale sung at a rapid tempo; 70 participants (59.8%) gave it a rating of 1 and 35 (29.9%) gave it a rating of 2. The singing exercises rated as the most difficulty by participants was the *messa di*

voce sung at a high pitch; 18 participants (15.4%) gave it a rating of 4 and 8 (6.8%) gave it a rating of 5.

Participants were asked to describe the **sequence of their typical vocal warm-up regimen** (Figure 18) Fifty-one participants (43.6%) reported that their vocal warm-up regimen follows the same sequence of singing exercises each day, while 66 (56.4%) reported that sequence of singing exercises varies from day to day. The participants who reported following the same sequence of singing exercises each day (n: 51) were asked to indicate which singing exercises they completed first and last in a warm-up session (Figure 19). The most frequently indicated singing exercises for the first exercise completed were ascending/descending 5-note scales sung at a rapid tempo (16, 31.4%) and at a slow tempo (15, 29.4). The most frequently indicated singing exercises indicated for the last exercise completed were the ascending/descending arpeggios sung in the *staccato* style (10, 19.6%) and the *legato* style (9, 17.6%).

Use of Vocal Cool-Down

To gain preliminary data on the **use of vocal cool-down** in vocalists, participants were asked to indicate whether they complete a vocal cool-down following singing (Figure 20). Twenty-six participants (22.2%) reported that they utilize a vocal cool-down following singing, while 91 (77.8%) indicated that they do not utilize a vocal cool-down following singing. Of the 26 participants who indicated that they use a vocal cool-down following singing (Figure 21), 8 (30.8%) were aged 18-30, 4 (15.4%) were aged 31-40, and 14 (53.8%) were 41 and older; 5 (19.2%) were male, and 21 (80.8%) were female. Fifteen (57.7%) of the participants who use vocal cool-down were students, and 11 (42.3%) were non-students. For 1 (3.8%) participant, 1-4 years had elapsed since his/her first voice lesson; for 8 (30.8%) participants, 5-10 years had elapsed, and for 17 (65.4%) participants, more than 10 years had elapsed.

Table 1: Distribution of Singing Exercise Types (n: 117)

		How often do you use each singing exercise as part of your warm-up regimen?				
		<i>Always</i>	<i>Usually</i>	<i>Sometimes</i>	<i>Rarely</i>	<i>Never</i>
Singing Warm-Up Exercises	<i>Glissando</i>	24	24	32	24	13
	<i>Ascending/ Descending 5-note scale, rapid tempo</i>	61	27	17	7	4
	<i>Ascending/ Descending 5-note scale, slow tempo</i>	20	16	29	28	23
	<i>Ascending/ Descending scale spanning one octave, rapid tempo</i>	38	30	31	9	9
	<i>Ascending/ Descending scale spanning one octave, slow tempo</i>	6	11	20	26	53
	<i>Ascending/ Descending Arpeggio, legato</i>	29	30	29	16	13
	<i>Ascending/ Descending Arpeggio, staccato</i>	12	20	19	24	42
	<i>Messa di voce, low pitch</i>	4	13	17	33	50
	<i>Messa di voce, mid-range pitch</i>	4	14	39	21	38
	<i>Messa di voce, high pitch</i>	4	10	20	27	56
	<i>Ascending/ Descending Thirds</i>	5	19	31	17	45
	<i>Descending Triplet Motive</i>	9	19	31	12	46
	<i>Chromatic Scale</i>	0	4	26	22	65

Table 2: Perceived Difficulty of Singing Warm-Up Exercises (n: 117)

<i>Perceived Difficulty of Singing Warm-Up Exercises</i>						
On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)						
	1	2	3	4	5	<i>I do not use this exercise.</i>
<i>Glissando</i>	54	34	8	3	0	18
<i>Ascending/ Descending 5-note scale, rapid tempo</i>	70	35	6	2	0	4
<i>Ascending/ Descending 5-note scale, slow tempo</i>	45	29	17	4	0	22
<i>Ascending/ Descending scale spanning one octave, rapid tempo</i>	30	43	27	8	0	9
<i>Ascending/ Descending scale spanning one octave, slow tempo</i>	19	25	15	5	0	53
<i>Ascending/ Descending Arpeggio, legato</i>	32	41	26	4	1	13
<i>Ascending/ Descending Arpeggio, staccato</i>	16	31	18	9	0	43
<i>Messa di voce, low pitch</i>	12	20	16	13	4	52
<i>Messa di voce, mid-range pitch</i>	13	34	20	10	2	38
<i>Messa di voce, high pitch</i>	4	21	11	18	8	55
<i>Ascending/ Descending Thirds</i>	20	22	19	11	2	43
<i>Descending Triplet Motive</i>	24	20	19	8	0	46
<i>Chromatic Scale</i>	11	14	12	12	6	62

Singing Warm-Up Exercises

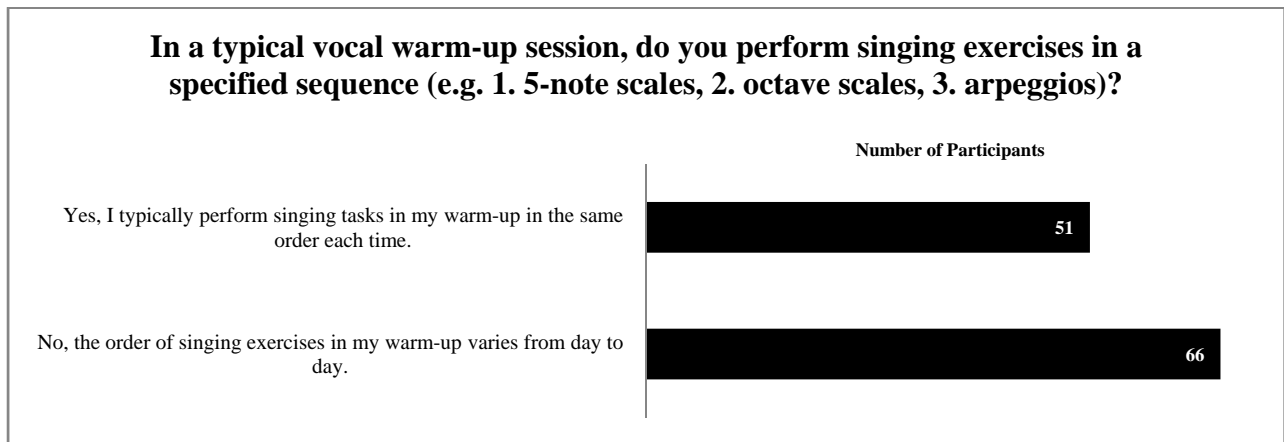


Figure 18: Vocal Warm-Up Sequence (n: 117)

First/Last Singing Exercises Completed During Participants' Warm-Up Regimens

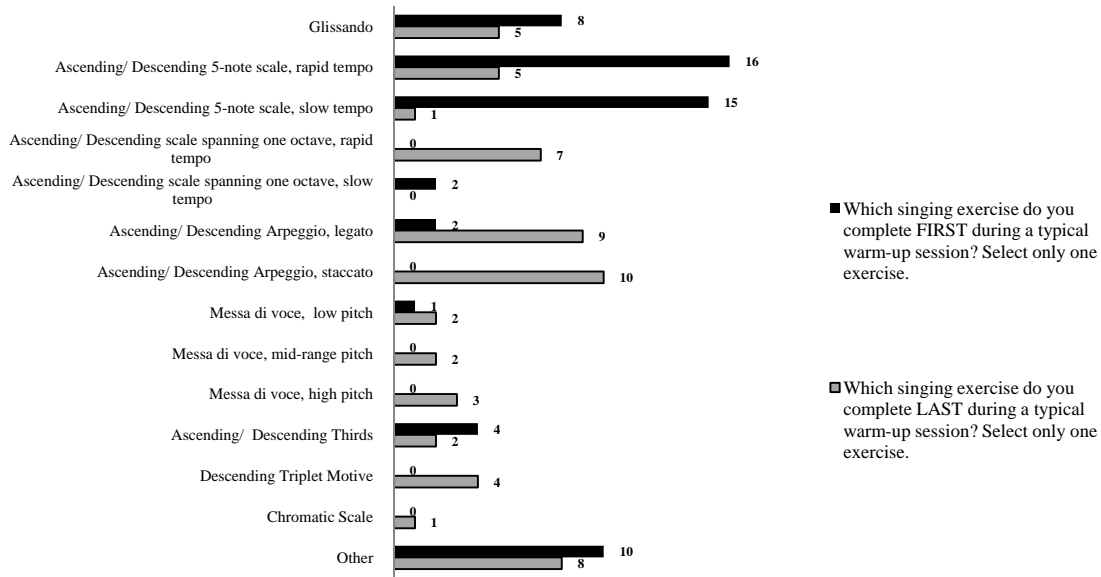


Figure 19: First/Last Singing Exercises Completed During Participants' Warm-Up Regimens (n: 117)

Do you ever utilize a vocal cool-down following singing?



Figure 20: Use of Vocal Cool-Down (n: 117)

Sociodemographic Characteristics of Participants Who Use a Vocal Cool-Down Following Singing (n: 26)

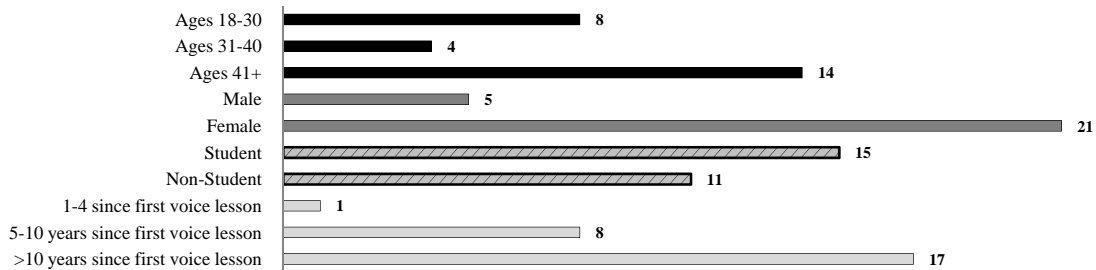


Figure 21: Sociodemographic Characteristics of Participants Who Use a Vocal Cool-Down Following Singing

Vocal Warm-Up Perceptions

The next section of the questionnaire addressed participants' **perceptions** about the importance of vocal warm-up and its effect on the voice (Table 3). The majority of participants indicated that "It is important to warm-up before singing"; 84 (71.8%) agreed strongly and 28 (23.9%) agreed with this statement. The majority of participants also indicated a belief that vocal warm-up aids in the prevention of vocal injury. Forty-six participants (39.3%) strongly agreed and 35 (38.5%) agreed with the statement "Singers who don't warm up are more likely to injure their voices," while 34 (29.1%) strongly agreed and 40 (34.2%) agreed with the statement "If I don't warm-up before singing, I could hurt my voice."

Participants reported that vocal warm-up has a positive effect on their overall voice quality. Eighty-seven participants (74.4%) strongly agreed and 21 (17.9%) agreed with the statement "My voice is more cooperative after I warm up." Improved confidence in voice quality was also reported by participants; 73 (62.4%) strongly agreed and 29 (24.8%) agreed with statement "I feel more confident about my voice about I warm-up." Participants indicated improvement in vocal flexibility, vocal range, and mental focus following vocal warm-up.

Occurrence of Voice Problems

Thirty participants (25.6%) reported that they had experienced **voice problems** in the past year (Figure 22). Of the participants with reported voice problems (Figure 23), 11 (36.7%) were between the ages of 18 and 30, 3 (10.0%) were between 31 and 40, and 16 (53.3%) were 41 years of age or older; 11 (36.7%) were male and 19 (63.3%) were female. Thirteen (43.3%) of the participants who reported voice problems were students, and 17 (56.7%) were not currently students. For 2 (6.7%) participants 1-4 years had elapsed since their first voice lesson, for 6 (20.0%) 5-10 years had elapsed, and for 22 (73.3%) more than 10 years had elapsed.

Table 3: Vocal Warm-Up Perceptions (n: 117)

		For each statement, select the one answer that best describes your feeling/opinion				
		Strongly Agree	Agree	Neutral / No opinion	Disagree	Strongly Disagree
Perceptions About Importance of Vocal Warm-Up	<i>It is important to warm-up before singing.</i>	84	28	4	1	0
	<i>Singers who don't warm up are more likely to injure their voices.</i>	46	45	15	9	2
	<i>If I don't warm up before singing, I could hurt my voice.</i>	34	40	24	11	6
	<i>I'm not sure why I'm supposed to warm up my voice.</i>	0	2	8	24	82
	<i>I only warm up because my voice teacher tells me to.</i>	1	3	12	35	65
Perceptions About the Effects of Vocal Warm-Up on the Voice	<i>My voice is more cooperative after I warm up.</i>	87	21	6	3	0
	<i>I feel more confident about my voice after I warm up.</i>	73	29	10	4	1
	<i>It is easier to sing my highest notes after I warm up.</i>	80	22	8	5	1
	<i>It is easier to sing my lowest notes after I warm up.</i>	50	19	19	24	5
	<i>My voice is more flexible after I warm up.</i>	82	28	2	3	0
	<i>My voice feels tired after I warm up.</i>	1	7	13	38	58
	<i>I feel more mentally focused after I warm up.</i>	62	37	14	4	0

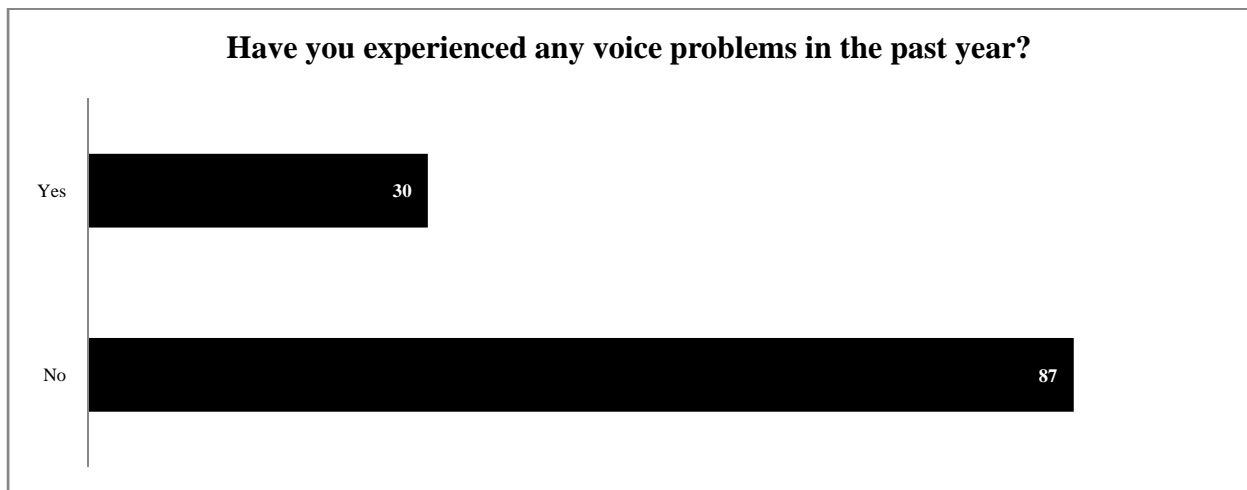


Figure 22: Distribution of Participants' Vocal Health Statuses (n: 117)

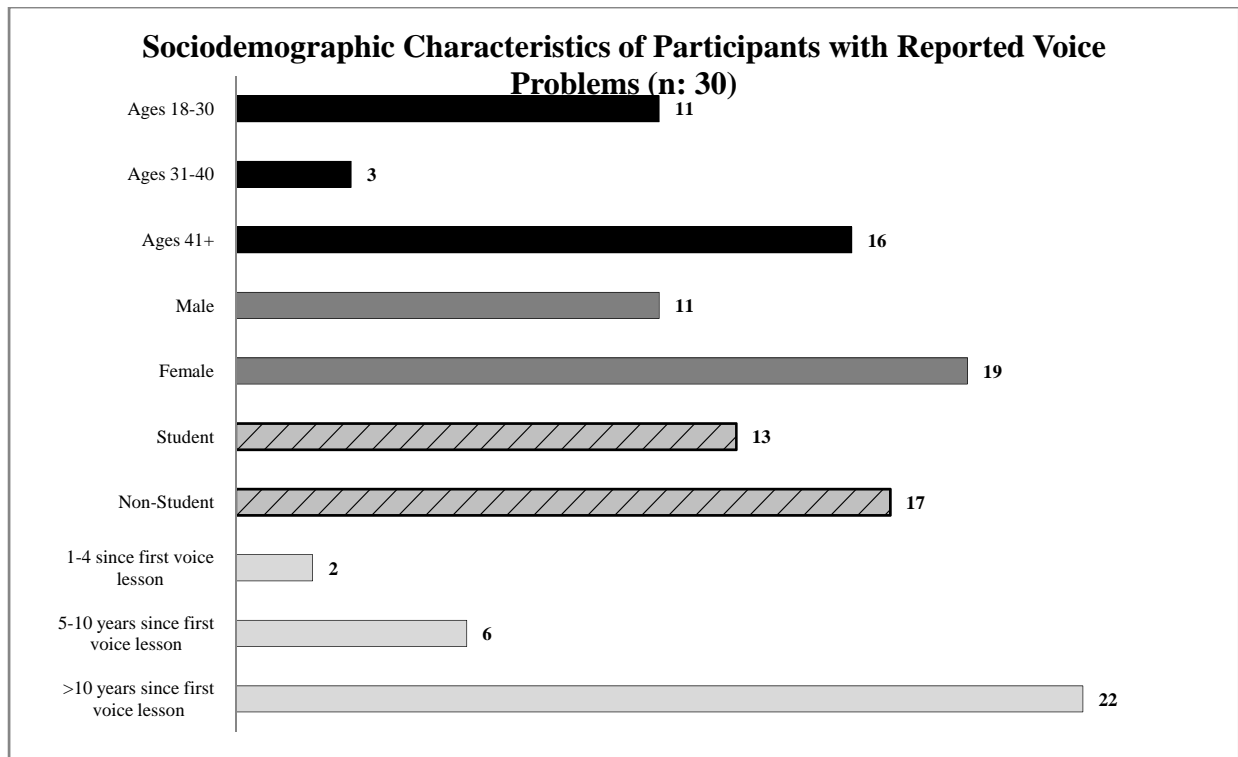


Figure 23: Sociodemographic Characteristics of Participants with Reported Voice Problems (n: 30)

Frequency and Duration of Vocal Warm-Up in Participants with Reported Voice Problems

Of the participants who reported voice problems in the past year (n: 30), distribution of reported **frequency** of using vocal warm-up (Figure 24) was as follows: 16 (53.3%) answered “always,” 11 (36.7%) answered “usually,” and 3 (10.0%) answered “sometimes.” The relationship between occurrence of voice problems in participants and warm-up frequency was not statistically significant ($p=0.6258$). Distribution of typical warm-up **duration** (Figure 25) was as follows: 4 (13.3%) warm up for less than 5 minutes, 9 (30.0%) warm up for 5-10 minutes, 6 (20.0%) warm up for 10-15 minutes, 8 (26.7%) warm up for 15-20 minutes, 2 (6.7%) warm up for 25-30 minutes, and 1 (3.3%) warms up for more than 30 minutes. The relationship between occurrence of voice problems in participants and warm-up duration was not statistically significant ($p=0.5316$).

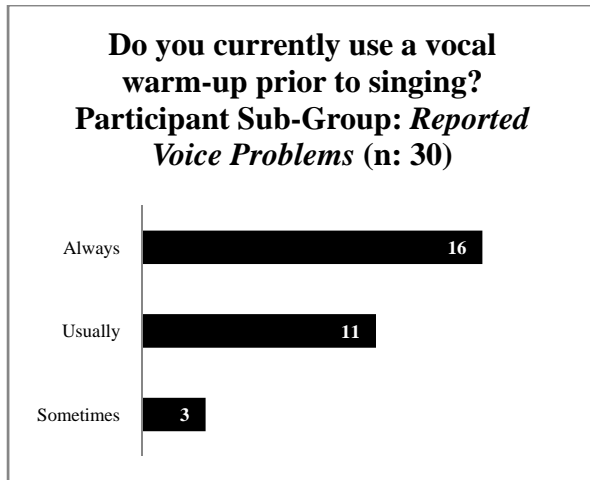


Figure 24: Frequency of Vocal Warm-Up in Participants with Reported Voice Problems (n: 30)

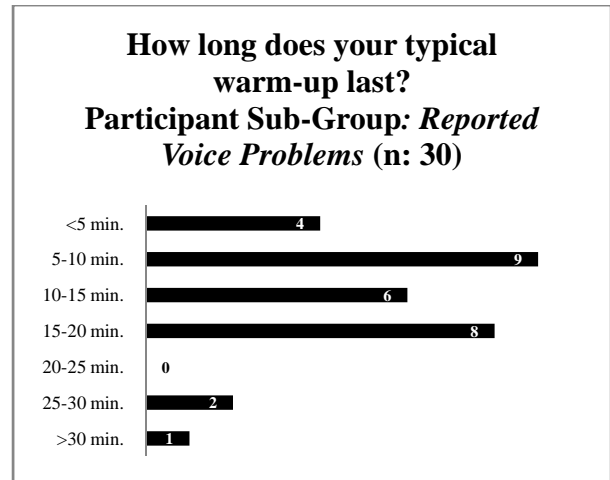


Figure 25: Duration of Vocal Warm-Up in Participants with Reported Voice Problems (n: 30)

Types of Vocal Warm-Up Exercises Used by Participants with Reported Voice Problems

The **most commonly used singing exercises** by participants with reported voice problems (n: 30) was the ascending/descending five-note scale sung at a rapid tempo, used by 29 (96.7%) participants, and the ascending/descending octave scale sung at a rapid tempo, used by 28 (93.3%). Other commonly used singing exercises included the *glissando* (26, 86.7%), the ascending/descending arpeggio sung *legato* (25, 83.3%), and the ascending/descending five-note scale sung at a slow tempo (22, 73.3%). The least commonly used singing exercise was the chromatic scale, used by only 8 participants (26.7%). Other less commonly used singing exercises were the ascending/descending octave scale sung at a slow tempo (13, 43.3%), the *messa di voce* sung at a high pitch (14, 46.7%), and the *messa di voce* sung at a low pitch (15, 50.0%).

Use of Vocal Cool-Down in Participants with Reported Voice Problems

Of the participants with reported voice problems (n: 30), six (20%) reported using a vocal cool-down following singing.

Table 4: Distribution of Vocal Warm-Up Exercise Types Used by Participants with Reported Voice Problems (n: 30)

		How often do you use each singing exercise as part of your warm-up regimen?				
		<i>Always</i>	<i>Usually</i>	<i>Sometimes</i>	<i>Rarely</i>	<i>Never</i>
Singing Warm-Up Exercises	<i>Glissando</i>	8	5	7	6	4
	<i>Ascending/ Descending 5-note scale, rapid tempo</i>	14	8	7	0	1
	<i>Ascending/ Descending 5-note scale, slow tempo</i>	7	3	7	5	8
	<i>Ascending/ Descending scale spanning one octave, rapid tempo</i>	9	8	9	2	2
	<i>Ascending/ Descending scale spanning one octave, slow tempo</i>	2	0	6	5	17
	<i>Ascending/ Descending Arpeggio, legato</i>	4	15	3	3	5
	<i>Ascending/ Descending Arpeggio, staccato</i>	2	8	4	4	12
	<i>Messa di voce, low pitch</i>	2	5	2	6	15
	<i>Messa di voce, mid-range pitch</i>	1	6	7	3	13
	<i>Messa di voce, high pitch</i>	1	2	3	8	16
	<i>Ascending/ Descending Thirds</i>	0	6	11	1	12
	<i>Descending Triplet Motive</i>	2	6	6	4	12
	<i>Chromatic Scale</i>	0	1	3	4	22

4 DISCUSSION

Frequency and Duration of Vocal Warm-Up

The first goal of this study was to determine **frequency and duration** of vocal warm-up sessions in singers and to examine the differences in vocal warm-up regimens in singers from varying sociodemographic groups with varying degrees of singing training. All participants reported that they currently use a vocal warm-up prior to singing, and the vast majority (88.9%) reported that they “always” or “usually” warm up prior to singing (Figure 6). This finding supports the notion that regular vocal warm-up is considered essential by singers, as described in the literature (Miller, 1990; Goldberg, 2007).

The relationships between frequency of vocal warm-up and age, education, and singing experience were not significant; however, there was a statistically significant relationship between gender and vocal warm-up frequency. In this study, voice problems appeared to occur more in males (11/36; 30.6%) than females (36/81; 23.5%). GERD symptoms appeared to occur slightly more frequently in males (18/36; 50.0%) than females (38/81; 46.9%); however, allergies appeared to occur more frequently in females (51/81; 63.0%) than in males (21/36; 58.3%). Future studies are needed to determine the contribution of frequency/duration of vocal warm up and other factors such as gastroesophageal reflux and allergies to vocal injury. Smith et al. (1998) found that in female teachers voice problems were more likely to be present than in males. A more recent study investigating the incidence of voice problems among different occupations in San Juan, Puerto Rico also found that females were more likely to report voice problems than males (Villaneuva-Reyes, 2009). Studies reporting more voice problems in females speakers might be the incentive for female singers to use vocal warm-up more frequently than males.

This study's findings suggest that **duration** of vocal warm-up varies considerably between singers, with warm-up regimens ranging from less than 5 minutes to more than 30 minutes (Figure 7). This variability in vocal warm regimens was apparent in previous studies reporting on effects of vocal warm up, (Elliott, Sundberg & Gramming, 1995; Motel, Fisher, & Leydon, 2002; Milbrath & Solomon, 2003; Amir, Amir, & Michaeli, 2005). The majority of participants in the current study (78.6%) reported warm-up regimens ranging from 5-20 minutes. Six participants reported using warm-up regimens lasting 25 minutes or longer, and three of these participants reported having experienced voice problems in the past year. Miller (1990; 1996) cautioned against the use of vocal warm-up regimens lasting longer than 30 minutes. Even though the findings of this preliminary study appear to suggest the same impression, further studies are needed to determine if vocal warm-up regimens in excess of 30 minutes have a negative impact on vocal health.

In this study, the participants were asked to identify **vocal activities in which they warm-up prior to participating** (Figure 8). The results suggest a trend that singers are more likely to complete a vocal warm-up prior to solo singing activities and less likely to complete a vocal warm-up prior to ensemble singing activities. It appears that singers rarely complete a vocal warm-up prior to extended periods of speaking. Thirty-eight (32.5%) participants reported warming up prior to teaching voice lessons, which was classified as a speaking activity in the questionnaire. It is important to note that although teaching voice lessons require extended periods of speaking, it also frequently requires the instructor to demonstrate singing examples, which may explain the higher percentage of participants completing a vocal warm-up as compared to the other speaking tasks. This trend was identical in the participants in this study who reported having experienced voice problems (n: 30).

Types of Vocal Warm-Up Exercises

Another goal of the current study was to determine the most frequently used vocal warm-up exercises in the singing community. Among **non-singing warm-up exercises** (Figure 17), the results suggest that singers are most likely to complete exercises that target the muscles of the face, head, neck and the respiratory muscles. Given that these are the muscles most used during singing, this result is expected. This finding is consistent with Goldberg's (2007) recommendation that vocal warm-up should include "stretching exercises for both body and voice". Although general aerobic exercise has been described in the literature (Miller 1990, 1996; McHenry, 1996), relatively few participants (21.4%) reported using general aerobic exercise as part of their vocal warm-up regimens.

This study's findings suggest **four singing exercises** most commonly used by singers (Table 1). These are ascending/descending 5-note scales, ascending/descending octave scales, ascending/descending *legato* arpeggios, and glissandi. Each of these exercises serves as a mechanism for stretching the vocal folds, as the singer moves from a low pitch to a high pitch; and, with the exception of the glissando, each targets agility and vocal flexibility. In addition, these four exercises were all ranked as being relatively easy (Table 2). These findings supports Miller's statement that "heavy vocalization should never form part of the warm-up series" (Miller, 1996). Of the 51 singers who utilized a fixed warm-up regimen, 31 (60.8%) indicated that they complete the 5-note ascending/descending scale, at either a fast or slow tempo, first (Figure 19). This result further supports the recommendation that the vocal warm-up should progress from easy to more difficult exercises (Miller 1990; 1996). Exercises targeting variations in loudness (i.e. *messa di voce*) and comprised of more complex musical patterns (i.e. ascending/descending thirds, descending triplet motive) were less commonly used. Exercises

sung in the *staccato* style were less common. These trends were similar between male and female participants.

For all exercises, participants described varying methods for executing each exercise (e.g. different vowels, preceding consonants, alternating syllables, etc). The use of nasal consonants to improve resonance was frequently noted by participants, as described in the literature (Miller, 1996; Gregg, 1996). Lip and tongue trills, another exercise described in the literature as a means of improving resonance (Nix, 1999; Titze, 1996), were also frequently used by participants.

Use of Vocal Cool-Down

Relatively few participants (22.2%) reported using a vocal cool-down following singing. Females, as with frequency of vocal warm-up, were more likely to use a vocal cool-down than males. This trend was similar in participants with reported voice problems. The investigation of a relationship between vocal cool-down and vocal injury was not the main goal of this study. However, further research on the effect of vocal cool-down on vocal health could lead to better understanding of this exercise in vocal health in singers.

Vocal Warm-Up Perceptions

The next goal of the current study was to examine singers' perceptions of the role of vocal warm-up in the prevention of vocal fold injury. The findings of this study suggest that singers believe vocal warm-up plays an important role in preventing vocal injury. Additionally, the findings suggest that singers believe vocal warm-up improves voice quality and mental focus for singing. This finding is consistent with perceptions of vocal warm-up described in vocal pedagogy literature (Miller, 1996; Goldberg, 2007).

Occurrence of Voice Problems

The final goal of this study was to obtain preliminary data on the occurrence of vocal fold injury in singers who use/do not use a vocal warm-up regimen. Since all of the singers who participated in this study reported using a vocal warm-up prior to singing, it was not possible to determine if using a vocal warm-up plays a role in the prevention of vocal injury. Thirty participants (25.6%) reported experiencing voice problems in the past year despite using a vocal warm-up prior to singing, and the majority of these participants (77.6%) reported using warm-up regimens between 5-20 minutes, which is consistent with the participant group (n: 117). However, as described earlier, of the six participants in the study who reported using warm-up regimens lasting 25 minutes or longer, three reported experiencing voice problems. The most commonly used singing exercise types (i.e. 5-note scale, octave scale, legato arpeggio, glissando) were identical between the participant group (n: 117) and participants with reported voice problems (n: 30).

Of the participants with reported voice problems, 23 (76.7%) reported that they suffer from allergies, and 23 (76.7%) reported that they experience one or more symptoms of gastroesophageal reflux disease (GERD). Additionally, when asked to describe his/her voice problem, many participants cited upper respiratory symptoms and GERD as the cause of their voice difficulties. The literature describes both conditions as known contributors to dysphonia (Sataloff, 1991), which could explain why these participants experienced voice problems. The results of this study suggest that while vocal warm-up is perceived by singers to improve voice quality and may contribute to the prevention of vocal injury, vocal health and hygiene factors, such as allergies and GERD, are a contributing factor to voice problems in singers, despite the

regular use of a vocal warm-up. These findings highlight the importance of educating singers about the prevention and management of allergy and GERD symptoms.

Limitations of Current Study

This pilot study's findings on vocal warm-up practices in singers warrant future studies. Although there were participants representing all regions of the mainland United States and some international locations, the more than half of the participants (55.6%) identified themselves as residing in the Southern region of the United States (most likely due to the fact that the researcher also resides in this region).

All participants in this study reported that they use a vocal warm-up prior to singing; therefore, it was not possible to determine if using a vocal warm-up plays a role in the prevention of vocal injury. Future studies investigating singers who are seen at a voice clinic due to their voice problems are of interest since they may reveal the type, frequency and type of vocal warm up regimen in that population and allow comparison to the current study population.

This survey targeted singers with at least one year of formal voice study, and the majority of participants (63.2%) were very experienced singers, having received more than 10 years of formal voice training.

Additionally, participants were not asked what style of singing (e.g. classical, musical theater, pop, etc.) they typically use when performing or to identify their voice classifications (i.e. soprano, mezzo-soprano, tenor, baritone/bass). A future study will be useful to determine if there is a style or voice classification specific vocal warm up regimen to ensure vocal health in professional singers.

Implications for Future Research

Future survey studies should attempt to recruit singers from a wider range of geographic locations, to control for any regional bias. Singers who do not complete a vocal warm-up prior to singing should be surveyed to determine their rationale for not using vocal warm-up and to determine if voice problems exist in these singers. Additionally, singers with less than 5 years of formal voice training and singers with no formal voice training should be surveyed to determine how their vocal warm-up regimens differ from the more experienced singers examined in this study. Future survey studies should recruit participants with different singing styles and singing classifications.

This preliminary survey study's findings have implications for future studies seeking to determine the effects of vocal warm-up on the anatomy and physiology of the voice and its role in the prevention of vocal injury. A significant limitation of previous studies is that the warm-up regimens employed varied considerably between the studies, and the results of these studies also varied considerably. The results of this study suggest that some of the exercises utilized in these studies were not among the most commonly used exercises; therefore, participants in the study may not have received maximum benefit from them. This study found that, indeed, singers' vocal warm-up regimens are diverse in duration, exercises used, and the way in which exercises are used (e.g. the vowels on which vocalises are sung, the order in which exercises are sung, etc.). However, the results of this study reveal several characteristics of singers' warm-up regimens that may be incorporated when designing warm-up regimens to be used in future studies on the effect of vocal warm-up on the vocal mechanism (Table 5). This study's findings suggest that the warm-up regimen should range between 5 and 15 minutes. The warm-up should include non-singing exercises targeting the face, head, and neck muscles, breathing exercises,

and postural alignment exercises. Simple vocalises including ascending/descending 5-note scales, ascending/descending octave scales, ascending/descending arpeggios, and glissandi should be incorporated.

Table 5: Suggested Vocal Warm-Up Regimen. Percentages are based on participants' responses (n: 117).

<i>Suggested Vocal Warm-Up Regimen</i>	
<i>Duration</i>	5-15 minutes (56.4%)
<i>Non-Singing Exercises</i>	<ol style="list-style-type: none"> 1. Stretching exercises targeting the face/head/neck muscles (61.5%) 2. Breathing exercises (54.7%) 3. Postural alignment exercises (50.4%)
<i>Singing Exercises</i>	<ol style="list-style-type: none"> 1. 5-note scale (95.7%) 2. Octave scale (92.3%) 3. Arpeggio, <i>legato</i> (88.9%) 4. Glissando (88.9%)

The manner in which these exercises are sung (e.g. vowels used, preceding consonants) varied considerably among participants; future studies could examine if executing singing exercises on different vowels and nasal consonants produce differing effects on the vocal mechanism and on the acoustic parameters of the voice. In designing future studies, it may also be helpful to compare the effects of warm-up regimens of varying duration and type. Such studies could determine the optimal vocal warm-up regimen for improving voice quality and preventing vocal injury in singers.

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APPENDIX A
GLOSSARY OF MUSICAL TERMS
(Oxford Music Online, 2007-2010)

Arpeggio: The notes of a chord ‘spread’, i.e. played one after the other from the bottom upwards, or from the top downwards”



Bel Canto: The term ‘bel canto’ refers to the Italian vocal style of the 18th and early 19th centuries, the qualities of which include perfect legato production throughout the range, the use of a light tone in the higher registers and agile and flexible delivery. More narrowly, it is sometimes applied exclusively to Italian opera of the time of Rossini, Bellini and Donizetti.

Glissando: Passing all or part of the way from one note to another such that the pitches passed through, instead of representing the fixed tones and semitones of a scale, are infinite in number.



Legato: Of successive notes in performance, connected without any intervening silence of articulation.

Messa di voce: The singing or playing of a long note so that it begins quietly, swells to full volume, and then diminishes to the original quiet tone.



Staccato: Of an individual note in performance, usually separated from its neighbours by a silence of articulation. The separation may be, but is not invariably, accompanied by some degree of emphasis, and occasionally the term may imply emphasis without physical separation. The term may be regarded as the antonym of legato.

APPENDIX B: VOCAL WARM-UP SURVEY

Consent Statement

Thank you for your interest in "Vocal Warm-Up Practices and Perceptions in Vocalists: A Pilot Survey."

Participants in this survey study should be 18 years or older, and should have completed at least one year of formal vocal instruction (private voice lessons).

In this survey, you will be asked about:

- (1) Your vocal warm-up practices
- (2) Your perceptions about vocal warm-up
- (3) Health and behavioral issues related to vocal health.
- (4) Demographic information (i.e. birth year and zip code)

Your participation in this survey is completely voluntary, and your responses are anonymous. You may withdraw from the survey at any time.

Your responses will be used to further understanding of how singers utilize vocal warm-up, and how singers perceive vocal warm-up.

You may contact the investigators at any time with concerns, for more information, or for the results of the study:

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I have read the description of this study, and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692, irb@lsu.edu, www.lsu.edu/irb. I agree to participate in the study described above and understand that my responses are anonymous.

- Yes
 No

General Information

Location

ZIP/Postal Code: _____

In what year were you born? _____

What is your gender?

Male

Female

Education

What is your current educational classification?

- 1st year undergraduate
- 2nd year undergraduate
- 3rd year undergraduate
- 4th+ year undergraduate
- 1st year masters
- 2nd year masters
- 3rd year masters
- 4th+ year masters
- 1st year doctoral
- 2nd year doctoral
- 3rd year doctoral
- 4th+ year doctoral

Other (Please specify) _____

How many years have elapsed since you first enrolled in formal voice instruction (i.e. voice lessons)?

- <1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- >10

Vocal Warm-Up Practices

The next several pages will ask questions about your current use of vocal warm-up as part of your singing/speaking routine.

Do you currently use a vocal warm-up prior to singing?

- Always
- Usually
- Sometimes
- Rarely
- Never

Indicate the types of activities in which you use vocal warm-up prior to participating (check all that apply):

- Solo performance: full-length recital
- Solo performance: opera/oratorio role
- Solo performance: audition
- Solo performance: brief solo appearance (e.g. single piece on a concert or church service)
- Ensemble performance: choir concert
- Ensemble performance: opera chorus
- Independent vocal practice session
- Ensemble rehearsal: choir
- Ensemble rehearsal: opera chorus
- Private voice lesson
- Extended periods of speaking: teaching voice lessons
- Extended periods of speaking: teaching a class/lecture
- Extended periods of speaking: theater rehearsal
- Extended periods of speaking: other

Other (Please specify) _____

How long does your typical vocal warm-up last?

- <5 min.
- 5-10 min.
- 10-15 min.
- 15-20 min.
- 20-25 min.
- 25-30 min.
- >30 min.

What types of non-singing tasks do you use during a typical vocal warm-up session (check all that apply)?

- Breathing exercises
- Postural alignment exercises
- Stretching—face/neck/shoulder muscles
- Stretching—other muscles (e.g. arms, legs)
- Muscle relaxation—face/neck/shoulder muscles
- Muscle relaxation—other muscles (e.g. arms, legs)
- Mental relaxation/focus exercises (e.g. visualization, meditation)
- Laryngeal massage
- General aerobic exercise (e.g. running, brisk walking)
- I do not use non-singing tasks as part of my warm-up routine.

Other (Please Specify) _____

Vocal Warm-Up Practices

The next several questions will ask you about the types of singing tasks you utilize in your vocal warm-up routine.

Ascending/Descending Glissando, octave interval



How often do you use this exercise as part of your warm-up routine?

- Always
- Usually
- Sometimes
- Rarely
- Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please Specify) _____

Ascending/Descending 5-Note Scale, fast tempo



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Ascending/Descending 5-note scale, slow tempo



How often do you use this exercise as part of your warm-up routine?

- Always
- Usually
- Sometimes
- Rarely
- Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
- 2
- 3
- 4
- 5
- I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Ascending/Descending Scale spanning one octave, rapid tempo



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Ascending/Descending Scale spanning one octave, slow tempo



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/

- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Arpeggio, legato



How often do you use this exercise as part of your warm-up routine?

- Always
- Usually
- Sometimes
- Rarely
- Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
- 2
- 3
- 4
- 5
- I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Arpeggio, staccato



How often do you use this exercise as part of your warm-up routine?

- Always
- Usually
- Sometimes
- Rarely
- Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
- 2
- 3
- 4
- 5
- I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Messa di voce, low pitch



How often do you use this exercise as part of your warm-up routine?

- Always
- Usually
- Sometimes
- Rarely
- Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
- 2
- 3
- 4
- 5
- I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Messa di voce, mid-range pitch



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

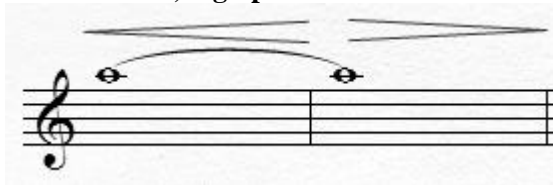
- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Messa di voce, high pitch



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/

- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Ascending/Descending Thirds



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1 2 3 4 5 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
- On the vowel /e/
- On the vowel /i/
- On the vowel /o/
- On the vowel /u/
- On the nasal consonant /m/ or /n/
- On a lip or tongue trill
- On other vowels (please specify the vowel(s) below)
- Preceded by a consonant (please specify the consonant(s) below)
- I do not use this exercise.

Other (Please specify) _____

Descending Triplet Motive



How often do you use this exercise as part of your warm-up routine?

- Always Usually Sometimes Rarely Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
 2
 3
 4
 5
 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
 On the vowel /e/
 On the vowel /i/
 On the vowel /o/
 On the vowel /u/
 On the nasal consonant /m/ or /n/
 On a lip or tongue trill
 On other vowels (please specify the vowel(s) below)
 Preceded by a consonant (please specify the consonant(s) below)
 I do not use this exercise.

Other (Please specify) _____

Chromatic Scale



How often do you use this exercise as part of your warm-up routine?

- Always
 Usually
 Sometimes
 Rarely
 Never

On a typical day, how difficult is this exercise for you? (1=Easiest; 5=Most Difficult)

- 1
 2
 3
 4
 5
 I do not use this exercise.

How do you typically sing this exercise? Check all that apply.

- On the vowel /a/
 On the vowel /e/
 On the vowel /i/
 On the vowel /o/
 On the vowel /u/
 On the nasal consonant /m/ or /n/
 On a lip or tongue trill
 On other vowels (please specify the vowel(s) below)
 Preceded by a consonant (please specify the consonant(s) below)
 I do not use this exercise.

Other (Please specify) _____

Do you ever utilize a vocal cool-down following singing?

- Yes
 No

Vocal Warm-Up Perceptions

In this section, you will be asked questions about your perceptions of vocal warm-up.

For each statement, select the one answer that best describes your feeling/opinion.

	Strongly Agree	Agree	Neutral / No opinion	Disagree	Strongly Disagree
It is important to warm-up before singing.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My voice is more cooperative after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Singers who don't warm up are more likely to injure their voices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I only warm up because my voice teacher tells me to.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel more confident about my voice after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I'm not sure why I'm supposed to warm up my voice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easier to sing my highest notes after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
It is easier to sing my lowest notes after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My voice is more flexible after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My voice feels tired after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I don't warm up before singing, I could hurt my voice.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel more mentally focused after I warm up.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Vocal Use and Health

The next several questions will ask about your daily vocal use and your vocal health.

On a typical day, how much time do you spend engaging in the following vocal activities (in hours)? Select one answer for each activity.

	<1	1	2	3+
Solo Singing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Choral Singing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speaking (normal volume)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speaking (loud volume)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shouting/Screaming	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speaking over noise (e.g. bars, parties)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In a typical month, how often do you smoke?

- Most days 2-3 days per week
- Once per week
- 2-3 days per month
- Never

On days that you smoke, how many cigarettes do you typically smoke?

- 1
- 2-5
- 5-9
- Half pack (10)
- 11-19
- Whole pack (20)
- > Whole pack

In a typical month, how often do you consume alcohol?

- Most days
- 2-3 days per week
- Once per week
- 2-3 days per month
- Never

On days that you consume alcohol, how many alcoholic beverages do you typically consume?

- <1
- 1
- 2-3
- 4-5
- >5

In a typical month, how often do you consume caffeine?

- Most days
- 2-3 days per week
- Once per week
- 2-3 days per month
- Never

On days that you consume caffeine, how many caffeinated beverages do you consume?

- <1
- 1
- 2-3
- 4-5
- >5

In a typical month, how often do you spend time in noisy environments?

- Most days
- 2-3 days per week
- Once per week
- 2-3 days per month
- Never

On days that you spend time in noisy environments, how long do you spend noisy environments (in hours)?

- <1
- 1
- 2
- 3
- >3

Vocal Health

Have you experienced any voice problems within the past year?

- Yes
- No

Comments (Optional): _____

In the past year, how many episodes of voice problems did you experience?

- 1
- 2
- 3
- 4
- 5
- >5

On average, approximately how long did each episode of voice problems last?

- 1 day or less
- 2-3 days
- 4-5 days
- 1 week
- 2 weeks
- 3 weeks
- 1 month or longer

Do you regularly experience any of the following symptoms? Check all that apply.

- Heartburn
- Difficulty swallowing
- Feeling "something stuck in the throat"
- Bitter or acidic taste in the mouth
- Coughing or throat clearing after eating
- Hoarseness
- Chest pain
- Regurgitation of food or sour liquid
- None of these

On a typical night, how many hours do you sleep?

- <5
- 6
- 7
- 8
- >8

Do you suffer from allergies?

- Yes
- No

On a typical day, how many glasses of water do you drink? (1 glass= 8 oz.)

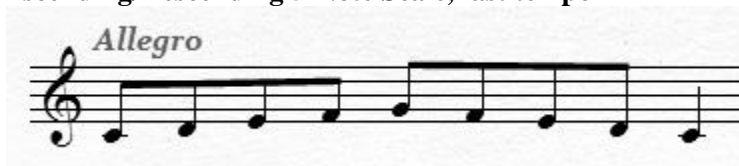
- <1
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- >8

APPENDIX C
SINGING WARM-UP EXERCISES INCLUDED IN SURVEY

Ascending/Descending Glissando, octave interval



Ascending/Descending 5-Note Scale, fast tempo



Ascending/Descending 5-note scale, slow tempo



Ascending/Descending Scale spanning one octave, rapid tempo



Ascending/Descending Scale spanning one octave, slow tempo



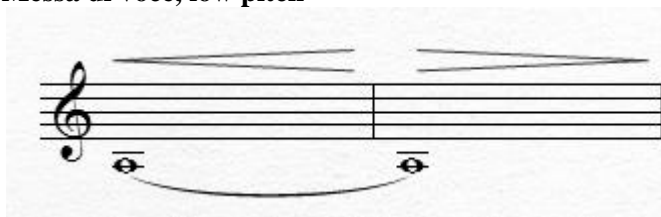
Arpeggio, legato



Arpeggio, staccato



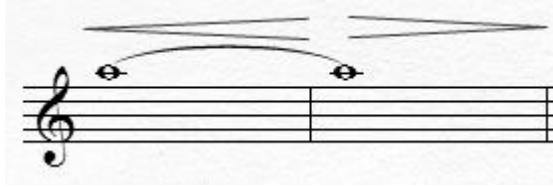
Messa di voce, low pitch



Messa di voce, mid-range pitch



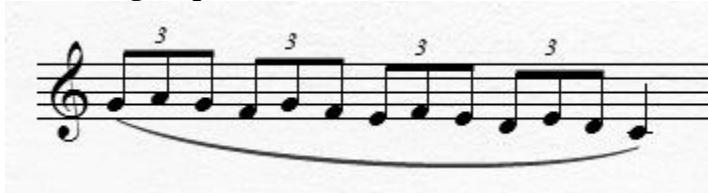
Messa di voce, high pitch



Ascending/Descending Thirds



Descending Triplet Motive



Chromatic Scale



VITA

Allison Gish, a native of Alexandria, Louisiana, earned a Bachelor of Music degree in vocal performance from Louisiana State University in 2007, where she studied voice under the direction of Patricia O'Neill. Upon graduation, she enrolled in the Master of Arts program in communication disorders at Louisiana State University. While a student, she also served as a graduate assistant for the LSU START Program and sang professionally at First United Methodist Church, Christ the King Catholic Church, and for special events in the Baton Rouge area. Upon completion of the Master of Arts degree in May 2010, Mrs. Gish plans to pursue a Ph.D. in communication disorders, specializing in the area of voice science and disorders, under the direction of Dr. Melda Kunduk. She will also complete her clinical fellowship experience at the Our Lady of the Lake Voice Center. Mrs. Gish resides in Baton Rouge with her husband, Nicholas Gish.