Vocal Fatigue in the Choral Rehearsal

An Examination of Contributing Factors and Ongoing Research

Presented by Sarah Gould

Thank you for attending this Poster Session and learning about my research! Below you will find:

- Contact Information
- Preliminary Study Statistics & Details
- Potential Further Research
- The research paper that sparked this study
- Resources for preventing vocal fatigue and other related topics

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Preliminary Study Statistics and Details

- Why is this research important?

    - A majority of college singers are required to sing in choral ensembles, yet the self-awareness in the understanding of singer fatigue is lacking.
    - The data collected in this study will help assess preventative measures in vocal injury.
- Prevention is best aided by:
    - Rehearsal practices
    - Student awareness
    - Technique
- All data is self reported by students, and therefore contains biases and discrepancies based on student perception.
- Study Phase 1: Including the preliminary survey and weeks 1-4, this phase provides the control for phases 2 & 3.
    - A self-reported rating of 1-4 = poor/less than average vocal health. A rating of 10 = perfect vocal health. Less than 6% of students experienced vocal health of a 1-4 rating.
- Study Phase 2: Weeks 5-8 suggest a slight increase in fatigue. There was a 10% increase in 1-4 rating of poor/less than average vocal health. 73% of students in Phase 1 rated vocal health as a 7-10 (great vocal health), whereas in phase 2, only 54% of students rated their vocal health as a 7-10.
- Study Phase 3: The study will end mid-November. Statistics will be reported on at future presentations.

- Preliminary Data suggests the leading cause of singer fatigue is long choral rehearsals (54% of survey submissions). The second leading cause is reported as “Singing for extended periods of time outside of your tessitura.
- Preliminary Data suggests the leading non-musical factors causing singer fatigue are sleep deprivation and allergies.

Potential Further Research

- This research could lend itself useful to directors looking to track singer fatigue within their own ensembles. Similar studies could be conducted on different types of ensembles with different ages and demographics of singers.
- A more in-depth study could be conducted to involve weekly in-person interviews with participants, listening to and recording their voice and its fatigue over a specified time. Various exercises could be used to test their range, vocal onsets, and any perceived strain or tension.

Research Paper and Resources (located in the Bibliography on page 18)

Vocal Fatigue in Choral Singers and Contributing Factors

Developing singers face increased challenges with vocal health as expectations of their instrument increase. As someone who has personally experienced vocal damage as a developing singer, I understand the importance of educating singers on healthy vocal habits. Sometimes, educators place the focus for developing singers on maintaining healthy singing habits, but the onset of vocal injury often comes as a surprise. I believe part of this disconnect may stem from a lack of education in high school regarding the intense demands placed on pre-professional singers. Research on injury prevention and vocal health promotion could help address this gap in knowledge. In choral settings, directors may teach healthy singing technique, but vocal fatigue is often inevitable due to the number of rehearsals and the way directors conduct them. Choir directors are often the first—and only—voice teacher many students encounter, making their role in providing healthy vocal training important. Unfortunately, many choral directors lack the education and time necessary to implement this training effectively. This research aims to identify the causes of vocal fatigue specifically in developing choral singers (primarily aged fourteen to nineteen), to discuss vocal injury and paths to recovery, and to offer suggestions for prevention and treatment.

Vocal fatigue refers to weakness, strain, or stress that a singer may experience when attempting to produce sound. It can contribute to "reduced vocal function in singers by affecting not only the laryngeal muscles directly involved in singing, for example, intrinsic and extrinsic muscles, but also the supportive muscles of the upper torso and back."[1] High performance demands, physical exhaustion, and singing at elevated pitch or loudness levels are common

[1]Mary Gorham-Rowan, Karl Paoletti, and Richard Morris, 2017, "Effect of a Tapered Rehearsal Schedule on Voice in Choir Singers," *Journal of Singing* 73, no. 4 (2017): 391.

contributors to vocal fatigue. Singers may discover fatigue through throat soreness or tension, changes in voice quality after extensive use, facial or physical distortions while producing certain sounds, an inability to sustain a phrase, or uneven and irregular vibrato.[2] In their study focused on vocal fatigue in young trained singers, Welham and Mclagan observed vocal use throughout a one-hour warm-up, performance, and rest process. The researchers measured the singers' vocal function by "acoustic perturbation, sound pressure level and semitone pitch indices."[3] Students also self-reported through an analogue scale and checklist. The results revealed insights into vocal endurance, repertoire that may increase fatigue, sound pressure levels, and other factors.[4]

Studies like these are valuable for researchers and teachers, but especially for students, as they deepen understanding of their instrument's capabilities. Vocal abuse is a primary contributor to vocal fatigue. According to Lynn Gackle, vocal abuse includes "injurious types of vocalization such as shouting, screaming, cheering, throat clearing, abrupt glottal attack, strained vocalizations, and talking over loud noises."[5] Seventy-four female university voice students from Northwestern University responded to a survey that provided important insights into vocal attrition and symptoms. The researchers surveyed symptoms which included "hoarseness, reduced pitch range, vocal fatigue, sensation of tightness or pressure in the throat, discomfort in the throat, dryness in the throat, or pain in the throat."[6] The survey found that thirteen percent of students were free of symptoms, twenty-six percent had a few symptoms, and sixty-one percent reported multiple symptoms. Forty-seven percent had sought medical help for voice problems, and were more likely to feel upset, unhappy, or depressed about their voice. They were also more

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[2]John Richard Weiss, "Vocal Health in the Choral Rehearsal: Common Ground for Operatically Trained Singers, Studio Voice Teachers and Choral Conductors," ProQuest Dissertations & Theses (2001): 26-27.
[3]Nathan V. Welham and Margaret A. Maclagan, "Vocal Fatigue in Young Trained Singers across a Solo Performance: A Preliminary Study," *Logopedics, Phoniatrics, Vocology* 29, no. 1 (2004): 7.
[4]Welham and Maclagan, "Vocal Fatigue in Young Trained Singers across a Solo Performance," 7.
[5]Carol Ann Cook-Koenig, 1995, "Vocal Fatigue in Choral Singing: Causes and Suggestions for Prevention Voiced by Prominent Choral Directors," ProQuest Dissertations & Theses, 13.
[6]Shimon Sapir, "Vocal Attrition in Voice Students: Survey Findings," *Journal of Voice* 7, no. 1 (1993): 72.

likely to quit performing, practicing, or singing altogether.[7] University voice students typically participate in collegiate choral ensembles, which can contribute to the fatigue some of these students experienced. Continued vocal abuse and poor vocal practices can lead to injury—whether choral rehearsals directly caused the issue or intensify an existing one.

Within the choral setting, vocal demands often lead to vocal fatigue and injury when singers do not approach rehearsals in a healthy manner. Increased rehearsals leading up to a performance cause much of the fatigue singers experience in the choral setting. However, studies prove that this practice results in greater vocal damage and less effective vocal output during performances. Many singers—who resemble vocal athletes—"fear that a reduction in practice time or volume will result in a loss of muscle strength, overall conditioning, and performance abilities; however, no studies have found such a pattern."[8] Researchers suggest a tapered rehearsal schedule, which supports the idea that a high-quality practice session is more beneficial than one that is excessively long. In her dissertation, Gebhardt explores how music educators can help students prevent vocal injury. She studied, surveyed, and evaluated the vocal problems young choir singers experience. Additionally, she offers educators tools for developing healthy vocal habits that support the singer's entire well-being—not just the health of their vocal folds and larynx. She acknowledges the broad range of musical time periods and genres that music educators often try to teach equally and urges directors to set realistic goals for their singers. Educators cannot solve every vocal problem at once; they must apply sequencing to ensure the development of healthy vocal habits.[9]

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[7]Sapir, "Vocal Attrition in Voice Students," 72.
[8]Gorham-Rowan, Paoletti, and Morris, "Effect of a Tapered Rehearsal Schedule on Voice in Choir Singers," 392.
[9]Rianne Marcum Gebhardt, 2016, "The Adolescent Singing Voice in the 21st Century: Vocal Health and Pedagogy Promoting Vocal Health," ProQuest Dissertations & Theses, iii.

Vocal fold nodules and polyps are two of the most common vocal injuries. Vocal fold nodules act as hard calluses on the folds and are present on both sides, whereas a polyp is soft, filled with fluid, and sits on one vocal fold. Doctors can treat nodules holistically through voice, speech, and/or physical therapy, whereas doctors need to surgically remove a polyp. Both injuries can result from various causes, not just vocal abuse due to poor singing habits. "A Pilot Survey of Vocal Health in Young Singers" correlates many vocal problems with student demographics and behaviors. Of the 571 singers offered this questionnaire, 129 students, up to the age of twenty-five, responded. The demographic that reported vocal difficulties were primarily older adolescents. The survey encouraged laryngologists and choral conductors to communicate to ensure healthy singing habits among their ensembles, with special consideration for changing voices during puberty and for post-pubescent girls.[10] Another study, discussed by Weiss, focused on students at the University of Miami in 1999. The study examined sixty-five singers who claimed to have fully healthy vocal folds, or believed they did. However, "the evaluation revealed that 'a significant number of... students had an abnormal appearance to their larynges, including 5 with benign vocal fold lesions, 35 with posterior erythema, 17 with edema, and 20 with incomplete glottic closure.'"[11] Weiss believes that if students underwent a pre-screening of their vocal folds prior to entering an intensive collegiate music program, they would have a better chance of avoiding vocal injury.

Time after time in collegiate vocal music education programs, pre-service teachers routinely hear that they may very likely be the only voice teacher a student ever has. Cook-Koenig stated, "It is the duty of the choir director to teach choristers how to become efficient singers so that they will profit from, and not be injured by, the musical demands placed

[10]Emily S. Tepe, Ellen S. Deutsch, Quiana Sampson, Stephen Lawless, James S. Reilly, and Robert Thayer Sataloff, "A Pilot Survey of Vocal Health in Young Singers," *Journal of Voice* 16, no. 2 (2002).
[11]Weiss, "Vocal Health in the Choral Rehearsal."

on them and so that the quality of sound from the ensemble is of the highest possible order."[12] While solo and choral singing are not necessarily interchangeable, healthy technique in one supports healthy technique in the other. The journal article "Factors Associated With Singers' Perceptions of Choral Singing Well-Being" recognizes that solo and choral singing are their own styles because of "varying spectral characteristics, sound levels, and phonation frequency. These acoustic differences translate to separate technical demands."[13] In an ideal world, every chorister would take private lessons with a reputable voice teacher. In an even more ideal world, the private voice teacher and choral director would collaborate to help developing singers be as healthy and well-rounded as possible.

Choral directors with a vocal music degree are better equipped to lead an ensemble than those without a degree, but even more important is that choral directors receive training in vocal pedagogy. While not all vocal music education programs require a formal course, future choral directors who study vocal anatomy, pedagogy, registers, and the inner workings of the voice will be better prepared to support their students. Regardless of what a future choral director's degree includes, directors must educate themselves on vocal science, rehearsal environments, and repertoire choices. It is vitally important for a choir director to prioritize vocal health before even standing in front of the ensemble.[14] Healthy singing is good singing–it improves uniform vowels, tone color, and helps create a beautiful and free choral sound.

Realistically, a student will spend far more time in choral rehearsals than private voice lessons. Choral directors face the challenge of ensuring healthy singing, creating unified sound, and also allowing singers to sing the way they naturally do. No two voices are the same.

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[12]Cook-Koenig, "Vocal Fatigue in Choral Singing," 49.
[13]Elliana R. Kirsh, Eva van Leer, Heidi J. Phero, Changchun Xie, and Sid Khosla, 2013, "Factors Associated With Singers' Perceptions of Choral Singing Well-Being." *Journal of Voice* 27, no. 6 (2013): 786.e25.
[14]Jeffrey L. Webb, "Promoting Vocal Health in the Choral Rehearsal: When Planning for and Conducting Choral Rehearsals, Guide Your Students in Healthful Singing." *Music Educators Journal* 93 no. 5 (2007).

Cook-Koenig wrote, "As Robert Shaw has publicly stated on occasion, it is as illogical for the choral conductor to demand one vocal quality from all categories of voices as for the orchestral conductor to request that all instruments have the same timbre. Balancing voices is far better choral technique than is the unrealizable goal of trying to blend them."[15] Prioritizing balance over blend is a useful skill to gain as a director, but one that develops over time. I have witnessed many pre-service educators stand in front of a choir and not understand why the singers are not matching tone. Often, the issue lies in poor vocal balance between individual voices and sections. Cook-Koenig believes the responsibility to teach efficient singing in a high-demand career—with a goal of preventing injury—falls to the choir director.[16] Surprisingly, this is not new research. In 1967, The National Association of Teachers of Singing released a statement: "'Choral directors who have made a serious study of the function and technique of the individual singing voice will be the ones who can be expected to produce beautiful choral singing.'"[17]

In an ideal world, a choral singer would enter rehearsal having only sung lightly beforehand and completing a healthy vocal warm-up appropriate for their specific instrument. Warm-ups are important because vocal folds depend on "efficient blood circulation in order to retain good function and viscosity."[18] Unfortunately, in an academic environment, choral rehearsals are often held at odd times in the school day. One student may have just eaten lunch, another may be arriving from a voice lesson, and another might be running in after finishing a lengthy written exam. The choral director is thus faced with a diverse group of singers, all hoping to create beautiful music in a healthy way. Each rehearsal must begin with a warm-up to ensure vocal unification. Many choral directors forgo a proper warm-up series believing it

[15]Cook-Koenig, "Vocal Fatigue in Choral Singing," 49.
[16]Cook-Koenig, "Vocal Fatigue in Choral Singing," 49.
[17]Cook-Koenig, "Vocal Fatigue in Choral Singing," 65-66.
[18]Johan Sundberg, *The Science of the Singing Voice*, (DeKalb, Ill: Northern Illinois University Press, 1987), 193.

detracts from rehearsal time. However, an effective choral director recognizes the necessity of even a brief, five-minute warm-up to ensure a more productive rehearsal. "Wolverton (1989) makes clear that 'it is incumbent upon the choral director/voice teacher to be able to recognize and identify problems in vocal production commonly encountered among adolescent singers and to work at eliminating these problems through the knowledgeable and systematic application of appropriate instruction and vocalises'"[19]

The director's selected exercises may not fully prepare every student vocally, but the warm-up process impacts more than just the activation of the vocal folds. Webb suggests, "The ultimate goal of warm-ups should be to create a healthy habit of singing. In other words, your students should sing the warm-ups the way you ultimately want them to perform the music you are rehearsing."[20] A proper warm-up leads seamlessly into a successful rehearsal. Kirsh et al. acknowledge that "vocalizations differ depending on the age and skill of the singers in the choir, yet general WU [warm-up] recommendations include (1) glides, scales, or arpeggios with a partially occluded vocal tract, (2) two-octave pitch glides (up and down) using high vowels (eg, /i/), (3) scales using forward tongue roll extensions (/a/ to /i/), and (4) staccato singing."[21]

Sundberg recognizes the vastness of an individual's warm-up process, noting that "many prefer to sing softly at very low phonation frequencies and to make many long pauses between the first voice exercises of the day. Others sing loudly at high phonation frequencies and then rest."[22] This variation makes it more challenging to holistically warm up a large group of singers simultaneously. In my undergraduate choral methods course, we discussed a useful warm-up sequence for an ensemble. The choir begins with physical preparation and stretches to engage the

[19]Cook-Koenig, "Vocal Fatigue in Choral Singing," 66.
[20]Webb, "Promoting Vocal Health in the Choral Rehearsal."
[21]Kirsh, et al., "Factors Associated With Singers' Perceptions of Choral Singing Well-Being," 786.e26.
[22]Sundberg, *The Science of the Singing Voice*, 193.

whole body. Next, they focus on engaging the breath through breathing exercises. Third, the singers explore initial phonation with exercises such as light humming and lip trills. Then, the choir activates the entire vocal mechanism using exercises that expand range, timbre, and vowel unification. Finally, the warm-up should end with a tuning exercise to unify the choir's tone. Webb reminds directors that the goals of the warm-up must align with the goals of the rehearsal, and that warm-ups should be approached with the same intention as the repertoire.[23]

Recent research suggests that Semi Occluded Vocal Tract (SOVT) exercises are a beneficial and healthy approach to vocal warm-ups. SOVTs are exercises in which the singer keeps the mouth partially closed—typically with a small straw, tongue trills, or lip bubbles. These exercises reduce pressure on the vocal folds, allowing the singer to produce sound more efficiently and with less effort. A proper SOVT requires the singer to prevent air from escaping through any part of the lips that is not intended. In his study on SOVTs, Dr. Titze examined the physical principles behind SOVT training. Titze found that SOVT exercises are effective in both training and rehabilitating the vocal folds. To support this, he used computer simulations with a self-oscillating vocal fold model. His results concluded that both SOVTs and non-occluded exercises can make the voice more "efficient and more economic."[24] Applying SOVTs in a choral setting is beneficial because they encourage singers to focus on producing healthy sound individually. An added benefit is that singers better understand they can produce less sound than they perhaps previously believed was necessary in the choral setting.

> A choral environment provides individual singers with "less than a desired amount of auditory feedback" because their sound is masked by surrounding voices. "When the masking effect occurs... there is a tendency for singers to push or force their voices to

[23]Webb, "Promoting Vocal Health in the Choral Rehearsal."
[24]Ingo R. Titze, "Voice Training and Therapy with a Semi-Occluded Vocal Tract: Rationale and Scientific Underpinnings," *Journal of Speech, Language, and Hearing Research* 49 no. 2 (2006).

> enhance feedback." Therefore, it is important for chorus members to resist singing beyond their vocal intensity limits.[25]

SOVTs can help train choir members to avoid pushing their sound to be heard over others. SOVTs are even useful at the end of a rehearsal to ensure singers leave without feeling vocally exhausted.

The vocal cool-down is a widely underused tool to prevent vocal injury. Ragan's study examined singer's and listener's perception of the vocal cool-down after singing to determine if they noticed any differences in overall vocal health and performance. Ragan concluded that singers strongly perceived benefits in their voice's well-being from the vocal cool-down, though she acknowledged that objective measurements of this data were relatively inconclusive and challenging to maintain. Exercises that work well for a vocal cool-down include straw exercises, humming, floaty /u/, and other gentle vocalises. Ragan used these exercises in her study, which focused on female classically-trained singers. "Exercises were selected based on extensive teaching and singing experience, and informed by current research. For example, utilizing the 'floaty /u/' as the final exercise helped to determine the functional state of the voice."[26] Ragan's study also included a daily questionnaire based on the singer's self-perception. Each day, singers completed the survey at various intervals over a twenty-four hour period to analyze vocal use. "Singers provided a numeric value to assess vocal fatigue at four intervals: (1) before the beginning of that day's rehearsal, (2) immediately after the rehearsal was finished, (3) 2 hours after the rehearsal concluded, and (4) at the beginning of the next day's rehearsal."[27] Singers assessed how rehearsal affected their voice and whether it had a positive or negative impact. Ragan found that singers became more passionate about their vocal well-being and vocal

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[25]Weiss, "Vocal Health in the Choral Rehearsal," 29.
[26]Kari Ragan, "The Impact of Vocal Cool-down Exercises: A Subjective Study of Singers' and Listeners' Perceptions." *Journal of Voice* 30, no. 6 (2016): 764.e3.
[27]Ragan, "The Impact of Vocal Cool-down Exercises," 764.e3.

preservation because of the implementation of the vocal cool-down. The results suggested that recovery following intense singing was faster after incorporating a cool-down. Ragan stated, "Many singers made observations about the cumulative impact. They felt able to sing longer before experiencing vocal fatigue during the week they utilized cool-down exercises as compared with the week they did not."[28]

Ragan's study suggested that the majority of participating singers would incorporate the vocal cool-down into their future practice. Yet, the vocal cool-down remains one of the most underutilized tools in vocal preservation. Choral directors often neglect to implement a vocal cool-down because, like warm-ups, they believe it takes time away from the rehearsal. However, if directors expect singers to consistently arrive to rehearsals with a healthy and strong voice, the vocal cool-down is one of the best practices for making a long-lasting impact on the ensemble's efficacy.

Singers must consider their vocal use after rehearsal and be judicious in how they use their voices to better preserve their instrument. Rather than rushing from an intensive choral rehearsal straight into a loud speaking environment or big performance, singers should assess their vocal use and potential abuse. Singers are sociable people, but their voice is their livelihood. This is a concept that many developing singers have yet to fully understand and come to terms with. Vocal rest, whether for only an hour after rehearsal or for a couple of days to recover from illness or an intensive singing schedule, helps prevent injury. If a singer ignores feelings of fatigue and pushes through, damage is more likely to occur. Because of the pressure placed on singers in intense rehearsal environments, it is important to implement rest when needed.

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[28]Ragan, "The Impact of Vocal Cool-down Exercises," 764.e6.

The expectations of a choral rehearsal vary depending on the average age of the ensemble, the frequency of its meetings, the musical level, whether the ensemble is auditioned or non-auditioned, the time of day it meets, and the environment in which it exists, such as a church, high school, university, or elsewhere. Outside of traditional rehearsals, different environments can significantly impact a choral singer's vocal fatigue and how quickly this fatigue occurs. Choral festivals, conventions, and tours are some of the most demanding experiences a singer can place on their instrument. The rehearsal hours are longer, later, and more intense. Cook-Koenig recommends that singers condition their voices before these experiences to meet the higher stamina demands necessary for success.[29] She goes on to reference Doscher who states,

> She refers to all-day workshops or two-hour rehearsals just prior to a performance, warning: Even if one is singing with correct technique, fatigue sets in after an hour of continuous singing, and makes its presence known first in the respiratory muscles. After another 30 minutes, fatigue may so reduce respiratory efficiency that tension will move to the muscles of the neck and larynx. At this stage, whether it be a rehearsal for an opera or a musical, or a choral rehearsal, the singer needs at least one day of vocal rest.[30]

I vividly remember two experiences that, in retrospect, should have alerted me to my own vocal damage. The first occurred as a member of the Georgia Governor's Honors Program summer choir. We spent four hours each day rehearsing high-level high school and collegiate choral music for four weeks. I frequently experienced extreme vocal fatigue and would often lose my voice. The second experience was when I developed laryngitis from an illness just a few days before attending the 2016 Southern Region American Choral Directors Association Conference, where I was a member of the high school honor choir. I spent most of my time in rehearsals on vocal rest. However, I wanted to perform in the concert, so despite my voice being

[29]Cook-Koenig, "Vocal Fatigue in Choral Singing," 61
[30]Cook-Koenig, "Vocal Fatigue in Choral Singing," 59.

nowhere near recovered, I felt the pressure to fully sing with only half of my normal vocal ability. I am certain that these experiences are universal among high-achieving developing singers.

In Texas, the All-State Chorus audition process is extremely competitive and intense, leading students to attend All-State summer camps to prepare for their fall auditions. According to a study on these camps, "One schedule example featured approximately 14 hours of activity per day with a combined 9 hours of sectional time and 8 hours of rehearsal time over the camp's 72-hour length."[31] While one can hope that not every minute is spent singing—perhaps one section sings while another audiates their part, or perhaps the pianist plays the parts while the singers listen—the reality is that most time in a choral rehearsal is spent singing. The same study urges that, "Two or more hours of daily rehearsal may be feasible, but additional voice use that occurs throughout the day must be considered; a concern especially highlighted in adolescent/pubescent voices."[32] Although this paper focuses primarily on singers aged fourteen to nineteen, adolescents typically experience the effects of puberty over several years. Additionally, the voice does not immediately stabilize once puberty finishes. Many singers require changes in their training to adapt to their evolving voices. The adolescent voice undergoes high levels of hormonal, physical, and mental change. Their voices are muscularly immature and as a result, "their voices may not be stable enough to healthily sustain such an overly taxing rehearsal process."[33]

While a perfect alternative to the intensity of honor choir and tour schedules has yet to be determined, adjustments can be made to lessen this demand. For example, choral directors

[31]Paul M. Patinka, Jesus De Hoyos, and James Rodriguez, "Quantitative Analysis of the Texas Music Educators Association (TMEA) All-State Choral Audition Music," *Journal of Voice* 36, no. 5 (2022): 732.e9.
[32]Patinka, Hoyos, and Rodriguez, "Quantitative Analysis of the Texas Music Educators Association (TMEA) All-State Choral Audition Music," 732.e10.
[33]Patinka, Hoyos, and Rodriguez, "Quantitative Analysis of the Texas Music Educators Association (TMEA) All-State Choral Audition Music," 732.e9.

should consider the tessitura and range of each section to avoid overexerting their abilities. Directors can have students mark phrases by singing down an octave, at a less taxing dynamic, or, in the case of younger singers, alternate which sections sing which parts.[34] Cook-Koenig wrote, "She [Herman] explains, 'You don't have a [singer] stay on one part and only be able to sing half a piece because his or her voice is changing and a lot of the part is out of range.'"[35] She recognizes that a piece can be adapted to keep the singer singing. In their questionnaire, Kirsh et al. found that singers experienced increased vocal fatigue when singing outside their tessitura. However, singing loudly contributed less to fatigue. This further suggests that singing at a voice's extremities can be damaging.[36] Some tips for directors to create a healthy rehearsal include making a plan for every rehearsal, rehearsing music in chunks, having sectionals, and being aware of singers who are straining. Directors should also be cognizant of the order in which they rehearse each piece, recognizing that some repertoire is more vocally taxing than others. Additionally, directors should try to model healthy singing and remind students of healthy singing, especially during intensive rehearsals.[37]

Repertoire selected by directors should reflect the capabilities of the singers within the ensemble. While much research has been conducted on many aspects a director should consider in repertoire selection, vocal stamina must be top of the list. Research on the TMEA process suggested, "Ensembles do not have singers with equally allocated vocal ranges, musical abilities, and physiological capabilities, and directors must make compromises to fit voices to the literature."[38] TMEA and other All-State choirs are unique because directors select the repertoire before meeting the ensemble. Additionally, the clinicians selected to conduct these choirs often

[34]Cook-Koenig, "Vocal Fatigue in Choral Singing," 58
[35]Cook-Koenig, "Vocal Fatigue in Choral Singing," 57-58.
[36]Kirsh, et al., "Factors Associated With Singers' Perceptions of Choral Singing Well-Being," 786.e26.
[37]Kirsh, et al., "Factors Associated With Singers' Perceptions of Choral Singing Well-Being," 786.e26.
[38]Patinka, Hoyos, and Rodriguez, "Quantitative Analysis of the Texas Music Educators Association (TMEA) All-State Choral Audition Music," 732.e17.

work in collegiate and professional settings. While they may have previously worked with high school choirs, it may have been many years since they were closely working with fourteen to eighteen-year-olds. These directors must consider that their expectations of success may vary from reality, and select repertoire appropriate to the age, environment, and amount of time spent singing it during the preparation process.

The tapered rehearsal study previously mentioned discusses how increased rehearsal time before a performance does not strengthen the output, especially with younger, developing singers. In fact, the study suggests that the last few rehearsals leading up to a performance should focus on minor technique correction rather than intensive, loud repetition of the music.[39] Reputable sources for finding appropriate choral repertoire for developing singers include state music education websites, which often feature previous years of All-State music. Additionally, attending professional development sessions focused on repertoire for specific demographics at conferences and conventions is a great starting point. For the longevity of a developing singer's career, it is crucial that their director values vocal health in repertoire selections.

Vocal fatigue is not only a recent experience for singers. As the intensive expectations for singers increase alongside the "busy culture" many performers feel compelled to participate in, it is of utmost importance that healthy singing habits be instilled from a young age. Preventing an injury is much easier than treating one caused by vocal abuse. Choral singing can be a lifelong activity, but only if the singer treats their voice with respect. Without a director to guide them on a healthy path, their career could be cut short. Through proper warm-ups, exercises, cool-downs, and rehearsal practices, choral directors can continue to help singers, even from a young age, thrive in the music field.

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[39]Gorham-Rowan, Paoletti, and Morris, "Effect of a Tapered Rehearsal Schedule on Voice in Choir Singers," 392-393.

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