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Weight fluctuation and the voice: A survey of effects from the singer's perspective

Shannon Lowe Redburn

WEIGHT FLUCTUATION AND THE VOICE:
A SURVEY OF EFFECTS FROM THE SINGER'S PERSPECTIVE

by

Shannon Lowe Redburn

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Acknowledgements

The purpose of this project is to determine if weight fluctuation has any effect on how the voice functions. I will attempt to answer this question by surveying a sample of professional and amateur singers who have experienced significant weight fluctuation throughout their singing careers. This survey will be used to determine which aspects of singing might be affected by weight fluctuation and how singers can expect and prepare for these possible changes.

My hope is that this project will open the door for other avenues of research into the topic of weight fluctuation, how it affects singers' voices, and how it affects their careers.

This project would not have been possible without the support of Dr. Miriam van Mersbergen and Dr. Kyle Ferrill, along with committee members Mary Wilson, Dr. Josef Hanson, and Benjamin Wayne Smith, who have provided me with support and guidance through every step of this project. I would also like to thank Dr. Sarah Harper for her insight, friendship, and constant encouragement.

To my family, Holly, Russ, and Erin, who have afforded me the ability to earn a terminal degree in my field, thank you. And special thanks to my husband, Aaron, for his unwavering support as we embarked upon this journey together. To everyone else who has ever supported my dream of getting a doctorate, thank you for your belief in my abilities. I am so grateful.

Abstract

Though there has been much research on the effects of weight fluctuation on the speaking voice, there is a distinct lack of published data regarding how it affects the bodily mechanisms used for singing. This study aims to survey professional and amateur singers about changes to their breathing, phonation, vocal quality, and vocal mechanism after experiencing a significant (10% or more of total body mass or greater) weight change. Specifically, it aims to provide anecdotal data regarding which aspects of singing are most affected, on average, by weight loss and gain. An anonymous, mixed-method survey was given to 90 singers. On average, singers indicated positive changes to breathing ability with weight loss, in addition to perceiving a slightly brighter, more shallow timbre. Participants who gained weight indicated that their access to full breath suffered, but their timbre became darker and fuller. Although these results do not indicate actual scientific findings, they do indicate that many singers who took this survey experienced the similar changes to their singing when they experienced weight fluctuation. Through this study, a better understanding of the respiratory, phonatory, and resonatory changes that singers can experience as effects of weight fluctuation has been gained. Though the results of this survey illuminate only trends in the data, a large amount of information was collected, and a basis for further avenues of research was established.

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Introduction

The aim of this study is to learn about singers' experiences with weight fluctuation and ultimately to compile information about how changes in body mass can affect vocal production and singing sensation. Though there is a wide array of literature discussing weight fluctuation and its effect on the speaking voice, there is not nearly as much compiled data on its effect on the singing voice. Weight fluctuation is a natural phenomenon that most adults will experience. There are a variety of outside influences that affect body weight, such as diet, activity level, and hormonal changes. Any time a person undergoes a significant change in body mass, it can change a variety of anatomical aspects. Some examples of these changes include the efficiency of the bodily systems and the effort level perceived by the individual. For singers who use their bodies as their instrument, even minute fluctuations can dramatically influence performance.

This cross-sectional survey shows the trends in singer's experiences with weight fluctuation and how it affected different aspects of their singing. The vocal aspects asked about in the survey were breath, phonation, vocal quality, and vocal mechanism. Results show that aspects of breathing, on average, became easier with weight loss and slightly more difficult with weight gain. Participants also indicated a fuller, darker timbre was consistent with weight gain.

CHAPTER 1: BACKGROUND AND LITERATURE REVIEW

Body Size and the Singer

In the last 100 years, body size and shape have emerged as increasing points of contention in the singing world. Today, singers are expected to have flawless voices and sensitive musicality while looking like models and movie stars. This is especially true in the opera and musical theater communities. With innovations such as the MET HD broadcast, singers' bodies are in the limelight more each day. Singers who carry more weight are often met with reviews that mention nothing at all about their performance, but instead discuss how unbelievable it is that someone of their stature could be a love interest. "One reviewer particularly, Manuel Brug, has been called out for talking about 'fat women in tight corsets spreading their legs'."[1] This kind of weight bias can be infuriating for singers, who spend years perfecting their craft.

While directors, teachers, and patrons are demanding that singers be increasingly thinner, many singers have expressed that having more body mass can make their singing better. Because body size is under a microscope in the singing community, many singers have felt their physiques scrutinized and thus experienced weight fluctuation. While there are studies about how weight changes affect the voice, researchers have not compiled singers' own personal experiences with weight change and how it affected specific aspects of their singing, such as breath, phonation, vocal quality, and the vocal mechanism. This survey was created to learn about those experiences in an effort to create a better understanding of what singers' actual experiences have been.

[1] Maddy Shaw Roberts, "Opera Singer Calls out Critic for Body-Shaming Her – His Reply Sparks Huge Backlash," *Classic FM* (Classic FM, August 29, 2019), last modified August 29, 2019, accessed March 23, 2021, https://www.classicfm.com/music-news/soprano-kathryn-lewek-opera-critics-body-shaming/.

Breath

Breathing is the basis of all singing. In fact, it is the basis of all phonation. In order to sing healthily, singers need to create a steady stream of air and the only way that can occur is by changing the size of the chest. When a person is working with extra weight around the thorax, it is possible that these breathing actions can become harder to manage. Alternatively, if a person has an extremely low body mass, they may not have the strength of inspiratory and expiratory muscles needed to maintain a steady stream of air. As breathing occurs, the chest wall expands, volume increases, pressure decreases, and air comes rushing in. When the chest wall is stretched, the muscles of expiration want to snap back quickly. This phenomenon is called "elastic recoil." If a singer inhales and then allows the chest wall to snap back too quickly, the stream of air cannot remain steady. Singers must use their inspiratory muscles to control the stream of air at the beginning of the exhale and to push the rest of their air out at the end of the exhale.

Current studies show how excess body fat can affect breathing. Singers and teachers of singing often talk about the diaphragm when they discuss "support," but really, support is a combination of ribcage, thoracic, back, and abdominal muscle function.[2] "This support mechanism constitutes the power source of the voice and should generate a vector of force in the direction of the air column passing between the vocal folds."[3] Singers and teachers alike recognize that proper training of the thoracic and abdominal support mechanism is essential. A singer's ability to use these systems to support their breathing may change as their body weight changes.

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[2] A. L. Hamdan et al., "Obesity, Respiration, and Voice," in *Obesity and Voice* (San Diego, CA: Plural Publishing, Inc., 2020), pp 161-162.

[3] Ibid, 143

Studies have shown that obesity may disturb the respiratory system in a variety of ways. People with high body mass index (BMI) often exhibit breathlessness and dyspnea (difficult or labored breathing), even in the absence of other respiratory diseases.[4] BMI is not the only predictor of respiratory issues in patients. Numerous reports indicate that the way fat is distributed on the body plays an important role in the respiratory disfunction of obese subjects.[5] In a study by Collins et al,[6] patients with upper body fat distribution, with a waist to hip ratio of 0.950 or greater, had worse FVC (forced vital capacity) than patients with lower body fat distribution. FVC is the amount of air that can be forcibly exhaled from the lungs after taking the deepest breath possible. It is a test that is often used in the diagnosis of asthma. The authors of this study discussed the negative impact of upper body obesity on lung volumes.[7]

While there is not as much research on the effect of being underweight on breathing, one study shows that underweight people with sedentary lifestyles have reduced FVC, poor respiratory muscles, and may also struggle with dynamic lung function.[8]

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[4] Krishnan Parameswaran, David C Todd, and Mark Soth, "Altered Respiratory Physiology in Obesity," *Canadian Respiratory Journal* 13, no. 4 (2006): 203-210.

[5] Ross Lazarus, David Sparrow, and Scott T. Weiss, "Effects of Obesity and Fat Distribution on Ventilatory Function," *Chest* 111, no. 4 (1997): 891-898.

[6] Lynell C. Collins et al., "The Effect of Body Fat Distribution on Pulmonary Function Tests," *Chest* 107, no.5 (1995): 1298-1302.

[7] A. L. Hamdan et al., "Obesity, Respiration, and Voice," in *Obesity and Voice* (San Diego, CA: Plural Publishing, Inc., 2020), p. 163.

[8] Ahmed Azad and Akram Zamani, "Lean Body Mass Can Predict Lung Function in Underweight and Normal Weight Sedentary Female Young Adults," *Tanaffos* 13, no. 2 (2014): 20-26, accessed February 14, 2021, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4260069/.

Another cross-sectional study of the general population without apparent lung disease, found that being underweight is closely associated with decreased pulmonary function.[9]

Ultimately, according to current research, being significantly below or above average weight can affect respiratory parameters because it can cause small airway dysfunction, expiratory flow limitation, respiratory mechanics change, chest wall and lung compliance reductions, change in respiratory muscle strength, change in pulmonary gas exchange, change in breathing control, and limitations in exercise capacity.[10] This, in turn, affects singing by changing a person's ability to utilize the muscles needed to maintain a steady stream of air.

In order to learn about singers' personal experiences with weight fluctuation and breath support, this survey asked whether or not singers had difficulty sustaining long phrases, taking full breaths, controlling exhalation, maintaining a steady stream of air, and controlling crescendos and decrescendos. The survey also asked about changes in breathing sensation. Some of the questions asked if the singer experienced sensation of breathing in the chest, sensation of breathing in the back, sensation of breathing in the shoulders, sensation of breathing in the abdomen, sensation of breathlessness, sensation of sudden closure of the throat, sensation of still having air, but no ability to phonate, and sensation of increased effort in breathing. Many of these variables were referenced from other similar cross-sectional studies about aspects of singing affected by various bodily changes.

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[9] Jong Geol Do et al., "Association between Underweight and Pulmonary Function in 282,135 Healthy Adults: A Cross-Sectional Study in Korean Population," *Scientific Reports* 9, no. 1 (April 2019), accessed February 14, 2021, https://www.nature.com/articles/s41598-019-50488-3.

[10] Urooj Bhatti, Zulfiqar Ali Laghari, and Binafsha Manzoor Syed, "Effect of Body Mass Index on Respiratory Parameters: A Cross-Sectional Analytical Study," *Pakistan Journal of Medical Sciences* 35, no. 6 (November 10, 2019): 1724-1729, accessed February 14, 2021, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6861468/.

Since this cross-sectional study is based on self-reporting from participants, it may not provide insight into actual relationships between BMI and respiratory function in singers. However, it can shed light on any similarities singers have experienced after body mass change. This insight may help singers who undergo weight fluctuation in the future understand what kinds of changes in breathing they may experience.

Phonation

If a change in body weight can change a person's breathing function, it stands to reason that it can change their ability to phonate as well. The phonatory system consists of the vocal folds themselves. Scientists cannot discuss phonation without also discussing respiration and resonation. The three systems depend upon each other. The technical definition of phonation is sound production in the larynx at the level of the vocal folds. It is a component of speech production that also requires articulation, or the modification of those sounds by other anatomical structures (resonation). These structures include the pharynx, oral cavity, nasal cavity, and paranasal sinuses. They combine to make up the particular and distinctive sound of an individual's voice.[11]

It is very difficult to have sensations at the level of the vocal folds, as there are not many pain sensors that reside in and around them. Unless the degree of fat in the vocal folds is measured, it is difficult to know how weight fluctuation actually affects the phonatory system.[12] Often, phonatory issues are solved when respiratory issues are solved. Since so much of phonation relies on the proper subglottal pressure and the amount of air pressure required to get

[11] Patricia L. Barnes-Svarney and Thomas E. Svarney, *The Handy Anatomy Answer Book: Includes Physiology* (Detroit, MI: Visible Ink Press, 2016).

[12] Naoki Nishio et al., "Computed Tomographic Assessment of Autologous Fat Injection Augmentation for Vocal Fold Paralysis," *Laryngoscope Investigative Otolaryngology* 2, no. 6 (2017): 459-465.

the folds moving, what singers perceive as phonatory struggles may in fact be trouble with proper breathing.

Studies have shown, that both underweight and obese people may experience changes in FVC (as seen in the breathing studies) and maximum phonation time. A study by Barsties et al.[13] analyzed the impact of body weight and body fat volume on vocal quality and phonatory range in females. Underweight subjects had significantly lower vital capacity than expected, as well as having a MPT (maximum phonation time) lower than that of subjects of normal weight. The group of obese subjects showed significantly lower shimmer values than normal weight subjects.[14] Another study followed eight obese adults who had undergone bariatric surgery, measuring changes in their phonation threshold pressure (PTP) over time. Examination of individual data revealed a trend for PTP at 30% F0 to decrease as body mass index decreased.[15]

Since studies show that change in weight and body fat percentage can affect phonation, this survey asked questions regarding singers experiences with different types of phonation after undergoing a body mass change. Participants reported on whether they experienced difficulty with any of the following: singing in the upper register, singing in and around the passaggi (the transition areas between vocal registers), singing in the lower register, singing with agility, singing with legato, singing quieter than mezzo piano (medium soft), singing louder than mezzo forte (medium loud), singing high pitches quietly, and producing sound without a slight delay at onset.

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[13] Ben Barsties et al., "Do Body Mass Index and Fat Volume Influence Vocal Quality, Phonatory Range, and Aerodynamics in Females?" *CoDAS* 25, no. 4 (2013): 310-318, accessed February 15, 2021, http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2317-17822013000400003.

[14] Ibid

[15] Nancy Solomon et al., "Do Obesity and Weight Loss Affect Vocal Function?" *Seminars in Speech and Language* 32, no. 01 (2011): 031-042, accessed February 15, 2021, https://pubmed.ncbi.nlm.nih.gov/21491357/.

Once again, the results from this survey do not represent generalizable data. They merely help show any similarities in phonatory changes that singers experienced as their body mass changed.

Vocal Quality

Since body mass change may affect the size of the vocal tract, which in turn could change the resonating space, it stands to reason that weight fluctuation could change vocal quality. A singer's respiratory, phonatory, and resonatory system work together to create sound, but changes in vocal quality are most often made by the resonatory system. This system is made up of three major cavities. These categories are the pharynx, which resides just above the larynx and leads to the larynx and the esophagus; the oral cavity, which includes the hard palate, soft palate, and teeth; and the nasal cavity, which can be closed off from the pharynx by the raising the soft palate. The pharynx, oral cavity, and nasal cavity collectively make up the "vocal tract."[16] The shape of this tract determines which types of sounds will be produced. Manipulation of the vocal tract can change a variety of aspects of the produced sound. Some of these qualities include sensation of sound in the back of the throat, brighter vocal quality, strident vocal quality, breathy vocal quality, or heavier vocal quality. The quality of sound is determined by listening to the sound produced. The quality can sound different to the singer than it does to a third-party listener.

Vocal Mechanism

This survey specifically asks about two aspects of the vocal mechanism that may change if one undergoes a change in body mass, rhinitis and vocal edema. Rhinitis is the inflammation

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[16] "Supralaryngeal Structures and Resonance," *The Anatomy of the Supralaryngeal Structures*, accessed March 7, 2021, http://my.ilstu.edu/~jsawyer/resonancesoftchalk/resonancesoftchalk2.html.

of the inner lining of the nose. This swelling can cause changes in size and shape of one or more of the three resonating cavities and the result may be a difference in vocal quality. Vocal edema or "Reinke's Edema", is categorized as swelling in Reinke's space. This space is the non-muscle part of the vocal fold "just underneath the surface lining of the vocal fold. It plays a key role in vocal fold vibration."[17] One of the common causes of Reinke's edema is GERD (gastroesophageal reflux disease), which can be exacerbated by changes in weight.

[17] "Reinke's Edema," *The Voice Foundation*, last modified September 9, 2013, accessed March 8, 2021, https://voicefoundation.org/health-science/voice-disorders/voice-disorders/reinkes-edema/.

CHAPTER 2: SURVEY METHODS

Purpose of the Study

Although research has been done on the effects of obesity and weight change on the voice, little has been specifically compiled about singers and their experience singing after undergoing a significant (10% or more) change in body mass. The aim of this study is to gather information from professional and amateur singers about their general experience with weight fluctuation and how that fluctuation affected aspects of their breathing, phonation, vocal quality and vocal mechanism. From this information, a clearer understanding of gaps in research may be discovered. Additionally, results of this study may be used as a reference for singers who have undergone or may undergo a change in body mass. The research for this document was gathered by creating a survey to distribute among singers who have experienced one time weight loss, one time weight gain, or multiple bouts of weight loss and gain throughout their lives. The purpose of this survey was to better understand the perceived vocal changes of self-reporting singers who sang before, during, and after their weight change about any perceived changes in the voice. From the information collected, a clearer understanding of singers' experiences was gained, and pathways for possible future research were obtained.

Research Design

The survey is a cross-sectional design of a population of singers who have experienced weight fluctuation one or multiple times in their lives with the purpose of determining the effects of change in body mass on the voice. A mixed-method study was chosen so that participants could answer specific questions in a multiple-choice format, but also had the opportunity to respond with their own personal experiences in an open-ended section. This research proposal

was submitted to the Institutional Review Board (IRB) at the University of Memphis and was granted an exempt approval on February 3, 2021 under protocol number PRO-FY2021-159.

Participants

The participants in this study were 90 individuals who identified themselves as singers through an anonymous survey distributed through social media groups. These groups included the National Association for Teachers of Singing, the NEW New Forum for Classical Singers, Shoperatic, the Alpha Delta Pi Alumnae group, personal Facebook pages of singing colleagues, and through direct distribution of the anonymous survey link. The survey was available from February 4, 2021 to March 8, 2021.

Procedures

Participants learned about the survey and made the decision to participate. Participants then completed an original survey inquiring about general weight fluctuation information, demographics, health-seeking information, and experiences singing after weight fluctuation. The survey included space for optional and additional comments from participants. There was no compensation provided for participants. Participants were reminded to take the survey 3 separate times. All survey results were anonymized, so no IP addresses were linked to participants.

Instrumentation and Collection

Survey Format:

Data collection via an original survey was made available through Qualtrics.com. Participants could answer survey questions through an anonymous link. Survey questions included information regarding experience with weight fluctuation; positive and negative changes to breathing sensation, phonation, vocal quality, and vocal mechanism; positive and

negative feedback received; and whether they were hired more or less frequently post fluctuation. The complete survey can be found in Appendix B.

Survey Outline:

Demographics: This section contained basic demographic questions inquiring about items such as, gender, biological sex, race, height, and voice type. It also contained questions regarding the type of music the participant usually sings, the vocational and volunteer activities in which they participate, and highest level of vocal training. The final question in this section asked if the singer had experienced weight loss, weight gain, or weight fluctuation. The participant's answer to this question took them to the corresponding portion of the survey.

Loss/Gain Information: This section contained questions about how much of the participant's original body weight was lost or gained. It also contained questions about whether the loss or gain was intentional.

Health Seeking Information: This section contained questions about reasons for weight change, method for achieving weight goal (if change was intentional), how old the participant was when they underwent weight fluctuation, weight related health conditions and whether those conditions improved or declined after weight change.

Effects Experienced after Loss or Gain: This section asked the participant to answer questions about their experience with changes in breathing, phonation, vocal quality, and vocal mechanism, as well as inquiring about what percentage of their total body weight had been lost or gained when they began experiencing those changes. It also asked if the singer's performing load changed as a result of their weight change.

Additional Questions: This section asked questions about any feedback, positive or negative, the singer received as a result of their weight change, along with questions about who

provided this feedback to the participant. There were also questions in this section about whether or not weight change created an economic disadvantage for the participant and whether or not the participant was diagnosed with an eating disorder.

Other Comments: This open-ended section asked participants to elaborate on any other experiences they had as a result of weight fluctuation. A sampling of these comments can be found in Appendix A.

Variables for Analysis

In order to collect data on what singers experienced after weight fluctuation, the results had to be broken into two categories, effects experienced after weight loss and effects experienced after weight gain. The participants who indicated weight fluctuation were asked to answer questions based on their most significant change in weight. Their responses are compared with the respective categories. There were three variables for analysis, (1) net change noted, (2) direction of change, and (3) average response.

Net change was calculated by determining if participants indicated a post-weight fluctuation change in the categories of breath, phonation, vocal quality and mechanism, and/or professional impact.

Direction of change was noted by determining if participants received an improvement or a reduction in one or more of the categories. This directional change was calculated by appropriately keying responses to reflect overall improvement. For example: an individual who noticed a large change in effort in breathing was keyed as a large change in the negative direction. The answers were keyed in and the net change was averaged. Responses were appropriately keyed in to reflect an overall improvement or overall degradation of breathing,

phonation, vocal quality and mechanism, and/or professional impact. Average responses were rounded to the nearest whole number.

CHAPTER 3: RESULTS

Results from the "Demographics," "Effects Experienced after Weight Loss," and "Effects Experienced after Weight Gain" sections were calculated using simple statistics (calculation of percentage). Of the 90 participants who opened the survey, 83 participants completed the demographics information. Of the 83 participants who completed the demographics section, 77 completed the survey. The remaining 6 participants were removed from the data because their weight fluctuation was less than 10% of their original body weight. For examples of open-ended responses, see Appendix A.

Participant Demographics

Of the 83 participants who completed this section, 39 (47.0%) reported that their primary singing role is that of an opera singer, 16 (19.3%) reported choral singer, 14 (16.9%) indicated that their primary singing role is that of a solo singer, 3 (3.6%) reported musical theater performer, 3 (3.6%) reported primary music educator, 3 (3.6%) reported university teacher, 2 (2.4%) reported secondary music educator, 2 (2.4%) reported private voice teacher, and 1 (1.2%) reported studio singer. See **Figure 1.1** for a graphical display.

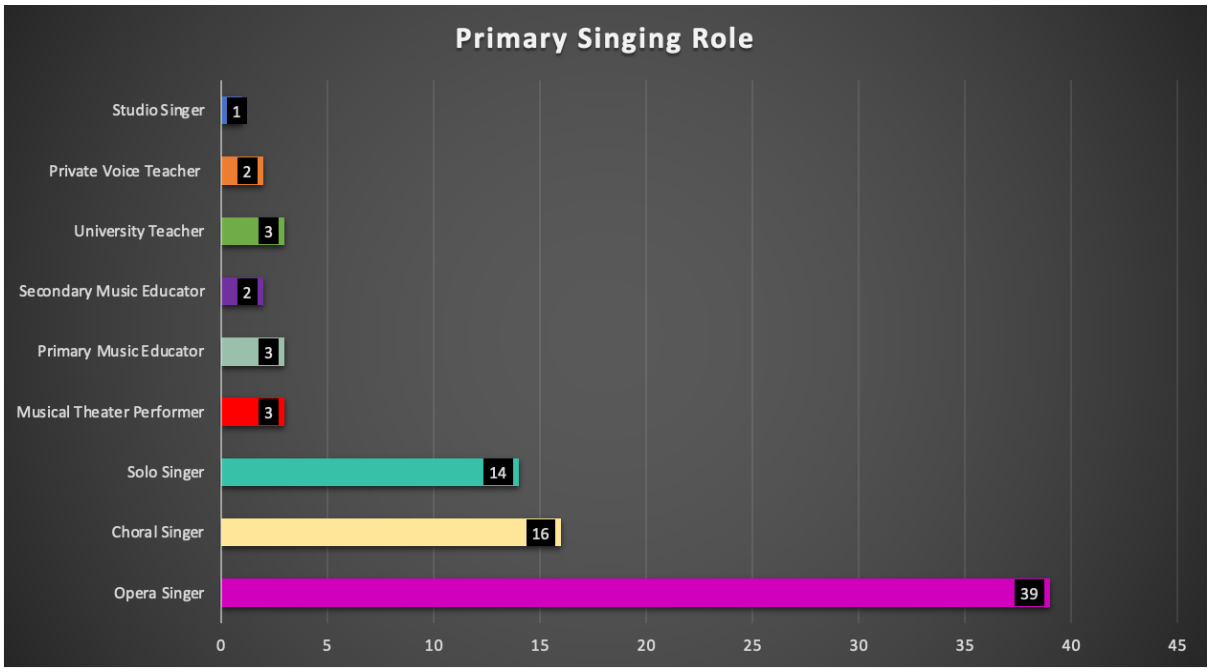


Figure 1.1. Primary singing roles reported by all respondents (n=83) The next section asked singers to select all other styles in which they sing outside of their primary singing role. Because participants were asked to select all that apply, the results display a sum greater than that of the 83 participants. Of the given 278 answers, 63 reported that they also were solo singers, 55 reported choral singers, 39 reported private voice teacher, 33 reported opera singers, 31 reported musical theater performer, 21 reported university teacher, 14 reported studio singers, 13 reported secondary music educator and 9 reported primary music educator. For a graphical display, see **Figure 1.2**.

Of the 83 participants, 35 (42.2%) reported that their highest earned degree was a master's degree, 23 (27.7%) reported earning a bachelor's degree, 19 (22.9%) reported earning a doctoral degree, 4 (4.8%) reported earning a high school diploma, 2 (2.4%) reported earning an associate's degree, and 0 (0%) reported earning an artist's diploma. See **Figure 1.3** for a graphical display.

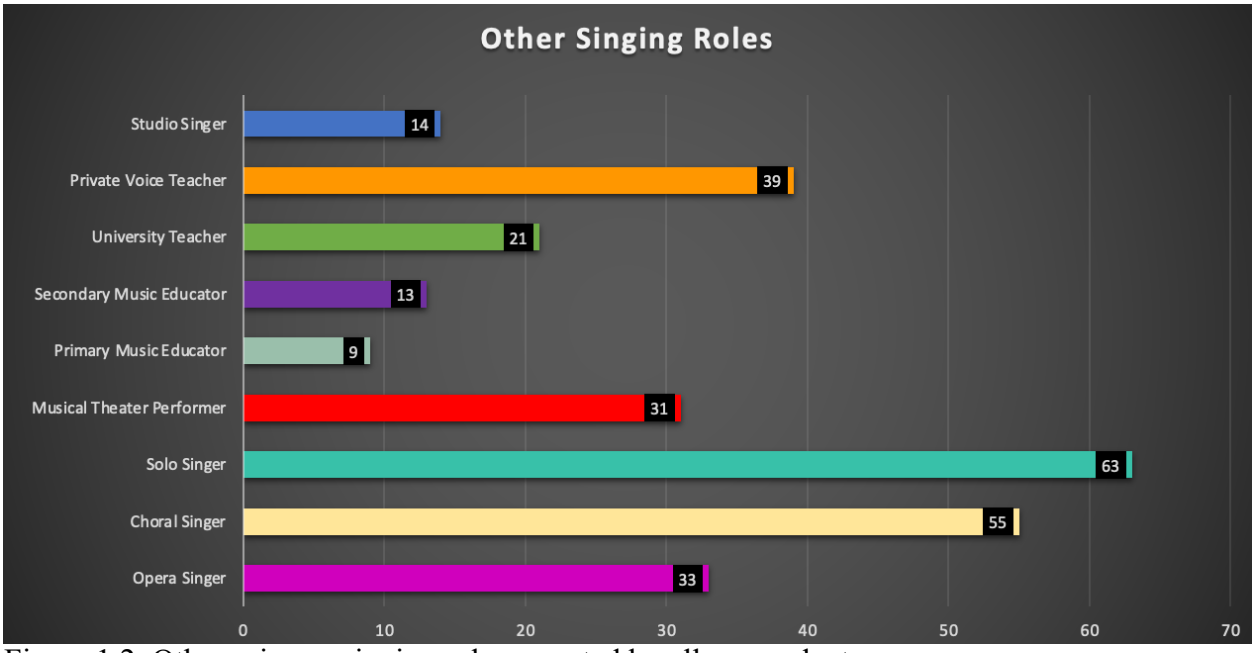


Figure 1.2. Other primary singing roles reported by all respondents.

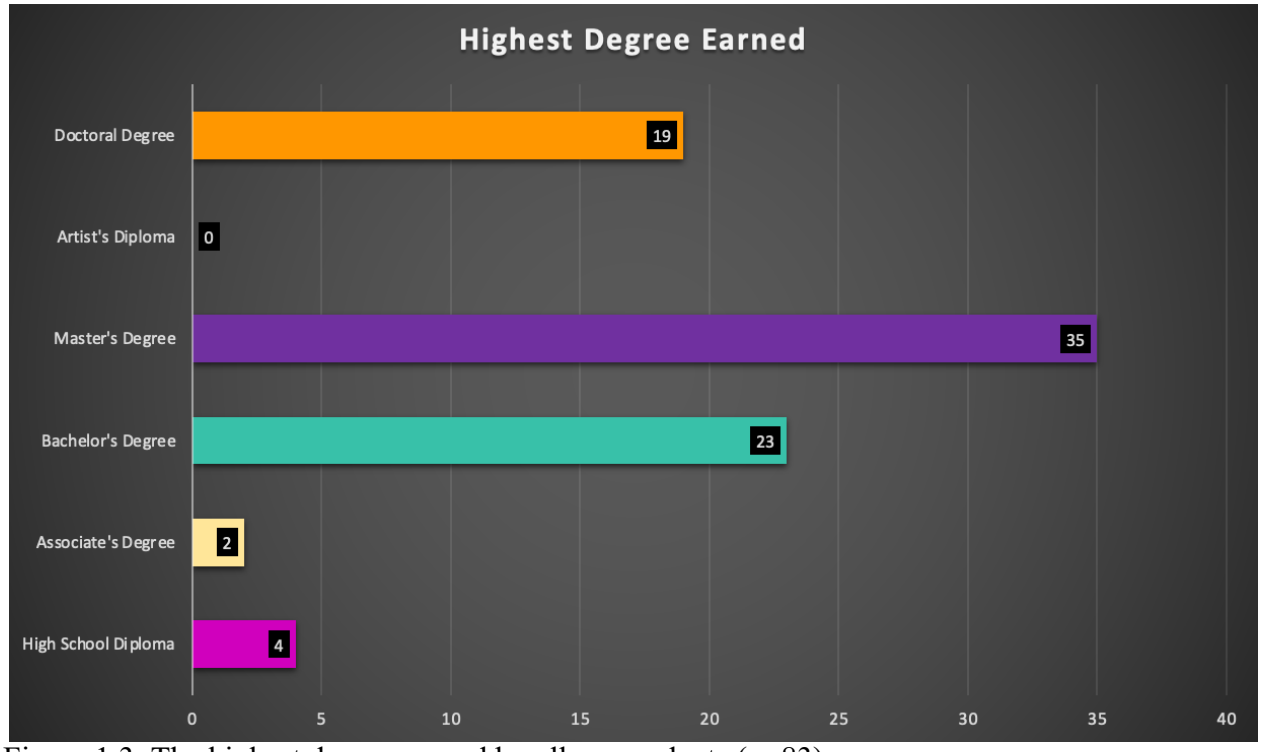


Figure 1.3. The highest degree earned by all respondents (n=83)

One participant did not answer the "level of training" question, so the following response was completed by only 82 participants. Of the 82 participants, 32 (39%) reported training at the master's level, 21 (25.6%) reported training at the bachelor's level, 17 (20.7%) reported training

at the doctoral level, 6 (7.3%) reported having taken private voice lessons, 4 (4.9%) reported high school vocal training, 2 (2.4%) reported no vocal training, and 0 (0%) reported training at the associate's level. See **Figure 1.4** for a graphical display.

The rest of the demographic questions were completed by 83 participants. The next question asked about the primary style of music sung. This differs from the primary singing role question because people who identify as opera singers can have different classical backgrounds. Some will primarily sing oratorio, others will primarily sing art song, and still others will primarily sing opera. Of the 83 participants, 33 (39.8%) reported they primarily sing opera, 19 (22.9%) reported primarily sacred/church music, 14 (16.9%) reported primarily art song, 9 (10.9%) reported primarily musical theater, 4 (4.8%) reported primarily oratorio, 2 (2.4%) reported primarily other styles of music, 1 (1.2%) reported popular/commercial music, 1 (1.2%) reported primarily gospel, and 0 (0%) reported rock and roll, folk/country, and jazz. See **Figure 1.5** for a graphical display.

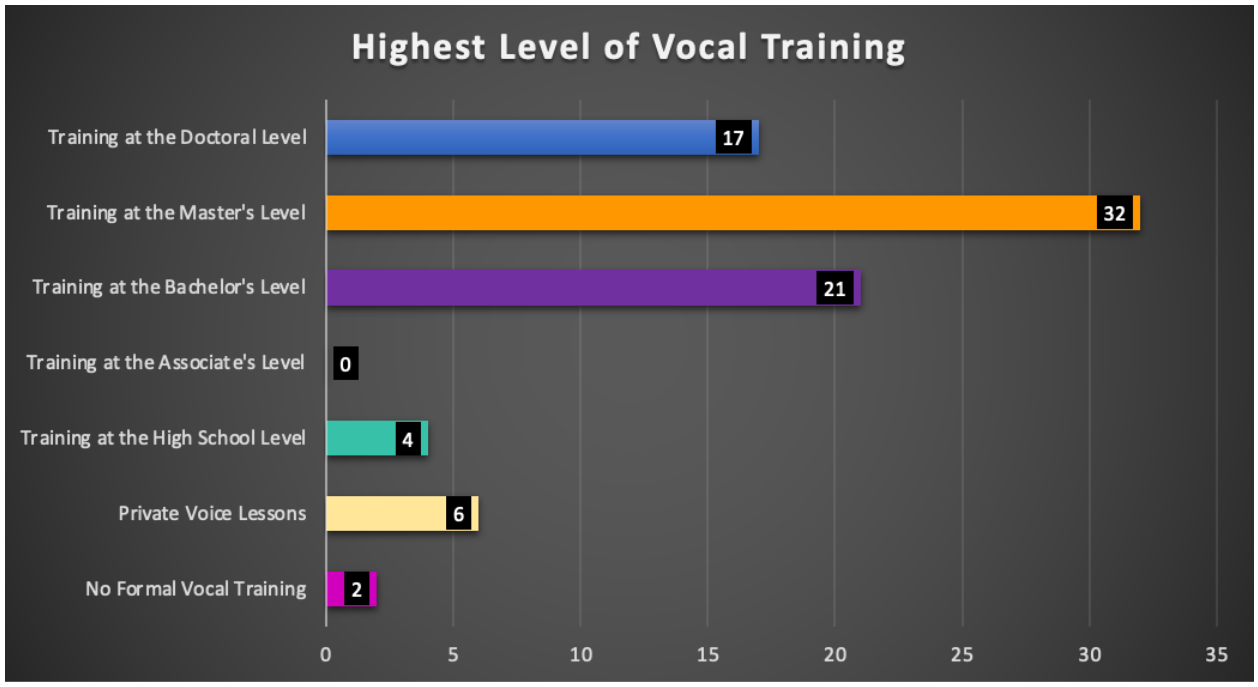


Figure 1.4. Highest level of training reported by all respondents (n=83)

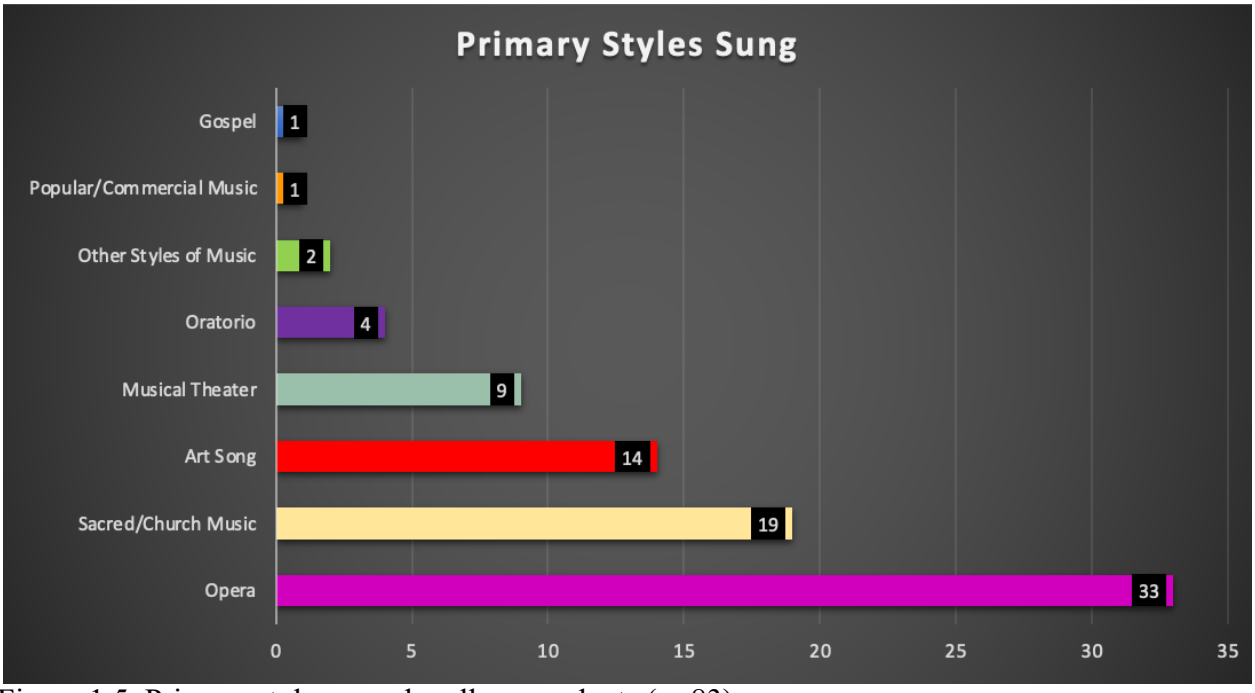


Figure 1.5. Primary styles sung by all respondents (n=83)

Singers were asked about their gender. Of the 83 participants, 64 (74.7%) reported as female, 20 (24.1%) reported as male, and 1 (1.2%) reported as non-binary.

Singers were asked which of the following races they would consider themselves. Of the 83 participants, 71 (88.8%) reported as White, 3 (3.8%) reported as Black or African American, 3 (3.8%) reported that they preferred not to disclose their race, 2 (2.5%) reported as other or mixed race, 1 (1.3%) reported as Asian, 0 (0%) reported as American Indian or Alaska Native, and 0 (0%) reported as Native Hawaiian or other Pacific Islander.

When asked about voice type (*fach*), of the 83 participants, 44 (53%) reported that they were sopranos, 18 (21.7%) reported that they were mezzo-sopranos, 13 (15.7%) reported that they were tenors, 6 (7.2%) reported that they were baritones, 1 (1.2%) reported that they were an alto, and 1 (1.2%) reported that they were a bass.

Singers were asked about their height. Of the 83 participants, 21 (25.3%) reported to be between 5’1” and 5’3”, 20 (24.1%) reported to between 5’4” and 5’6”, 19 (22.9%) reported to be

between 5’7” and 5’9”, 11 (13.3%) reported to be between 5’9” and 5’11”, 5 (6%) reported to be between 4’11” and 5’0”, 5 (6%) reported to be between 6’0” and 6’2”, 2 (2.4%) reported to be between 6’3” and 6’5”. See **Table 1** for a display of participant demographics.

Of the 83 participants who answered the demographics questions, 77 reported that they had experienced weight loss or gain of more than 10% of their total body weight. Of the 77 participants who had lost or gained 10% or more of their body weight, 40 (52%) reported that they had experienced weight loss and gain multiple times in their life, 20 (26%) reported one time weight gain, and 17 (22%) reported one time weight loss. See **Figure 1.6** for a graphical display.

Table 1. Participant Demographic Information (n=83)

Demographics	**Participant (%)**	**Number**
Gender		
Female	74.4	64
Male	24.1	20
Non-Binary/Other Gender	1.2	1
Race		
American Indian or Alaska Native	0.0	0
Asian	1.3	1
Black or African American	3.8	3
Native Hawaiian or other Pacific Islander	0.0	0
White	88.8	71
Other or Mixed Race	2.5	2
Voice Type (Fach)		
Soprano	53.0	44
Mezzo-Soprano	21.7	18
Alto	1.2	1
Tenor	15.7	13
Baritone	7.2	6
Bass	1.2	1
Other	0.0	0
Height (ft)		
4'11"-5'0"	6.0	5
5'1"-5'3"	25.3	21
5'4"-5'6"	24.1	20
5'7"-5'9"	22.9	19
5'9"-5'11"	13.3	11
6'0"-6'2"	6.0	5
6'3"-6'5"	2.4	2

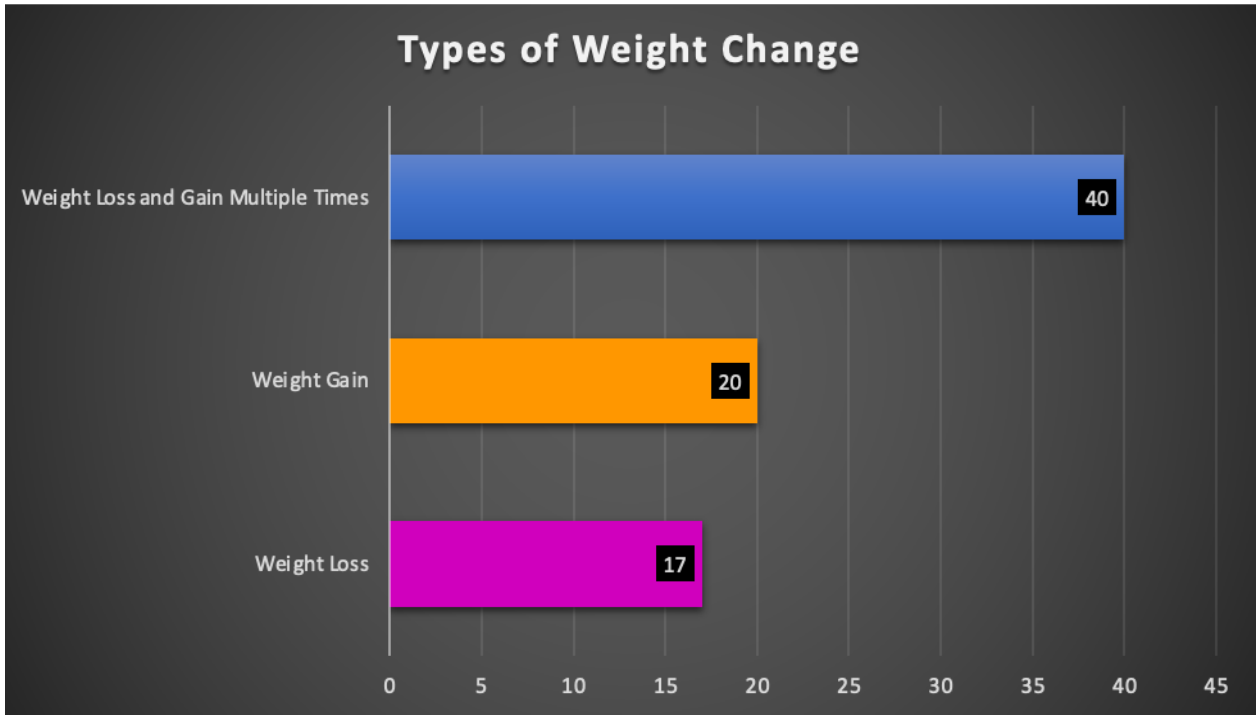


Figure 1.6. Type of weight change indicated by all respondents (n=77)

EFFECTS EXPERIENCED AFTER WEIGHT LOSS

Breath

Participants responded to questions about changes in both breathing and breathing sensation.

Participants reported on their experience after weight loss in how breath control changed their breathing technique on a scale of 1-6, 1 = *no change* and 6 = *extremely challenging*. The characteristics of breathing addressed included (1) sustaining long phrases, (2) taking a full breath, (3) controlling exhalation (maintaining appoggio), (4) maintaining a steady stream of air, and (5) controlling crescendo and decrescendo (messa di voce). Of the 44 participants who completed this question, 35 reported a change in breathing. On average, respondents who experienced weight loss reported only a slight change in breathing technique for all listed characteristics of breathing. See **Table 2** for a display of reported experiences and **Table 3** for a display of average response for each characteristic. A few participants offered additional

comments about changes in their breathing technique after weight loss. Please refer to Appendix A for a list of open-ended responses.

Table 2. Breathing change after weight loss as indicated by respondents (n=35)

Change in Breathing	Not Challenging	Slightly Challenging	Moderately Challenging	Very Challenging	Extremely Challenging
Sustaining Long Phrases	13 (23.6%)	6 (17.1%)	12 (34.3%)	2 (5.7%)	0 (0.0%)
Taking a Full Breath	20 (57.1%)	8 (22.9%)	4 (11.4%)	2 (5.7%)	0 (0.0%)
Controlling Exhalation (Maintaining Appoggio)	8 (22.9%)	12 (34.3%)	6 (17.1%)	6 (17.1%)	2 (5.7%)
Maintaining Steady Stream of Air	12 (34.3%)	8 (22.9%)	8 (22.9%)	4 (11.4%)	3 (8.6%)
Controlling Crescendo and Decrescendo (Messa di Voce)	13 (37.1%)	6 (17.1%)	8 (22.9%)	0 (0.0%)	4 (11.4%)

Table 3. Average answer from all respondents - breathing (n=35)

Change in Breathing After Weight Loss	Average Answer from Respondents
Sustaining Long Phrases	Slightly Challenging
Taking a Full Breath	Not Challenging
Controlling Exhalation (Maintaining Appoggio)	Slightly Challenging
Maintaining Steady Stream of Air	Slightly Challenging
Controlling Crescendo and Decrescendo (Messa di Voce)	Slightly Challenging

Singers responded to questions about changes in breathing sensation after weight loss using a binary "yes/no" scale, with an additional option of "not sure". The aspects of breathing sensation addressed included (1) sensation of breathing in the chest, (2) sensation of breathing in the back, (3) sensation of breathing in the shoulders, (4) sensation of breathing in the abdomen, (5) sensation of breathlessness, (6) sensation of closure of the throat, (7) sensation of still having air, but no ability to phonate, and (8) increased sense of effort. Of the 40 participants who completed this question, 22 reported a change in breathing sensation and 18 reported no change in breathing sensation. See **Table 4** for a display of reported experiences. A few participants offered additional comments about changes in their breathing sensation after weight loss. Please refer to Appendix A for a list of open-ended responses.

Table 4. Change in breathing sensation after weight loss reported by all respondents (n=40)

Change in Breathing Sensation	**No**	**Yes**	**Not Sure**
Sensation of breathing in the chest	16 (40%)	15 (37.5%)	8 (20%)
Sensation of breathing in the back	20 (50%)	14 (35%)	5 (12.5%)
Sensation of breathing in the shoulders	25 (62.5%)	8 (20%)	6 (15%)
Sensation of breathing in the abdomen	11 (27.5%)	22 (55%)	7 (17.5%)
Sensation of breathlessness	20 (20%)	14 (35%)	6 (15%)
Sensation of sudden closure of the throat	29 (72.5%)	7 (17.5%)	4 (10%)
Sensation of still having air, but no ability to phonate	34 (85%)	3 (7.5%)	3 (7.5%)
Increased sense of effort	20 (50%)	17 (42.5%)	3 (7.5%)

Participants disclosed, to the best of their knowledge, what percentage of their body weight they had lost when they experienced these changes in breathing and breathing sensation.

Of the 41 participants who completed this question, 17 (42.5%) said they began experiencing these changes when they had lost 10-15% of their total body weight, 14 (35%) reported changes after losing 16-20% of their body weight, 7 (17.5%) reported changes after losing 21-30% of their body weight, and 2 (5%) reported changes after losing 31-40% of their body weight. See **Figure 2.1** for a graphical display of the amount of weight loss experienced before breathing changes occurred.

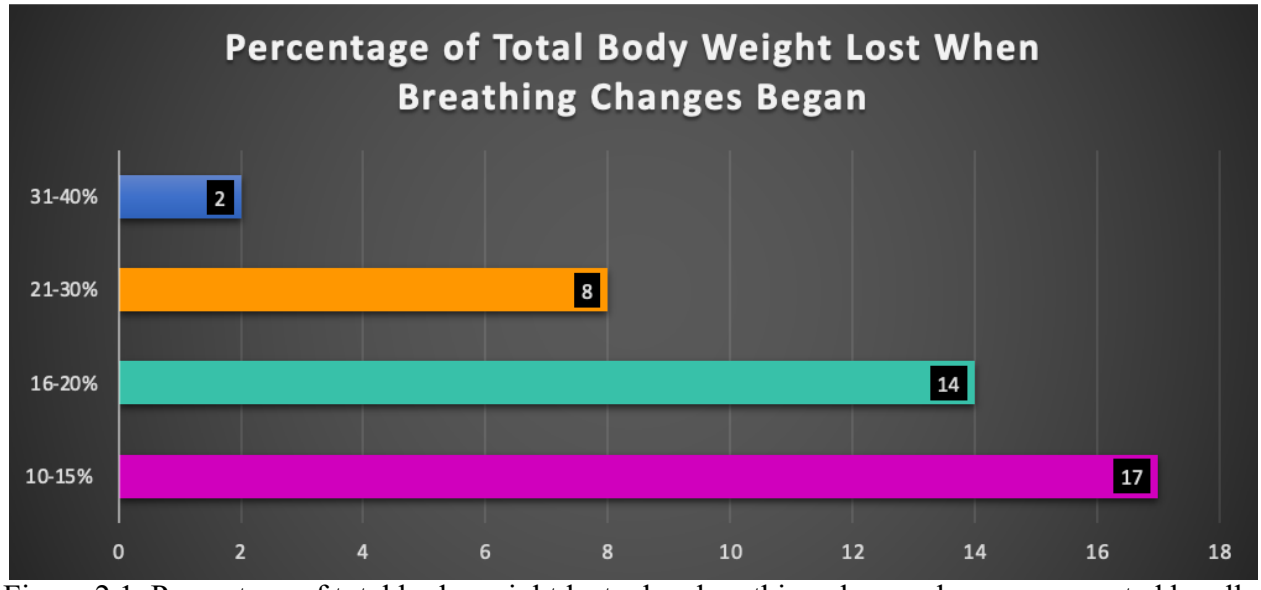


Figure 2.1. Percentage of total body weight lost when breathing changes began as reported by all respondents (n=41)

Phonation

In the phonation section, singers reported on nine aspects of phonation using a 5-point bipolar scale from "much easier" to "much more difficult" with the option to select "no change." The aspects of phonation addressed included (1) singing in the upper register, (2) singing around the passaggi, (3) singing in the lower register, (4) singing with agility, (5) singing with legato, (6) singing quieter than mezzo piano (medium soft), (7) singing louder than mezzo forte (medium loud), (8) singing high pitches quietly, and (9) producing sound without a slight delay. Of the 38 participants who completed this question, 38 reported a change in phonation. Of the 38 participants who reported change, 11 reported a change as more difficult and 27 reported a

change as easier. See **Table 5** for a display of reported changes in phonation and **Table 6** for a display of average response for each characteristic. A few participants offered additional comments about changes in their phonation after weight loss. Please refer to Appendix A for a list of open-ended responses.

Table 5. Phonation change after weight loss as reported by all respondents (n=38)

Change in Phonation	**Much Easier**	**Somewhat Easier**	**Somewhat More Difficult**	**Much More Difficult**
Singing in the upper register	9 (23.7%)	7 (18.4%)	7 (18.4%)	1 (2.6%)
Singing around the passaggi	6 (15.8%)	10 (26.3%)	7 (18.4%)	3 (7.9%)
Singing in the lower register	6 (15.8%)	7 (18.4%)	7 (18.4%)	2 (5.3%)
Singing with agility	12 (31.6%)	9 (23.7%)	5 (13.2%)	1 (2.6%)
Singing with legato	6 (15.8%)	6 (15.8%)	11 (29%)	2 (5.3%)
Singing quieter than mezzo-piano (medium soft)	8 (21.1%)	9 (23.7%)	4 (10.5%)	2 (5.3%)
Singing louder than mezzo-forte (medium loud)	5 (13.2%)	3 (7.9%)	8 (21.1%)	0 (0.0%)
Singing high pitches quietly	4 (10.5%)	7 (18.4%)	5 (13.2%)	1 (2.6%
Producing a sound without a slight delay	2 (5.3%)	3 (7.9%)	2 (5.3%)	2 (5.3%)

Participants disclosed, to the best of their knowledge, what percentage of their body weight they had lost when they experienced these changes in phonation. Of the 29 participants who completed this question, 17 (50%) said they began experiencing these changes when they had lost 10-15% of their total body weight, 9 (26.5%) reported changes after losing 16-20% of their body weight, 2 (5.9%) reported changes after losing 21-30% of their body weight, 5 (14.7%) reported changes after losing 31-40% of their body weight and 1 (2.9%) reported

changes after losing 41-50% of their body weight. See **Figure 2.2** for a graphical display of the amount of weight loss experienced before phonation changes occurred.

Table 6. Average answer from all respondents (n=38)

Change in Phonation after Weight Loss	**Average Answer from Respondents**
Singing in the upper register	Much Easier
Singing around the passaggi	Somewhat Easier
Singing in the lower register	Much Easier
Singing with legato	Much Easier
Singing quieter than mezzo-piano (medium soft)	Much Easier
Singing louder than mezzo-forte (medium loud)	Somewhat Easier
Singing high pitches quietly	Much Easier
Producing a sound without a slight delay	Much Easier

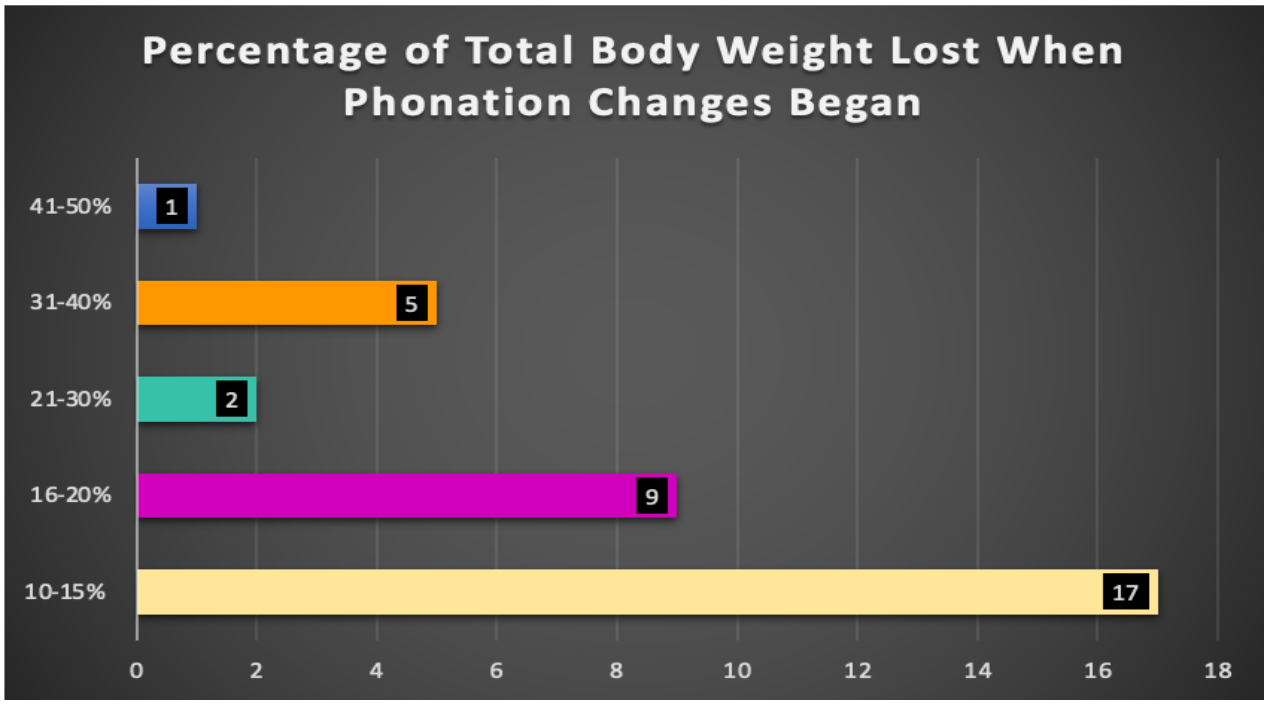


Figure 2.2. Percentage of total body weight lost when phonation changes began as reported by all respondents (n=34)

Vocal Quality

In the vocal quality section singers reported on seven aspects of vocal quality. The aspects of vocal quality addressed included (1) sensation of sound in the back of the throat, (2) brighter vocal quality, (3) difficulty producing clear tone, (4) breathiness, (5) strident vocal quality, (6) fuller/heavier vocal quality, and (7) hoarseness. Of the 34 participants who completed this question, 29 reported a change in vocal quality. See **Table 7** for a display of reported changes in vocal quality. A few participants offered additional comments about changes in their vocal quality after weight loss. Please refer to Appendix A for a list of open-ended responses.

Table 7. Change in vocal quality after weight loss as reported by all respondents (n=34)

Changes in Vocal Quality	**Number of respondents who experienced this change**
Sensation of sound in the back of the throat	4 (11.8%)
Brighter vocal quality	16 (47.1%)
Difficulty producing a clear tone	5 (14.7%)
Breathiness	7 (20.6%)
Strident vocal quality	7 (20.6%)
Fuller/heavier vocal quality	8 (23.5%)
Hoarseness	6 (17.7%)
No changes	5 (14.7%)

Vocal Mechanism

In the vocal mechanism section, singers reported on two aspects of the vocal mechanism. The aspects of vocal mechanism addressed included vocal swelling/edema and rhinitis (swelling

of the nasal cavity). Of the 37 participants who completed this question, 5 (13.9%) reported change in vocal mechanism. Of the 5 participants who reported change, 100% reported negative change. 4 (11.1%) experienced vocal swelling/edema and 1 (2.8%) experienced rhinitis. See **Figure 2.3** for a graphical display of reported changes in vocal mechanism. A few participants offered additional comments about changes in their vocal mechanism after weight loss. Please refer to Appendix A for a list of open-ended responses.

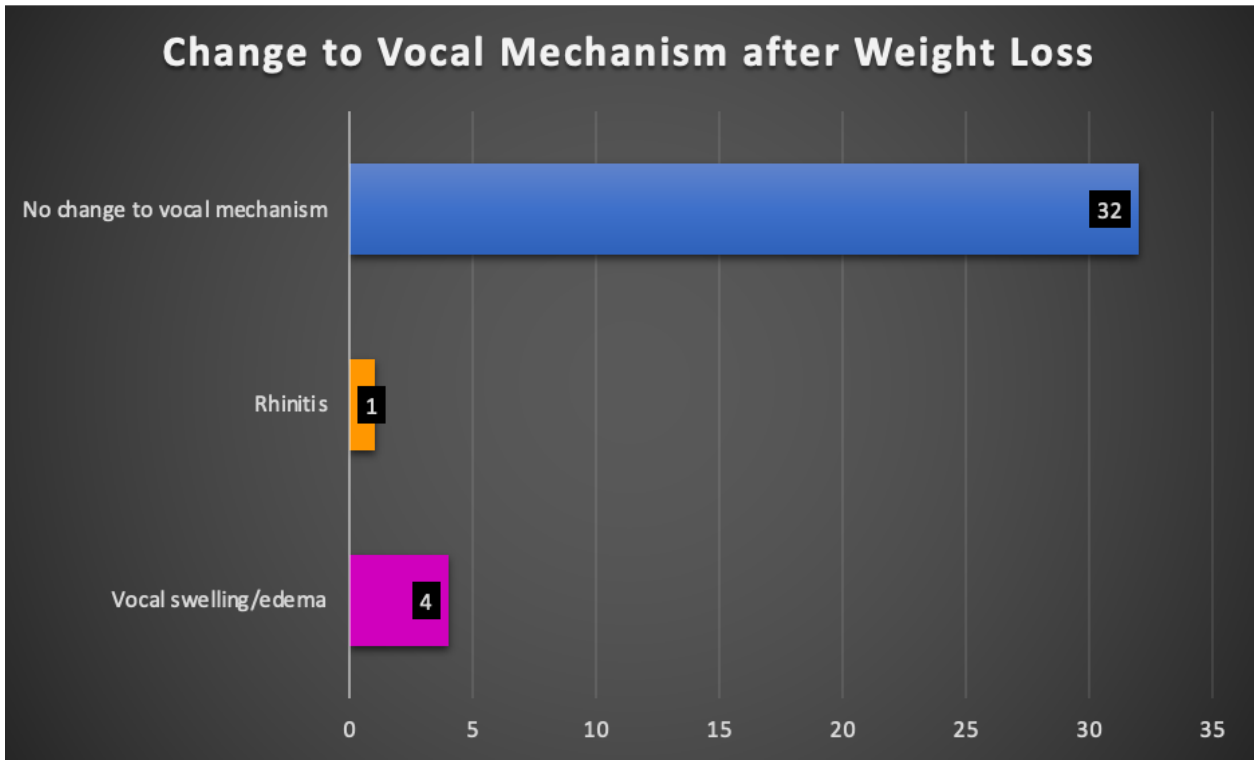


Figure 2.3. Change to vocal mechanism after weight loss reported by all respondents (n=37)

Participants disclosed, to the best of their knowledge, what percentage of their body weight they had lost when they experienced these changes in vocal mechanism. Although only 5 participants indicated change in vocal mechanism, 31 participants responded to this question. Of the participants who completed this question, 17 (54.8%) said they began experiencing these changes when they had lost 10-15% of their total body weight, 6 (19.4%) reported changes after losing 16-20% of their body weight, 4 (12.9%) reported changes after losing 21-30% of their

body weight, and 4 (12.9%) reported changes after losing 31-40% of their body weight. See **Figure 2.4** for a graphical display of weight loss experienced before changes in the vocal mechanism occurred.

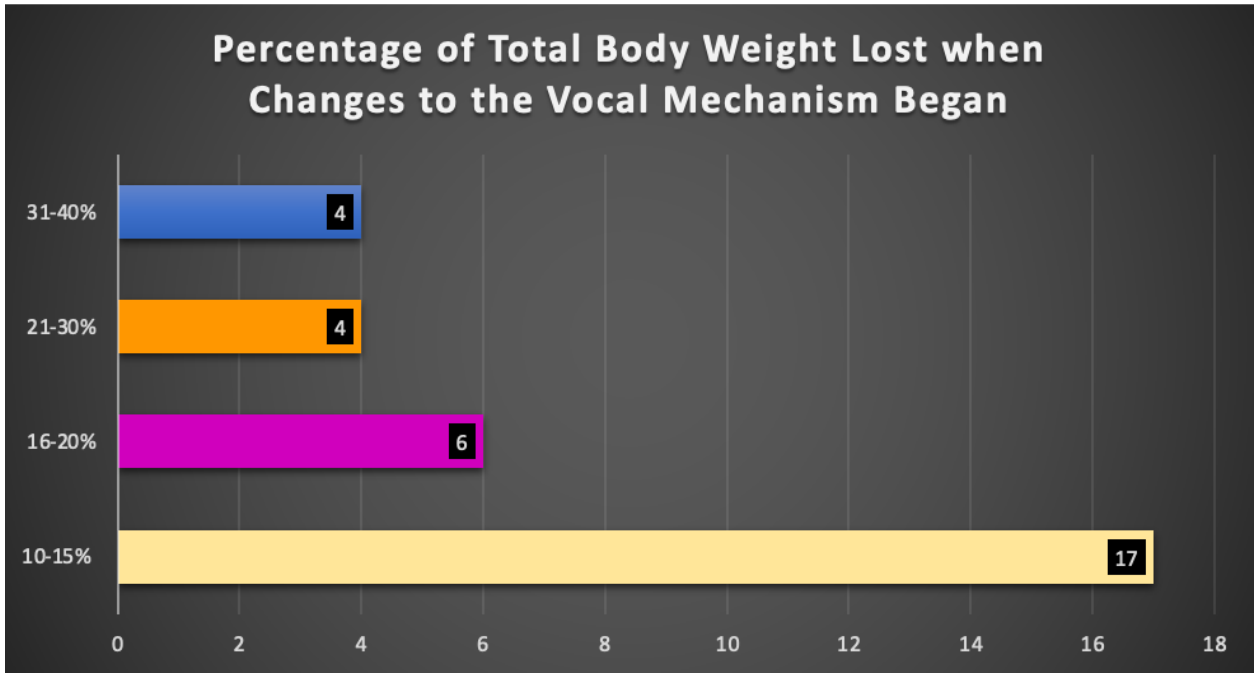


Figure 2.4. Percentage of total body weight lost when changes to the vocal mechanism began as reported by all respondents (n=31)

EFFECTS EXPERIENCED AFTER WEIGHT GAIN

Breath

Participants were asked questions about changes in both breathing and breathing sensation.

Participants reported on their experience after weight gain in how breath control changed their breathing technique on a scale of 1-6, 1 = no change and 6 = extremely challenging. The aspects of breathing addressed included (1) sustaining long phrases, (2) taking a full breath, (3) controlling exhalation (maintaining appoggio), (4) maintaining a steady stream of air, and (5) controlling crescendo and decrescendo (messa di voce). Of the 23 participants who completed

this question, 22 reported a change in breathing. Of the 22 participants who reported a change, 13 reported positive change and 9 reported negative change. See **Table 8** for a display of reported experiences with change in breathing and **Table 9** for a display of average response from participants. A few participants offered additional comments about changes in their breathing technique after weight gain. Please refer to Appendix A for a list of open-ended responses.

Table 8. Breathing change after weight gain as indicated by respondents (n=22)

Change in Breathing	**Not Challenging**	**Slightly Challenging**	**Moderately Challenging**	**Very Challenging**	**Extremely Challenging**
Sustaining Long Phrases	8 (36.4%)	7 (31.8%)	2 (9.1%)	6 (27.3%)	0 (0.0%)
Taking a Full Breath	2 (9.1%)	3 (13.6%)	0 (0.0%)	5 (22.7%)	0 (0.0%)
Controlling Exhalation (Maintaining Appoggio)	3 (13.6%)	3 (13.6%)	0 (0.0%)	3 (13.6%)	1 (4.6%)
Maintaining Steady Stream of Air	5 (22.7%)	4 (18.2%)	0 (0.0%)	2 (9.1%)	0 (0.0%)
Controlling Crescendo and Decrescendo (Messa di Voce)	1 (4.6%)	2 (9.1%)	4 (18.2%)	3 (13.6%)	1 (4.6%)

Table 9. Average response from all respondents (n=23)

Change in Breathing after Weight Gain	**Average Answer from Respondents**
Sustaining Long Phrases	Slightly Challenging
Taking a Full Breath	Slightly Challenging
Controlling Exhalation (Maintaining Appoggio)	Slightly Challenging
Maintaining Steady Stream of Air	Slightly Challenging
Controlling Crescendo and Decrescendo (Messa di Voce)	Slightly Challenging

Singers responded to questions about changes in breathing sensation after weight gain, using a binary "yes/no" scale, with an additional option of "not sure". The aspects of breathing sensation addressed included (1) sensation of breathing in the chest, (2) sensation of breathing in the back, (3) sensation of breathing in the shoulders, (4) sensation of breathing in the abdomen, (5) sensation of breathlessness, (6) sensation of closure of the throat, and (7) sensation of still having air, but no ability to phonate. Of the 23 participants who completed this question, 23 reported some change in breathing sensation. See **Table 10** for a display of reported experiences. A few participants offered additional comments about changes in their breathing sensation after weight gain. Please refer to Appendix A for a list of open-ended responses.

Participants disclosed, to the best of their knowledge, what percentage of their body weight they had gained when they experienced these changes in breathing and breathing sensation. Of the 23 participants who completed this question, 11 (47.8%) said they began experiencing these changes when they had gained 10-15% of their total body weight, 6 (26.1%) reported changes after gaining 16-20% of their body weight, 5 (21.7%) reported changes after gaining 21-30% of their body weight, and 1 (4.4%) reported changes after gaining 31-40% of

their body weight. See **Figure 3.1** for a graphical display of weight gain experienced before breathing changes occurred.

Table 10. Change in breathing sensation after weight gain as reported by all respondents (n=23)

Change in Breathing Sensation	**No**	**Yes**	**Not Sure**
Sensation of breathing in the chest	9 (39.1%)	7 (30.4%)	7 (30.4%)
Sensation of breathing in the back	8 (34.8%)	11 (47.8%)	4 (17.4%)
Sensation of breathing in the shoulders	17 (73.9%)	4 (17.4%)	2 (8.7%)
Sensation of breathing in the abdomen	4 (17.4%)	18 (78.3%)	1 (4.35%)
Sensation of breathlessness	11 (47.8%)	13 (56.5%)	0 (0.0%)
Sensation of sudden closure of the throat	17 (73.9%)	4 (17.4%)	2 (8.7%)
Sensation of still having air, but no ability to phonate	13 (56.5%)	7 (30.4%)	3 (13.0%)
Increased sense of effort	9 (39.1%)	10 (43.5%)	3 (13.0%)

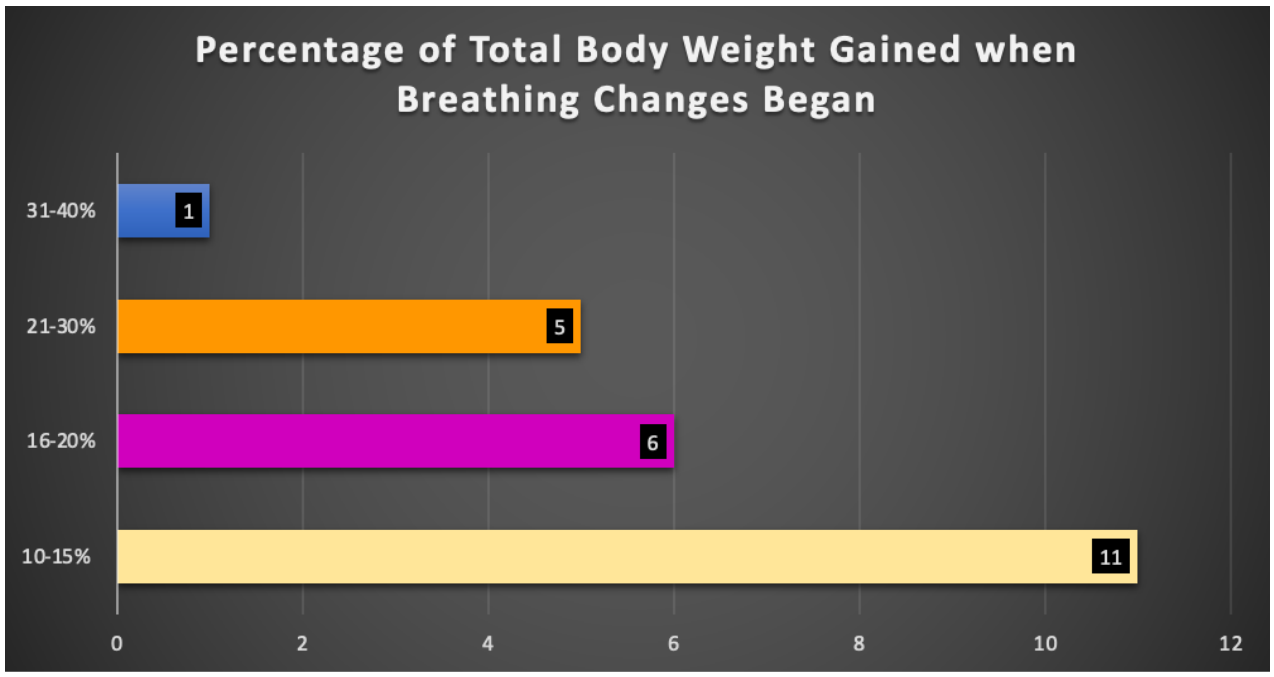


Figure 3.1 Percentage of total body weight gained when breathing changes began as reported by all respondents (n=23)

Phonation

In the phonation section, singers reported on nine aspects of phonation using a 5-point bipolar scale from "much easier" to "much more difficult" with the option to choose "no change." The aspects of phonation addressed included (1) singing in the upper register, (2) singing around the passaggi, (3) singing in the lower register, (4) singing with agility, (5) singing with legato, (6) singing quieter than mezzo piano (medium soft), (7) singing louder than mezzo forte (medium loud), (8) singing high pitches quietly, and (9) producing sound without a slight delay. Of the 23 participants who completed this question, 23 reported a change in phonation. Of the 23 participants who reported change, 19 reported a change as more difficult and 4 reported a change as easier. See **Table 11** for a display of reported changes in phonation and **Table 12** for a display of average response from participants. A few participants offered additional comments about changes in their phonation after weight gain. Please refer to Appendix A for a list of open-ended responses.

Participants disclosed, to the best of their knowledge, what percentage of their body weight they had gained when they experienced these changes in phonation. Of the 21 participants who completed this question, 11 (52.4%) said they began experiencing these changes when they had gained 10-15% of their total body weight, 5 (23.8%) reported changes after gaining 16-20% of their body weight, 4 (19.1%) reported changes after gaining 21-30% of their body weight, and 1 (4.8%) reported changes after gaining 31-40% of their body weight. See **Figure 3.2** for a graphical display of weight gain experienced before changes in phonation occurred.

Table 11. Change in phonation after weight gain as reported by respondents (n=23)

Change in Phonation	**Much Easier**	**Somewhat Easier**	**Somewhat More Difficult**	**Much More Difficult**
Singing in the upper register	2 (8.7%)	3 (13.0%)	9 (39.1%)	1 (4.4%)
Singing around the passaggi	2 (8.7%)	5 (21.7%)	9 (39.1%)	0 (0.0%)
Singing in the lower register	9 (39.1%)	5 (21.7%)	5 (21.7%)	1 (4.4%)
Singing with agility	0 (0.0%)	2 (8.7%)	8 (34.8%)	3 (13.0%)
Singing with legato	4 (17.4%)	2 (8.7%)	7 (30.4%)	2 (8.7%)
Singing quieter than mezzo-piano (medium soft)	1 (4.4%)	4 (17.4%)	9 (39.1%)	3 (13.0%)
Singing louder than mezzo-forte (medium loud)	6 (26.1%)	4 (17.4%)	4 (17.4%)	1 (4.4%)
Singing high pitches quietly	0 (0.0%)	1 (4.4%)	10 (43.5%)	4 (17.4%)
Producing a sound without a slight delay	0 (0.0%)	3 (13.0%)	8 (34.8%)	2 (8.7%)

Table 12. Average response from all participants (n=23)

Change in Phonation after Weight Gain	**Average Answer from Respondents**
Singing in the upper register	Somewhat More Difficult
Singing around the passaggi	Somewhat More Difficult
Singing in the lower register	Somewhat More Difficult
Singing with legato	Somewhat More Difficult
Singing quieter than mezzo-piano (medium soft)	Somewhat More Difficult
Singing louder than mezzo-forte (medium loud)	Somewhat More Difficult
Singing high pitches quietly	Somewhat More Difficult
Producing a sound without a slight delay	Somewhat More Difficult

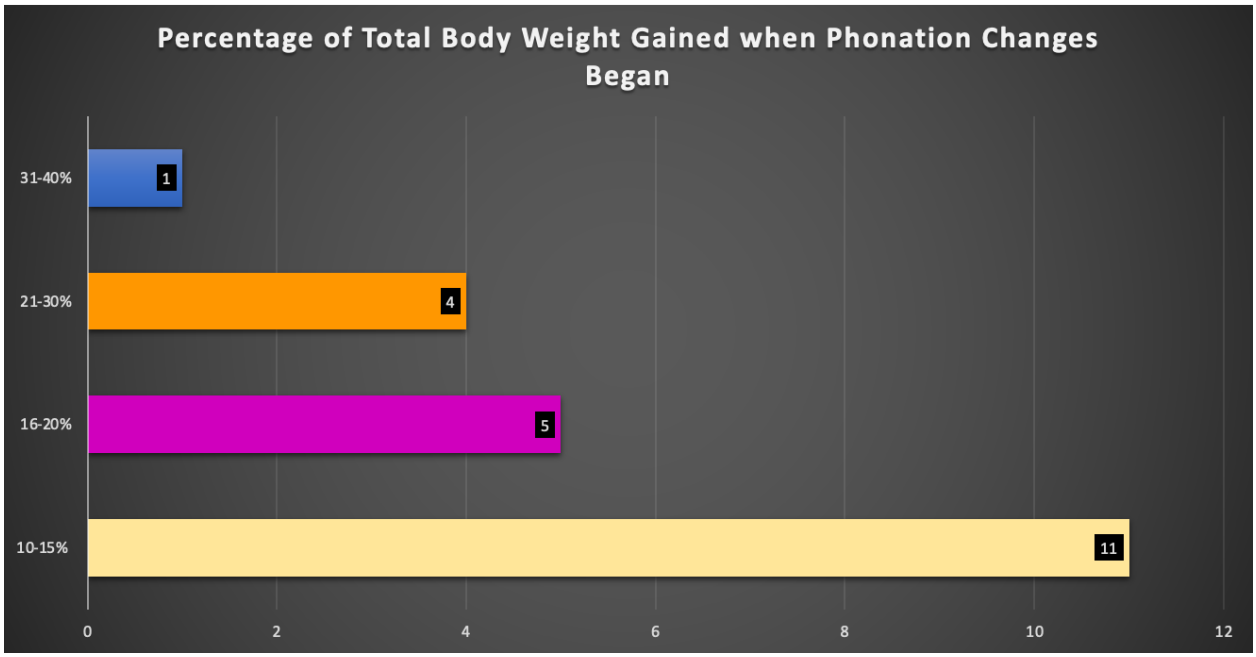


Figure 3.2. Percentage of total body weight gained when phonation changes began as reported by all respondents (n=21)

Vocal Quality

In the vocal quality section singers reported on seven aspects of vocal quality. The aspects of vocal quality addressed included (1) sensation of sound in the back of the throat, (2) brighter vocal quality, (3) difficulty producing clear tone, (4) breathiness, (5) strident vocal quality, (6) fuller/heavier vocal quality, and (7) hoarseness. Of the 24 participants who completed this question, 20 reported a change in vocal quality. See **Table 13** for a display of reported changes in vocal quality. A few participants offered additional comments about changes in their vocal quality after weight gain. Please refer to Appendix A for a list of open-ended responses.

Table 13. Change in vocal quality as reported by all respondents (n=20)

Changes in Vocal Quality	**Number of respondents who experienced this change**
Sensation of sound in the back of the throat	6 (30.0%)
Brighter vocal quality	2 (10.0%)
Difficulty producing a clear tone	6 (30.0%)
Breathiness	4 (20.0%)
Strident vocal quality	1 (5.0%)
Fuller/heavier vocal quality	8 (40.0%)
Hoarseness	6 (30.0%)
No changes	4 (20.0%)

Vocal Mechanism

In the vocal mechanism section, singers reported on two aspects of the vocal mechanism. The aspects of vocal mechanism addressed included vocal swelling/edema and rhinitis (swelling

of the nasal cavity). Of the 22 participants who completed this question, 5 (24%) reported change in vocal mechanism. Of the 5 participants who reported change, 100% reported negative change. 2 (9.1%) experienced vocal swelling/edema and 3 (18.2%) experienced rhinitis. See **Figure 3.3** for a graphical display of reported changes in vocal mechanism. A few participants offered additional comments about changes in their vocal mechanism after weight gain. Please refer to Appendix A for a list of open-ended responses.

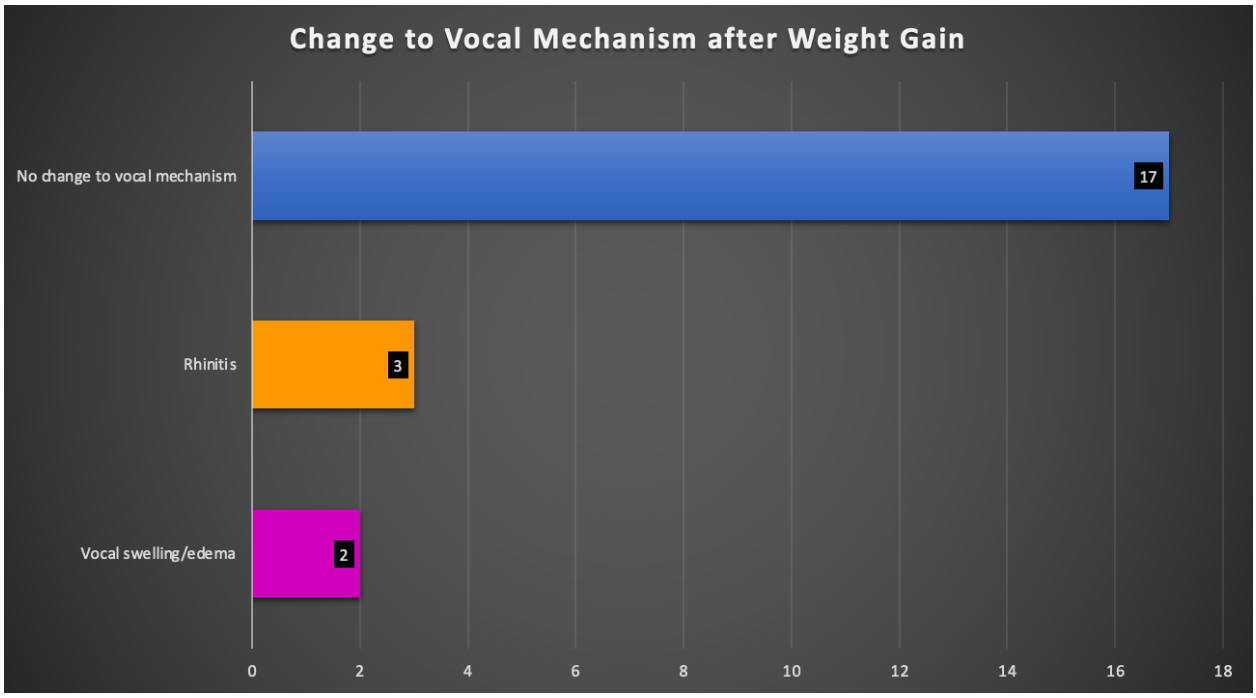


Figure 3.3. Change to vocal mechanism after weight gain as reported by all respondents (n=22)

Participants were asked to disclose, to the best of their knowledge, what percentage of their body weight they had gained when they experienced these changes in vocal mechanism. Although only 5 participants indicated change in vocal mechanism, 19 participants responded to this question. Of the 19 participants who completed this question, 14 (73.7%) said they began experiencing these changes when they had gained 10-15% of their total body weight, 2 (10.5%) reported changes after gaining 16-20% of their body weight, and 3 (15.8%) reported changes

after gaining 21-30% of their body weight. See **Figure 3.4** for a graphical display of weight gain experienced before changes in vocal mechanism occurred.

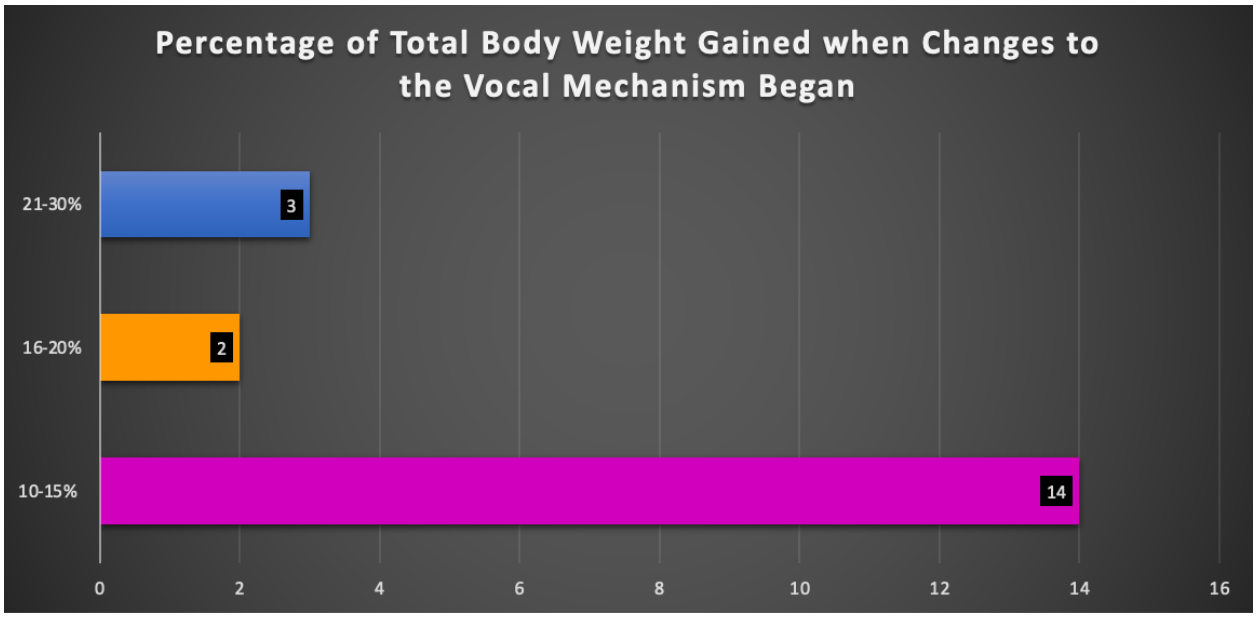


Figure 3.4. Percentage of total body weight gained when changes to the vocal mechanism began as reported by all respondents (n=19)

CHAPTER 4: ADDITIONAL CONSIDERATIONS

Performance Load

Participants were asked if their performance load (number of gigs they performed) changed as a result of their weight loss or gain.

Of the 33 participants who answered this question for weight loss, 17 (51.5%) said that their performance load did change as a result of their weight loss and 16 (48.5%) said that their performance load did not change as a result of their weight loss. See **Figure 4.1** for a graphical display.

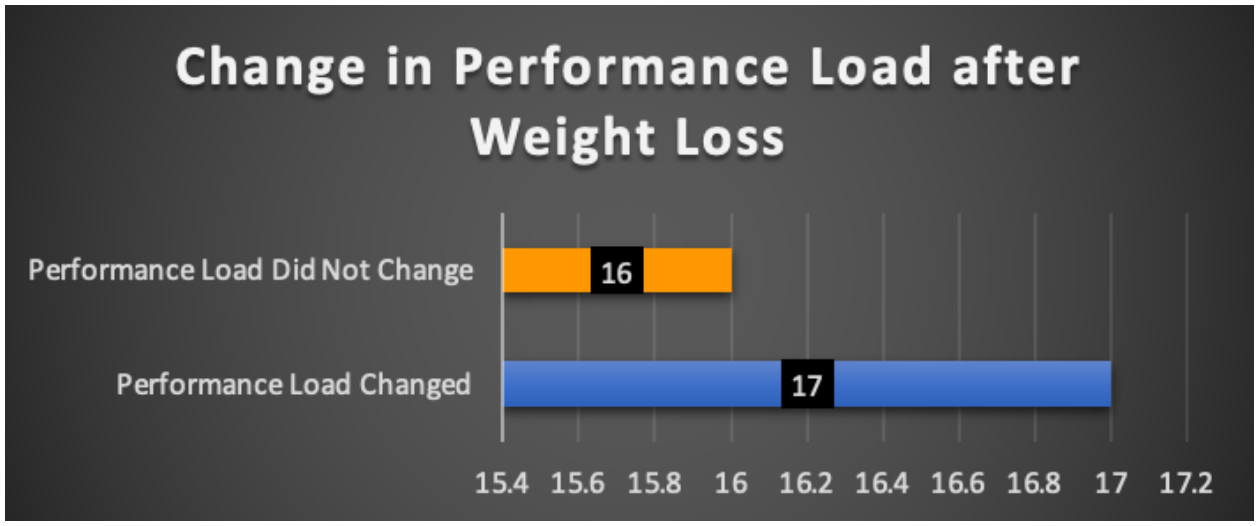


Figure 4.1. Change in performance load after weight loss as reported by all respondents (n=33)

Of the 18 participants who answered this question for weight gain, 8 (44.4%) said that their performance load did change as a result of their weight gain and 10 (55.6%) said that their performance load did not change as a result of their weight gain. See **Figure 4.2** for a graphical display.

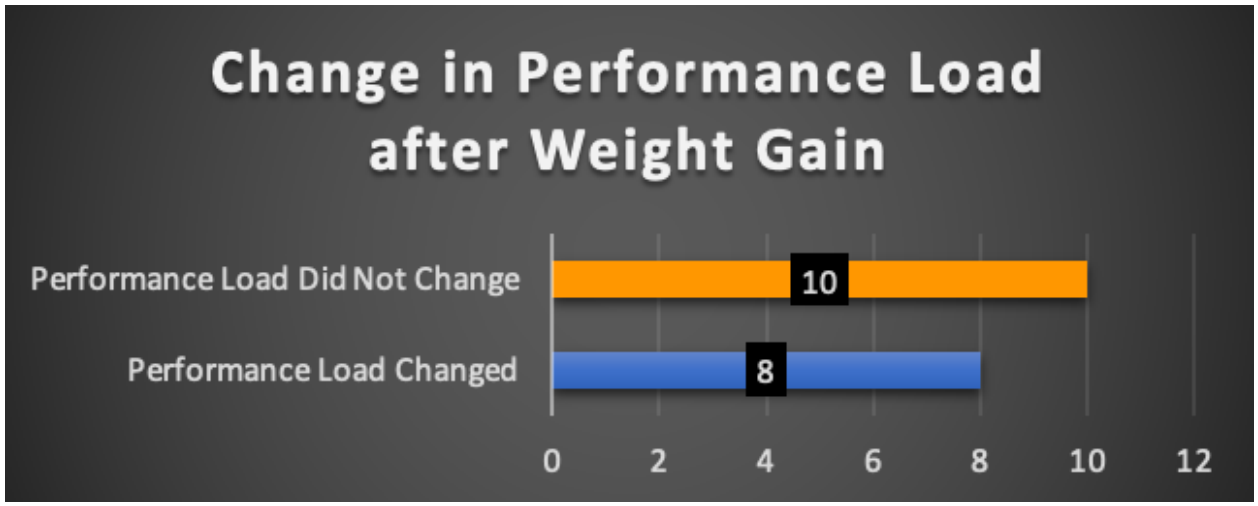


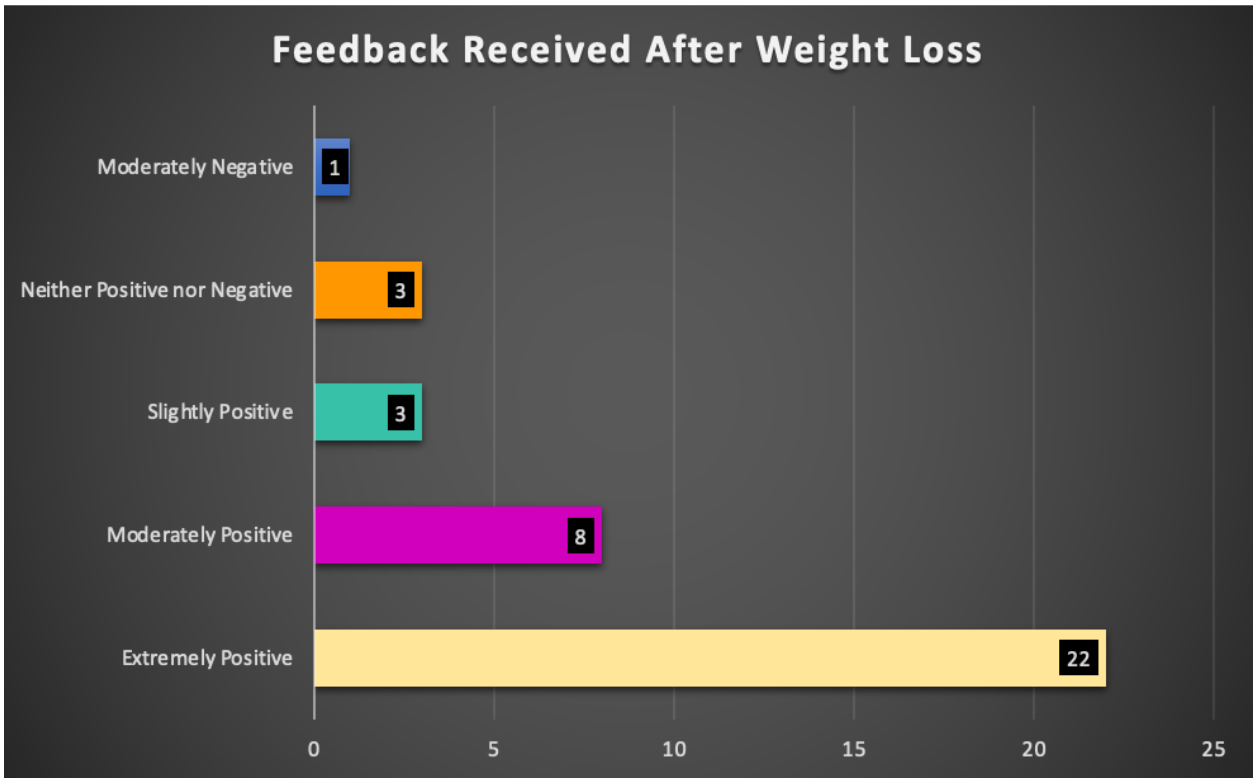
Figure 4.2. Change in performance load after weight gain as reported by all respondents (n=18)

A few participants offered additional comments about changes in their performance load after weight loss or gain. Please refer to Appendix A for a list of open-ended responses.

Feedback

Participants were asked if they received any feedback about their vocal ability or appearance after weight change and whether that feedback was positive or negative.

Of the 37 participants who answered the questions about weight loss and completed this question, 22 (59.5%) reported that they received extremely positive feedback, 8 (21.6%) reported that they received moderately positive feedback, 3 (8.1%) reported that they received slightly positive feedback, 3 (8.1%) reported that they received neither positive nor negative feedback, and 1 (2.7%) reported that they received moderately negative feedback. See **Figure 4.3** for a graphical display.



4.3. Feedback received after weight loss as reported by all respondents (n=37)

Of the participants who answered the questions about weight gain and completed this question, 1 (4.6%) reported that they received extremely positive feedback, 3 (13.6%) reported that they received slightly positive feedback, 11 (50%) reported that they received neither positive nor negative feedback, 2 (9.1%) reported that they received slightly negative feedback, and 5 (22.7%) reported that they received moderately negative feedback. See **Figure 4.4** for a graphical display.

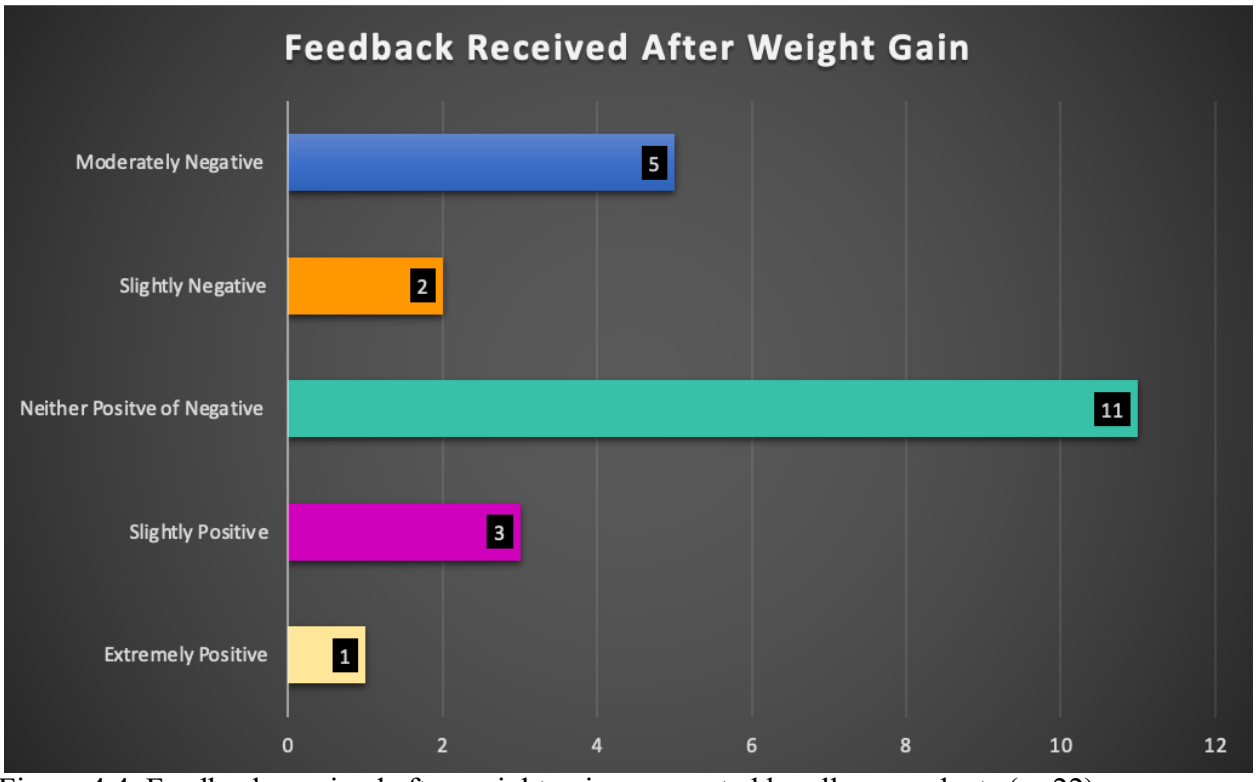


Figure 4.4. Feedback received after weight gain as reported by all respondents (n=22)

Participants were also asked from whom they received this feedback. Because participants were asked to select all that apply, the results display a sum greater than that of the 77 participants.

There were 128 total responses from the participants who indicated weight loss. Of the given 128 responses, 27 reported that they received feedback from family, 29 reported that they received feedback from friends, 26 reported that they received feedback from teachers, 18 reported that they received feedback from healthcare providers, 13 reported that they received feedback from students, and 15 reported that they received feedback from casting directors. See **Figure 4.5** for a graphical display.

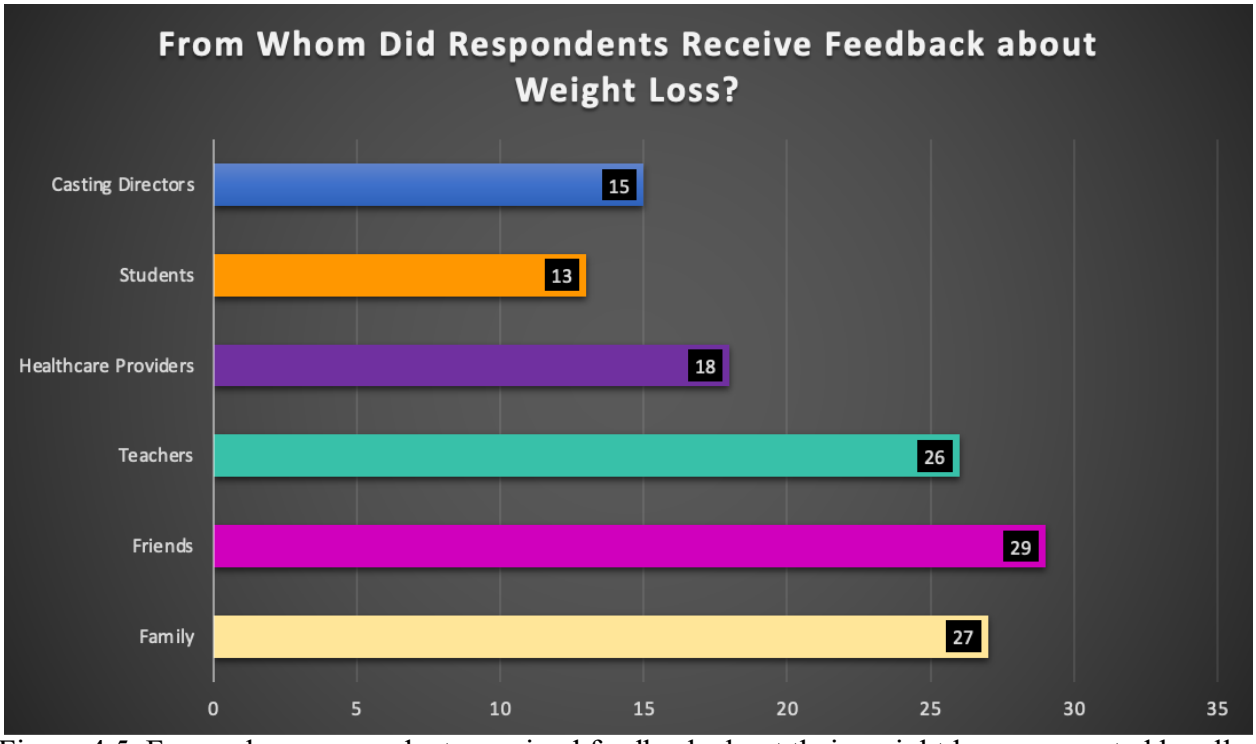


Figure 4.5. From whom respondents received feedback about their weight loss as reported by all respondents.

There were 20 total responses from the participants who indicated weight gain. Of the given 20 responses, 5 reported that they received feedback from family, 2 reported that they received feedback from friends, 5 reported that they received feedback from teachers, 3 reported that they received feedback from healthcare providers, 1 reported that they received feedback from students, and 4 reported that they received feedback from casting directors. See **Figure 4.6** for a graphical analysis.

A few participants offered additional comments about feedback they received after weight loss or gain. Please refer to Appendix A for a list of open-ended responses.

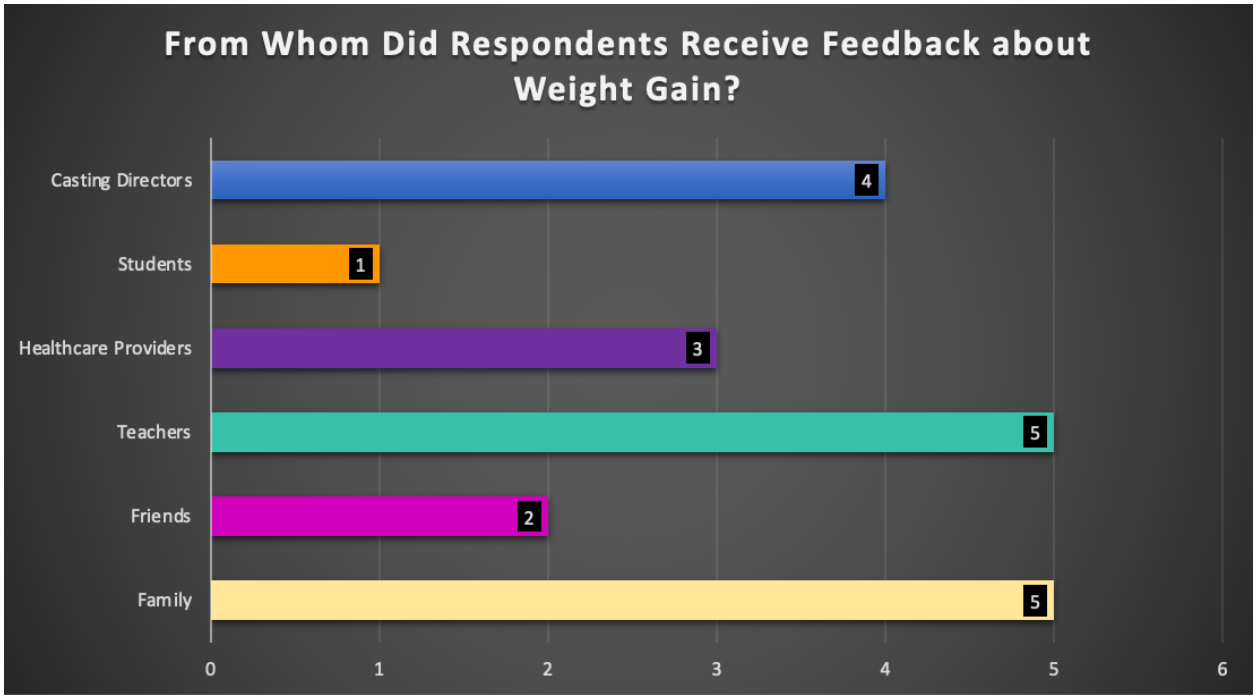


Figure 4.6. From whom respondents received feedback about their weight gain as reported by all respondents.

Economic Implications

Participants were asked to disclose whether or not their weight change had any economic impact on their lives, specifically whether they were hired less as a result of their weight change in either direction.

Of the participants who answered about weight loss and completed this question, 29 (96.7%) reported that their weight loss did not create an economic disadvantage for them and 1 (3.3%) reported that their weight loss did create an economic disadvantage for them. See **Figure 4.7** for a graphical display.

Of the participants who answered about weight gain and completed this question, 8 (80%) reported that their weight gain did not create an economic disadvantage for them and 2 (20%) reported that their weight gain did create an economic disadvantage for them. See **Figure 4.8** for a graphical display.

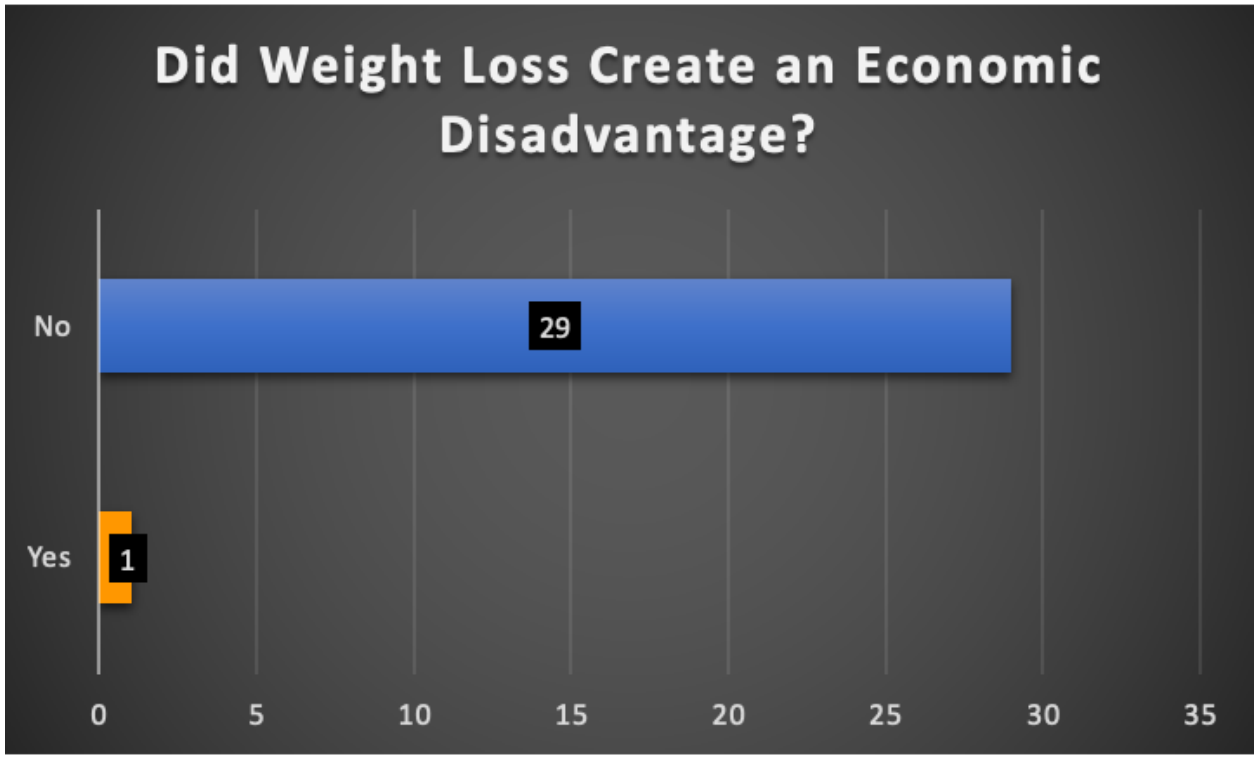


Figure 4.7. Economic disadvantage created by weight loss as reported by all respondents (n=30)

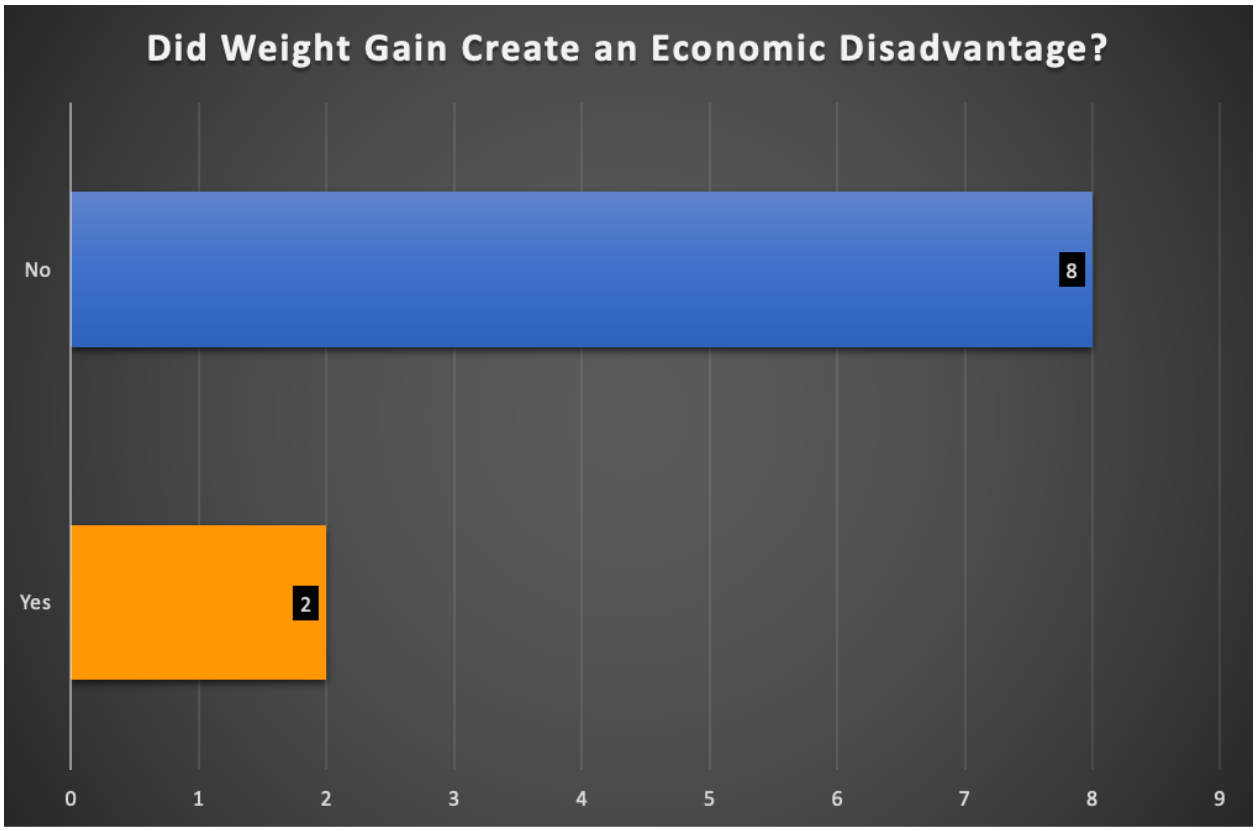


Figure 4.8. Economic disadvantage created by weight gain as reported by all respondents (n=10)

Discussion

The aim of this study was to learn about singers' experiences with weight fluctuation and ultimately, to compile information about how changes in body mass can affect breathing, phonation, vocal quality, and vocal mechanism. This project was designed to give singers and singing teachers a clearer understanding of the effects that body mass change can have on the singing voice. This survey was also created as a starting point for further and more detailed research into the actual anatomical effects that weight fluctuation can have on different aspects of the voice.

There are a variety of potential societal benefits deriving from this research. One of these potential benefits is an increased understanding of effects of weight loss and gain not just on the speaking voice, but on the singing voice as well. While there have been a variety of studies done already on how weight change affects the speaking voice, there have not been many studies specifically tailored to the effect of weight change on aspects of the vocal mechanism that are most important for professional singers. Pedagogically, this study could provide further information to the community of singing teachers about the extent to which weight loss and gain can affect the singing voice. This information can help teachers understand how to prepare for possible changes as students experience change in body mass. It may also help singers who plan to undergo an intentional change in body weight mitigate possible issues as they arise. The hope is that this preliminary study will be able to lead to further, more extensive research about this topic.

While no generalizable conclusions can be drawn from this study, overall, the data shows that there are trends in what singers experience when they undergo a change in body mass of

10% of their total weight or more. No two singers will experience the exact same effects after weight fluctuation, because no two bodies are exactly the same.

The majority of singers who experienced weight loss, 31 (61%), experienced it between the ages of 20 and 29, while the ages of singers who experienced weight gain were more evenly dispersed. Of participants who reported intentional weight loss, 27 (61.4%) reported losing weight as a result of a personal choice to be healthier. There were far fewer participants reporting intentional weight gain, but of the respondents, 3 (75%) reported gaining weight due to pregnancy.

For breathing, the most commonly reported issues for respondents who had gained weight were sustaining long phrases, taking a full breath, controlling exhalation, and controlling crescendo and decrescendo. The majority of participants reported experiencing changes in breathing after gaining 10-15% of their total body weight. The most commonly reported issues for respondents who had lost weight were sustaining long phrases, controlling exhalation, and maintaining a steady stream of air. The majority of participants reported experiencing changes in breathing after losing 10-15% of their total body weight.

For phonation, the most commonly reported items for respondents who had gained weight were ease singing in the lower register, ease singing with legato, difficulty singing quieter than mezzo-piano, and difficulty singing high pitches quietly. The majority of participants reported experiencing changes in phonation after gaining 10-15% of their total body weight. The most commonly reported items for respondents who had lost weight were ease singing with agility, ease singing around the passaggi, difficulty singing with legato, and difficulty singing louder than mezzo forte. The majority of participants reported experiencing changes in phonation after losing 10-15% of their total body weight.

For vocal quality, the most common effects experienced by participants who reported weight gain were a fuller/heavier vocal quality, sensation of sound in the back of the throat, difficulty producing a clear tone, and hoarseness. The most common effects experienced by participants who lost weight were a brighter vocal quality, fuller/heavier vocal quality, strident vocal quality, and hoarseness.

About half of the participants answering the questions for both gain and loss reported that their performance load changed as a direct result of their weight change. The other half reported that their performance load did not change.

The majority of participants who gained weight reported receiving neither positive nor negative feedback about their weight gain, while the majority of participants who lost weight reported receiving extremely positive feedback about their weight gain. Perhaps this is a direct reflection of the weight bias in the singing community. Participants who gained weight and received feedback, reported receiving that feedback from mostly family, teachers, and casting directors. Participants who lost weight and received feedback, reported receiving that feedback from mostly family, friends, and teachers.

Limitations of the Study

The primary limitations of the study arise from the anecdotal nature of the information being collected. To make definitive conclusions about the effects of weight fluctuation on the singing voice, controlled experimental studies would need to be implemented. Another limitation is the number of respondents. In order to draw real correlations between weight change and the singing voice, researchers would need a far higher number of respondents. This survey looks at trends in data but is unable to provide any conclusive evidence of effects on the voice. Another limitation is potential selection bias in respondents. Fully determining the extent to which

selection bias is present is impossible. It is possible that certain respondents answered the survey because of vocal problems they had after experiencing weight loss or gain and that others who did not have problems did not complete the survey. Since the goal of this survey is to find out about specific issues that singers experienced after weight change, it is acceptable that participants may have had specific bias. This data provides a foundation for future studies.

Future Research

Although this survey provided a large amount of anecdotal information surrounding trends in weight fluctuation and its effect on the singing voice, it also opened a variety of avenues for possible future research. In the results, a large number of respondents who had gained weight experienced a deeper/heavier vocal quality, while a large number of respondents who had lost weight experienced a brighter vocal quality. It would be interesting to research if weight fluctuation in either direction actually changes the shape of the vocal tract, or if the deepening and brightening of timbre is a direct result of a greater or lesser amount of body mass inhibiting breath movement. Specific, controlled, studies could be used to better pinpoint the exact reason for changes in vocal quality and phonatory ability after weight change. Another avenue for further research is the effect of body fat percentage versus muscle mass percentage on the singing voice. It would be interesting to see if there is a difference in effects experienced after a gain of 10% of a participant's body mass in fat versus a gain in 10% of a participant's body mass in muscle. An identical study could be done for body mass decrease. A study into muscle mass versus fat mass could easily pivot into research on the effects of consistent exercise on the singing voice. Ultimately, although this survey provides much needed anecdotal knowledge about the effects of weight fluctuation on the voice, there are a number of pathways for future research that could expand upon the information that is currently available.

Conclusion

Weight fluctuation is natural and highly common. Most adults will experience this phenomenon at least once throughout the course of their lifetime. When a person undergoes a significant weight change, there are a variety of anatomical issues that may arise. For the singer, who's instrument is their body, even the smallest fluctuations can cause changes in singing sensation. Many assumptions have been made about effects that weight loss or gain can have on the singing voice, but most of these assumptions are based upon a cursory understanding of what *may* happen as body mass changes. Through this study, a better understanding of the respiratory, phonatory, and resonatory changes that singers can experience as effects of weight fluctuation has been gained. Though the results of this survey illuminate only trends in the data, a large amount of information was collected, and a basis for further avenues of research was established.

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Appendix A

SAMPLING OF OPEN RESPONSES

Participants were given the option to add additional comments in the "Effects Experienced After Weight Gain" and "Effects Experienced after Weight Loss" sections. These answers were not analyzed or used in the previously measured data. Respondents were asked to answer these questions to reflect further upon experiences that they may have had as a result of their weight change. The comments in this section represent highly reported spontaneous responses.

Effects Experienced After Weight Gain

Participants were asked for additional comments about experienced changes in breathing, phonation, vocal quality, and vocal mechanism after weight gain. They were also asked if there was any other information they would like to add. Some comments include:

I sing better now in every respect

[I] have a much darker and fuller tone

[I] have a darker, meatier sound

[My] body composition was a factor. A lot of the "fat" was turned into muscle, so I still had the strength to support my voice.

The effects of weight gain were all positive for me and stayed with me after I lost it all, when pregnancy ended.

Effects Experienced After Weight Loss

Participants were asked for additional comments about experienced changes in breathing, phonation, vocal quality, and vocal mechanism after weight loss. They were also asked if there was any other information they would like to add. Some comments include:

[It was] much easier to find resonance.

[I was] pushing on the sound and working harder than needed because I was trying to create the same sensations from when I was heavier.

[I had] trouble maintaining stamina throughout a program.

I was hired for DIFFERENT roles than before I lost weight. No way of knowing if it was more or less.

I found that my weight loss actually changed people. People's opinions of me were more positive.

I was hired more in the year after I lost weight than I ever had been before.

Appendix B

WEIGHT FLUCTUATION AND THE SINGING VOICE SURVEY

Start of Block: Default Question Block

Q1 Are you a singer?

- Yes (1)
- No (2)

Skip To: End of Survey If Are you a singer? = No

Q2 What kind of singer are you? Please click the one that best describes you.

- Solo Singer (1)
- Studio Singer (2)
- Choral Singer (3)
- Opera Singer (4)
- Musical Theater Performer (5)
- Primary Music Educator (6)
- Secondary Music Educator (7)
- University Teacher (8)
- Private Voice Teacher (9)

Q3 Please select all other answers that apply to you:

- [ ] Solo Singer (1)
- [ ] Studio Singer (2)
- [ ] Choral Singer (3)
- [ ] Opera Singer (4)
- [ ] Musical Theater Performer (5)
- [ ] Primary Music Educator (6)
- [ ] Secondary Music Educator (7)
- [ ] University Teacher (8)
- [ ] Private Voice Teacher (9)

Q4 Highest Degree Earned:

- ○ High School Diploma (1)
- ○ Associate's Degree (2)
- ○ Bachelor's Degree (3)
- ○ Artist's Diploma (4)
- ○ Master's Degree (5)
- ○ Doctoral Degree (6)

Q5 Highest Level of Vocal Training:

- ○ No formal vocal training (1)
- ○ Private voice lessons (2)
- ○ High School vocal experience (3)
- ○ Training at the associate's level (4)
- ○ Training at the bachelor's level (5)
- ○ Training at the master's level (6)
- ○ Training at the doctoral level (7)

Q6 In which style do you primarily sing?

- ○ Opera (1)
- ○ Art Song (2)
- ○ Oratorio (3)
- ○ Musical Theater (4)
- ○ Sacred/Church Music (5)
- ○ Jazz (6)
- ○ Folk/Country (7)
- ○ Gospel (8)
- ○ Popular/Commercial Music (9)
- ○ Rock and Roll (10)
- ○ Other. Please specify. (11) _____

Q7 What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Non-binary / other gender (3)
- ○ Prefer not to say (4)

Q8 What is your biological sex? (the sex you were assigned at birth)?

- ○ Male (1)
- ○ Female (2)
- ○ Prefer not to say (3)

Q9 What is your voice type? (e.g., fach?)

- ○ Soprano (1)
- ○ Mezzo Soprano (2)
- ○ Alto (3)
- ○ Tenor (4)
- ○ Baritone (5)
- ○ Bass (6)
- ○ Other. Please specify. (7) _____

Q10 How tall are you?

- ○ Shorter than 4’11” (1)
- ○ 4’11” - 5’0" (2)
- ○ 5’1” - 5’3” (3)
- ○ 5’4” - 5’6” (4)
- ○ 5’7” - 5’9” (5)
- ○ 5’9” - 5’11” (6)
- ○ 6’0" - 6’2” (7)
- ○ 6’3” - 6’5” (8)
- ○ 6’6”- 6’8” (9)
- ○ Taller than 6’8” (10)

Q11 Have you ever experienced weight loss or weight gain that is more than 10% of your body weight?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Have you ever experienced weight loss or weight gain that is more than 10% of your body weight? = No

Q12 Which did you experience?

- ○ Weight LOSS (1)
- ○ Weight GAIN (2)
- ○ LOSS and GAIN multiple times throughout my life (3)

End of Block: Default Question Block

Start of Block: Fluctuation Questions

Q13 How many times in your adult life have you experienced weight fluctuation?

- ○ 2-4 (1)
- ○ 5-7 (2)
- ○ 8-10 (3)
- ○ More than 10 (4)

Q14 What percentage of your body weight have you LOST each time you have LOST weight? Check all that apply.

- ☐ 10%-15% (1)
- ☐ 16%-20% (2)
- ☐ 21%-30% (3)
- ☐ 31%-40% (4)
- ☐ 41%-50% (5)
- ☐ More than 50% (6)

Q15 What percentage of your body weight have you GAINED each time you have GAINED weight? Check all that apply.

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q16 For your biggest LOSS, how long did it take you to LOSE the weight?

- ○ less than 1 month (1)
- ○ 1-2 months (2)
- ○ 3-5 months (3)
- ○ 6-8 months (4)
- ○ 9-11 months (5)
- ○ 1 year + (6)

Q17 For your biggest GAIN, how long did it take you to GAIN the weight?

- ○ less than 1 month (1)
- ○ 1-2 months (2)
- ○ 3-5 months (3)
- ○ 6-8 months (4)
- ○ 9-11 months (5)
- ○ 1 year + (6)

Q18 At what age did you LOSE the most weight?

- ○ 10-15 years old (1)
- ○ 16-20 (2)
- ○ 21-30 (3)
- ○ 31-40 (4)
- ○ 41-50 (5)
- ○ 51-60 (6)
- ○ 61-70 (7)
- ○ 71-80 (8)
- ○ 81+ (9)

Q19 At what age did you GAIN the most weight?

- ○ 10-15 years old (1)
- ○ 16-20 (2)
- ○ 21-30 (3)
- ○ 31-40 (4)
- ○ 41-50 (5)
- ○ 51-60 (6)
- ○ 61-70 (7)
- ○ 71-80 (8)
- ○ 81+ (9)

Q20 Of your greatest LOSS/GAIN, which would you consider intentional, the loss or the gain?

- ○ Loss (1)
- ○ Gain (2)

End of Block: Fluctuation Questions

Start of Block: Intentional Gain (Fluctuation)

Q21 Reason for gain

- ○ Suggestion from healthcare provider (1)
- ○ Suggestion from counselor or coach (2)
- ○ Personal choice to be healthier (3)
- ○ Stress related (4)
- ○ Eating disorder (5)
- ○ Pregnancy (6)
- ○ Other. Please specify. (7) _____

Q22 How old were you when you gained this weight?

- ○ 10-15 years old (1)
- ○ 16-20 (2)
- ○ 21-30 (3)
- ○ 31-40 (4)
- ○ 41-50 (5)
- ○ 51-60 (6)
- ○ 61-70 (7)
- ○ 71-80 (8)
- ○ 81+ (9)

Q23 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight gain. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE".

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Malnutrition (1)	○	○	○	○	○
Osteoporosis (2)	○	○	○	○	○
Decreased Immune Response (3)	○	○	○	○	○
Fertility Issues (4)	○	○	○	○	○
Irregular Menstrual Cycles (5)	○	○	○	○	○
Growth/Development Issues (6)	○	○	○	○	○
Fatigue (7)	○	○	○	○	○
Dermatological Issues (8)	○	○	○	○	○
Other. Please specify. (9)	○	○	○	○	○
Other Please specify. (10)	○	○	○	○	○
Other Please specify. (11)	○	○	○	○	○

End of Block: Intentional Gain (Fluctuation)

Start of Block: Effects Experienced After Weight GAIN

Q24 To the best of your knowledge, which changes in BREATHING did you experience after your weight GAIN?

	Extremely challenging (1)	Very challenging (2)	Moderately challenging (3)	Slightly challenging (4)	Not challenging at all (5)	No change (6)
Sustaining long phrases (1)	○	○	○	○	○	○
Taking a full breath (2)	○	○	○	○	○	○
Controlling exhalation (maintaining appoggio) (3)	○	○	○	○	○	○
Maintaining steady stream of air (4)	○	○	○	○	○	○
Other. Please specify. (5)	○	○	○	○	○	○
Other. Please specify. (6)	○	○	○	○	○	○
Other. Please specify. (7)	○	○	○	○	○	○

Q25 To the best of your knowledge, which changes in BREATHING SENSATION did you experience after your weight GAIN?

	No (1)	Yes (2)	Not sure (3)
Sensation of breathing in the chest (1)	○	○	○
Sensation of breathing in the back (2)	○	○	○
Sensation of breathing in the shoulders (3)	○	○	○
Sensation of breathing in the abdomen (4)	○	○	○
Sensation of breathlessness (5)	○	○	○
Sensation of sudden closure of the throat (6)	○	○	○
Sensation of still having air, but no ability to phonate (7)	○	○	○
Other. Please specify. (8)	○	○	○
Other. Please specify. (9)	○	○	○
Other. Please specify. (10)	○	○	○

Q26 To the best of your knowledge, at what percentage of your original body weight had you GAINED when you began experiencing changes in BREATHING?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q27 To the best of your knowledge, which of the following changes in PHONATION did you experience after your weight LOSS?

	Much more Difficult (1)	Somewhat more Difficult (2)	Somewhat Easier (3)	Much Easier (4)	No Change (5)
Singing in the upper register (1)	○	○	○	○	○
Singing around the passaggi (2)	○	○	○	○	○
Singing in lower register (3)	○	○	○	○	○
Singing in higher register (4)	○	○	○	○	○
Singing with agility (5)	○	○	○	○	○
Singing with legato (6)	○	○	○	○	○
Singing quieter than mezzo piano (medium soft) (7)	○	○	○	○	○
Singing louder than mezzo forte (medium loud) (8)	○	○	○	○	○
Other. Please specify. (9)	○	○	○	○	○
Other. Please specify. (10)	○	○	○	○	○
Other. Please specify. (11)	○	○	○	○	○

Q28 To the best of your knowledge, what percentage of your body weight had you GAINED when you started experiencing changes in PHONATION?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q30 To the best of your knowledge, which of the following changes in VOCAL QUALITY did you experience after your weight GAIN? Please check all that apply.

- ☐ Sensation of sound in back of throat (1)
- ☐ Brighter vocal quality (2)
- ☐ Difficulty producing clear tone (3)
- ☐ Decrease in breathiness (4)
- ☐ Strident vocal quality (5)
- ☐ Ease in louder singing (6)
- ☐ Hoarseness (7)
- ☐ Other. Please specify. (8) _____
- ☐ Other. Please specify. (9) _____
- ☐ Other. Please specify. (10) _____
- ☐ None (11)

Q31 To the best of your knowledge, what percentage of your body weight had you GAINED when you started experiencing these changes in VOCAL QUALITY?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q32 To the best of your knowledge, which of the following other changes to the VOCAL MECHANISM did you experience after your weight GAIN? Please check all that apply.

- ☐ Vocal edema/swelling (1)
- ☐ Rhinitis (nasal swelling) (2)
- ☐ No changes to the vocal mechanism (3)
- ☐ Other. Please specify. (4) _____

Q33 To the best of your knowledge, what percentage of your body weight had you GAINED when you started experiencing changes to the VOCAL MECHANISM?

- 10%-15% (1)
- 16%-20% (2)
- 21%-30% (3)
- 31%-40% (4)
- 41%-50% (5)
- More than 50% (6)

Q34 Did your performing load change as a result of your weight GAIN?

- Yes (1)
- No (2)
- Not applicable (3)

End of Block: Effects Experienced After Weight GAIN

Start of Block: Additional GAIN questions

Q35 Did you receive any positive or negative feedback based on your weight GAIN?

- Extremely positive (1)
- Moderately positive (2)
- Slightly positive (3)
- Neither positive nor negative (4)
- Slightly negative (5)
- Moderately negative (6)
- Extremely negative (7)

Skip To: Q37 If Did you receive any positive or negative feedback based on your weight GAIN? = Neither positive nor negative

Q36 From whom did you receive this feedback?

- ☐ Family (1)
- ☐ Friends (2)
- ☐ Teachers (3)
- ☐ Healthcare Professionals (4)
- ☐ Students (5)
- ☐ Casting directors (6)

Q37 Were you diagnosed with an eating disorder?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Were you diagnosed with an eating disorder? = No

Q38 Please check all that apply.

- [ ] Anorexia Nervosa (1)
- [ ] Bulimia Nervosa (2)
- [ ] Binge Eating Disorder (3)
- [ ] Any combination of the above (4)
- [ ] Other. Please specify. (5) _____

End of Block: Additional GAIN questions

Start of Block: Other Comments

Q39 Is there anything you would like to add about your weight fluctuation experience that we did not ask on this survey?

- ○ Yes (1) _____
- ○ No (2)

End of Block: Other Comments

Start of Block: Intentional Loss (Fluctuation)

Q40 Reason for loss

- ○ Suggestion from healthcare provider (1)
- ○ Suggestion from counselor or coach (2)
- ○ Personal choice to be healthier (3)
- ○ Stress related (4)
- ○ Eating disorder (5)
- ○ Other. Please specify. (6) _____

Q41 How did you lose the weight? Check all that apply.

- ☐ Diet (1)
- ☐ Exercise (2)
- ☐ Bariatric Surgery (3)
- ☐ Change in Medication (4)
- ☐ Change in Medical Condition (5)
- ☐ Other. Please Specify. (6) _____

Skip To: Q42 If How did you lose the weight? Check all that apply. = Diet

Skip To: Q43 If How did you lose the weight? Check all that apply. = Exercise

Skip To: Q43 If How did you lose the weight? Check all that apply. = Bariatric Surgery

Skip To: Q43 If How did you lose the weight? Check all that apply. = Change in Medication

Skip To: Q43 If How did you lose the weight? Check all that apply. = Change in Medical Condition

Skip To: Q43 If Condition: Other. Please Specify. Is Not Empty. Skip To: How old were you when you lost your w....

Q42 Please indicate which diet you followed. Check any that apply.

- [ ] Calories in, calories out (1)
- [ ] Keto diet/low carb diet (2)
- [ ] Paleo diet (3)
- [ ] Whole 30 diet (4)
- [ ] Mediterranean diet (5)
- [ ] Organized diet (Weight Watchers, Jenny Craig, Atkins, Nutrition solutions) (6)
- [ ] Other. Please Specify. (7) _____

Q43 How old were you when you lost your weight?

- ○ 10-15 years old (1)
- ○ 16-20 (2)
- ○ 21-30 (3)
- ○ 31-40 (4)
- ○ 41-50 (5)
- ○ 51-60 (6)
- ○ 61-70 (7)
- ○ 71-80 (8)
- ○ 81+ (9)

Q44 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight loss. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE"

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Heart Disease (1)	○	○	○	○	○
High Blood Pressure (2)	○	○	○	○	○
High Cholesterol (3)	○	○	○	○	○
Type 2 Diabetes (4)	○	○	○	○	○
Gallbladder Disease (5)	○	○	○	○	○
Osteoarthritis (6)	○	○	○	○	○
Gout (7)	○	○	○	○	○
Sleep Apnea (8)	○	○	○	○	○
GERD (Gastroesophageal Reflux Disease) (9)	○	○	○	○	○
Other. Please Specify. (10)	○	○	○	○	○
Other. Please Specify. (11)	○	○	○	○	○
Other. Please Specify. (12)	○	○	○	○	○

End of Block: Intentional Loss (Fluctuation)

Start of Block: Effects Experienced After Weight LOSS Questions

Q45 To the best of your knowledge, which changes in BREATHING did you experience after your weight LOSS?

	Extremely challenging (1)	Very challenging (2)	Moderately challenging (3)	Slightly challenging (4)	Not challenging at all (5)	No change (6)
Sustaining long phrases (1)	○	○	○	○	○	○
Taking a full breath (2)	○	○	○	○	○	○
Controlling exhalation (maintaining appoggio) (3)	○	○	○	○	○	○
Other. Please specify. (4)	○	○	○	○	○	○
Other. Please specify. (5)	○	○	○	○	○	○
Other. Please specify. (6)	○	○	○	○	○	○

Q46 To the best of your knowledge, which changes in BREATHING SENSATION did you experience after your weight LOSS?

	No (1)	Yes (2)	Not sure (3)
Sensation of breathing in the chest (1)	○	○	○
Sensation of breathing in the back (2)	○	○	○
Sensation of breathing in the shoulders (3)	○	○	○
Sensation of breathing in the abdomen (4)	○	○	○
Other. Please specify. (5)	○	○	○
Other. Please specify. (6)	○	○	○
Other. Please specify. (7)	○	○	○

Q47 To the best of your knowledge, what percentage of your body weight had you LOST when you began experiencing changes in BREATHING?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q48 To the best of your knowledge, which of the following changes in PHONATION did you experience after your weight LOSS?

	Much more Difficult (1)	Somewhat more Difficult (2)	Somewhat Easier (3)	Much Easier (4)	No Change (5)
Singing in the upper register (1)	○	○	○	○	○
Singing around the passaggi (2)	○	○	○	○	○
Singing in lower register (3)	○	○	○	○	○
Singing in higher register (4)	○	○	○	○	○
Singing with agility (5)	○	○	○	○	○
Singing with legato (6)	○	○	○	○	○
Singing quieter than mezzo piano (medium soft) (7)	○	○	○	○	○
Singing louder than mezzo forte (medium loud) (8)	○	○	○	○	○
Other. Please specify. (9)	○	○	○	○	○
Other. Please specify. (10)	○	○	○	○	○
Other. Please specify. (11)	○	○	○	○	○

Q49 To the best of your knowledge, what percentage of your body weight had you LOST when you started experiencing changes in PHONATION?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q50 To the best of your knowledge, which of the following changes in VOCAL QUALITY did you experience after your weight LOSS? Please check all that apply.

- [ ] Darker/warmer vocal quality (1)
- [ ] Brighter vocal quality (2)
- [ ] Difficulty producing clear tone (3)
- [ ] Breathiness (4)
- [ ] Strident vocal quality (5)
- [ ] Fuller/heavier vocal quality (6)
- [ ] Hoarseness (7)
- [ ] Other. Please specify. (8) _____
- [ ] Other. Please specify. (9) _____
- [ ] Other. Please specify. (10) _____
- [ ] None (11)

Q51 To the best of your knowledge, what percentage of your body weight had you LOST when you started experiencing these changes in VOCAL QUALITY?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q52 To the best of your knowledge, which of the following other changes to the VOCAL MECHANISM did you experience after your weight LOSS? Please check all that apply.

- ☐ Vocal edema/swelling (1)
- ☐ Rhinitis (nasal swelling) (2)
- ☐ No changes to the vocal mechanism (3)
- ☐ Other. Please specify. (4) _____

Q53 To the best of your knowledge, what percentage of your body weight had you LOST when you started experiencing changes to the VOCAL MECHANISM?

- 10%-15% (1)
- 16%-20% (2)
- 21%-30% (3)
- 31%-40% (4)
- 41%-50% (5)
- More than 50% (6)

Q54 Did your performing load change as a result of your weight LOSS?

- Yes (1)
- No (2)
- Not applicable (3)

End of Block: Effects Experienced After Weight LOSS Questions

Start of Block: Additional Loss Questions

Q55 Did you receive any positive or negative feedback based on your weight LOSS?

- Extremely positive (1)
- Moderately positive (2)
- Slightly positive (3)
- Neither positive nor negative (4)
- Slightly negative (5)
- Moderately negative (6)
- Extremely negative (7)

Skip To: Q57 If Did you receive any positive or negative feedback based on your weight LOSS? = Neither positive nor negative

Q56 From whom did you receive this feedback?

- ☐ Family (1)
- ☐ Friends (2)
- ☐ Teachers (3)
- ☐ Healthcare Professionals (4)
- ☐ Students (5)
- ☐ Casting directors (6)

Q57 Were you diagnosed with an eating disorder?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Were you diagnosed with an eating disorder? = No

Q58 Please check all that apply.

- ☐ Anorexia Nervosa (1)
- ☐ Bulimia Nervosa (2)
- ☐ Binge Eating Disorder (3)
- ☐ Any combination of the above (4)
- ☐ Other. Please specify. (5) _____

End of Block: Additional Loss Questions

Start of Block: Loss Questions

Q59 What percentage of your total body weight did you LOSE?

- ○ 10%-15% (1)
- ○ 16%-20% (2)
- ○ 21%-30% (3)
- ○ 31%-40% (4)
- ○ 41%-50% (5)
- ○ More than 50% (6)

Q60 Was your weight LOSS intentional?

- ○ Yes (1)
- ○ No (2)

End of Block: Loss Questions

Start of Block: Unintentional Weight Loss Questions

Q61 If your weight loss was UNINTENTIONAL, do you know why you lost the weight?

- ○ Yes (1)
- ○ No (2)

Skip To: Q62 If If your weight loss was UNINTENTIONAL, do you know why you lost the weight? = Yes

Skip To: Q63 If If your weight loss was UNINTENTIONAL, do you know why you lost the weight? = No

Q62 Please check your reason for weight loss. Check all that apply.

- ☐ Illness (1)
- ☐ Stress (2)
- ☐ Depression (3)
- ☐ Anxiety (4)
- ☐ Eating Disorder (5)
- ☐ Change in Medication (6)
- ☐ Change in Medical Condition (7)
- ☐ Other. Please specify. (8) _____
- ☐ Other. Please specify. (9) _____
- ☐ Other. Please specify. (10) _____

Q63 How old were you when you lost your weight?

- 10-15 years old (1)
- 16-20 (2)
- 21-30 (3)
- 31-40 (4)
- 41-50 (5)
- 51-60 (6)
- 61-70 (7)
- 71-80 (8)
- 81+ (9)

Q64 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight loss. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE".

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Heart Disease (1)	○	○	○	○	○
High Blood Pressure (2)	○	○	○	○	○
High Cholesterol (3)	○	○	○	○	○
Type 2 Diabetes (4)	○	○	○	○	○
Gallbladder Disease (5)	○	○	○	○	○
Osteoarthritis (6)	○	○	○	○	○
Gout (7)	○	○	○	○	○
Sleep Apnea (8)	○	○	○	○	○
GERD (Gastroesophageal Reflux Disease) (9)	○	○	○	○	○
Other. Please specify. (10)	○	○	○	○	○
Other. Please specify. (11)	○	○	○	○	○
Other. Please specify. (12)	○	○	○	○	○

Q65 Did you develop any medical conditions after your weight loss?

○ Yes (1)

○ No (2)

Skip To: Q66 If Did you develop any medical conditions after your weight loss? = Yes

Skip To: End of Block If Did you develop any medical conditions after your weight loss? = No

Q66 Please indicate which condition(s) you developed after your weight loss. Check any that apply.

- ☐ Heart Disease (1)
- ☐ High Blood Pressure (2)
- ☐ High Cholesterol (3)
- ☐ Type 2 Diabetes (4)
- ☐ Gallbladder Disease (5)
- ☐ Osteoarthritis (6)
- ☐ Gout (7)
- ☐ Sleep Apnea (8)
- ☐ GERD (Gastroesophageal Reflux Disease) (9)
- ☐ Other. Please specify. (10) _____
- ☐ Other. Please specify. (11) _____
- ☐ Other. Please specify. (12) _____

End of Block: Unintentional Weight Loss Questions

Start of Block: Intentional Loss Questions

Q67 Reason for loss

- ○ Suggestion from healthcare provider (1)
- ○ Suggestion from counselor or coach (2)
- ○ Personal choice to be healthier (3)
- ○ Stress related (4)
- ○ Eating disorder (5)
- ○ Other. Please specify. (6) _____

Q68 How did you lose the weight? Check all that apply.

- ☐ Diet (1)
- ☐ Exercise (2)
- ☐ Bariatric Surgery (3)
- ☐ Change in Medication (4)
- ☐ Change in Medical Condition (5)
- ☐ Other. Please Specify. (6) _____

Skip To: Q69 If How did you lose the weight? Check all that apply. = Diet
Skip To: Q70 If How did you lose the weight? Check all that apply. = Exercise
Skip To: Q70 If How did you lose the weight? Check all that apply. = Bariatric Surgery
Skip To: Q70 If How did you lose the weight? Check all that apply. = Change in Medication
Skip To: Q70 If How did you lose the weight? Check all that apply. = Change in Medical Condition
Skip To: Q70 If How did you lose the weight? Check all that apply. = Other. Please Specify.

Q69 Please indicate which diet you followed. Check any that apply.

- [ ] Calories in, calories out (1)
- [ ] Keto diet/low carb diet (2)
- [ ] Paleo diet (3)
- [ ] Whole 30 diet (4)
- [ ] Mediterranean diet (5)
- [ ] Organized diet (Weight Watchers, Jenny Craig, Atkins, Nutrition solutions) (6)
- [ ] Other. Please Specify. (7) _____

Q70 How old were you when you lost your weight?

- ○ 10-15 years old (1)
- ○ 16-20 (2)
- ○ 21-30 (3)
- ○ 31-40 (4)
- ○ 41-50 (5)
- ○ 51-60 (6)
- ○ 61-70 (7)
- ○ 71-80 (8)
- ○ 81+ (9)

Q71 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight loss. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE"

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Heart Disease (1)	○	○	○	○	○
High Blood Pressure (2)	○	○	○	○	○
High Cholesterol (3)	○	○	○	○	○
Type 2 Diabetes (4)	○	○	○	○	○
Gallbladder Disease (5)	○	○	○	○	○
Osteoarthritis (6)	○	○	○	○	○
Gout (7)	○	○	○	○	○
Sleep Apnea (8)	○	○	○	○	○
GERD (Gastroesophageal Reflux Disease) (9)	○	○	○	○	○
Other. Please Specify. (10)	○	○	○	○	○
Other. Please Specify. (11)	○	○	○	○	○
Other. Please Specify. (12)	○	○	○	○	○

End of Block: Intentional Loss Questions

Start of Block: Gain Questions

Q72 What percentage of your total body weight did you GAIN?

- 10%-15% (1)
- 16%-20% (2)
- 21%-30% (3)
- 31%-40% (4)
- 41%-50% (5)
- More than 50% (6)

Q73 Was your weight GAIN intentional?

- Yes (1)
- No (2)

End of Block: Gain Questions

Start of Block: Unintentional Gain Questions

Q74 If your weight gain was UNINTENTIONAL, do you know why you gained the weight?

- Yes (1)
- No (2)

Skip To: Q75 If If your weight gain was UNINTENTIONAL, do you know why you gained the weight? = Yes

Skip To: Q76 If If your weight gain was UNINTENTIONAL, do you know why you gained the weight? = No

Q75 Why did you gain this weight? Check any that apply.

- [ ] Change of diet (1)
- [ ] Change in exercise (2)
- [ ] Illness (3)
- [ ] Stress (4)
- [ ] Depression (5)
- [ ] Anxiety (6)
- [ ] Eating Disorder (7)
- [ ] Change in Medication (8)
- [ ] Pregnancy (9)
- [ ] Other. Please specify. (10) _____

Q76 How old were you when you gained this weight?

- 10-15 years old (1)
- 16-20 (2)
- 21-30 (3)
- 31-40 (4)
- 41-50 (5)
- 51-60 (6)
- 61-70 (7)
- 71-80 (8)
- 81+ (9)

Q77 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight loss. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE".

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Malnutrition (1)	○	○	○	○	○
Osteoporosis (2)	○	○	○	○	○
Decreased Immune Response (3)	○	○	○	○	○
Fertility Issues (4)	○	○	○	○	○
Irregular Menstrual Cycles (5)	○	○	○	○	○
Growth/Development Issues (6)	○	○	○	○	○
Fatigue (7)	○	○	○	○	○
Dermatological Issues (8)	○	○	○	○	○
Other. Please specify. (9)	○	○	○	○	○
Other. Please specify. (10)	○	○	○	○	○
Other. Please specify. (11)	○	○	○	○	○

End of Block: Unintentional Gain Questions

Start of Block: Intentional Gain Questions

Q78 Reason for gain

- Suggestion from healthcare provider (1)
- Suggestion from counselor or coach (2)
- Personal choice to be healthier (3)
- Stress related (4)
- Eating disorder (5)
- Pregnancy (6)
- Other. Please specify. (7) _____

Q79 How old were you when you gained this weight?

- 10-15 years old (1)
- 16-20 (2)
- 21-30 (3)
- 31-40 (4)
- 41-50 (5)
- 51-60 (6)
- 61-70 (7)
- 71-80 (8)
- 81+ (9)

Q80 The following is a list of weight related health conditions. Please indicate which, if any, you had and whether they IMPROVED or DECLINED after your weight loss. If you DID NOT have any of these conditions, please choose "NOT APPLICABLE".

	Greatly Declined (1)	Slightly Declined (2)	NOT APPLICABLE (3)	Slightly Improved (4)	Greatly Improved (5)
Malnutrition (1)	○	○	○	○	○
Osteoporosis (2)	○	○	○	○	○
Decreased Immune Response (3)	○	○	○	○	○
Fertility Issues (4)	○	○	○	○	○
Irregular Menstrual Cycles (5)	○	○	○	○	○
Growth/Development Issues (6)	○	○	○	○	○
Fatigue (7)	○	○	○	○	○
Dermatological Issues (8)	○	○	○	○	○
Other. Please specify. (9)	○	○	○	○	○
Other Please specify. (10)	○	○	○	○	○
Other Please specify. (11)	○	○	○	○	○

End of Block: Intentional Gain Questions