ABSTRACT

THE EFFECT OF VOICE DISORDERS ON ADOLESCENTS’ PHYSICAL/SOCIAL CONCERNS AND CAREER DECISIONS

By Megan Pack

The effect of voice disorders on adolescents’ physical/social concerns and career decisions has not been previously reported in the literature. The purpose of this study was to describe the effects of voice disorders following airway reconstruction surgery upon physical/educational concerns, social concerns, as well as career decisions in comparison to control participants. Sixteen experimental participants between the ages of 14 and 18 years were gender- and grade-matched with 16 control participants, who had no history of voice disorder or airway surgery. All participants were administered a 31-question survey via telephone. Results indicated that experimental participants had lower self-reported quality of life in the areas of physical/educational concerns and social concerns in comparison with control participants. Career decisions did not differ significantly from experimental to control participants.
THE EFFECT OF VOICE DISORDERS ON ADOLESCENTS’ PHYSICAL/SOCIAL CONCERNS AND CAREER DECISIONS

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Megan Pack
Miami University
Oxford, Ohio
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Advisor__________________________
Barbara Weinrich, Ph. D.

Reader__________________________
Susan Baker, Ph. D.

Reader__________________________
Lisa Kelchner, Ph. D.
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When quality, pitch, and loudness characteristics of an individual’s voice differ from that of his/her peers, it is known as a voice disorder. Children, adolescents, and adults are susceptible to a range of voice disorders with etiologies including medical, neurologic, respiratory, and laryngeal factors (Boyle, 2000; Stemple, Glaze, & Klaben, 2000). Studies have reported a prevalence range from 1% to 23% of voice disorders in children (Wilson, 1987). However, the most recent research reveals a 6% prevalence rate for American children (Carding, Roulstone, Northstone & ALSPAC Study Team, 2006). Of all possible voice disorders, some of the most common in children are congenital airway anomalies, including subglottic stenosis and laryngomalacia (Dobres, Lee, Stemple, Kummer, & Kretschmer, 1990).

**Congenital Airway Anomalies**

Airway anomalies are conditions that occur congenitally, initially altering respiration more than the quality of children’s voices. Subglottic stenosis and laryngomalacia are two of the most common congenital anomalies (Dobres et al., 1990). Both occur from maldevelopment of the larynx and/or trachea.

**Laryngomalacia**

Laryngomalacia is a maldevelopment of the epiglottis that causes congenital laryngeal stridor. In this condition, the epiglottis remains abnormally pliable. Consequently, respiratory movements of inspiration and expiration cause the epiglottis to create resistance to the air stream. Laryngomalacia typically does not require treatment, as normal maturation spontaneously alleviates the condition by three years of age (Stemple et al., 2000). Stridor is most commonly caused by laryngomalacia in children (Olney, Greinwald, Smith, & Bauman, 1999).

**Subglottic Stenosis**

Congenital narrowing of the larynx causes an airway obstruction called subglottic stenosis. The narrowing, typically occurring below the glottis, may be accompanied by inhalatory stridor. Embryologically, maldevelopment of the cricoid cartilage is responsible for the anomaly, although cricoid development after birth may continue and
the child may essentially outgrow the problem. However, without adequate growth to alleviate the condition, or in more severe cases, airway reconstruction may be necessary for the physiological purpose of allowing the child to breathe more efficiently (Sarker et al., 2002; Stemple et al., 2000).

Acquired Laryngeal Pathologies

In addition to the congenital condition, the more severe, acquired subglottic stenosis is of growing prevalence due to increased premature births requiring intubations in the pediatric population (Rahbar & Healy, 2003). Narrowing of the airway lumen is a common side effect of prolonged intubation, making ventilation an additional concern in the child’s care.

Varying degrees of stenosis are possible. Therefore, a grading system for subglottic stenosis was developed by Myer, O’Conner, & Cotton (1994). An airway lumen that falls within the range from open to 50% obstructed characterizes a Grade I stenosis, while a Grade II stenosis represents 51-70% airway obstruction. Grade III stenosis is 71-99% obstruction, and the designation of a Grade IV represents the absence of a detectable lumen. Acquired stenoses can potentially be Grade III or Grade IV, meaning that surgery is often a necessity in achieving a patent airway (Myer et al., 1994). The grade of stenosis preoperatively affects the voice outcome, as well as the type of surgery performed. Myer and colleagues noted that lesser grade stenoses (Grade I) yielded 75% of patients with acceptable postoperative voices, while higher grade stenoses (Grades II, III, and IV) were associated with only 40-50% having acceptable postoperative voices.

The aforementioned pathologies are some of the most prevalent among the pediatric population. In order to correct these airway anomalies, reconstruction is often surgically required, impacting vocal quality as a result. Some of the commonly performed surgical procedures include cricoid split, laryngotracheal reconstruction, and cricotracheal reconstruction.

Surgical Management

The management of airway anomalies, such as subglottic stenosis and laryngomalacia, may require immediate intervention. Obstructed airways can be managed with an endotracheal tube or tracheotomy in severe cases. After stabilization of
the child’s condition, permanent surgical solutions are needed to create a functionally patent airway. Permanent surgical solutions must be chosen with consideration of the necessity for adequate airway protection, as well as the possibility of doing further damage to laryngeal structures. Two types of procedures exist to reconstruct the larynx. In general, procedures are either augmentation or resection surgeries (Baker et al., 2006).

Laryngotracheal Reconstruction

Laryngotracheal reconstruction (LTR) may be in one or two stages, and consists of an augmentation procedure that increases the subglottic and tracheal lumen diameter. This is achieved by creating a split in the anterior cricoid plate, posterior cricoid plate, or both, and grafting a cartilage section taken from another location into the surgically created split. Cartilage grafts may be created from rib or thyroid cartilages, among other possibilities (Willging & Cotton, 1995). Introduced by Fearon and Cotton in 1972, the procedure expands the stenotic airway segments with the placement of cartilage grafts, but it requires a tracheostomy tube and an intraluminal stent to maintain the patency of the larynx as it heals. Several complications are associated with the fundamentals of the procedure including granulation tissue or infection at the site of the stent, as well as the morbidity of tracheostomy tubes. Despite the fundamental risks, it has become a common surgical intervention technique for subglottal stenosis (Gustafsen et al., 1999).

Single stage laryngotracheal reconstruction. The single-stage LTR (SSLTR) is a single surgical procedure designed to require only one short period of intubation. This alleviates some of the risk associated with prolonged stenting and tracheostomy tube use. Due to the smaller amount of time given to the reconstructed larynx before it is required to sustain ventilation, respiratory distress is a possible outcome. In cases that result in respiratory distress, and once significant enough, reintubation or tracheostomy may be needed. Gustafsen et al. (1999) found that out of 200 SSLTR procedures performed at Cincinnati Children’s Hospital Medical Center, 29% required reintubation. However, long-term effects revealed that 96% of the children were successfully decannulated in a range from 2-33 months. Of the 200 subjects in the retrospective study, only 9 patients required additional operations to be decannulated, and one required 2 additional operations.
**Double-stage laryngotracheal reconstruction.** Double-stage laryngotracheal reconstruction is a laryngotracheal surgery that preceded the single-stage procedure. Single-stage procedures are regarded as being more conservative in terms of the damage that intubation and the surgical process may create. The double-stage procedure is simply the same process as the single-stage procedure, done in two parts. Grafting is used in the anterior, posterior or anterior and posterior portion of the larynx in order to expand the laryngotracheal lumen. During the procedure, a tracheostomy is placed, which remains in place until the patient is stabilized. A stent is also placed to ensure the increased lumen of the stenotic portion of the larynx. This procedure is still used, as it is beneficial for patients with compromised pulmonary reserve or a particular case of stenosis for which prolonged stenting is more appropriate (Lusk, Gray, & Muntz, 1991; Seid, Pransky, & Kearns, 1991). Double-stage procedures have been shown to cause more post-operative complications, which include the necessity for reintubation and tracheostomy (Argawal, Black, & Morrison, 2007).

**Cricotracheal Resection**

Laryngotracheal reconstruction for higher grade stenoses may require a resection procedure, such as the cricotracheal resection (CTR). This involves the removal of the anterior and lateral cricoid plates in order to remove the stenotic region. Reapproximation of the healthy trachea segment is achieved by suturing it to the inferior border of the thyroid cartilage (Rutter, Yellon, & Cotton, 2003).

Complications of a CTR could potentially be vocal fold paralysis due to recurrent laryngeal nerve damage, prolapse of the base of the epiglottis, and restenosis of the airway. Although these potential risks are experienced by some of the population, the primary function of such surgeries are to create a patent airway and successfully decannulate patients that previously required cannulation. Successful decannulation is reported to be achieved in 95% of children undergoing CTR, and in general, has been reported as high as 80-90% following laryngotracheal reconstruction (Rutter, Link, Hartley, & Cotton, 2001)

**Cricoid Split**

The cricoid split is a procedure that requires an incision through the anterior portion of the cricoid cartilage as well as one or two upper tracheal rings. The procedure
is intended to be an alternative to a tracheostomy, as it increases lumen of the airway without tracheotomy. Post-surgically, an endotracheal tube is kept in place for two weeks, essentially functioning as a stent until adequate healing has been reached to attempt extubation (Cotton, 1985). The candidates that Cotton (1985) described as being most appropriate for cricoid split are young infants with adequate pulmonary reserve and the potential for airway growth in the future. Since this delineation was made, Cotton, Myer, Bratcher, and Fitton (1998) stated that this procedure is not only limited to infants, but also appropriate for children with mild to moderate subglottic stenosis.

As with any surgical procedure, risks are associated with both augmentation and resection procedures. The cricoid split procedure poses particular risk to create direct vocal fold damage, arytenoid prolapse due to incisions in the interarytenoid muscle, and misapproximation of the vocal folds following surgery. Despite the successful decannulation and airway advances that these intricate surgeries are providing, post-surgical vocal quality is a concern for the majority of cases.

Vocal Issues Resulting from Laryngeal Reconstruction

Post-surgical voice quality following LTR procedures has been described by Zalzal et al. (1991). In this study, at least six months post-LTR, 16 children were evaluated. Fifty percent of parents reported that their child’s voice had improved from their pre-operative voice following surgery. Evaluation by a speech-language pathologist on voice parameters, such as pitch, breath control, intensity, resonance, speaking rate, and intelligibility, revealed that all but one child was rated as having an abnormal vocal quality. The most prevalent qualities observed included hoarseness accompanied by breathiness, low pitch, and restricted pitch range.

Smith, Marsh, Cotton, and Myer (1993) also examined vocal quality post-LTR. Perceptual evaluations, acoustic evaluations, and endoscopic analyses were performed. Results were consistent with those found by Zalzal and colleagues (1991), as perceptual characteristics of all children included hoarseness characterized by breathiness, low pitch, and a restricted pitch range. Children also had diminished maximum phonation time. Previous research by Bailey, Clary, Penguilly, and Albert (1995) and Zalzal et al., was supported by the stroboscopic findings of Smith et al. (1993). Findings included
supraglottic compression, lack of vertical level approximation of the vocal fold edges, anterior commissure changes, vocal fold immobility, and glottic incompetence after LTR.

Bailey et al. (1995) conducted a study of 108 consecutive laryngotracheal reconstructions performed on children over a 10-year period. Voice outcomes were measured at least 2 years following surgery. Of the 108 children in the study, 52% were deemed to have normal or near-normal voices by speech-language pathologists. In order to be included in this percentage, children had to have one or no aberrant features of vocal quality. However, among the aberrant features exhibited by children, the most common were harshness, whisper, continuity, and ventricular band voice.

**Vocal Quality Perception**

Vocal quality may have an impact on how individuals are perceived, or how they perceive themselves. Deary, Wilson, Carding, and Mackenzie (2003) examined the dysphonic voice and its correlation to self-reported and objective measures of personality, coping, and affect. Based on previous literature, which established a link between dysphonia and psychological affective disturbances and poorer quality of life, the study aimed to assess the relationship between subjective and objective measurements of voice quality and psychological factors (Deary et al., 1997; Scott, Deary, MacKenzie et al., 1997; White, Deary, & Wilson, 1997; Wilson, Deary, Millar, & MacKenzie, 2002; Wilson, Deary, & Scott, 1995). A randomized, controlled trial of 204 participants included self-rated, expert-rated, and objective measurements of participants’ voices, along with personality and coping measures (Deary et al., 2003). These measures were correlated to the experience of medically unexplained symptoms and dysphonia, taken from clinical measures of psychological distress, neurotic symptoms, quality of life, anxiety, and depression. Results revealed that self-rated and expert-rated assessments were significantly correlated. Both self-rated and expert-rated voice assessments were significantly correlated with age, as younger participants were found to rate their voice quality as being worse. Self-reports were shown to have significant relationship to psychological distress and quality of life measures. Therefore, the younger population’s increased negativity in self-reports, and its relationship to psychological distress and quality of life make this population of interest in terms of the reported quality of life of
adolescents. The current study assesses the quality of life, career, and social decisions made by adolescents following laryngeal reconstruction.

Deary and colleagues (2003) found that participant’s ratings of their voice quality were more severe than the experts rating them. This demonstrated a hyper-awareness of voice quality that could impact the social, career, and quality of life ratings of adolescents with dysphonia secondary to laryngeal reconstruction.

Individuals with voice disorders may face unnecessary judgment relating to listeners’ perceptions of their voices. In fact, as the disorder’s severity increases, so do the negative attributes that listeners use to describe an individual with voice disorders (Altenberg & Ferrand, 2006; Lass, Ruscello, Bradshaw, & Blankenship, 1991; Lass, Ruscello, Stoud, & Hoffmann, 1991; McKinnon, Hess, & Landry, 1986). The negative effect of voice disorders on listener’s perception is important due to its potential to negatively impact a speaker’s social standing, in some instances, inducing a stereotype that affects educational and vocational domains (Love, 1981). Subsequently, individuals with voice disorders have the potential to have a poorer quality of life than individuals without voice disorders.

*Quality of Life with Voice Disorders*

A wide range of negative effects can be observed in individuals with voice disorders, such as physical pain and detrimental social effects, which may possibly influence future plans and goals. One cause of such negative effects includes the responses of listeners. Some listener responses may be detrimental socially, as research reports teasing and annoyance (Smith et al., 1996). Speakers with voice disorders may feel anxiety and depression as a result of the reactions that they get from listeners (Cannito, Murry, & Woodson, 1994).

Physical problems may also be a source of quality of life differences in the population of individuals with voice disorders. In a study conducted by Scott, Robinson, Wilson, and Mackenzie (1997), 133 survey respondents with dysphonia reported 437 types of problems. Using the World Health Organization International Classification of Impairments, Disabilities, and Handicaps (1980), of the problems reported, 60% were classified as dysfunction at the organ level, indicating an impairment. Twenty-five percent of problems were reportedly affecting the performance or behavior of
participants, which was characterized as a disability. Fourteen percent of participants revealed that their dysphonia-related problems were handicapping, as evidenced by their disadvantages with respect to other’s opportunities, often manifested by reduced social contact. The majority of the problems reported included physical problems that affected communication. However, the handicaps expressed by respondents included emotional issues, employment difficulties, and negative effects on family and friends. Individuals with voice disorders also reported poorer general health than those without voice disorders (Wilson et al., 2002).

Socially and psychologically, individuals with voice disorders may be different than those without. The effects of voice disorders on the lives of adolescents in relation to social, career, and physical components has been overlooked in previous research. While general studies exist evidencing the negative effects of voice disorders on the quality of life of adults, none have targeted the post-laryngeal reconstruction voice in adolescents. However, in the general population, adolescent quality of life has been linked to individuals’ perceptions of physical health and age (Meuleners & Lee, 2003). An attitudinal study of children with dysphonia by Connor et al. (2006) revealed that adolescents found emotional and physical factors to be the biggest issues associated with dysphonia, causing anger, sadness, and frustration.

The possible impact of voice disorders in adolescents relative to those reported by adults, along with evidence that the adolescent group is distinct from other populations and under-reported, provides a considerable argument for the need to study the social and physical aspects of voice disorders in adolescents. In addition to these measures, the career choices and goals of adolescents are of interest in order to gain knowledge regarding the long-term effects that adolescents may face.

Currently, research specific to adolescent quality of life following laryngotracheal reconstruction does not exist. Adult quality of life measures do exist to determine the effect of voice disorders on various life functions. In a study by Jones, Carding, and Drinnan (2006), the Voice Symptom Scale (VoiSS), a self-report quality of life measure, was administered to adults with voice disorders. Completion of the VoiSS revealed a correlation between decreased quality of life and increased voice disorder severity, meaning quality of life was poorer with more severe dysphonia.
A dysphonic voice has an effect on quality of life, reported health function, and perceived voice-related quality of life scores. Adults with voice disorders report poorer health scores on the Medical Outcome Study Short Form 36-Item Health Survey (SF-36) in comparison to a control group of adults without voice disorders (Krischke et al., 2004). Although individuals with voice disorders have consistently reported poorer scores on other similar studies (Wilson, Deary, Millar, & Mackenzie, 2002), research suggests that there may be other individualized factors that influence reported scores on quality of life questionnaires. On the shorter, more specific Voice-Related Quality of Life measure (VRQOL), Rasch, Gunter, Hoppe, Eysholdt, and Rosanowski (2005) found that regardless of etiology, women reported poorer voice status than men, with more negative scores on social-emotional components. Individuals with dysphonia often report the avoidance of social situations that are challenging, indicating a change in behavior that may be uncharacteristic of the individual and may decrease social-emotional contentedness.

Individuals with dysphonia have poorer reported Health-Related Quality of Life scores (HRQOL) than normal peers, indicating a perceived handicap (Zraick et al., 2007). Significant communication partners, such as spouses, close friends, and family, have reported similar perceptions of voice handicap for their dysphonic partners, indicating that the disadvantages of dysphonia are evident to individuals close to dysphonic adults. According to Zraick and colleagues, regardless of the severity or etiology of a voice disorder, adults with dysphonia reported moderate perceived disability and significant others’ perceptions were in agreement.

Using the Voice Activity Participation Profile (VAPP; a questionnaire focused on self-perceived severity of a voice disorder, as well as social, emotional, communication, and job effects of the voice disorder), researchers correlated individuals’ perceptions of their voice problem with the impact of the voice disorder on their participation in daily activities (Ma & Yiu, 2001). There was no significant correlation between the severity of voice impairment and the impact of voice disorders, suggesting that the perception of impairment was more influential in daily life than the actual degree of physical impairment.

Career Development/Choices of Adolescents
Career development among adolescents is not a separate entity from career development in childhood or adulthood, but rather a life-span process encompassing childhood, adolescence, and adulthood continuing through post-retirement age. Contributing factors include personal and contextual variables (Hartung, Porfeli, & Vondracek, 2004). Of those contributing factors, predictors of career development are educational attainment and peer adjustment. Consequently, adolescents with poor educational attainment and peer adjustment have been found to be more likely to be unemployed long-term as adults (Wiesner, Vondracek, Capaldi, & Porfeli, 2003). In light of the aforementioned adolescent social stigmatization that often results from dysphonia, peer adjustment would likely be a factor in inhibiting career development.

Although general contributions to adolescent career goals and achievement have been studied, the literature lacks studies that relate career goals to the post-laryngeal reconstruction voice. As with several other aspects of the voice-related research, children and adults have been studied much more extensively than adolescents.

**Summary**

Voice disorders secondary to laryngotracheal reconstruction may affect adolescents beyond the perceptual characteristics typical of this population. Social, physical, and career development components are of interest, as the previous research lacks data in this subject area. The measurement of the impact of laryngotracheal reconstruction surgery has not been completed in adolescents, and is therefore not understood in the domains of social issues, physical issues, and career development. Such issues are important to understanding the impact of laryngotracheal reconstruction long-term, and implementing that knowledge to improve laryngotracheal reconstruction surgery in the future.

**Purpose**

The purpose of this study is to describe the effects of voice characteristics following airway reconstruction surgery upon physical/educational/social behaviors, as well as career decisions in adolescents. The IRB shall serve as approval to contact participants who have had airway reconstruction surgery in the past and collect data about their physical/educational/social concerns, and subsequent career decisions. The following will be described:
a) Physical/Educational Concerns: The relationship between airway reconstruction surgery, voice characteristics, and physical/educational concerns will be assessed with specific survey questions targeting the participants’ vocal health, physical experiences while talking, and physical impairments that may affect social interactions and career decisions. Educational limitations that may affect career decisions will also be addressed. This will identify co-occurring limitations that may influence quality of life.

b) Social Concerns: Participants will be asked to delineate their social concerns in relation to their voice. This will be beneficial in determining how adolescents view their voice characteristics post-surgery and whether participants have lasting dysphonia that affects socialization.

c) Career Decisions: It is unknown whether the implications of airway reconstruction surgery limit potential career decisions due to the changes in laryngeal anatomy, and therefore voice characteristics following surgery. Specific survey questions will target the career decisions made by participants and the role of the post-surgical voice in the determination of career choices.

Research Questions

The present study sought to answer the following questions:

1. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported being enrolled in speech therapy in comparison with control participants?

2. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported attending voice therapy in comparison with control participants?

3. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported experiencing pain while talking in comparison with control participants?

4. What was the percentage of adolescent participants, post-laryngeotracheal reconstruction who reported experiencing breathlessness while talking in comparison with control participants?
5. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported their voice remained strong throughout the day in comparison with control participants?

6. What was the percentage of adolescent participants, post-laryngeotracheal reconstruction, who reported being bothered by their voice in comparison with control participants?

7. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported drinking at least six glasses of water a day in comparison with control participants?

8. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported drinking alcohol in comparison with control participants?

9. What was the percentage of adolescent participants, post-laryngotraceal reconstruction who reported smoking in comparison with control participants?

10. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported engaging in yelling or screaming frequently in comparison with control participants?

11. What was the percentage of adolescent participants, post-laryngeotracheal reconstruction, who reported using voice amplification in comparison with control participants?

12. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported having physical limitations affecting their ability to walk in comparison with control participants?

13. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported having physical limitations affecting their hand movement in comparison with control participants?

14. What was the percentage of adolescent participants, post-laryngotraceal reconstruction, who reported having a visual impairment in comparison with control participants?
15. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported having any hearing in comparison with control participants?

16. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported current or past enrollment in individual assistance for reading in comparison with control participants?

17. What were the reported social activities of adolescents, post-laryngotracheal reconstruction, in comparison with control participants?

18. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that their voice affected the activities they participate in compared to control participants?

19. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported receiving comments about their voice in comparison with control participants?

20. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that their voice keeps them from doing things they would like in comparison with control participants?

21. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported being happy with their voice in comparison with control participants?

22. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that they think their voice will affect their career choices in comparison with control participants?

23. What were the reported career choices of adolescents, post-laryngotracheal reconstruction, in comparison with control participants?

24. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that there were career choices they would not consider due their voice, in comparison with control participants?

25. What were the career choices that adolescent participants, post-laryngotracheal reconstruction, would not consider due to their voice, in comparison with control participants?
26. What percentage of adolescent participants, post-laryngotracheal reconstruction, who would not consider doing a job that requires a lot of talking, in comparison with control participants?

27. How did adolescent participants, post-laryngotracheal reconstruction rate their voice in comparison with control participants?

**Research Hypotheses**

1. There will be significantly lower self-reported quality of life in the area of physical/educational concerns for experimental compared to control adolescents.

2. There will be significantly lower self-reported quality of life in the area of social concerns for experimental compared to control adolescents.

3. There will be significantly lower self-reported quality of life in the area of career decisions for experimental compared to control adolescents.

4. There will be significantly poorer self-reported overall voice rating for experimental compared to control adolescents.

**Null Hypotheses**

1. There will be no significant difference in self-reported quality of life in the area of physical/educational concerns for experimental compared to control adolescents.

2. There will be no significant difference in self-reported quality of life in the area of social concerns for experimental compared to control adolescents.

3. There will be no significant difference in self-reported quality of life in the area of career decisions for experimental compared to control adolescents.

4. There will be no significant difference in self-reported overall voice rating for experimental compared to control adolescents.
CHAPTER II
Methods

Participants

Sixteen adolescents (ages 14-18 years) who had previously undergone airway reconstruction surgery at Cincinnati Children’s Hospital Medical Center (CCHMC) were participants for the study. An additional 16 adolescent participants with normal voice quality and no history of airway reconstruction surgery were recruited to serve as the control group.

Experimental Group Inclusion Criteria

In order to be included in the experimental group, a history of airway reconstruction surgery was necessary. Candidates were required to be a minimum of 1 year post-surgery with a history of a voice disorder resulting from the airway reconstruction surgery. Participants needed parent/guardian permission-to-contact and personal assent to participate in the survey in order to be included. Also necessary for the telephone survey, were an ability to be accessible for telephone contact, adequate speech intelligibility for telephone conversation, and the ability to comprehend and answer the questions from the survey protocol.

Experimental Group Exclusion Criteria

Participants were excluded from the study if they were unable to verbally communicate or had a post-surgery period of less than one year.

Control Group Inclusion Criteria

To be included in the control group, participants were required to have parent/guardian permission to contact as well as participant assent. Accessibility for telephone contact, adequate speech intelligibility for telephone conversation, and the ability to comprehend and answer questions in the survey protocol were necessary to be part of the control population.

Control Group Exclusion Criteria

Control group members were excluded from the study if they had a history of airway reconstruction surgery or a history of a voice disorder.

Procedures

Experimental Group
The present study included a telephone survey (Appendix A; B) conducted with both experimental and control populations. Sixteen adolescents, ages 14 -18 years, were recruited from the CCHMC otolaryngology airway reconstruction surgery database, using a procedure for random selection. Participants were selected from a field of 200. Of the 200 eligible participants, 89 medical charts were reviewed for contact information, with attempted contact. Of those reviewed, due to variables such as medical history and an inability to contact participants, among others, only 16 adolescents were able to participate in the study. Contact with parents/guardians was established by telephone and a description of the study was given, as scripted (Appendix A). The investigators asked for parental permission to contact the adolescent, which was confirmed verbally. Adolescents were then contacted and asked to give assent to participate in a short survey (Appendix A). Participants were asked a series of questions about school, personal perceptions of voice, physical effects of airway reconstruction surgery on the voice, and career decisions. The participants were asked to report any physical limitations or learning limitations that could affect the responses given to some survey questions, such as limited mobility that could influence career goals.

Control Group

The control group consisted of 16 adolescents, ages 14 -18 years, recruited from Talawanda High School in Oxford, OH. A form was sent home with students in order to gain parental permission to contact (Appendix C). By returning the signed form, parents gave permission to call their child. Eligible participants were matched, from a pool of 48, with the randomly selected experimental group participants by gender and grade level to the exact year. After phone contact was established, the adolescents were asked to assent to participate (Appendix B). The investigators then asked a series of questions about school, personal perceptions of voice, physical aspects of voice, and career decisions. The participants were asked to report any physical or learning limitations that may affect the responses given to some survey questions, such as limited mobility that could influence career goals.

Survey Questions

The survey design for this study was developed based on other similar studies, although the literature currently lacks a study that specifically aims to determine the
physical/education, social, and career factors affected by voice disorders following laryngotraheal reconstruction. The questions included in the survey were modeled after previously administered quality of life measures in similar studies, including: the HRQOL (Zraick et al., 2007), the VAPP (Ma & Yiu, 2001), the VRQOL (Rasch, Gunter, Hoppe, Eysholdt & Rosanowski, 2005), the SF-36 (Krischke et al., 2004; Wilson, Deary, Millar & Mackenzie, 2002), and the VoiSS (Jones, Carding & Drinnan, 2006).

Educational questions were included in the survey for control-matching purposes. Responses to questions could also provide insight into the educational background of participants, as it might pertain to career decision-making. Questions addressing physical mobility were included to determine the presence of any factors that might influence career choice, such as a physical inability to write or limited movement. Questions designed to determine the affect of dysphonia on physical voicing capability were included to describe the participants’ vocal challenges.

Items pertaining to career decisions targeted the participants’ perception of voice quality and its effect on occupational choices. This was included to determine whether patterns in occupational interest or disinterest existed across individuals with a history of laryngotraheal reconstruction, due to undergoing the surgery. Survey questions designed for social function were included to gauge the participants’ interest in activities and reported social difficulties.

Analysis of Data

The experimental and control participants’ survey responses were recorded and data was analyzed using descriptive and inferential analyses. Inferential data was obtained by coding the survey quantitative responses as positive or negative and totaling the negative responses for comparisons of differences between experimental and control groups in subcategories of physical/educational concerns, social concerns, and career decisions (Appendices D, E, F). The inferential data analysis was performed using a two-sample t-test.
CHAPTER III

Results

Descriptive Statistics

From the surveys completed, descriptive data was analyzed in order to address the research questions. Sixteen experimental participants completed the protocol, as well as 16 control participants. Both qualitative and quantitative information was gathered. Participants were in high school, and the control group was gender- and grade-matched to the experimental group. Both groups consisted of 10 males and 6 females, in 9th through 12th grade in high school. The experimental and control groups consisted of one 9th grader, three 10th graders, eleven 11th graders, and one 12th grader. The mean age of the experimental group was 16.3 years (SD=1.043), with a range of 14 to 18 years; while the mean age of the control group was 16.1 years (SD=1.047), with a range of 14 to 18.

Experimental participants had a variety of surgical procedures performed, and in addition to the length of time since the most recent surgery, investigators asked the participants to specify what type of surgery was the most recent performed. Experimental participants had a time lapse since surgery of 1.5 to 15.5 years (M=7.71; SD=5.53). In the event that the participant was unable to remember or was unclear as to the type of surgery the investigator was referring to, the investigator used the participants’ medical chart in order to gather the information accurately. The most recent surgeries undergone by the experimental participants, included laryngotracheoplasty with posterior costal cartilage graft (LTPPCCG), laryngotracheoplasty with anterior costal cartilage graft (LTPACCG), laryngotracheoplasty with anterior-posterior costal cartilage graft (LTPAPCCG), cricotracheal resection (CTR), unspecified laryngotracheal reconstruction (LTR), CO2 procedures, and keel and stent placement. The distribution of experimental participants for these procedures is presented in Figure 1.
Figure 1: The most recent surgeries undergone by the experimental participants.

Survey Results by Research Question

Physical/Educational Concerns

One of the primary purposes of this study was to determine the social and career implications of having laryngeal reconstructive surgery. All participants within the experimental group had to first indicate that they had a voice problem following surgery before completing the survey. Survey questions then aimed to determine the social and career ramifications of the voice disorders following laryngeal reconstructive surgeries.

Research question 1. What was the percentage of adolescent participants, post-laryngotraheal reconstruction, who reported being enrolled in speech therapy in comparison with control participants? Of the 16 participants in the experimental group, 12 (75%) indicated that they had been enrolled in speech therapy before, while only 1 participant (.06%) in the control group had been in speech therapy for 5 years. The experimental participants, who had received speech therapy, ranged in duration from 3 months to 5 years (M=1.86 years.)

Research question 2. What was the percentage of adolescent participants, post-laryngotraheal reconstruction, who reported attending voice therapy in comparison
with control participants? Ten of the experimental participants (62%) reported attending therapy specifically for their voice, with none of the controls attending therapy specific to their voice.

All adolescent participants were contacted by the same investigator. Perceptual quality of voice was not assessed in the survey; however, if any particular quality, noticeable to investigator, was determined to be relevant, a note was made of it. Within the experimental group, two participants had a vocal quality that the investigator differentiated as being severely hoarse and breathy, and one other participant in the experimental group indicated that he/she was using an electrolarynx. Aside from these three participants, the remaining 13 participants (81%) were not perceptually different than normal speakers, as assessed by the investigator. Physical concerns were addressed with survey questions targeting pain, breathlessness, and a decreasing vocal strength throughout the day, some of the physical indicators that a person may feel are due to laryngeal reconstruction.

**Research question 3.** What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported experiencing pain while talking in comparison with control participants? Pain was only reported by one experimental participant (.06%) in comparison to being reported by no control participants.

**Research question 4.** What was the percentage of adolescent participants, post-laryngotracheal reconstruction who reported experiencing breathlessness while talking in comparison with control participants? Breathlessness was reported by 4 of the experimental group (25%) and only 1 of the control participants (.06%).

**Research question 5.** What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported their voice remained strong throughout the day in comparison with control participants? After being asked whether their voice remained strong throughout the day, all 16 (100%) control participants reported that their voices remained strong throughout the day. Thirteen (81%) of the experimental participants said that their voices remained strong throughout the day.

**Research question 6.** What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported being bothered by their voice in comparison with control participants? When asked whether or not they were bothered
by their voice, two experimental participants (12%) indicated that they were, while none of the control participants were bothered by their voice.

What bothers you most about your voice? Both experimental participants indicated that others’ comments were most bothersome. One participant indicated that he/she didn’t like getting laughed at, while the other, being a female, indicated that people often tell her she sounds like a man.

Research question 7. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported drinking at least six glasses of water a day in comparison with control participants? Some of the factors that may affect survey responses were identified as being vocal hygiene, as well as any physical limitations that would possibly impact career choices, and/or vocal quality. The vocal hygiene questions were answered similarly by participants in the experimental and control groups. Six of experimental participants (37%) indicated that they drink six glasses of water per day, while 5 of control participants (31%) said that they do. Alcohol use, smoking and yelling frequently were all addressed in the survey.

Research question 8. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported drinking alcohol in comparison with control participants? Within the experimental group, none of the participants indicated that they used alcohol, while two (12%) control participants indicated alcohol use.

Research question 9. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported smoking in comparison with control participants? None of the experimental or control participants reported smoking.

Research question 10. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported engaging in yelling or screaming frequently in comparison with control participants? Four experimental participants (25%) identified themselves as using frequent yelling or screaming vocal abuse behaviors, while only two of the control participants (12%) answered the same way. Other factors that the investigators addressed due to their possible impact on career decisions, were the use of voice amplification, as well as physical impairments that affected the ability to walk or hand movement.
Research question 11. What was the percentage of adolescent participants, post-laryngeotracheal reconstruction, who reported using voice amplification in comparison with control participants? The experimental group consisted of two participants (12%) that said that they used voice amplification, while none of the control group did.

Research question 12. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported having physical limitations affecting their ability to walk in comparison with control participants? None of the participants in either group had physical limitations which affected their ability to walk.

Research question 13. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported having physical limitations affecting their hand movement in comparison with control participants? Hand movement was indicated as being impaired in 1 experimental (.06%) and 1 control participant (.06%). The control participant indicated a medical history of arthritis and the experimental participant described the impairment as an inability to grasp objects tightly in one hand.

Research question 14. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported having a visual impairment in comparison with control participants? Seven experimental participants (43%) were visually impaired, with all indicating being corrected with glasses. Only 2 of the controls (12%) designated themselves as having visual impairments, which were also corrected with glasses.

Research question 15. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported having any hearing in comparison with control participants? One experimental participant (.06%) and none of the controls had a hearing impairment. The experimental participant indicated unilateral deafness.

Research question 16. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported current or past enrollment in individual assistance for reading in comparison with control participants? This specific question within the survey was directed towards identifying educational issues that may be associated with career decisions. Four of the experimental group (25%) had received individual assistance, while none of the control participants had.
Physical/education concerns overall response score. Survey questions 2 through 20 (excluding questions 4, 5, and 12) were used to determine an overall response score for physical/educational concerns. Each response in this subcategory was coded in order for the investigator to determine negative responses in the category. A negative response was coded as a 1 and a positive response was coded as a 0. Therefore, the higher the total number of each subcategory, the more negative the response was. This procedure was used for the social concerns subcategory, as well as the career decisions subcategory. The coding system for physical/educational concern questions can be found in Appendix D.

The maximum number of negative responses in the physical/educational concern subcategory was 16. Experimental participants had physical/educational concern overall responses that ranged from 0 to 8. Control participants had overall physical educational concern responses that ranged from 0 to 3. Table 1 represents the physical/educational concerns overall response score means by group.

Table 1
Physical/Educational Concerns Overall Response Score Means by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.25</td>
<td>1.92</td>
</tr>
<tr>
<td>Experimental</td>
<td>3.63</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Social Concerns

Research question 17. What were the reported social activities of adolescents, post-laryngotracheal reconstruction, in comparison with control participants? This question was asked to determine whether the types of activities differed from control to experimental group, indicating a possible link to laryngotracheal surgery. Four of the experimental group (25%) described “hanging out with friends” as being their only social activity. Five of the experimental group (41%) indicated involvement in sports activities at school. Four (25%) said that they didn’t participate in many activities, didn’t have many friends, or that they didn’t interact with others most of the time. Two participants (12%) identified themselves as being school leaders, with responsibilities that included
speaking in front of large groups, and/or leading a singing worship team at church. One participant said that his/her previous athletic activities had to be stopped due to exercise-induced asthma, which wasn’t a problem until after surgery. The participant felt very strongly that surgery was the reason the previous athletic activities could not be pursued.

In comparison to the control group, activities were less strenuous in the experimental group. Fourteen of the control participants (87%) were involved in sports at school. One participant in the control group indicated that he/she was primarily involved in clubs and 1 participant indicated that he/she liked to “hang out with friends”.

Research question 18. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that their voice affected the activities they participate in compared to control participants? Three of the experimental group participants (18%) said that their voices affected the activities they participated in and none of the control participants reported any affect.

Research question 19. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported receiving comments about their voice in comparison with control participants? Eight of the experimental participants (50%) indicated that they receive comments about their voice; while one of the control participants indicated that people comment about his/her voice. Participants from experimental and control groups that responded positively to this question elaborated on their answers without prompting. The experimental participants indicated that people comment about their voice negatively, while the control participant that said that he/she receives compliments about his/her voice, which leads the investigators to believe that this was simply a difference in interpretation of the question.

Research question 20. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that their voice keeps them from doing things they would like in comparison with control participants? None of the control participants said that their voice keeps them from doing things that they would like to do; whereas, 5 of the experimental group (31%) responded positively that they indeed were kept from doing things that they would like to do by their voice.

Research question 21. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported being happy with their voice in
comparison with control participants? Questions concerning overall happiness with their voice were asked of the participants to determine their satisfaction with their voice. The experimental group had 14 participants (87%) indicating that they were happy with their voice, while 100% of the control participants were happy with their voice.

Social concerns overall response score. The social concerns subcategory was coded in the same manner that the physical/education concerns subcategory was, consisting of questions 21 through 25 (excluding question 21). The negative responses were coded and totaled to represent the overall negative response for the category. The higher the total, the more negative the response, with a maximum negative response being 4. The experimental participants had social concern overall responses that ranged from 0 to 3. Control participants’ scores were less negative, ranging from 0 to 1. Coding of the social concerns subcategory for response score determination can be found in Appendix E. Table 2 represents the social concerns response score means by group.

Table 2
Social Concerns Response Score Means by Group

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.06</td>
<td>0.25</td>
</tr>
<tr>
<td>Experimental</td>
<td>1.12</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Career Decisions

Research question 22. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that they think their voice will affect their career choices in comparison with control participants? When asked whether they believed that their voices would affect their career decisions, 3 of the experimental group (18%) said that it would and 2 of the control group (12%) said that it would.

Research question 23. What were the reported career choices of adolescents, post-laryngotracheal reconstruction, in comparison with control participants? Participants were asked to indicate which careers they would like to pursue. Careers of experimental participants included engineering, veterinary medicine, veterinary assistant, law enforcement, graphic designer, computer programming, architecture, secondary education, receptionist, work with computers, writing, and several indicated that they
were undecided. Career choices for the control group included law, nursing, becoming a college student, joining the navy, physical therapy, undecided, politics, teaching, radiology, radiology, advertising, and four participants indicated that they wanted to be in the education field.

Research question 24. What was the percentage of adolescent participants, post-laryngotracheal reconstruction, who reported that there were career choices they would not consider due to their voice, in comparison with control participants?

Participants were asked if there were career choices that they would not consider due to their voices. Seven experimental participants (43%) said that there were jobs that they would not consider, whereas one control participant (.06%) indicated that he/she would not consider some jobs due to his/her voice.

Research question 25. What were the career choices that adolescent participants, post-laryngotracheal reconstruction, would not consider due to their voice, in comparison with control participants? The experimental participants indicated that they would not consider careers, such as singing, construction, professional coaching, meteorology, or trial lawyer. The control participant would not consider a singing career.

Research question 26. What percentage of adolescent participants, post-laryngotracheal reconstruction, who would not consider doing a job that requires a lot of talking, in comparison with control participants? When asked whether or not they would consider a job that requires a lot of talking, 12 of the experimental group (75%) and 14 of the control group (87%) said that they would.

Career decisions overall response score. Questions 26-30 addressed career decisions. Of these questions, 26, 28, and 30 were used to determine the overall response negativity of the participants using the aforementioned coding system for overall response scores. The maximum negative response was 3. Experimental participants had negative responses ranging from 0 to 3, while control participants had less negative responses, which ranged from 0 to 2. Coding of the career decisions questions for the determination of response scores can be found in Appendix F. Table 3 represents the overall response score mean for career decisions by group.
Research question 27. *How did adolescent participants, post-laryngotracheal reconstruction rate their voice in comparison with control participants?* An overall rating of voice was elicited through a likert scale. Participants were asked to identify their overall feeling about their voice, on a scale of one to five. Five was indicated as being excellent, and one was indicated as being poor. Therefore, the lower the value, the more negative it was. Control participants rated their voices as being higher than the experimental group, with mean ratings of 4.25 (SD=.68) and 3.63 (SD=.93) respectively. Indeed, 15 of the 16 control participants rated their voice as 4 (n=9) or 5 (n=6); while 7 of the 16 experimental participants rated their voice as 4 (n=3) or 5 (n=4). The experimental group’s ratings of their voices ranged from 2-5, while the control group rated their voices within a range from 3-5. It is important to note that a 2 was designated as the overall voice rating by only one experimental participant. Of the participants, this particular participant’s voice was relatively severe, requiring an electrolarynx to speak. Although the overall voice rating was a 2 for this individual, other survey questions were answered somewhat contradictorily. For example, the same individual said that his/her voice did not bother him/her or affect the activities he/she participated in, while also responding that his/her voice would affect their career choices.

**Inferential Statistics**

Inferential statistics were performed on the data in order to determine differences between the control and experimental participants’ overall response data for the subcategories of physical/educational concerns (PEC), social concerns (SC), and career decisions (CD), as well as overall voice rating (OVR) of participants. A two-sample t-test was used for the inferential analysis. Table 4 represents the results of the two-sample t-test data analysis in regards to PEC, SC, CD, and OVR.
Table 4

Two-Sample *T*-test of Experimental and Control Data

<table>
<thead>
<tr>
<th>Areas of Interest</th>
<th>t-value</th>
<th>p-value</th>
<th>df</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEC</td>
<td>-4.56</td>
<td>0.00</td>
<td>21</td>
</tr>
<tr>
<td>SC</td>
<td>-3.81</td>
<td>0.002</td>
<td>16</td>
</tr>
<tr>
<td>CD</td>
<td>-1.75</td>
<td>0.092</td>
<td>25</td>
</tr>
<tr>
<td>OVR</td>
<td>2.45</td>
<td>0.021</td>
<td>28</td>
</tr>
</tbody>
</table>

The results of the analysis indicated that experimental group means were significantly higher than control group means for physical/educational concerns (p= 0.00) and social concerns (p= 0.002). The mean response to CD was marginally higher in the experimental group compared to the control group (p= 0.092). The mean response to overall voice rating was significantly lower in the experimental group (p=0.021).
CHAPTER IV
Discussion

Interpretation of Results

Physical/Educational Concerns

Research hypothesis 1. There will be significantly lower self-reported quality of life in the area of physical/educational concerns for experimental compared to control adolescents. The experimental group reported significantly more negative scores in physical/educational concern questions than the control group. Therefore, the more negative results are indicative of lower self-reported quality of life in regards to physical/educational concerns for experimental participants with control participants.

Experimental participants reported higher percentages of the following than the control group: pain while talking, breathlessness while talking, a history of speech therapy, a history of voice therapy, being bothered by their voice, drinking six glasses of water or more a day, using voice amplification, having visual impairment, having a hearing impairment, and engaging in frequent screaming or yelling, and having had individual assistance at school. A higher percentage of control participants reported the following: a voice that remains strong throughout the day and alcohol use. The groups demonstrated an equal percentage of participants that reported physical limitations that affect hand movement, as well as a history of smoking (0% of both groups). The results indicate that the experimental group reported using more vocal hygiene practices than the control group. However, the experimental group surprisingly reported more frequent yelling or screaming behaviors than the control group. Therefore, null hypothesis 1 was rejected, as a significantly lower self-reported quality of life in the area of physical/educational concerns for experimental to control adolescents was revealed. This supports the previous research demonstrating that individuals with dysphonia report poorer health than individuals without dysphonia (Krischke et al., 2004). The physical limitations and concerns of experimental participants are similar to the Zraick and colleagues’ (2007) findings that individuals with dysphonia reported poorer HRQOL (Health-Related Quality of Life), suggesting a perceived handicap in comparison with individuals without dysphonia.

Social Concerns
Research hypothesis 2. There will be significantly lower self-reported quality of life in the area of social concerns for experimental compared to control adolescents. The experimental group means were significantly higher than control group means for the social concern subcategory of questions. This is indicative of a significantly lower self-reported quality of life in the area of social concerns for experimental participants in comparison with control participants.

A higher percentage of experimental participants reported the following social concerns: their voice affects the activities they participate in, people comment about their voice, and their voice keeps them from doing things that they would like. There was a higher percentage of control participants that reported being happy with their voice in comparison to the experimental group. Results indicated that individuals post-laryngeotracheal reconstruction have greater social concerns about their voice. Therefore, null hypothesis 2 was rejected, as there was a significantly lower self-reported quality of life in the area of social concerns for experimental compared to control adolescents.

Career Decisions

Research hypothesis 3. There will be significantly lower self-reported quality of life in the area of career decisions for experimental compared to control adolescents. The analysis of career decision questions revealed that differences in self-reported quality of life in this area were not significant. Although the experimental group overall response to these questions, was marginally higher and thus more negative, the results indicated that individual’s post-laryngeotracheal reconstruction did not have significantly different career decisions than the controls.

Within the career decision questions, a higher percentage of experimental participants reported that they believed their voice would affect their career choices. A higher percentage of experimental participants also reported that there were career choices they would not consider due to their voice. Control participants reported that they would consider doing a job with a lot of talking in higher percentages than the experimental participants. Null hypothesis 3 failed to be rejected, as there was no significant difference in the career decisions of experimental compared to control adolescents.

Overall Voice Rating
Research hypothesis 4. There will be significantly poorer self-reported overall voice rating for experimental compared to control adolescents. Survey question #31 required participants to rate their voice from 1 to 5, with 1 representing “poor” and 5 representing “excellent”. The mean for the experimental group was significantly lower than the control group, indicating a difference in the way that individuals with a history of laryngotracheal reconstruction perceive their voice in comparison with control peers. Null hypothesis 4 was rejected, as there was a significantly poorer self-reported overall voice rating for experimental compared to control adolescents.

Factors Influencing Collection of Data for Experimental Participants

The present study intended to determine the effect of voice disorders secondary to laryngotracheal reconstruction on the career and social decisions of adolescents. Several variables impeded the collection of data through phone survey including factors specifically related to contacting people on the telephone and the exclusion criteria previously stated. Of the 200 potential experimental participants provided in the CCHMC otolaryngology database, 89 medical charts were reviewed with attempted contact yielding 16 participants.

After random selection of potential experimental participants from the database, participants’ information was reviewed in the individuals’ medical chart. In terms of the unique challenges presented to the investigators by the experimental group, medical history, inability to contact, and unwillingness to participate were some of the main variables that presented a challenge to data collection for 73 of the 89 potential participants.

Medical History

Cognition. Of the 89 individuals whose medical charts were reviewed with attempted contact, 41 were determined to be inappropriate due to cognitive or communication delays.

Recent procedures. Some potential participants had laryngotracheal reconstruction that did not meet the minimum set as inclusion criteria. From the medical charts reviewed, 5 had surgical procedures within the past 12 months.

Inability to Contact
Incorrect contact information. Some participants had outdated information in their medical charts, while others had contact information that was a disconnected phone number or belonged to another individual. Of those that the investigator could not contact, 6 participants had incorrect phone numbers in their medical charts. In addition 18 potential participants were unable to be contacted due to no answer.

Foreign residence. As an internationally-recognized hospital, Cincinnati Children’s Hospital Medical Center and its Otolaryngology department receive patients from all over the world. Of the potential participants, 2 were not contacted for reasons associated with location and language barriers.

Unwillingness to Participate

Of the contacted participants, 1 refused to participate. The parent reported that the child was not ready for this type of survey, and refused to allow the child to participate.

Factors Influencing Collection of Data for Control Participants

The collection of data for 16 control participants presented its own challenges. After being given a permission slip to have signed from their parents, adolescents from Talawanda High School, were then matched to the experimental population from a pool of 48 potential control participants. Matching by grade, gender, and age as well as an inability to contact were issues that affected data collection.

Matching

Matching with the experimental population was made more difficult due to the fact that several of the experimental participants were found to be in a grade that would not typically be expected for their age. For this reason, the decision was made to match by grade and gender rather than grade, gender, and age.

Inability to Contact

As in the case of the experimental group, both parental contact and adolescent contact was needed. It was found that adolescents were difficult to reach by telephone due to their busy schedules.

Conclusions

The results of the present study suggest that experimental participants had more negative physical/educational effects, as well as social concerns than control participants.
Career decisions were not significantly different between the experimental and control participants, indicating that the participants who had undergone laryngotracheal reconstruction were not affected in the areas related to what they would like to do, as well as their perception of their voice’s impact on career decisions. This could be due to the fact that, as teenagers, they had not yet formulated thoughts about career options or did not perceive that their voice would impact their ability to perform specific career choices.

Limitations

The results of this study provide new insight into the long term affects of laryngeal reconstructive surgery. This type of information is unlike any other current data, which is lacking in regards to social and career implications of voice disorders following laryngeal reconstruction. This research data is a relevant contribution to voice research, even though there is a lack of research to compare these results with.

The current study consisted of 32 total survey respondents. The 16-subject control and experimental groups were relatively small. However, this study may serve as a pilot study for future research.

Implications for Future Research

With the addition of more participants, the present study will be stronger. The factors affecting data collection could facilitate future research. Modifications to the survey may increase the accuracy of results. Specifically, two survey questions were too broad, resulting in responses that potentially did not measure the desired information. Survey question #18 (Do you have any visual impairment?) was included to identify a visual impairment that would influence the participant’s career decisions. However, participants who had corrected vision answered “yes” to this question and required further probing to determine that there was no visual impairment that would impact their career decisions. Also, survey question #23 (Do people comment about your voice?) was interpreted by experimental participants as “negative comments” when responding “yes”, while control participants responded “yes” when receiving compliments about their voice.

Expanding the number of participants in this study will give professionals in speech pathology and otolaryngology a clearer idea of the long-term negative effects of
laryngeal reconstruction, possibly impacting the manner and/or frequency with which these surgeries are performed.
References


Appendix A

Telephone Survey for Experimental Adolescent

(This is to be read to parents first for consent, and then to adolescents for assent.)

Consent/Assent Script Following Laryngeal Reconstructive Surgery:
Hello. This is ____________ from Cincinnati Children’s Hospital Pediatric Voice Clinic. We have record that your child (you) had laryngeal reconstructive surgery at the hospital. We are calling to ask for your permission to ask your child (you) a few questions over the phone for research. The research is about the social and career choices patients make after having voice problems following surgery. Has your child (you) experienced a voice problem, for example hoarseness or a voice that’s too quiet? (If subject answers yes, continue script). We want to know if voice problems still affect what your child (you) does. This will help us to find out about some of the long-term effects of airway reconstruction. The survey should only take about 10 minutes and it is voluntary, meaning your child (you) can choose to discontinue at any time. Any information gathered from the survey will be kept confidential and will not be linked to your child’s (your) name in publications. Will you allow your child to take part? (Will you take part?) If you have any questions about the research, you can contact Ravindhra Elluru, MD at 513-636-4356 or Barbara Weinrich, Ph.D., at 513-636-6281.

<table>
<thead>
<tr>
<th>Demographic Information</th>
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</thead>
<tbody>
<tr>
<td>Participant Number:</td>
<td>Time Since Surgery:</td>
</tr>
<tr>
<td>Type of Surgery:</td>
<td>Dates:</td>
</tr>
</tbody>
</table>

1. What grade are you in? 9 10 11 12

Physical/Educational Concerns

2. Have you ever been enrolled in speech therapy? Yes No

3. Have you ever attended therapy for your voice? Yes No

4. If so, when did you begin and end therapy? Length in months:

5. Where did you attend therapy?

6. Do you experience pain while talking? Yes No
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Yes</th>
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<tbody>
<tr>
<td>7</td>
<td>Do you experience breathlessness while talking?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Does your voice remain strong throughout the day?</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Are you bothered by your voice?</td>
<td></td>
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<tr>
<td>10</td>
<td>If so, what bothers you most about your voice?</td>
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<tr>
<td>11</td>
<td>Do you drink at least six glasses of water a day?</td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>Do you drink alcohol?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Do you smoke?</td>
<td></td>
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<tr>
<td>14</td>
<td>Do you engage in yelling or screaming frequently?</td>
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<tr>
<td>15</td>
<td>Do you use voice amplification?</td>
<td></td>
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<tr>
<td>16</td>
<td>Do you have any physical limitations that affect your ability to walk?</td>
<td></td>
<td></td>
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<tr>
<td>17</td>
<td>Do you have any physical limitations that affect your hand movement?</td>
<td></td>
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<tr>
<td>18</td>
<td>Do you have any visual impairment?</td>
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<td>Do you have any hearing impairment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Are you currently enrolled, or in the past have you been enrolled, in individual assistance for reading?</td>
<td></td>
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</table>

**Social Concerns**

<p>| 21 | What social activities do you participate in?                           |     |     |</p>
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<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>22.</td>
<td>Does your voice affect the activities you participate in?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Do people comment about your voice?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Does your voice keep you from doing things you’d like?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Are you happy with your voice?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Career Decisions</strong></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>26.</td>
<td>Do you think your voice will affect your career choices?</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
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<tr>
<td>27.</td>
<td>What are your career choices?</td>
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</tr>
<tr>
<td>28.</td>
<td>Are there career choices you would not consider due to your voice?</td>
<td>Yes</td>
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</tr>
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<td>29.</td>
<td>If so, name them.</td>
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<td></td>
<td></td>
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<td>30.</td>
<td>Would you consider doing a job that requires a lot of talking?</td>
<td>Yes</td>
<td>No</td>
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</tr>
<tr>
<td><strong>Overall Voice Rating</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>31.</td>
<td>On a scale of 1 to 5, how would you rate your voice? (1-being poor and 5-being excellent)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
Appendix B

Telephone Survey for Control Adolescent

*(For adolescents whose parents have completed and returned a parental permission to contact form)*

Consent/Assent Script for Control Group (Normal Voice Quality):
Hello. This is ____________ from Cincinnati Children’s Hospital Pediatric Voice Clinic. We’ve contacted you because you returned a permission form to your child’s school saying we could call. We are calling to ask for your permission to ask your child a few questions over the phone for research. (If verbal parental permission is given, continue script with child.) The research is about the social concerns and career choices patients make after having voice problems following surgery. Have you experienced a voice problem? (If subject answers yes, discontinue script). This survey will help us to find out about some of the long-term effects of airway reconstruction in comparison to individuals who have not undergone this type of surgery. The survey should only take about 10 minutes of your time and it is voluntary, meaning you can choose to discontinue at any time. Any information gathered from the survey will be kept confidential and will not be linked to your name in publications. Will you take part? If you have any questions about the research, you can contact Ravindhra Elluru, MD at 513-636-4356, Barbara Weinrich, Ph.D., at 513-529-2548, or the Miami University IRB (OARS, 513-529-3600).

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<th>Demographic Information</th>
<th>Time Since Surgery:</th>
<th>Age:</th>
<th>Gender:</th>
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<tr>
<td>Participant Number:</td>
<td>NA</td>
<td>M</td>
<td>F</td>
</tr>
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<td>NA</td>
<td>Dates: NA</td>
<td></td>
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</tbody>
</table>

1. What grade are you in?  

<table>
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<tr>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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Physical/Educational Concerns

2. Have you ever been enrolled in speech therapy?  

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4. If so, when did you begin and end therapy?  

   Length in months:

5. Where did you attend therapy?

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**Social Concerns**

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Appendix C

Permission to Contact-Control Adolescent

Researchers from Cincinnati Children’s Medical Center Pediatric Voice Clinic seek permission to contact your child via telephone to complete a short survey. The survey is part of a research project studying the effects of a voice disorder following airway reconstruction surgery on adolescents’ social concerns and career choices. We would like to compare survey results in adolescents with voice disorders to those without voice disorders. The adolescents without voice disorders or a history of airway reconstructive surgery will be asked the same questions as their voice-disordered peers. There is a minimal risk of discomfort associated with participation in this study, and your child may end the interview at any time. This research will help us understand the way airway reconstructive surgery and associated voice disorders affect adolescents and will benefit future surgical candidates. The survey will take approximately 10 minutes to complete by telephone. You and your child are free to consent or refuse participation in this study. Any personal information obtained in this study will be kept confidential and will not be used in publications. The data will be coded so that the identifying information will be kept confidential.

By signing this document and providing a telephone number, you are giving permission for the research team to contact your child via telephone. Please return this form to the school with your child. If you have any questions about the research, you can contact Ravindhra Elluru, MD, at 513-636-4356 or Barbara Weinrich, Ph.D., at 513-529-2548. You may also contact the Miami University IRB (OARS, 513-529-3600) for information about participants’ rights.

______________________________  ___________________________
Print Name                      Age

______________________________  ___________________________
Signature of Parent/ Guardian   Gender

______________________________  ___________________________
Home Phone Number               Grade
Appendix D

*Coding For Physical/Educational Concerns Overall Response Score*

<table>
<thead>
<tr>
<th>Survey Question #</th>
<th>Positive Response</th>
<th>Negative Response</th>
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</tr>
<tr>
<td>3</td>
<td>No</td>
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<td>4</td>
<td>Not Coded-Qualitative Data</td>
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</tr>
<tr>
<td>5</td>
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<tr>
<td>6</td>
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</tr>
<tr>
<td>7</td>
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</tr>
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<td>20</td>
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Note. Negative response=1; positive response=0.
### Appendix E

**Coding For Social Concerns Overall Response Score**

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Positive Response</th>
<th>Negative Response</th>
</tr>
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<tr>
<td>25</td>
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</table>

Note. Negative response=1; positive response=0.
### Coding For Career Decisions Overall Response Score

<table>
<thead>
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<th>Survey Question</th>
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<th>Negative Response</th>
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<tbody>
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<td>27</td>
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<td>28</td>
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<td>30</td>
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<td>No</td>
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</table>

Note. Negative response=1; positive response=0.