Perceptions of Employability for Adolescents Related to Varying Degrees of Hypernasality: Making the Case for Interprofessional Collaboration & Advocacy in Speech Language Pathology

by

Barry Scott Tye

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Approved by

Mary J. Sandage, Ph.D., Chair, Associate Professor, Dept. of Speech, Language, and Hearing Sciences
Marisha Speights-Atkins, Ph.D., Assistant Professor, Dept. of Speech, Language, and Hearing Sciences
Megan-Brette Hamilton, Ph.D., Assistant Professor, Dept. of Speech, Language, and Hearing Sciences
Aurora J. Weaver, Ph.D., Assistant Professor, Dept. of Speech, Language, and Hearing Sciences

Abstract

Objective: The primary aim of this investigation was to evaluate the impact listener perception has on vocational success in adolescents with hypernasal speech.

Methods: Using Qualtrics, an online survey platform, listeners from Master of Business Administration (MBA) and Master of Public Administration (MPA) programs at Auburn University were recruited to evaluate speech samples from adolescents with hypernasal resonance disorders to determine their auditory-perceptual judgments regarding intelligence and employability.

Results: Speech samples representing adolescents with hypernasal speech were rated lower on scales of intelligence and employability. They were also more likely to be selected for jobs with infrequent rates of communication and lower levels of responsibility. Additionally, males with hypernasal speech were perceived as less intelligent, less employable, and more likely to be selected for a job with infrequent communication in comparison to females with hypernasal speech.

Conclusions: Results of this investigation suggest that adolescents with hypernasal speech will face some degree of difficulty when entering the work force. In addition to experiencing vocational struggles, these students may also experience academic and social struggles as well. School-based SLPs play an integral role in the referral process necessary to help mitigate these difficulties. It is imperative that school-based SLPs reach out to SLPs on a craniofacial team for outside support when working with students who have hypernasal speech. Craniofacial SLPs also have a responsibility in creating an open line of communication. School-based SLPs knowledgeable about hypernasal speech can be these students' biggest advocate for receiving services.

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Table of Contents

List of Tables

Chapter I

Literature Review

The presence of a communication impairment can influence employability. Vocational success has been studied in individuals with fluency disorders, voice disorders, and motor speech disorders (Abou-Dahech & Gabel, 2020; Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Gilmore, 1974; Hurst & Cooper, 1983; Stern et al., 2017); however, there is limited research describing the effect resonance disorders have on employability (Scheuerle, Guilford, & Garcia, 1982). It is the responsibility of both specialized craniofacial teams and school-based clinicians to treat children who present with resonance disorders due to a cleft of the secondary palate. School-based services are the most readily available speech and language services provided to children within the public school system. Given that resonance disorders have the capacity to impact both academic and extracurricular engagement, these students may in fact meet the eligibility criteria to receive services in the schools. Additionally, it is just as important that speech-language pathologists who work in the schools are prepared to potentially work with students who present with a resonance disorder. Quality school-based services should be provided to these students in order to maximize their ability to be successful in the public school setting in addition to pursuing their future career path. The goal of this preliminary investigation was to identify the influence of resonance disorder on perceptions of employability and to make the case that students who fall within this disorder area receive the services necessary to mitigate negative vocational judgement based solely off their speech.

Resonance & Resonance Disorders Defined

The acoustic signal produced by our vocal folds must be shaped in the vocal tract by a phoneme-specific balance between the oral, nasal, and pharyngeal cavities. Interruptions to this balance in the vocal tract may result in deviant or disordered speech production. Resonance is the term that is used to describe the process of balancing the acoustic signal created by the articulatory structures between the oral, nasal, and pharyngeal cavities. For example, all speech sounds, except for /m, n, ng/, require the velopharyngeal port to close off the nasal cavity from the oral cavity (Kummer, 2011).

The term resonance disorder is an overarching term for a speech sound disorder that results when adequate closure of the soft palate (velum) during connected speech is impaired. Impairments of the velopharyngeal valving system may be due to any of the following: complete inability to close off the nasal cavity with the velum, insufficient timing of closure, and complete or partial blockage of the nasal, pharyngeal, or oral mechanisms used during speech. It also refers to the alteration of the quality of sound an individual produces as a result of these structural deficits or impairments. This breakdown in quality of sound can result in either atypical nasal resonance, oral resonance, or a combination of the two (Kummer, 2011).

Resonance Disorders

Oral resonance alteration occurs when the velopharyngeal mechanism is unable to properly seal off the entrance into the nasal cavity, allowing some of the sound energy to leak through the nasal passages. This is typically referred to as hypernasal resonance. Oral resonance breakdown occurs when there is difficulty creating phonemes with the articulators within the oral cavity (tongue, teeth, lips, alveolar ridge, palate, velum etc.) due to structural differences inhibiting full range of articulatory motion. The acoustic result of the breakdown of oral

resonance is speech that is often described as muffled, secondary to the absorption of the acoustic signal within the pharyngeal and nasal cavities. Aerodynamically in typical speech production of non-nasal sounds, air enters into the oral cavity and exits through the mouth. Because individuals with hypernasal speech are unable to sufficiently close off their nasal passageway, some of this air is funneled through the nasal turbinates. This decrease in overall airflow into the oral cavity also acts to dampen the sound signal being produced by the individual resulting in lower overall sound level (dB SPL; Mason & Grandstaff, 1971; Kummer, 2011).

Hyponasality, sometimes called denasality, is characterized by reduced air flow and acoustic energy transmitted through the nasal cavity, resulting in the individual sounding as if they have nasal congestion. Individuals who present with hyponasality often exhibit an open mouth during breathing to compensate for their lack of nasal airflow. Denasalence occurs when there is an obstruction in the nasopharyngeal or nasal cavity. The acoustic result is primarily heard during the production of nasal phonemes (m, n, ng). Obstruction(s) blocking entrance of the acoustic signal into the nasal cavity cause these three sounds to be produced as an oral phoneme. Blockages within either the nasal or nasopharyngeal cavity avert airflow into the oral cavity, which decreases the presence of nasal phonemes even more. This change in direction of airflow is also what causes the individual to sound as if they're "stopped up", mimicking nasal congestion (Kummer & Lee, 1996; Kummer, 2011).

Cul-de-sac resonance has similarities to both hypernasal and hyponasal resonance. The hyponasal aspect of cul-de-sac resonance is that they are both linked to some type of blockage within the vocal tract. However, cul-de-sac resonance is heard across a majority of the speech sounds an individual produces, not just nasal phonemes. Because it spans across production and the acoustic result is often dependent on the location of the obstruction, there are three types of

cul-de-sac resonance an individual may present with: oral cul-de-sac, nasal cul-de-sac, and pharyngeal cul-de-sac. Speech patterns of individuals with cul-de-sac resonance are often described as stifled and quiet, this is primarily because the acoustic energy is decreased by the obstruction or the cavity itself (Kummer, 2011).

Mixed resonance is a blend of any of the aforementioned types of resonance. They may not be present in an individual's speech at the same time (i.e. hypernasality & hyponasality) but could emerge at different points during conversational speech (Kummer, 2011). The varying types of resonance disorder are summarized in Table 1.

Hypernasality	Hyponasality	Cul-de-sac resonance	Mixed resonance
Nasal cavity not sealed off Nasal leakage Breakdown due to atypical oral structures Acoustic signal often muffled Difficulty producing oral speech sounds	Denasality Reduced airflow through nasal passage Open mouth breathing Decrease in overall acoustic signal of nasal speech sounds	Possible blockage of the vocal tract in multiple locations (e.g. oral, nasal, & pharyngeal cavities) Heard across the majority of speech sounds produced Individual will acoustically stifled and quiet	A blend of previously described resonance disorders in the table

Disorders of the Velum

Resonance disorders can be divided into two primary etiological categories: congenital resonance disorders and acquired resonance disorders (Guyton et al., 2018; Kummer & Lee, 1996; Kummer, 2014). Congenital & acquired factors affecting typical function of the velopharyngeal (VP) port, include but not are limited to the following: cleft palate, cerebral palsy (CP), dysarthria, and deafness/hearing loss. Disorders of the velum can be categorized into three

general categories depending on the etiology of the disorder: velopharyngeal insufficiency, velopharyngeal incompetence, and velopharyngeal mislearning (Kummer, 2014; Smith & Kuehn, 2007).

Velopharyngeal insufficiency is a type of velopharyngeal dysfunction that restricts appropriate closure of the nasopharyngeal port during the production of oral speech sounds. (Kummer, 2014; Trost-Cardamone, 1989). A primary etiology of velopharyngeal insufficiency is an unrepaired cleft of the secondary palate, which inhibits velopharyngeal function for acoustically balanced and intelligible speech production (Witt & D'Antonio, 1993). Difficulty directing both airflow and acoustic energy through the oral cavity for the production of oral phonemes will result in production of weak oral pressure consonants, increased nasal resonance, a dampening of oral acoustic energy that results is quieter speech, and shorter utterance length (Kummer, 2011, 2014).

Velopharyngeal incompetence is the term used for dysfunction of the velopharyngeal mechanism caused by neurophysiological deficit (Kummer, Marshall, & Wilson, 2015), indicating that an impairment in the central or peripheral nervous system is linked to the lack of movement of the musculature within the VP port. This leads to poor or absent elevation of the velum during speech, which results in hypernasal speech production. Individuals with cerebral palsy (CP) may experience velopharyngeal incompetence originating from their inability to control the musculature of the VP port, despite having intact length of the velum (Krägeloh-Mann, 2008). Dysarthria is an acquired motor speech disorder, characterized by a loss of strength and range of motion, caused by brain injury such as stroke, traumatic brain injury (TBI), or brain tumor (Schröter-Morasch & Ziegler, 2005). Dysarthria affecting the velopharyngeal mechanism

may create difficulties in the person's ability to adequately move their velum with the speed and accuracy required for typical resonance balance during speech production.

Velopharyngeal mislearning describes intact velar structure, strength, and range of motion with inappropriate engagement of the structure for production of oral pressure phonemes. Deafness/hearing loss is linked to this causation of resonance disorders because those born with a complete lack of or reduced auditory-perceptual signal may learn to produce speech sounds using the VP port incorrectly (Kummer, 2011, 2014). After surgical repair of a cleft of the secondary palate some children may still present with compensatory resonance errors. These compensatory strategies indicate a referral for speech therapy (Kummer, Marshall, & Wilson, 2015).

Influence of Speech Intelligibility on Employability

The characteristics of a person's speech play a key role in how others perceive them, regardless of personal attitudes or opinions, listeners make judgements about others solely based off their speech signal (Allard & Williams, 2008). Speech intelligibility and overall quality of speech production play an important role in one's ability to engage in effective communication. Individuals diagnosed with resonance disorders struggle with both. Not only is their acoustic signal quality altered, the degree of the severity of the alteration can impede their ability to be understood (Lee et al., 2008). The effectiveness of one's communication is important across all aspects of life: social interaction, relationship building, employability, academics, and overall perception. Effective communication is not limited to how the individual communicates; the willingness of other people to listen without judgement is just as important.

Numerous studies conducted on the perception of individuals with resonance disorders, described listener perceptions as predominantly negative (Blood & Hyman, 1977; Blood, Mahan,

& Hyman, 1979). Watterson and colleagues (2013) reported that even children with mild hypernasality were judged more negatively by their peers using a set of social acceptance questions, with judgements becoming increasingly negative as severity of the hypernasality worsened. Exposure to information and knowledge about resonance disorders had little effect on the decrease in judgment these individuals receive (Lallh & Rochet, 2000).

Negative perception of disordered speech extends to teachers as well as future employers. Two investigations reported that young females with voice disorders were rated more negatively when listers were asked questions related to academics and vocation. Females with vocal fry were more likely to be judged negatively when compared to males who exhibit similar voice quality (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Zacharias, Kelchner, & Creaghead, 2013). Negative perception relating to employability has also been examined with individuals who stutter. Hurst and Cooper (1983) found that employers categorized stuttering as a "vocationally handicapping" disorder and decreased a person's overall sense of employability; however, employers reported that, once hired, stuttering did not interfere with job performance. Individuals with resonance disorders are also likely at risk for facing negative repercussions in academics & employability.

The relationship between speech intelligibility in general and employment is important as some jobs require more excellent verbal effectiveness than others. Stern et al., (2017) studied the influence of vocal effectiveness on hirability across a variety of job categories with volunteers using either their naturally dysarthric speech or a speech generating device (SGD). The results of this study found that the participants using a SGD were more likely to be rated hirable for highly verbal jobs (drive thru worker, greeter, telemarketer). They were also rated more frequently for jobs requiring a higher skill level (mental rehabilitation specialist, administrative assistant,

dispatcher). The individuals using a SGD were frequently rated highly across both categories; highly verbal and high skill level. Meanwhile, the participants speaking with mild dysarthria were more likely to be rated for low skill level jobs, regardless of level of communication usage. Through this study, Stern et al., (2017) highlighted the judgments people received based off the effectiveness and intelligibility of their speech. The perceptions applied to the individuals speaking with a dysarthria may also be applied to individuals with resonance disorders given the decline in intelligibility experienced by individuals with a resonance disorder.

Evidence indicates that speech samples characterized by hypernasal resonance disorder have a tendency to be rated more negatively. (Addington, 1968; Blood & Hyman, 1977; Blood et al., 1979; McKinnon, Hess, & Landry, 1986). In general, listeners are less familiar with resonance disorders than voice disorders. A majority of individuals have typically experienced or heard a voice disorder, like hoarseness. This "familiarity" in a way de-stigmatizes voice disorders when they are compared to a resonance disorder. Resonance disorders are less familiar, this is what can be attributed to extreme negative perceptions from listeners (Lallh & Rochet, 2000). This unfamiliarity with resonance disorders, specifically hypernasal speech, could potentially affect an individual's level of employability within the job market. If familiar disorders, such as fluency and voice disorders are perceived negatively in terms of employability, it is hypothesized that similar or worse perceptions will be held with regards to hypernasal speech in terms of employability.

Receiving School-Based Speech and Language Services

In order for special education funding to be used for a student's speech and language services in the schools, a set of three criteria must be met: 1) there must be a disability, 2) the disability has to negatively impact the student's educational performance, and 3) the student

must be in need of specially designed instruction or services in order to access general classroom education material (ASHA, n.d.). However, states across the U.S. have more specific guidelines when it comes to the allocation of special education funds being used for speech and language services. This regulation is set forth by the Individuals with Disabilities Education Act (IDEA), which mandates that states must follow federal regulations, 34 CFR Parts 300 and 301 Assistance to States for the Education of Children with Disabilities and Preschool Grants for Children with Disabilities Final Rule (U.S. Department of Education, 2006; 34 CFR § 300-301) while also developing their own state regulations (34 CFR § 300.149 b.). While IDEA does allow the states to specify their own guidelines, measures have been taken in order to ensure children can still receive services in the absence of strict academic failure. According to § 300.320 (a)(2)(i)(A), Individualized Education Program (IEP) goals must include "academic and functional goals," this update to focusing on "academic achievement and functional performance" allows students to receive services for reasons other than academic failure. In section 300.107(a) it is stated that a child's IEP team must take necessary steps to ensure that children with disabilities have an equal opportunity to engage in nonacademic and extracurricular activities. Extracurricular activities, defined in § 300.107, includes referrals to agencies that assist in the process of employing students. This could include employment by the public agency or providing help to find employment outside the agency available.

Many school-based speech language pathologists are unfamiliar with the knowledge base necessary for treating children with clefts of the lip or secondary palate (Grames, 2004, 2008; Karnell, Bailey, Johnson, Dragan, & Canady, 2005; Kuehn, Kummer, D'Antonio, & Karnell, 2006; Ruscello, Yanero, & Ghalichebaf, 1995). Furthermore, in a survey of speech language pathologists conducted with members of the North Carolina Speech and Hearing Association

about their experience with clefts, 44.1% reported feeling "not competent at all" to treat communication disorders secondary to cleft palate (Callahan & Hazelwood, 2004). Regardless that cleft lip/palate have been documented as a common craniofacial birth defect affecting approximately one out of every 600 newborns (American Cleft Palate – Craniofacial Association [ACPA], 2009), children with communication disorders secondary to a palatal cleft are rarely seen by school-based speech language pathologists (Grames, 2004; Pannbacker, 2004). While it is uncommon, children with clefts can present with communication disorders and they're often a mixture of complex factors. These factors could include malocclusion, velopharyngeal dysfunction (VPD), and hearing loss. A craniofacial team is typically involved with the treatment of these individuals, but if speech therapy is warranted these children are usually treated by school-based speech language pathologists or another local practice (Bedwinek, Kummer, Rice, & Grames, 2010).

Children exhibiting resonance disorders due to some degree of palatal cleft may not be failing their academic coursework; however, the resonance disorder could be affecting them in terms of educational functionality. As stated in Lee et al., (2008) individuals with resonance disorders struggle with the intelligibility and overall clarity of their voice production. Difficulties related to these issues could manifest themselves in terms of difficulty being understood by a teacher during a presentation, lack of in-class participation, or social isolation due to judgement from peers. Both teacher and student perceptions of voice and resonance disorders have been found to be primarily negative, which could place these children at risk for academic, social, and vocational difficulties (Watterson, Mancini, Brancamp, & Lewis, 2013; Zacharias, Kelchner, & Creaghead, 2013).

Given that student success across all aspects, including future vocational success, is the responsibility of an educational system the argument could be made that this would be a valid reason for adding a student with a resonance disorder to a school-based SLPs caseload. Furthermore, children with resonance disorders have difficulty with speech which could in fact be affecting their academics in a negative manner. If speech production is a part of the grading criteria, as would be required in a public speaking class, this could lead to adverse impact on academic performance. Considering the findings of Allard & Williams (2008), it can be inferred that individuals responsible for interviewing students with resonance disorders for collegiate purposes will make judgments solely on the basis of their speech production. Given that the literature has found primarily negative perceptions relating to individuals with resonance disorders, these judgements of speech could negatively impact aspirations for post-secondary education.

Ways to Quantify Severity of Resonance Disorders

Objectively quantifying degree of resonance impairment provides a means of determining severity of the resonance disorder and then correlating severity with measures of intelligibility. Determination of severity may be made via auditory-perceptual, acoustic, and aerodynamic methods.

Perceptual assessment of speech disorders are best conducted in a validated, standardized manner (Bettens et al., 2018). A few valid and reliable assessments for the auditory-perceptual quantification have been published: The Great Ormond Street Speech Assessment (GOS.SP.ASS; Sell et al., 1994, 1999), The Cleft Audit Protocol for Speech (CAPS; Harding et al., 1997), and The Cleft Audit Protocol for Speech – Augmented (CAPS-A; John, Sell, Sweeney, Harding-Bell, and Williams, 2006). The CAPS-A was created due to reliability and

validity deficits identified within the CAPS, which have not been thoroughly assessed, rendering it insufficient to determine the clinical pathway for speech therapy and/or velopharyngeal surgery (John et al., 2006). The GOS.SP.ASS was amended after its original creation in 1994, and while it received quality levels of interrater reliability, it was deemed too detailed for audit purposes. However, the use of this method is recommended for clinical purposes (John et al., 2006). Given that the majority of this research was conducted in Europe, specifically the United Kingdom and Ireland, generalization to American English dialects may be limited. The CAPE-V is more widely used in the U.S. for the treatment of vocal disorders and the standardized tool includes one item that addresses perceptual judgement of resonance (Kempster et al., 2009).

An acoustic method used to quantify the severity of resonance disorders is nasometry. Nasometry enables clinicians and researchers to analyze the ratio of nasal acoustic energy compared to the total oral and nasal acoustic energy produced in standard reading passages or picture-cued carrier phrases. The ratio determined is called a nasalence score (Fletcher, Adams, & McCutcheon, 1989). This score is then compared to a set of predetermined criteria in order to determine resonance severity (Dalston, Warren, & Dalston, 1991; Watterson, Hinton, & McFarlane, 1996). Acoustic analysis using nasometry requires a Nasometer (Pentax Medical, New Jersey), which is typically used when assessing a client who presents with a resonance disorder. In order to determine the level of acoustic energy being released a specialized microphone plate is positioned on the client's upper lip. The plate consist of two separate microphones, one microphone is on top of the plate (captures nasal acoustic energy) and the other is on the bottom of the plate (captures oral acoustic energy). While the client is producing speech these microphones are collecting acoustic energy from the two microphone locations and this information will be used to calculate the nasalence score/percentage.

Aerodynamic methods include quantification of nasal airflow and oral pressure during production of target words and phrases. Presence of nasal airflow can be indicated via visual-perceptual evidence of a fogged mirror, movement of an air paddle or a foam ball via a See Scape™ during production of oral pressure phonemes. Nasal airflow and oral pressure can be concurrently objectively quantified through the use of aerodynamic instrumentation such as the Phonatory Aerodynamic System (PAS; Pentax Medical, New Jersey) and the Aeroview System (Glottal Enterprises Incorporated, Syracuse, NY). Aerodynamic measurements and techniques are often used to assess velopharyngeal dysfunction (Dotevall, Ejnell, & Bake, 2001). Instrumentation provides clinicians with more precise measurements in comparison to other methods used for the assessment of nasal airflow. For example, there should be negligible nasal airflow measured during production of oral pressure consonants. Presence of nasal airflow during production of oral pressure consonants can quantify the degree of velopharyngeal dysfunction. Measurements gathered from this and also other similar instruments can then be compared to measurements from patients without resonance difficulties in order to determine level of severity of the nasal or oral leakage (Quigley, Shiere, Webster, & Cobb, 1964).

Visual vs. Auditory Perceptions

Perceptions about individuals with resonance disorders are determined through two main avenues; how they sound and how they look. The construct of visual perception is complex, including aspects of personal opinion and prior experience. Research focusing on the perceptions of new parents of children born with cleft lip and palate describe parent reports of shock, anger, denial, distress and anxiety, and a sense of "loss of control" (Hodgkinson et al., 2005; Ingstrup et al., 2013; Johansson & Ringsberg, 2004; Nelson, Glenny, Kirk, & Caress, 2012; Ter Poorten & Louw, 2012). Individuals born with cleft lip and palate experience frequent judgement due to

their outer appearance, which can cause difficulties with sociability (Hunt, Burden, Hepper, & Johnston, 2005; Hunt, Burden, Hepper, Stevenson, & Johnston, 2006). It has also been found that individuals with facial anomalies are less content with their facial appearance than those with unseen anomalies (Thomas, Turner, Rumsey, Dowell, & Sandy, 1997).

Studies that focus solely on the auditory perception of resonance disorders have found that these individuals are primarily judged negatively (Addington, 1968; Blood & Hyman, 1977; Blood et al., 1979; McKinnon et al., 1986; Watterson, Mancini, Brancamp, & Lewis, 2013). It can be inferred that these individuals would be perceived even more negatively if listeners were given a picture along with the audio recording, given the research describing negative visual-perceptual judgment of cleft lip. There is little literature presenting how the negative auditory perceptions related to hypernasal speech affects one's employability (Scheuerle, Guilford, & Garcia, 1982). Research has been published related to other communication disorders and employability; voice (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Gilmore, 1974), fluency (Abou-Dahech & Gabel, 2020; Hurst & Cooper, 1983), and dysarthria (Stern et al., 2017). In each of these studies, the individuals diagnosed with communication disorders were more likely to be perceived or judged negatively across certain employability parameters. For example, Hurst & Cooper (1983) found that having dysfluency adversely affected level of overall employability and decreased advancement possibilities if they were hired. Stern et al., (2017) concluded that individuals would rather persons with dysarthria use a speech generating device with those using a speech generating device determined to be more employable for more verbal and high skill jobs. Anderson, Klofstad, Mayhew, & Venkatachalam (2014) described situations in which females presenting with vocal fry were judged to be less employable when compared with men who presented with similar vocal symptoms. Due to the lack of recent

research focusing on the relation between employability and the auditory perception of resonance disorders, this study investigates listener ratings of hypernasal speech samples according to a set of employability questions and scenarios.

Justification

The impact of communication impairment on employability is not well understood for individuals who present with resonance disorders, particularly hypernasal resonance disorders. While there has been research published about the connection between resonance disorders and employability, a majority of the research focuses on both the visual and auditory aspects of a resonance disorder. Judgement of the potential visual aspects of a resonance disorder are important, however it is important to separate them from the auditory aspect. This is due to the fact that individuals who have had a repaired cleft palate may not exhibit any visual anomalies but present with a distorted auditory signal or individuals with obvious visual evidence of craniofacial differences may not present with any communication impairment at all. Separating the auditory communication difference from the visual differences is important to understand the impact of the communication impairment. Furthermore, current and future vocational success is a crucial aspect of an adolescent's quality of life and activities of daily living. This study will use auditory recordings of speech samples, ranging from mild to severe hypernasality to elicit perceptions related to employability. Identification of the extent to which resonance disorders may impact employability will help craniofacial teams and speech language pathologists frame the importance of timely treatment for this specific type of speech impairment, with emphasis on the necessity for these clients to receive competent school based services in an attempt to mitigate the likely affects a resonance disorder will have on an adolescent's ability to be viewed as employable. The results of this study will contribute to the growing body of work that is

addressing the psychosocial aspects of resonance disorders and benefit those with resonance disorders by opening up a discussion about how the difference in their speech production may affect their employment opportunities. The following are hypothesized: 1) Individuals with resonance disorders will be rated lower for the parameters of intelligence and employability; 2) more severely hypernasal speech samples will be rated the least intelligent and employable; 3) individuals with resonance disorders will be rated as less employable for occupations requiring excellent speech skills with severe hypernasality rated as the least employable; and 4) individuals with resonance disorders will be rated less employable for occupations requiring a high level of responsibility with severe hypernasality rated as the least employable.

Chapter II

Manuscript

Perceptions of Employability Related to Varying Degrees of Hypernasality: Making the Case for School-Based Referrals

Introduction

The presence of a communication impairment can influence employability. Vocational success has been studied in individuals with fluency disorders, voice disorders, and motor speech disorders (Abou-Dahech & Gabel, 2020; Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Gilmore, 1974; Hurst & Cooper, 1983; Stern et al., 2017); however, there is limited research describing the effect that resonance disorders have on employability (Scheuerle, Guilford, & Garcia, 1982). It is the responsibility of both specialized craniofacial teams and school-based speech language pathologists (SLPs) to treat children who present with resonance disorders due to a cleft of the secondary palate or secondary to neuromuscular disorder. Given that resonance disorders have the potential to impact both academic and extracurricular engagement, these students may qualify for services in the schools. Therefore, it is just as important that SLPs who work in the schools are prepared to work with students who present with a resonance disorder and understand the psychosocial impact of a resonance disorder. Quality school-based SLP services support school success as well as vocational success as teenagers pursue first job opportunities. The goal of this preliminary investigation was to identify the influence of resonance disorder on perceptions of employability and intellectual ability as vital aspects to consider when determining eligibility for school-based SLP service.

Resonance & Resonance Disorders

The acoustic signal produced by our vocal folds must be shaped in the vocal tract by a phoneme-specific balance between the oral, nasal, and pharyngeal cavities. Interruptions to this balance in the vocal tract may result in deviant or disordered speech production. Resonance is the term that is used to describe the process of balancing the acoustic signal created by the articulatory structures between the oral, nasal, and pharyngeal cavities (Kummer, 2011).

The term resonance disorder is an overarching term for a speech sound disorder that results when adequate closure of the soft palate (velum) during connected speech is impaired. Impairments of the velopharyngeal valving system may be due to any of the following: complete inability to close off the nasal cavity with the velum, insufficient timing of closure, and complete or partial blockage of the nasal, pharyngeal, or oral mechanisms used during speech. It also refers to the alteration of the quality of sound an individual produces as a result of these structural deficits or impairments. This breakdown in quality of sound can result in either atypical nasal resonance, oral resonance, or a combination of the two (Kummer, 2011).

Resonance Disorders

Hypernasal resonance occurs when the velopharyngeal mechanism is unable to properly seal off the entrance into the nasal cavity, allowing some of the sound energy to leak through the nasal passages. The acoustic result that characterizes hypernasal resonance is speech that is often described as muffled, secondary to the absorption of the acoustic signal within the pharyngeal and nasal cavities. Aerodynamically in typical speech production of non-nasal sounds, air enters into the oral cavity and exits through the mouth. Because individuals with hypernasal speech are unable to sufficiently close off their velopharyngeal port, some of this air is funneled through the nasal turbinates. This decrease in overall airflow into the oral cavity also acts to dampen the

sound signal being produced by the individual resulting in lower overall sound level (dB SPL; Mason & Grandstaff, 1971; Kummer, 2011). Hypernasal speech can have a significant impact on overall speech intelligibility (Copeland, 1990; Han, 2009; Landis & Thi-Thu-Cuc, 1975; Maegawa, Sells, & David, 1998; Moore & Sommers, 1975; Zajac, Plante, Lloyd, & Haley, 2011); as hypernasality increases, one's ability to be understood decreases (Maegawa, Sells, & David, 1998). Thus, students may have difficulty producing clear articulation with sufficient loudness for oral presentations as are often required in high school courses. These students may also be more reluctant to speak up in class, despite knowing the answer, because of concerns of speech intelligibility and adequate loudness.

Hyponasality, sometimes called denasality, is characterized by reduced air flow and acoustic energy transmitted through the nasal cavity, resulting in the individual sounding as if they have persistent nasal congestion. Individuals who present with hyponasality often exhibit an open mouth during breathing to compensate for their lack of nasal airflow. Denasalence may occur when there is an obstruction in the nasopharyngeal or nasal cavity. The acoustic result is primarily heard during the production of nasal phonemes (m, n, ng). This change in direction of airflow is also what causes the individual to sound as if they're "stopped up", mimicking nasal congestion (Kummer & Lee, 1996; Kummer, 2011. Moser, Dreher, & Adler (1955) found that hyponasal speech was less detrimental to speech intelligibility in comparison to hypernasal speech. Therefore, students presenting with hyponasal resonance will not likely experience the same challenges as a student with hypernasal speech as we are accustomed to hearing denasality when individuals have a cold or upper respiratory infection. It is unlikely that school-based SLPs will receive referrals solely due to a hyponasal resonance disorder.

Cul-de-sac resonance has similarities to both hypernasal and hyponasal resonance. Cul-de-sac resonance is heard across most of the speech sounds an individual produces, not just nasal phonemes. There are three types of cul-de-sac resonance an individual may present with depending on the location of an airway obstruction: oral cul-de-sac, nasal cul-de-sac, and pharyngeal cul-de-sac. Speech patterns of individuals with cul-de-sac resonance are often described as stifled and quiet, this is primarily because the acoustic energy is decreased by the obstruction or the cavity itself (Kummer, 2011). In a case study of a 7 year old boy with Nager Syndrome, he was found to have moderate hypernasality & cul-de-sac resonance with impaired speech intelligibility due to his difficulties with resonance (Van Lierde, Luyten, Mortier, Tijskens, Bettens, & Vermeersch, 2011). Therefore, children experiencing cul-de-sac resonance may also experience difficulties with communication, both in school and in their daily lives.

Mixed resonance is a blend of any of the aforementioned types of resonance. They may not be present in an individual's speech at the same time (i.e. hypernasality & hyponasality) but could emerge at different points during conversational speech (Kummer, 2011). The varying types of resonance disorder are summarized in Table 1.

Influence of Speech Intelligibility on Employability

The characteristics of a person's speech play a key role in how others perceive them, regardless of personal attitudes or opinions, listeners make judgements about others solely based off their speech signal (Allard & Williams, 2008). Speech intelligibility and overall quality of speech production play an important role in one's ability to engage in effective communication. Individuals diagnosed with resonance disorders struggle with both. Not only is their acoustic signal quality altered, the degree of the severity of the alteration can impede their ability to be understood (Lee et al., 2008). The effectiveness of one's communication is important across all

aspects of life: social interaction, relationship building, employability, academics, and overall perception.

Numerous studies conducted on the perception of individuals with resonance disorders, described listener perceptions as predominantly negative (Blood & Hyman, 1977; Blood, Mahan, & Hyman, 1979). Watterson and colleagues (2013) reported that children with mild hypernasality were judged more negatively by their peers using a set of social acceptance questions as severity of the hypernasality increased. Exposure to information and knowledge about resonance disorders had little effect on the decrease in judgment these individuals receive (Lallh & Rochet, 2000).

Negative perception of disordered speech extends to teachers as well as future employers. Two investigations reported that young females with voice disorders were rated more negatively when listers were asked questions related to academics and vocation (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Zacharias, Kelchner, & Creaghead, 2013). Females with vocal fry were more likely to be judged negatively when compared to males who exhibit similar voice quality (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014). Negative perception relating to employability has also been examined with individuals who stutter. Hurst and Cooper (1983) found that employers categorized stuttering as a "vocationally handicapping" disorder and decreased a person's overall sense of employability; however, employers reported that, once hired, stuttering did not interfere with job performance. Individuals with resonance disorders are also likely at risk for facing negative repercussions in academics & employability.

The relationship between speech intelligibility in general and employment is important as some jobs require more excellent verbal effectiveness than others. Stern et al., (2017) studied the influence of vocal effectiveness on hirability across a variety of job categories with volunteers

using either their naturally dysarthric speech or a speech generating device (SGD). The results of this study found that the participants using a SGD were more likely to be rated hirable for highly verbal jobs (drive thru worker, greeter, telemarketer). They were also rated more frequently for jobs requiring a higher skill level (mental rehabilitation specialist, administrative assistant, dispatcher). Meanwhile, the participants speaking with mild dysarthria were more likely to be rated for low skill level jobs, regardless of level of communication usage. Through this study, Stern et al., (2017) highlighted the judgments people received based on the effectiveness and intelligibility of their speech.

Evidence indicates that speech samples characterized by hypernasal resonance disorder have a tendency to be rated more negatively. (Addington, 1968; Blood & Hyman, 1977; Blood et al., 1979; McKinnon, Hess, & Landry, 1986). In general, listeners are less familiar with resonance disorders than voice disorders. Most individuals have heard a voice disorder, like hoarseness, or experienced it themselves. This familiarity with hoarseness may de-stigmatize voice disorders when they are compared to a resonance disorders, which are less familiar. This may contribute to negative perceptions from listeners (Lallh & Rochet, 2000). This unfamiliarity with resonance disorders, specifically hypernasal speech, could potentially affect an individual's level of employability within the job market. If familiar disorders, such as fluency and voice disorders are perceived negatively in terms of employability, it is hypothesized that similar or worse perceptions will be held with regards to hypernasal speech in terms of employability.

Receiving School-Based Speech and Language Services

Many school-based speech language pathologists are unfamiliar with the knowledge base necessary for treating children with clefts of the lip or secondary palate (Grames, 2004, 2008; Karnell, Bailey, Johnson, Dragan, & Canady, 2005; Kuehn, Kummer, D'Antonio, & Karnell,

2006; Ruscello, Yanero, & Ghalichebaf, 1995). Furthermore, in a survey of speech language pathologists conducted with members of the North Carolina Speech and Hearing Association about their experience with clefts, 44.1% reported feeling "not competent at all" to treat communication disorders secondary to cleft palate (Callahan & Hazelwood, 2004). Even though cleft lip/palate have been documented as a common craniofacial birth defect affecting approximately one out of every 600 newborns (American Cleft Palate – Craniofacial Association [ACPA], 2009), children with communication disorders secondary to a palatal cleft are rarely seen by school-based speech language pathologists (Grames, 2004; Pannbacker, 2004). A craniofacial team is typically involved with the treatment of these individuals, but if speech therapy is warranted these children are usually treated by school-based speech language pathologists or another local practice (Bedwinek, Kummer, Rice, & Grames, 2010).

Children exhibiting resonance disorders due to some degree of palatal cleft may not be failing their academic coursework; however, the resonance disorder could be affecting them in terms of educational functionality. As stated in Lee et al., (2008) individuals with resonance disorders struggle with the intelligibility and overall clarity of their voice production. Difficulties related to these issues could manifest themselves in terms of difficulty being understood by a teacher during a presentation, lack of in-class participation, or social isolation due to judgement from peers. Both teacher and student perceptions of voice and resonance disorders have been found to be primarily negative, which could place these children at risk for academic, social, and vocational difficulties (Watterson, Mancini, Brancamp, & Lewis, 2013; Zacharias, Kelchner, & Creaghead, 2013).

Given that student success across all aspects, including future vocational success, is the responsibility of an educational system the case could be made that resonance disorder would be

a valid reason for adding a student to a school-based SLPs caseload. If speech production is a part of the grading criteria, as would be required in a public speaking class, this could lead to adverse impact on academic performance. Considering the findings of Allard & Williams (2008), it can be inferred that individuals responsible for interviewing students with resonance disorders for collegiate purposes will make judgments solely on the basis of their speech production. Given that the literature has found primarily negative perceptions relating to individuals with resonance disorders, these judgements of speech could negatively impact aspirations for post-secondary education.

Determining Severity of Resonance Disorders

Objectively quantifying degree of resonance impairment provides a means of determining severity of the resonance disorder and then correlating severity with measures of intelligibility. Determination of severity may be made via auditory-perceptual, acoustic, and aerodynamic methods.

An acoustic method used to quantify the severity of resonance disorders is nasometry. Nasometry enables clinicians and researchers to analyze the ratio of nasal acoustic energy compared to the total oral and nasal acoustic energy produced in standard reading passages or picture-cued carrier phrases. The ratio determined is called a nasalence score (Fletcher, Adams, & McCutcheon, 1989). This score is then compared to a set of predetermined criteria in order to determine resonance severity (Dalston, Warren, & Dalston, 1991; Watterson, Hinton, & McFarlane, 1996). Acoustic analysis using nasometry requires a Nasometer (Pentax Medical, New Jersey). In order to determine the level of acoustic energy being released a specialized microphone plate is positioned on the client's upper lip. The plate consist of two separate microphones, one microphone is on top of the plate (captures nasal acoustic energy) and the

other is on the bottom of the plate (captures oral acoustic energy). While the client is producing speech these microphones are collecting acoustic energy from the two microphone locations and this information will be used to calculate the nasalence score/percentage.

Visual vs. Auditory Perceptions

Perceptions about individuals with resonance disorders may be determined through two main avenues; how they sound and how they look. The construct of visual perception is complex, including aspects of personal opinion and prior experience. Research focusing on the perceptions of new parents of children born with cleft lip and palate describe parent reports of shock, anger, denial, distress and anxiety, and a sense of "loss of control" (Hodgkinson et al., 2005; Ingstrup et al., 2013; Johansson & Ringsberg, 2004; Nelson, Glenny, Kirk, & Caress, 2012; Ter Poorten & Louw, 2012). Individuals born with cleft lip and palate experience frequent judgement due to their outer appearance, which can cause difficulties with sociability (Hunt, Burden, Hepper, & Johnston, 2005; Hunt, Burden, Hepper, Stevenson, & Johnston, 2006).

Studies that focus solely on the auditory perception of resonance disorders have found that these individuals are primarily judged negatively (Addington, 1968; Blood & Hyman, 1977; Blood et al., 1979; McKinnon et al., 1986; Watterson, Mancini, Brancamp, & Lewis, 2013). It can be inferred that these individuals would be perceived even more negatively if listeners were given a picture along with the audio recording, given the research describing negative visual-perceptual judgment of cleft lip. There is little literature presenting how the negative auditory perceptions related to hypernasal speech affects one's employability (Scheuerle, Guilford, & Garcia, 1982). Research has been published related to other communication disorders and employability; voice (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Gilmore, 1974), fluency (Abou-Dahech & Gabel, 2020; Hurst & Cooper, 1983), and dysarthria (Stern et al.,

2017). In each of these studies, the individuals diagnosed with communication disorders were more likely to be perceived or judged negatively across certain employability parameters.

The impact of communication impairment on employability is not well understood for teenage individuals who present with resonance disorders, particularly hypernasal resonance disorders. While a connection between resonance disorders and employability has been established, most of the research focused on both the visual and auditory aspects of resonance disorder. Parsing out the auditory-perceptual impacts of a resonance disorder are important because individuals who have had a repaired cleft palate may not exhibit any visual anomalies. Furthermore, vocational success is a crucial aspect of an adolescent's quality of life and activities of daily living. Identification of the extent to which resonance disorders may impact employability will provide evidence for craniofacial teams and school-based speech language pathologists to determine eligibility for school-based services. Timely school-based therapy is critical for mitigation of the likely affects a resonance disorder will have on an adolescent's ability to be viewed as employable.

Due to the lack of recent research focusing on the relationship between employability and the auditory perception of resonance disorders, the primary aim of this study was to investigate listener ratings of hypernasal speech samples from teenage speakers relative to employability scenarios that required communication skills. The following were hypothesized: 1) teenage speakers with resonance disorders will be rated lower for the parameters of intelligence and employability; 2) more severe hypernasal speech samples will be rated the least intelligent and employable; 3) individuals with resonance disorders will be rated as less employable for occupations requiring excellent speech skills with severe hypernasality rated as the least employable; and 4) individuals with resonance disorders will be rated less employable for

occupations requiring a degree of higher education with severe hypernasality rated as the least employable.

Methods

Speaker Samples

Speech samples used in this study were collected from an ongoing study at Children's Healthcare of Atlanta (CHOA): Center for Craniofacial Disorders. The speech samples were clinical recordings organized for research purposes under an approved CHOA IRB (#00000526). Eight teenage speakers with varying levels of disordered resonance were selected from CHOA's database of patients with consented release of speech recordings. Selected speakers were 16-19 years of age (average age = 17), had a history of cleft and or craniofacial disorders, had non-impaired or resolved hearing, and typical articulation. There were five male (average age = 17.2) and three female (average age = 16.7) speakers. Of the eight speakers, six of them identified as White, with four of them identifying as Non-Hispanic and the remaining two identifying as Hispanic. The other two speakers included in the study identified as Asian/Non-Hispanic. Speakers with articulation errors that were maladaptive in nature, unresolved developmental errors, or secondary to concomitant speech disorders such as dysarthria, apraxia, or dysphonia were excluded from the study. Speakers with cul-de-sac resonance or mixed resonance were also excluded from the study. In an attempt to mitigate the impact of confounding variables on participant perception, speech samples were affirmed to have Mainstream American English (MAE) dialectical features.

Speech samples were recorded in a quiet room using the Nasometer II directional stereo microphone with a signal resolution of 16 bit and a sampling rate of 44.1 kHz. Recordings were saved as .wav files. Speech samples were categorized into four speech stimuli groups based on

the speaker's degree of disordered resonance. The four speech stimuli groups included: severe hypernasality, moderate hypernasality, mild hypernasality, and non-disordered or balanced resonance. Speech stimuli group assignment was determined by nasalence percentages from the recorded standard speech sample. Nasalence percentages from the recorded oral speech sample were compared to criteria for speaker group categorization described by Smith & Kuehn (2007); approx. 15% - typical resonance, greater than 30% - mild hypernasality, 40%-60% - moderate hypernasality, & greater than 60% - severe hypernasality. However, Watterson (2020) states that nasalence scores greater than 45% are considered severe. Due to the limited number of speaker samples with severe hypernasality, both papers were used for categorization in order for the severe speech samples (60% & 59% nasalence scores) would be empirically based. Within each speech stimuli group category there were two speakers, one male and one female, to account for any gender biases held by the listeners in the survey ratings (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014), except for the severe hypernasality speaker group, which had two male speakers. By the time children have reached their teenage years, most instances of moderate-severe hypernasality have been addressed surgically and behaviorally, thus limiting the pool of potential speaker samples for this investigation.

A singular non-nasal sentence was selected to determine speaker resonance in phoneme specific sentences used in the Americleft Resonance Rating Evaluation (Papa popped up; Chapman et al., 2016). An additional sentence, "Thank you for considering me for this opportunity," was collected as a realistic example of language used in a hiring environment to support this investigation's interest in employability of resonance disordered speakers (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014).

Listener Participants

Participants were recruited from students currently enrolled in a Master of Business Administration (MBA) of Master of Public Administration (MPA). Participants had to be 19 years of age or older in order to participate in the survey. Individuals presenting with hearing loss were not excluded from participating in this study given that ~15% of adults age 18 years and older in America (37.5 million) report some trouble hearing and 2-7% of the population have undiagnosed auditory processing related difficulties (Blackwell, Lucas, & Clarke, 2014; Palfrey & Duff, 2007). In contrast, only 16% of Americans ages 20-69 years old that could benefit from management of their hearing loss use hearing aids and are likely to partake in the interviewing process (NIDCD, 2016). Due to these findings, participants were asked to self-identify the presence of hearing loss in lieu of the implementation of an online hearing screening prior to competition of the employability survey. MBA and MPA students were chosen as the recruitment population due to their familiarity with the subject of employability and their potential for making hiring decisions in the future. Additionally, these students have experience with business and public management coursework. Listener participants received an email invitation to participate from an administrator in their program who had access to student email lists. The listener volunteer email invitation was scripted for the administrator so that all participants received a consistent invitation to participate without bias or coercion. Interested listener participants then clicked on the survey link that was included in the email invitations. Following entry into the survey platform, volunteers indicated consent and entered to the survey platform to determine eligibility. Participant eligibility was based on their willingness to enter the employability survey after reading the IRB approved informational statement. Once

eligibility was established, the participant was then directed to the survey questions. Participants who did not meet inclusion criteria were thanked for their time and the survey ended.

Data Collection Procedures

Data were collected through distribution of an electronic survey via the Qualtrics platform (Qualtrics, Provo, UT). The survey was designed with a demographic information section to describe the listener volunteers. The demographic section was followed by the eights speech samples and four questions for each speech sample: two response scale format questions and two forced choice (FC) questions. Speaker samples were randomized through the Qualtrics platform and presented individually to avoid sex and group comparisons based on order effects. After listening to each speech sample, listeners were asked to mark two response scale format questions, rating perceptions of employability and intelligence (Rammstedt & Krebs, 2007; Toepoel & Funke, 2018; Yang, Moon, & Jeon, 2019). Two FC questions were presented to query perceptions of employability related to education and communication (Neuert, 2019). Listeners were asked 1) whether the person in the speech sample should be hired for a job requiring frequent or infrequent communication with others; and 2) whether they would be hired for a job requiring a high level of responsibility or a job that requiring a low level of responsibility (Stern et al., 2017). Each participant was exposed to a total of 32 speech trials (eights speaker samples x four rating tasks). To avoid an order effect during data collection, the response scale format and FC questions were randomized for each speaker sample as well.

Data Analyses

Descriptive statistics were used to characterize the demographic data of the listeners participating in this investigation. Demographic data collected were summarized with mean and standard deviation values for age, and count and percentage for categorical data calculated by the

Qualtrics platform. Qualtrics filters questions for completion in order to ensure correct calculations. Statistical analyses were completed in SPSS Statistics Version 25 (IBM Corp, 2015). Alpha levels for all analyses were set at .05. Following data preparation, descriptive statistics were completed, with the data meeting assumption for parametric analysis. A multivariate analysis of variance with repeated measures (RM MANOVA) was completed to determine significant differences in rating of employability and intelligence across the speakers in four resonance categories. Planned Helmert contrasts were completed to evaluate the effect of speaker resonance severity with multiple levels. A second RM MANOVA was completed on a subset of the data with speaker sex (i.e., male and female) represented, to explore speaker sex biases reported in prior literature. Bonferroni adjustment was set at .025 for this analysis. Analyses for the forced choice (FC) responses were completed using Pearson chi-square analysis with nested speaker resonance severity and speaker sex to evaluate non-parametric count data. The null hypothesis tested that the responses would be balanced across FC options for each question due to no assumptions being made about the distribution of the data collected. Comparison of column proportions are reported with adjusted Bonferroni correction to p-values.

Results

Listener Participant Demographics

A total of 81 MBA & MPA students completed the employability survey in its entirety, meaning they provided responses for a majority the demographic questions (>99.9%) and completed all the auditory perception rating tasks within the survey. Of the 81 listeners who completed the survey, 47 (58%) of them identified as male, 33 (40.7%) identified as female, and one (1.2%) selected “Or specify” but did not provide a gender identity. When asked about sexual orientation, 75 (92.6%) of the participants reported that they identified as heterosexual, four

(4.9%) identified as bisexual, one (1.2%) identified as homosexual (lesbian) and one (1.2%) preferred not to respond to the question. Race was self-reported as follows: 71 (87.7%) of the participants reported White, three (3.7%) reported Asian American, four (4.9%) reported Black/African American, one (1.2%) reported American Indian or Alaska Native, and two (2.5%) stated they were White & Asian American. 78 (96.3%) of the listeners identified their ethnicity as non-Hispanic, five (2.5%) identified as Hispanic, and one (1.2%) student preferred not to answer the question pertaining to ethnicity. The average age of 78 of the listeners was 33.91 (SD=9.95) years old, with three (3.7%) of the listeners preferring to record their age.

The college program enrollment status of the listeners who took the survey included 20 (24.7%) MBA (Executive) participants, 11 (13.6%) MBA (Full Time) participants, 46 (56.8%) MBA (Online) participants, and four (4.9%) MPA participants. Highest level of educational achievement was as follows: 53 (65.4%) of the listeners had a Bachelor's degree, 23 (28.4%) had a Master's degree, and five (6.2%) had a Doctorate degree. Participants were asked to report if they had a current role in management or HR, as the survey required respondents to complete ratings of employability. Of the 81 participants, 43 (53.1%) reported they did not have a role in management or HR while 38 (46.9%) reported they did hold a current management or HR position.

Country of origin for the participants included: 77 (95.1%) from the U.S., one (1.2%) from Canada, 1 (1.2%) from Germany, and two (2.5%) participants indicated they were not from the U.S. but did not provide a country of origin. English was reported to be the only spoken language of 72 (88.9%) participants, the remaining nine (11.1%) participants reported speaking English in addition to another language (Afrikaans, Chinese, French, German, Spanish, or Russian). Native languages of the participants was collected with 77 (95.1%) participants

reporting English was their native language, one (1.2%) student reported Afrikaans as their native language, one (1.2%) student reported it to be Chinese, one (1.2%) student reported English/Spanish as their native languages, and one (1.2%) student reported only Spanish as their native language.

A majority of the participants, 78 (96.1%), reported having no known hearing impairment while only three (3.7%) reported having a known hearing impairment. Participants were asked about their familiarity with cleft lip &/or palate to which 55 (67.9%) participants reported that they were not familiar, 21 (25.9%) participants reported that they were familiar, and five (6.2%) reported that they were unsure. Previous history of speech & language difficulties was inquired about from the participants, 66 (81.5%) participants reported no history of difficulties and 15 (18.5%) reported they had a history of speech & language difficulties. Demographic data are shared in Table 2.

Table 2. *Listener Demographics*

N=81; Percentage (%)			
Gender		**Highest Level of**	
Female	33 (40.7%)	**Educational Achievement**	
Male	47 (58%)	Bachelor	53 (65.4%)
Other	1 (1.2%)	Master's degree	23 (28.4%)
		Doctorate	5 (6.2%)
Sexual Orientation			
Heterosexual	75 (92.6%)	**Country of Origin**	
Bisexual	4 (4.9%)	U.S.	77 (95.1%)
Homosexual (lesbian)	1 (1.2%)	Canada	1 (1.2%)
No response	1 (1.2%)	Germany	1 (1.2%)
		Not U.S.	2 (2.5%)
Race		**Spoken Languages**	
White	71 (87.7%)	English	72 (88.9%)
Asian American	3 (3.7%)	English, Afrikaans	1 (1.2%)
Black/African American	4 (4.9%)	English, Chinese	1 (1.2%)
American Indian or Alaska Native	1 (1.2%)	English, French	1 (1.2%)
		English, German	1 (1.2%)
White, Asian American	2 (2.5%)	English, Spanish	3 (3.7%)
		English, Spanish, German	1 (1.2%)
Ethnicity		English, Spanish, Russian	1 (1.2%)
Non-Hispanic	78 (96.3%)		
Hispanic	5 (2.5%)	**Native Language**	
No response	1 (1.2%)	English	77 (95.1%)
		Afrikaans	1 (1.2%)
Age		Chinese	1 (1.2%)
Mean	33.91	English/Spanish	1 (1.2%)
Standard Deviation	9.95	Spanish	1 (1.2%)
No response	3 (3.7 %)		
		Hearing Impairment	
Enrollment		No	78 (96.3%)
MBA (Executive)	20 (24.7%)	Yes	3 (3.7%)
MBA (Full Time)	11 (13.6%)		
MBA (Online)	46 (56.8%)	**Role in HR / Management**	
MPA*	4 (4.9%)	No	43 (53.1%)
		Yes	38 (46.9%)
Familiarity with Clef Palate		**History of Speech and**	
No	55 (67.9%)	**Language Difficulties**	
Unsure	5(6.2%)	No	66 (81.5%)
Yes	21 (25.9%)	Yes	15 (18.5%)

MBA= Master of Business Administration; MPA= Master of Public Administration; HR= Human Resources; N = total number of respondents. n = number of respondents per place of employment. Note. % = percentage of respondents based on 81 respondents.

Repeated Measures Multivariate Analysis of Variance

A repeated measures MANOVA was conducted with speaker resonance severity set as the repeated measure and the listeners rating of the speakers' employability and intelligence entered as the dependent variables. The MANOVA revealed a significant multivariate main effect for speaker resonance severity, Wilks' $\lambda = .61$, F (6, 75) = 18.50, $p < .001$, $\eta 2 = .60$ (observed power >.99). Results indicated a significant difference among employability and intelligence rating for the speaker based on resonance severity. Univariate *F*-tests are reported in Table 3.

Table 3. *Univariate F-test Results for MANOVA for Speaker Resonance and Speaker Sex (N=81)*

Comparisons	*F*	*p*	*Df*	η^2	Observed power
Speaker Resonance Severity[1]					
Employability	47.58**	<.001	3,240	.37	.99
Intelligence	41.22**	<.001	3,240	.34	.99
Wilks' λ = .61, *F* (6, 75) = 18.50, p < .001, η2 = .60 (observed power >.99)					
Speaker Sex[2]					
Employability	11.68**	.001	1, 80	.13	.92
Intelligence	16.68**	< .001	1, 80	.17	.98
Wilks' λ = .82, *F* (2, 79) = 8.52, *p* < .001, η2 = .18 (observed power =.96)					

Note. Two separate RM MANOVAs were conducted, designated with subscript 1 & 2. The second set at an alpha level of .025. Greenhouse-Geisser corrections mirrored Spehericity assumed output for employability and intelligence rating by listener.
*p-value < 0.05 ** p-value ≤ .001

Planned Helmert contrasts indicated that individuals with balance resonance were rated higher on both employability (p <.001) and intelligence (p<.001) than the speakers with atypical resonance by the listeners in the sample. Individuals with mild resonance severity were not found to be rated significantly different from those with moderate to severe resonance characteristics on either employability (p=.272) or intelligence (p= .326). Individuals with severe resonance

severity were rated significantly higher on employability (p = .009) and intelligence (p = .024) than those with moderate resonance severity. Helmert contrast are reported in Table 4.

Table 4. Results of planned Helmert contrasts (N=81)

	Estimate	SE	df	F	p-value	η^2
Employability						
Balanced vs. Atypical	2.65	0.28	1	91.66**	<.001	.53
Mild vs. Moderate and Severe	0.24	0.23	1	1.22	.272	.02
Moderate vs. Severe	-0.62	0.23	1	7.08 *	.009	.08
Intelligence						
Balanced vs. Atypical	2.64	0.28	1	86.18**	<.001	.52
Mild vs. Moderate and Severe	0.24	0.24	1	0.98	.326	.01
Moderate vs. Severe	-0.59	0.26	1	5.27*	.024	.06

Note. Estimate indicates the contrast estimate for the level compare to the later conditions of resonance severity.
*p-value < 0.05 ** p-value ≤ .001

Speaker sample sex analyses

A second repeated measures MANOVA was conducted on the subset of the data, which included resonance severity samples with both male and female speakers. Authors note the severe category was removed for analysis, as it did not have a female speaker. Alpha level was set at .025 for secondary analysis. Speaker resonance severity and speaker sex were set as the repeated measures and the listeners' rating of the speaker's employability and intelligence were entered as the dependent variables. The MANOVA revealed a significant multivariate main effect for speaker sex Wilks' $\lambda = .82$, F (2, 79) = 8.52, $p < .001$, $\eta 2 = .18$ (observed power =.96). Results indicated female speakers (M= 14.19; SE= 0.42) were rated higher than male speakers (M= 13.34; SE= 0.41) on employability, p =.001. Additionally, female speakers (M= 12.89; SE= 0.37) were rated higher on intelligence compared to the male speakers (M= 11.98; SE= 0.35), p

< .001. Univariate *F*-tests for the main effect of speaker sex are reported in Table 3 and descriptive statistics based on speaker sex and severity are reported in Table 5.

Table 5. Descriptive statistics for listener ratings of speakers employability and intelligence (N=81)

Resonance Severity	**Balanced**	**Mild**	**Moderate**	**Severe**
Employability				
Female	15.95 (0.40)	13.77 (0.48)	12.86 (0.49)	
Male	15.27 (0.41)	12.47 (0.50)	12.27 (0.49)	13.19 (0.44)
Intelligence				
Female	14.62 (0.43)	12.41 (0.44)	11.65 (0.42)	
Male	13.91 (0.40)	11.16 (0.41)	10.85 (0.43)	11.84 (0.39)

Note. Means and standard error in parentheses are provided for employability and intelligence rating by listener for each level of speaker resonance severity, based on speaker sex. The severe category incorporated two male speakers was not included in analysis based on speaker sex.

The main effect reported across the four speaker resonance severity maintained with only three levels of severity, Wilks' $\lambda = .41$, $F\ (4, 77) = 28.10$, $p < .001$, $\eta 2 = .59$ (observed power >.99). Helmert contrasts indicated that individuals with balance resonance were rated higher on both employability (p <.001) and intelligence (p<.001) than the speakers with atypical resonance by the listeners in the sample. Individuals with mild resonance severity rated significantly higher from those with moderate resonance characteristics on employability (p=.014), but not intelligence (p= .028; alpha level set at .025). Results of the univariate F-test and Helmert contrast are reported in Table 6. There was no significant interaction among speaker severity x sex, Wilks' $\lambda = 97$, $F\ (4, 77) = 0.62$, $p = .65$.

Table 6. Univariate f-tests and planned Helmert contrasts for severity groups with male and female speaker representation (N=81)

	Estimate	SE	df	F	p-value	η^2
Employability						
Balanced vs. Atypical	2.77	0.28	1	101.01**	<.001	.13
Mild vs. Moderate	0.55	0.22	1	6.33*	.014	.17
F (2, 160) = 70.69, p < .001, η^2 = .47, observed power >.99						
Intelligence						
Balanced vs. Atypical	2.75	0.29	1	91.19**	<.001	.53
Mild vs. Moderate	0.53	0.24	1	5.01	.028	.06
F (2, 160) = 62.08 p < .001, η^2 = .44, observed power >.99						

Note. Estimate indicates the contrast estimate for the level compare to the later conditions of resonance severity. Note in this follow up MANOVA the severe speakers were not included in data analysis.
* p-value < 0.025 ** p-value ≤ .001

Job Requirements

The results of Pearson's chi-square tests indicated that listeners differed significantly in their forced choice responses related to job responsibility across the four resonance severity groups, X^2 (3) = 91.05, p < .001. Comparison of column proportions indicated that the speakers with balanced resonance were more likely to be selected for a "job that requires high level of (job) responsibility," p <.001. Individuals with mild resonance severity were more likely to be selected for a "job that requires a low level of (job) responsibility," p = .004. Individuals with moderate resonance severity were more likely to be selected for a "job that requires a low level of job responsibility," p < .001. There was no difference in the level of job responsibility respondents selected for individuals with severe resonance severity, p > .05. A second chi-square test determined there were no significant differences in the level of job responsibility respondents selected for individuals based on speaker sex, X^2 (1) = 3.72, p =.054. Results of Pearson's chi-square and comparison of column proportions are reported in Table 7.

Table 7. *Pearson Chi-Square table reporting forced choice responses for Job communication and responsibility requirements based on Resonance and speaker sex (N=81)*

	A job that requires responsibility			***A job where they communicate with people***		
	High level	**Low level**	**p-value**	**Frequently**	**Infrequently**	**p-value**
Balanced	128[**]	34	<.001	136[**]	26	<.001
Mild	63	99[*]	.004	67	95[*]	.013
Moderate	47	115[**]	<.001	47	115[**]	<.001
Severe	77	85	> .05	73	89	>.05
	Chi -Square = 91.05, df (3), p < .001			**Chi -Square = 109.65, df (3), p < .001**		
Females	130	113		145[**]	98	<.001
Males	185	220		178	227[**]	<.001
	Chi -Square = 3.72, df (1), p =.054			**Chi -Square = 15.05, df (1), p < .001**		

Note. Superscript a designates the column with significantly greater distributions of count; with p-values adjusted with Bonferroni correction
* p-value < 0.05 ** p-value ≤ .001

Job Communication

The Pearson's chi-square test indicated that participants differed significantly in their forced choice responses related to job communication based on speaker resonance severity, X^2 (3) = 109.65, p < .001. Comparison of column proportions indicated that for speakers with balanced resonance were more likely to be selected for a "job where they communicate with people *frequently*," p <.001. Individuals with mild resonance severity were more likely to be selected for a "job where they communicate with people *infrequently*," p = .013. Individuals with moderate resonance severity were more likely to be selected for a "job where they communicate with people *infrequently*," p < .001. There was no difference in the level of job communication respondents selected for individuals with severe resonance severity, p > .05. A second chi-square test determined there were differences in the level of job communication respondents selected for individuals based on speaker sex, X^2 (1) = 15.05, p < .001. Respondents were more likely to select a "job where they communicate with people *infrequently*," for male speakers (p < .001)

and “job where they communicate with people *frequently*,” for female speakers ($p<.001$). Results of Pearson’s chi-square are reported in Table 7.

Discussion

The primary aim of this investigation was to query if hypernasal resonance in the speech samples of teenagers influenced listener ratings of employability and communication effectiveness. Our first hypothesis, that individuals with hypernasal speech would be rated less intelligent & employable than those without hypernasal speech, was supported by the results of the employability survey. Overall, listeners ranked those with typical resonance to have higher intelligence & levels of employability than those with atypical resonance. This finding is consistent with literature in relation to other communication disorders. Rice, Hadley, & Alexander (1993) found that children with language disorders were more likely to be rated unintelligent by kindergarten teachers, females with same-matched educational backgrounds, undergraduate college students, and speech language pathologists. Similar results were reported by DeThorne & Watkins (2001). Individuals who stutter have been deemed to be “less employable” in an initial job interview than those who do not stutter (Hurst & Cooper, 1983).

As severity of hypernasality increased, the ratings of intelligence & employability decreased with the exception of the “severe hypernasality” category. Therefore, the second hypothesis is somewhat supported by the results of this investigation. The finding that severe hypernasality was not the most negatively rated group differs from Watterson, Mancini, Brancamp, & Lewis (2013) who found that negative perception of hypernasality consistently increased as severity became worsened. This unexpected finding is likely be linked to one of the speaker audio recordings used within the “severe hypernasality” category of the employability survey. While this speaker’s nasalence score was objectively categorized as severe with a 60%

nasalence value, the investigators hypothesize that this individual may have sounded more mature, thus skewing the study findings. Due to this proposed perceptual difference, listeners may have rated the speaker higher than the other speaker sample in the "severe hypernasality" category, which inflated the overall rating.

Listeners were more likely to select those with hypernasality for jobs where they do not communicate with people frequently, providing support for the third hypothesis. They were also more likely to select the individuals with hypernasality for jobs requiring a low level of responsibility which supports the final hypothesis of this study. These findings are consistent with Stern et al. (2017) where they found that individuals using their dysarthric speech instead of a SGD were rated for "lower level" jobs compared to when they were using a SGD.

Differences of perceptual ratings based on speaker sex were additionally analyzed, the "severe hypernasality" category was not used in this analysis since it contained two male speakers. Female speakers were rated significantly higher than male speakers on ratings of intelligence and employability. They were also more likely to be selected for jobs where the communicate with people frequently whereas males were more likely to be selected for jobs where they communicate with people infrequently. This could be due to the fact that hypernasality often creates "younger" sounding speech, which may be more perceptually distinct in a male voice in comparison to a female voice (Nyberg, Hagberg, & Havstam, 2020). This finding contradicts the findings of other studies where females are perceptually judged more negatively in comparison to males (Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Zacharias, Kelchner, & Creaghead, 2013). Future work with larger numbers of speaker samples would determine if this difference persists.

The present findings are consistent with prior research that described the perceptions of hypernasal speech as overwhelmingly negative (Blood & Hyman, 1977; Blood, Mahan, & Hyman, 1979). Given that the participants made negative judgements regarding level of intelligence, it could be postulated that teenagers with hypernasal resonance may be at a disadvantage academically. Success in the classroom is in part dependent on the relationship between the student and their teacher. However, this relationship may be degraded if educators are making subconsciously biased judgements, similar to the listeners in this study. For example, Zacharias, Kelchner, & Creaghead (2013) found that adolescent females with voice disorders were more likely to receive negative judgements from teachers than those without voice disorders. Assuming a student is unintelligent, even unconsciously, may hinder an educator's ability to connect with that student and give them the level of support they might need in the classroom. Academic success is also linked to class participation, such as raising a hand to answer a question and participating in classroom discussions. Hoffman-Ruddy & Sapienza (2004) reported that students diagnosed with voice disorders often feel embarrassed and withdraw from classroom participation. They also found that students with voice disorders were aware of their inability to create enough volume in the classroom. Teenagers with hypernasal resonance may be embarrassed to engage in classroom participation, or they may not be able to be loud enough in order to fully participate.

Negative perceptions may also impact the level of social acceptance a teenager with hypernasal resonance may feel. Watterson and colleagues (2013) found that even younger children with hypernasal resonance were ranked lower on a social rating form completed by same age peers. One can assume that these findings would also relate to teenagers, with the possibility that ratings of social acceptability might be worse than when they are with elementary

aged students. Being aware of how other students feel about them may risks social isolation for teenagers with hypernasal resonance. This could potentially lead to withdrawal from interacting with other students which only perpetuates the issue of social acceptability. Palmer and colleagues (2016) reported that having a communication disorder puts one at risk for smaller social circles, reduced quantity of positive communicative exchanges, lower levels of participation in social activities, and higher levels of loneliness. This has the potential of putting those with communication disorders at a disproportionate risk of developing mental and physical health problems. Overall, in terms of social relationships, communication disorders have a more profound impact on the negative aspects of social engagement in comparison to positive aspects (Palmer, Newsom, & Rook, 2016). Maintaining healthy and successful social relationships are important across the lifespan, but especially for teenagers. Hypernasal resonance puts them at risk of not developing necessary relationships.

Highlighted by the results of this study, teenagers with hypernasal resonance may be at a disadvantage when entering the job market. Vocational success is dependent on how employers feel about the candidate and the judgements they make on that person. The fact that individuals with hypernasal resonance were more likely to be ranked unintelligent and unemployable does not bode well for future job interview success. Neither does being more likely to be selected for a job where they communicate infrequently and a job with low levels of responsibility. The findings of this investigation indicates that teenagers with hypernasal resonance may have limited vocational prospects. This observation is supported by employability research conducted about other communication disorders (Abou-Dahech & Gabel, 2020; Anderson, Klofstad, Mayhew, & Venkatachalam, 2014; Gilmore, 1974; Hurst & Cooper, 1983; Stern et al., 2017).

It is important to note that vocational success may also be linked to academic success as many jobs require some level of post-secondary education. Teenagers with hypernasal resonance may also experience difficulty getting into a university of their choice, especially if that university conducts interviews as a part of their application process. Difficulty getting into their school of choice may begin while they're still in high school. Romano, Paradise, & Green (2009) reported that guidance counselors serving students requiring speech and hearing accommodations felt underprepared to provide the assistance necessary for these students, despite reporting that working with these students was an important part of their job. While guidance counselors may not hold inherent negative biases towards students who have atypical speech patterns, school SLPs should factor in guidance counselor biases when counseling their student clients. Once a student matriculates into their university of choice, there is potential for them to face the same academic difficulties as discussed above. Many college classes are discussion heavy and a young person with hypernasal resonance is likely going to struggle with participation, especially in a large class of students which is common at the collegiate level. Secondary school SLP services are important to mitigate these in class challenges.

School SLPs are uniquely positioned to play a vital role in providing speech and counseling support for teens who may experience hypernasal resonance disorder despite reports of SLPs feeling "not competent at all" to treat communication disorders secondary to cleft palate (Callahan & Hazelwood, 2004; Grames, 2004, 2008; Karnell, Bailey, Johnson, Dragan, & Canady, 2005; Kuehn, Kummer, D'Antonio, & Karnell, 2006; Ruscello, Yanero, & Ghalichebaf, 1995). Collaboration with the student's craniofacial team may be a key solution for perceived lack of knowledge base and clinical experience. School-based SLPs have the option of reaching out to the SLP on the specific craniofacial team that the student has been working with since they

were born. Craniofacial SLPs are an excellent resource for school-based SLPs who feel overwhelmed by working with this medically complex group of individuals. They can provide information about targets for therapy, techniques for promoting good oral pressure, tips for reinforcement, etc. It is also imperative that these students be placed on a school-based SLPs' caseload at an early age. School-based SLPs can be an excellent source of education for the general and special education teachers who may be working with these students as well as the guidance counselors. Once the school-based SLP has collected adequate resources about resonance disorders, they can provide teachers with examples of speech characteristics that would merit a referral for school-based speech and language services. The craniofacial SLP has a role to play in this process as well, it is important they are proactive in contacting the school-based SLP to discuss what they are seeing when the child visits the craniofacial team. A craniofacial SLPs report should be considered when reviewing allocation of school-based services. Craniofacially trained SLPs should take it upon themselves to provide ample support to the school-based SLPs working with these students on a more regular basis. Productive communication between the school-based and craniofacial SLPs will improve the services provided to students with hypernasal resonance. With the advent of telepractice, the ease in which these professionals can collaborate is greater than ever before. Craniofacial SLPs can watch a teletherapy session being led by the school-based SLP and offer real-time support during treatment.

These findings may also support the transition of high school students with resonance disorder to vocational rehabilitation programs. The aim of vocational rehabilitation programs are to assist with employment as they transition from high school to work. Due to the negative connotations associated with hypernasal resonance, these students could benefit from being

placed in a job setting selected for them by one of these programs. These vocational opportunities are designed to allow individuals the opportunity to immerse themselves in the work force while also receiving a necessary level of support and accommodation. Vocational rehabilitation programs would have resources otherwise unavailable to these students, including relationships with employers who are welcoming to all individuals regardless of their perceived level of intelligence or employability.

It is acknowledged that aspects of student confidence, self-efficacy, communication effectiveness and family/social support may mitigate some of the negative influences of resonance disorder as described in the study findings. This is a complex topic in that it relates to the personality of the student in question. Personality type is a multifaceted area of study that goes beyond the scope of this paper. Further, external support varies greatly from student to student; some students likely have supportive family and friends. However, a high level of external support is not guaranteed to all students exhibiting hypernasal resonance.

Children, including adolescents, who have a history of craniofacial disorder characterized by a resonance impairment should not have to settle for a vocational pathway based on their atypical resonance. These adolescents may not be seeking out services because they do not understand how speech services could influence their resonance and their vocational pathways/outcomes. Given that children only see the craniofacial SLP less frequently as they mature through their teen years, advocacy from the school-based SLP is of particular importance. The school-based SLP is able to ensure such students do not settle for less than optimal speech and resonance production.

Strengths and Limitations

To the authors' knowledge, this is the first study of its kind to query aspects of employability related to the auditory perception of resonance disorders. Previous studies have investigated the combination of visual and auditory perceptions. Many individuals who present with a cleft of the secondary palate alone will not demonstrate visual anomalies; therefore, it is important to better understand the role of auditory perception alone. Separating the two perceptions in order to establish how each are operating individually may facilitate in planning goals (phone interviews vs. in person video interview techniques). This study has successfully indicated that individuals with hypernasal resonance receive negative perceptions (significantly lower ratings reported by listeners) in relation to employability based on solely auditory perception.

Another strength of this investigation was an adequate number of listener participants to achieve statistical power. Being able to query a high number of listeners (N = 81) allowed for adequate support of the hypotheses that were supported in the data analyses. The characteristics of the listeners who participated in the employability survey was an additional strength. They were selected from training programs that would be more likely to train individuals who may be in positions to hire, which created more realistic results in terms of employability. The methodological decision to ask listeners to self-identify their level of hearing loss as opposed to completing a formal hearing screening, enhanced the ecological validity of the study design, given that ~15% of adults age 18 years and older in America (37.5 million) report some trouble hearing and 2-7% of the population have undiagnosed auditory processing related difficulties (Blackwell, Lucas, & Clarke, 2014; Palfrey & Duff, 2007).Use of ecologically valid adolescent speech samples was another strength of this study, in lieu of use of computer-generated

resonance disorders. Similarly to the listener participant population, this yielded more realistic results.

Limitations are acknowledged. One limitation of the study may be the length of the speech sample used for auditory-perceptual analysis ("Thank you for considering me for this opportunity"). Evidence suggests a significant difference in listener perceptions using stimuli as short as 12-17 words (O'Connor et al., 2014; Eadie, Doyle, Hansen, & Beaudin, 2008). The chosen phrase for this study was comprised of 8 words, which may have influenced the study findings. Another limitation was the use of two male speakers in the severe resonance group instead of one female and one male. Researchers were given the opportunity to wait for a female speech sample representing severe hypernasality, however there was no guarantee one would be provided. Due to time constraints related to the launch of the employability survey, researchers chose to forgo including a female speaker in the severe category at this time. Follow up investigation may aim to replicate the current findings with longer samples and representation of female and male speakers in reach resonance severity category.

Future directions of this study could include other communication disorders that are linked with negative perceptions, specifically disorders that have been studied with visual and auditory perceptions together in a singular study. Dialectical variations of English (i.e. African American English, Philippine English, Appalachian English, etc.) would be an additional category of interest to query in terms of employability. Using a similar study design, researchers could survey professions that have been found to be more compassionate (i.e. SLPs, nurses, counselors) in an effort to see if the results are more positive than the current investigation.

Conclusion

The results of this investigation provided support for the hypothesis that individuals with hypernasal resonance are more likely to face vocational difficulty based solely on the auditory perception of their speech by those interviewing them. Adolescent speakers with objectively determined hypernasal resonance were rated by listeners to be more appropriate for jobs where they would communicate with people infrequently as well as jobs with a low level of responsibility. In an attempt to mitigate this hardship, school-based SLPs may play a critical role through timely service provision. The study findings support the belief that teenagers presenting with hypernasal resonance may struggle academically and socially in addition to vocationally. Academic, vocational, and social challenges support the need for school-based speech and language services. Craniofacial and school-based SLPs need to work together in an effort to provide these students with the best possible care. It is crucial for students experiencing communication impairment secondary to velopharyngeal dysfunction to receive these services in order to maximize their ability to be vocationally successful.

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Appendix I

Employability Survey

Perceptions of Employability Related to Individuals with Hypernasal Speech

Start of Block: Information Letter

Information Letter for a Research Study entitled
"Perceptions of Employability Related to Varying Degrees of Hypernasality: Making the Case for School-Based Referrals"

You are invited to participate in a research study to analyze the auditory perceptions of individuals who present with hypernasal speech, specifically perceptions related to the employability of these individuals. The study is being conducted by Scott Tye, Graduate Student Researcher under the direction of Dr. Mary J. Sandage, Associate Professor in the Auburn University Department of Speech, Language, and Hearing Sciences. You are invited to participate because you are currently a graduate student enrolled in the Master of Business Administration or the Master of Public Administration program at Auburn University and are age 18 or older.

What will be involved if you participate? Your participation is completely voluntary. If you decide to participate in this research study, you will be asked to answer demographic questions about you, your education background, your experience with hiring, and your speech/language background. Additionally, you will be asked to participate in auditory perception and rating tasks. You will be presented with 8 separate speech samples of individuals with varying degrees of hypernasality producing a vocationally appropriate sentence. Questions related to intelligence, level of employability, job type, and level of education will be asked following each speech sample. There will be 4 questions per speech sample, making a total of 32 questions in addition to demographic questions. Your total time commitment will be approximately 20 to 30 minutes. They survey will be carried out using the Qualtrics platform. This is an internet-based survey tool used to implement survey methods for research and other information collection purposes.

Are there any risks or discomforts? There are no physical risks associated with this project. It is possible that questions may touch on uncomfortable challenges that can arise in vocational communication. You will not be individually linked to any of your responses in the presentation of study results. However, loss of confidentiality is a potential risk with participation in any research investigation.

Are there any benefits to yourself or others? Your involvement in this research will help determine the level to which auditory perception alone can impact an individual's potential success in their vocational journey. Additionally, you will be helping to make the case that these individual's need to receive speech & language services within the school system. School-based services are the most readily available and financially attainable if a student meets special

education criteria. However, your participation in this research investigation will not result in any direct benefit to you.

If you change your mind about participating, you can withdraw at any time by closing the Qualtrics survey browser & not submitting the responses you have already recorded. Once you've submitted anonymous data, it cannot be withdrawn since it will be unidentifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the Department of Political Science or the Raymond J. Harbert College of Business.

Any data obtained in connection with this study will remain anonymous. Any information collected from this project will be kept in a secure location with access only granted to research personnel. Responses to the Qualtrics survey will be used for statistical analyses, however your personal identity will remain anonymous throughout the research process. Qualtrics will not access the IP address of the device being used to take the survey and only the demographic questions being asked will be used as identification.

While taking the Survey. It would be best to access the Qualtrics survey using a laptop or desktop device. The use of a mobile device may be complicated due to the speech samples imbedded within the survey flow. Please listen to the speech samples at a comfortable volume, and if possible, the use of headphones for listening tasks is recommended.

If you have questions about this study, please contact me as the principal investigator, Scott Tye at bst0014@auburn.edu or Dr. Mary J. Sandage at sandamj@auburn.edu.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334) 844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

Sincerely,

Scott Tye, B.S., Graduate Student Researcher
Department of Speech, Language, and Hearing Sciences
Auburn University

Mary J. Sandage, Ph.D., Associate Professor
Department of Speech, Language, and Hearing Sciences
Auburn University

HAVING READ THE INFORMATION ABOVE, by clicking 'yes' you are agreeing to voluntarily participate in the research investigation. You many withdraw from the investigation at any point if you wish by not completing the survey. By clicking 'no' you are stating that you do not wish to participate in the investigation and will be re-directed to the end of the survey. There will be no consequence for withdrawing from the project or stating that you wish not to participate. By clicking 'yes' below I assert:

I am 18 years of age or older

If I agree to participate in the survey, I agree to answer the questions being asked of me and I understand that I have final say on my decision to participate in this research study.

Please indicate if you wish to voluntarily participate in this project by clicking “yes”. This will direct you to the rest of the survey.

- ○ Yes (1)
- ○ No (2)

End of Block: Information Letter

Start of Block: Demographics

Q1 How old are you?

_____

Q2 With which gender do you identify?

- ○ Male (1)
- ○ Female (2)
- ○ Or specify (3) _____

Q3 With which sexual orientation do you identify?

- ○ Heterosexual (1)
- ○ Homosexual (Gay) (2)
- ○ Homosexual (Lesbian) (3)
- ○ Bisexual (4)
- ○ Pansexual (5)
- ○ Asexual (6)
- ○ Queer (7)

Q4 With which race do you identify?

- ☐ White (1)
- ☐ Black and/or African American (2)
- ☐ American Indian or Alaska Native (3)
- ☐ Asian American (4)
- ☐ Native Hawaiian or Other Pacific Islander (5)

Q5 With which ethnicity do you identify?

- ○ Hispanic (1)
- ○ Non-Hispanic (2)

Q6 What is your country of origin?

- ○ U.S. (1)
- ○ Not U.S. (2) _____

Q7 What is your current highest level of education?

- ○ Bachelor's degree (1)
- ○ Master's degree (2)
- ○ Doctorate degree (3)
- ○ Other professional degree (4)

Q8 Do you know anyone with a cleft lip and/or cleft palate?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)

Q9 Do you have any past history of speech and/or language difficulties?

- ○ Yes (1)
- ○ No (2)

Q10 Are you in management or human resources?

- ○ Yes (1)
- ○ No (2)

Q11 Which language(s) do you speak?

- ☐ English (1)
- ☐ Spanish (2)
- ☐ Korean (3)
- ☐ Chinese (4)
- ☐ French (5)
- ☐ Or specify (6) _____

Q12 What is your native language?

- [ ] English (1)
- [ ] Spanish (2)
- [ ] Korean (3)
- [ ] Chinese (4)
- [ ] French (5)
- [ ] Or specify (6) _____

Q13 Do you have a known hearing impairment?

- ○ Yes (1)
- ○ No (2)

Q14 Please select the Master's program in which you are currently enrolled.

- ○ Master's of Business Administration (Full Time) (1)
- ○ Master's of Business Administration (Online) (2)
- ○ Master's of Business Administration (Executive) (3)
- ○ Master's of Business Administration (Physicians Executive) (4)
- ○ Master's of Public Administration (5)

End of Block: Demographics

Start of Block: Block 1

Q14 Based off the speech sample, how intelligent would you describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q15 Based off the speech sample, how employable would you describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q16 Based off the speech sample, for which job would you hire the speaker?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q17 Based off the speech sample, for which job would you hire the speaker?

- ○ A job in which they would need higher education (1)
- ○ A job in which they would not need higher education (2)

End of Block: Block 1

Start of Block: Block 2

Q28 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q29 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q30 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q31 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 2

Start of Block: Block 3

Q32 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q33 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q34 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q35 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 3

Start of Block: Block 4

Q36 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q37 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q38 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q39 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 4

Start of Block: Block 5

Q40 Based off the speech sample, which word would you use to describe the speaker?

Unintelligent	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)		Intelligent

Q41 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q42 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q43 Based off the speech sample, which job would you hire the speaker for?

- ○ A job in which they would need higher education (1)
- ○ A job in which they would not need higher education (2)

End of Block: Block 5

Start of Block: Block 6

Q44 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q45 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q46 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q47 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 6

Start of Block: Block 7

Q48 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

Q49 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q50 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q51 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 7

Start of Block: Block 8

Q52 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unintelligent																					Intelligent

X→

Q53 Based off the speech sample, which word would you use to describe the speaker?

	1 (.5)	2 (.10)	3 (.15)	4 (.20)	5 (.25)	6 (.30)	7 (.35)	8 (.40)	9 (.45)	10 (.50)	11 (.55)	12 (.60)	13 (.65)	14 (.70)	15 (.75)	16 (.80)	17 (.85)	18 (.90)	19 (.95)	20 (100)	
Unemployable																					Employable

Q54 Based off the speech sample, which job would you hire the speaker for?

- A job where they communicate with people frequently (1)
- A job where they do not communicate with people frequently (2)

Q55 Based off the speech sample, which job would you hire the speaker for?

- A job in which they would need higher education (1)
- A job in which they would not need higher education (2)

End of Block: Block 8

Appendix II

Student Email Language

Hello,

The Department of Speech, Language, and Hearing Sciences is interested in the interaction between a person's speech and perceptions of employability, specifically how a diagnosis of a resonance disorder, which can create hypernasal or hyponasal speech, effects these perceptions.

Graduate student, Scott Tye, advised by Dr. Mary J. Sandage, Associate Professor in the Department of Communication Disorders at Auburn University, has created a survey to examine the relationship between one's speech and their potential experiences within the job market.

Your involvement in this investigation will help analyze the connection between speech and employability. All responses within the survey will remain confidential and be used for research purposes only. Your participation is voluntary, and you may choose to end your involvement at any time by simply not submitting your responses to the survey.

Below you will find the link that will help you access the Qualtrics survey. Upon entry to the survey you will be presented with an information letter. Please read this letter in its entirety as it will explain the survey and your responsibilities in greater detail. Following your review of this letter you will be asked whether or not you agree to voluntarily participate in the completion of the survey.

Thank you!
Scott Tye, B.S., Graduate Student
Mary J. Sandage, Ph.D., Associate Professor

Auburn University Human Research Protection Program

EXEMPTION REVIEW APPLICATION

For information or help completing this form, contact: **THE OFFICE OF RESEARCH COMPLIANCE,**
Location: 115 Ramsay Hall **Phone:** 334-844-5966 **Email:** IRBAdmin@auburn.edu

Submit completed application and supporting material as one attachment to IRBsubmit@auburn.edu.

1. PROJECT IDENTIFICATION **Today's Date** 09/10/2020

a. Project Title Perceptions of Employability Related to Varying Degrees of Hypernasality: Making the Case for School-Based Referrals

b. Principal Investigator Scott Tye Degree(s) B.S. Communication Disorders
Rank/Title Graduate Student Researcher Department/School Speech, Language, and Hearing Sciences
Phone Number (334) 663-5515 AU Email bst0014@auburn.edu

Faculty Principal Investigator (required if PI is a student) Dr. Mary J. Sandage
Title Associate Professor Department/School Speech, Language, and Hearing Sciences
Phone Number AU Email sandamj@auburn.edu

Dept Head Dr. Laura W. Plexico Department/School Speech, Language, and Hearing Sciences
Phone Number AU Email lwp0002@auburn.edu

c. Project Personnel (other PI) – Identify all individuals who will be involved with the conduct of the research and include their role on the project. Role may include design, recruitment, consent process, data collection, data analysis, and reporting. Attach a table if needed for additional personnel.

Personnel Name Dr. Megan-Brette Hamilton Degree (s) Ph.D.
Rank/Title Assistant Professor Department/School Speech, Language, and Hearing Sciences
Role Committee member - data analysis, data reporting, survey design, document revisions
AU affiliated? ☒ YES ☐ NO If no, name of home institution
Plan for IRB approval for non-AU affiliated personnel?

Personnel Name Dr. Marisha Speights Atkins Degree (s) Ph.D.
Rank/Title Assistant Professor Department/School Speech, Language, and Hearing Sciences
Role Committee member - survey design, data collection, data analysis, document revisions
AU affiliated? ☒ YES ☐ NO If no, name of home institution
Plan for IRB approval for non-AU affiliated personnel?

Personnel Name Dr. Aurora J. Weaver Degree (s) Ph.D.
Rank/Title Assistant Professor Department/School Speech, Language, and Hearing Sciences
Role Committee member - data analysis, data reporting, survey design, document revisions
AU affiliated? ☒ YES ☐ NO If no, name of home institution
Plan for IRB approval for non-AU affiliated personnel?

d. Training – Have all Key Personnel completed CITI human subjects training (including elective modules related to this research) within the last 3 years? YES ☒ NO ☐

Allow Space for the

AU IRB Stamp

e. Funding source – Is this project funded by the investigator(s)? ☐ YES ☒ NO
Is this project funded by AU? ☐ YES ☒ NO If YES, identify source _____
Is this project funded by an external sponsor? ☐ YES ☒ No If YES, provide the name of the sponsor, type of sponsor (governmental, non-profit, corporate, other), and an identification number for theaward.
Name_____Type_____Grant # _____

f. List other AU IRB-approved research studies and/or IRB approvals from other institutions that are associated with this project.

---

2. Mark the category or categories below that describe the proposedresearch:

☒ 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices. The research is not likely to adversely impact students' opportunity to learn or assessment of educators providing instruction. 104(d)(1)

☒ 2. Research only includes interactions involving educational tests, surveys, interviews, public observation if at least ONE of the following criteria. (The research includes data collection only; may include visual or auditory recording; may NOT include intervention and only includes interactions). **Mark the applicable sub-category below (i, ii, or iii).** 104(d)(2)

☒ (i) Recorded information cannot readily identify the participant (directlyorindirectly/linked); **OR**
- surveys and interviews: no children;
- educational tests or observation of public behavior: can only include childrenwhen investigators do not participate in activities being observed.

☐ (ii) Any disclosures of responses outside would not reasonably place participant at risk; **OR**

☐ (iii) Information is recorded with identifiers or code linked to identifiers and IRB conducts limited review; no children. **Requires limited review by the IRB.***

☐ 3. Research involving Benign Behavioral Interventions (BBI)** through verbal, written responses (including data entry or audiovisual recording) from adult subjects who prospectively agree and ONE of the following criteria is met. (This research does not include children and does not include medical interventions. Research cannot have deception unless the participant prospectively agrees that they will be unaware of or misled regarding the nature and purpose of the research)
Mark the applicable sub-category below (A, B, or C). 104(d)(3)(i)

☐ **(A)** Recorded information cannot readily identify the subject (directly or indirectly/linked); **OR**

☐ **(B)** Any disclosure of responses outside of the research would not reasonably placesubject at risk; **OR**

☐ **(C)** Information is recorded with identifiers and cannot have deception unless participant prospectively agrees. **Requires limited review by the IRB.***

☐ 4. Secondary research for which consent is not required: use of identifiable information or identifiable bio-specimen that have been or will be collected for some other 'primary' or 'initial' activity, if one of the following criteria is met. Allows retrospective and prospective secondary use. **Mark the applicable sub-category below (I, ii, iii, or iv).** 104(d)(4)

☐ (i) Biospecimens or information are publically available;

☐ (ii) Information recorded so subject cannot readily be identified, directlyorindirectly/linked; investigator does not contact subjects and will not re-identify thesubjects;OR

☐ (iii) Collection and analysis involving investigators use of identifiable health information when use is regulated by HIPAA "health care operations" or "research or "public health activities and purposes" (does not include biospecimens (only PHI and requires federal guidance on how to apply); OR

☐ (iv) Research information collected by or on behalf of federal government usinggovernment generated or collected information obtained for non-researchactivities.

☐ 5. Research and demonstration projects which are supported by a federal agency/department AND designed to study and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs;(iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs. (must be posted on a federal web site). 104(d)(5) (must be posted on a federal web site)

☐ 6. Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture. The research does not involve prisoners as participants. 104(d)(6)

New exemption categories 7 and 8: Both categories 7 and 8 require Broad Consent. (Broad consent is a new type of informed consent provided under the Revised Common Rule pertaining to storage, maintenance, and secondary research with identifiable private information or identifiable biospecimens. Secondary research refers to research use of materials that are collected for either research studies distinct from the current secondary research proposal, or for materials that are collected for non-research purposes, such as materials that are left over from routine clinical diagnosis or treatments. Broad consent does not apply to research that collects information or biospecimens from individuals through direct interaction or intervention specifically for the purpose of the research.) **The Auburn University IRB has determined that as currently interpreted, Broad Consent is not feasible at Auburn and these 2 categories WILL NOT BE IMPLEMENTED at this time.**

Limited IRB review* – **the IRB Chairs or designated IRB reviewer reviews the protocol to ensure adequate provisions are in place to protect privacy and confidentiality.

***Category 3 – Benign Behavioral Interventions (BBI)* must be brief in duration, painless/harmless, not physically invasive, not likely to have a significant adverse lasting impact on participants, and it is unlikely participants will find the interventions offensive or embarrassing.**

3. PROJECT SUMMARY

a. Does the study target any special populations? (Mark applicable)

Minors (under 18 years of age)	☐ YES ☒ NO
Pregnant women, fetuses, or any products of conception	☐ YES ☒ NO
Prisoners or wards (unless incidental, not allowed for Exempt research)	☐ YES ☒ NO
Temporarily or permanently impaired	☐ YES ☒ NO

b. Does the research pose more than minimal risk to participants? ☐ YES ☒ NO

Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or test. 42 CFR 46.102(i)

c. Does the study involve any of the following?

Procedures subject to FDA regulations (drugs, devices, etc.)	☐ YES ☒ NO
Use of school records of identifiable students or information from instructors about specific students.	☐ YES ☒ NO
Protected health or medical information when there is a direct or Indirect link which could identify the participant.	☐ YES ☒ NO
Collection of sensitive aspects of the participant's own behavior, such as illegal conduct, drug use, sexual behavior or alcohol use.	☐ YES ☒ NO
Deception of participants	☐ YES ☒ NO

4. Briefly describe the proposed research, including purpose, participant population, recruitment process, consent process, research procedures and methodology.

The purpose of the proposed study is to examine the auditory perceptions listeners have about individuals who produce hypernasal speech, specifically employment related perceptions. The literature states that the overall perception of individuals with resonance disorders is negative (Addington, 1968; Blood & Hyman, 1977; Blood et al., 1979; McKinnon et al., 1986; Lallh & Rochet, 2000; Watterson, Mancini, Brancamp, & Lewis, 2013) but limited research has been conducted in terms of of employability (Scheuerle, Guilford, & Garcia, 1982). Even less research has separated the auditory aspects of a resonance disorder from the visual aspects. This is an important distinction because not all individuals will present with a visual anomaly. In order to more accurately target the employment aspect of this project, the participant population will be made up of graduate students from either the Masters of Business Administration or Masters of Public Administration programs at Auburn University. Graduate students will be recruited for this project through a mass email from department representatives chosen by the PI, participants will be provided IRB approved language and a Qualtrics link within the email they receive from their selected faculty representative. When students open the Qualtrics link they will be directed to the opening page containing an information letter about the researchers and the investigation. Students will be asked to read the letter in its entirety and after reading they will be prompted to click either yes or no to the following statement: "By clicking 'yes' you are agreeing to voluntarily participate in the research investigation. You many withdraw from the investigation at any point if you wish by not completing the survey. By clicking 'no' you are stating that you do not wish to participate in the investigation and will be re-directed to the end of the survey. There will be no consequence for withdrawing from the project or stating that you wish not to participate." Within the survey, students will fill out demographic information before proceeding to the listening tasks. The listening tasks are made up of 8 speech samples across 4 descriptors (typical resonance, mild hypernasality, moderate hypernasality, & severe hypernasality) with 2 speakers (1 male & 1 female) within each descriptor group. Based off the speech samples, the students will be asked 4 questions (2 response scale format rating employability & intelligence and 2 forced choice questions asking whether or not they would hire the individual for: 1) a job requiring excellent speech skills and 2) a job requiring a degree of higher education). Expected participation time for participants who complete the survey in its entirety is 20-30 minutes. Response scale format questions will be statistically analyzed using repeated measures of multivariate analysis of variance (RM-MANOVA) and forced choice questions will be analyzed using non-parametric repeated measures.

5. Waivers

Check any waivers that apply and describe how the project meets the criteria for the waiver. Provide the rationale for the waiver request.

☐ **Waiver of Consent (Including existing de-identified data)**

☒ **Waiver of Documentation of Consent (Use of Information Letter)**

☐ **Waiver of Parental Permission**

All retrospective information will be de-identified.

Participants will be recruited through mass emails sent out by their selected department representative who have access to class email lists. A link to the Qualtrics survey will be included in the email. The first question of the Qualtrics survey will be an information letter which includes the option to indicate interest in participation. By checking"yes" they will then proceed to the survey.

6. Describe how participants/data/specimens will be selected. If applicable, include gender, race, and ethnicity of the participant population.

Using the finalized version of the survey following IRB approval, the PI will email a description of the project and they survey link to a selected faculty member within selected programs for distribution to their students. The MBA faculty member is Dr. Stanley Harris and the MPA faculty member is Dr. Bridgett King. The only inclusion criteria is that they are a student within either program and there is no exclusion criteria for this investigation. Since faculty members will only be emailing the students within the designated programs, any student is eligible to participate in the investigation once they receive the email from their faculty member.

7. Does the research involve deception? ☐ YES ☒ NO If YES, please provide the rationale for deception and describe the debriefing process.

8. Describe why none of the research procedures would cause a participant either physical or psychological discomfort or be perceived as discomfort above and beyond what the person would experience in daily life.

Participants will not be subjected to any physical discomfort while engaging with the survey other than potentially having their volume set too loud when the speech samples begin playing. They survey may be completed in a comfortable and quiet area of their choosing and none of the research tasks require physical involvement beyond the normal extent of using a computer. It is unlikely that participants will experience any psychological discomfort beyond their normal level in daily life. They are being asked to tell us their auditory perceptions based off the speech samples they hear. We all create perceptions based off the way a person's speech sounds to us (Allard & Williams, 2008). We are just asking them to report these perceptions in a survey. However, should they feel uncomfortable at any time, they are informed prior to beginning the survey that they can withdraw at any time by not submitting their responses to the survey.

9. Describe the provisions to maintain confidentiality of data, including collection, transmission, and storage.

The Qualtrics survey will be set up to not collect IP addresses of the devices with which the students will complete the survey. This will help to further ensure tat their responses remain anonymous. All data collected from the survey will be kept within the Qualtrics platform or within Excel spreadsheets that have been created for data analysis. Only the PI, faculty advisor, committee members, and a few fellow graduate students (recruited for testing the survey before it is launched) will have access to the Qualtrics survey. With regards to the Excel spreadsheets used for data analysis, only the PI, faculty advisor, and committee members will have access to that document. The Excel spreadsheet will be saved to Dr. Sandage's password protected share drive, which is backed up daily. It should be noted that it is unlikely students will be identifiable based off the manner in which this survey is being distributed (via email).

10. Describe the provisions included in the research to project the privacy interests of participants (e.g., others will not overhear conversations with potential participants, individuals will not be publicly identified or embarrassed).

Participants will receive information about the investigation through email and will not be required to come in direct contact with the researches or any other participants. Demographic information will be de-identified to help ensure participants will not be publicly identified due to their involvement. All data will be reported anonymously.

11. Will the research involve interacting (communication or direct involvement) with participants?
☒ YES ☐ NO If YES, describe the consent process and information to be presented to subjects. This includes identifying that the activities involve research; that participation is voluntary; describing the procedures to be performed; and the PI name and contact information.

Communication with participants will be primarily carried out though their selected faculty representative, this communication will be conducted via mass email to the students within the chosen university programs (MBA & MPA). Participants will be presented with an informational letter prior to beginning the demographic information collection and auditory perception tasks. Within the letter the project will be explained and the PI & faculty advisor will be introduced. Participants will be provided the contact information for both the PI and the faculty advisor. The participants will be: 1) made aware that the survey is for research purposes, 2) informed they they can withdraw at any time by not submitting their survey, 3) told their participation is voluntary and that there will not be any consequences for choosing not to participate, and 4) informed of the demographic information questions & the 8 speech samples they will listen to and told that there are 4 questions per speech sample that will need to be answered.

Any communication between participants and the study investigators will have to be initiated by the participant, given that the investigators will be collecting participant data anonymously.

12. Additional Information and/or attachments.

In the space below, provide any additional information you believe may help the IRB review of the proposed research. If attachments are included, list the attachments below. Attachments may include recruitment materials, consent documents, site permissions, IRB approvals from other institutions, etc.

The speech samples provided for the employability survey were provided by the Clinic for Cleft and Craniofacial Anomalies at Children's Hospital of Atlanta. IRB STUDY00000526. CHOA representatives are only affiliated through the provision of speech samples, they will not be involved in the conduction of this research project at Auburn University.

Speech samples accessed for implementation in the employability survey using the database described in Dr. Marisha Speights Atkins' protocol for her speech intelligibility study. IRB 20-146 EX 2003. CHOA representative, Katherine Willoughby, will transfer speech samples to a "one drive" at Auburn University created by Dr. Marisha Speights Atkins. Following their transfer in the Auburn University "one drive", they will be uploaded to BOX for access.

Principal Investigator's Signature Matt Duge **Date** 9/10/2020

If PI is a student,
Faculty Principal Investigator's Signature Mary Sandage **Date** 9/10/2020

Department Head's Signature Laura Devine **Date** 9/10/2020