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AN EVALUATION OF COMMUNICATION APPREHENSION IN ADOLESCENTS WITH VELOPHARYNGEAL INSUFFICIENCY

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AN EVALUATION OF COMMUNICATION APPREHENSION IN ADOLESCENTS WITH VELOPHARYNGEAL INSUFFICIENCY

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ABSTRACT

The purpose of this study was to evaluate the communication apprehension (CA) of adolescents with velopharyngeal insufficiency (VPI). Phase one of the study involved completion of the MECA, a measure of CA, by 28 adolescents (14 from the VPI group and 14 from the control group) followed by voice recordings of speech phrases. Phase two of the study involved conducting a perceptual assessment of the speech samples provided by participants in phase one using the ACPA. Phase one and phase two of the study were conducted to answer two experimental questions: 1) Do adolescents with VPI experience higher levels of CA than adolescents who do not have a speech/voice disorder? 2) What is the relationship between MECA scores and perceptual assessment of voice quality scores? In addition, reliability of the MECA and the ACPA were also investigated. Results indicated good reliability of the MECA, and poor-to-good inter-rater and good-to-excellent intra-rater reliability of the ACPA. The VPI group reported statistically significant higher levels of CA than the control group. Finally, a statistically significant fair positive correlation was found between the MECA and the velopharyngeal function variable. Results of the study are discussed with special consideration given to the literature. Keywords: Communication Apprehension, MECA, ACPA, Velopharyngeal Insufficiency (VPI), Perceptual Assessment.

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Chapter One

Introduction

Individuals with communication disorders face many deficits in the context of social communication including social isolation, reductions in one's self-image and changes in one's overall pattern of interaction with others in multiple environments and situations (Horwitz, 2002; Klompas & Ross, 2004). One aspect of concern specific to those with communication disorders may be found in the concept of communication apprehension (CA). The construct of CA was first introduced in 1970 by James C. McCroskey who defined the term as "an individual's level of fear or anxiety associated with either real or anticipated communication with another person or persons" (McCroskey, 1977, p. 78; McCroskey, 1978). Individuals who are highly apprehensive about their communication will experience distress and feelings of anxiety when put into different social situations such as talking to an authority figure, giving a speech in front of an audience or in dyadic interactions. Past research concerned with examining anxiety and fear states of individuals who are communicating orally in different social situations have been carried out under different labels including: shyness (Zimbardo, 1978), reticence (Phillips, 1968), stage fright (Clevenger Jr., 1959), audience sensitivity (Paivio, 1964), willingness to communicate (Lang, Rowland-Morin, & Coe, 1998) and communication apprehension (McCroskey, 1970). Although these terms have often been used interchangeably, the concept of CA is conceptually distinct from these terms in that it is primarily concerned with the *cognitive* distress that communication apprehensive individuals experience when anticipating or engaging in communicative tasks.

Although individuals who are highly apprehensive relative to their communication have a tendency to *avoid* communication situations, or *withdraw* from communication when unexpected communication situations arise, these *behaviours* are typically addressed by constructs such as shyness and reticence. The primary focus of CA research is not the behaviours that communication apprehensive individuals engage in but the *feelings* of fear and anxiety accompanying the communication situations (McCroskey, 1977). In addition to providing a distinction between CA and other research constructs addressing issues of social anxiety, another distinction often made in CA research is the difference between *state* and *trait* anxiety.

Advanced initially through the work of Speilberger (1966) and Lamb (1972), a useful distinction between "*state*" apprehension and "*trait*" apprehension has been applied to CA research. State apprehension refers to a transitory state in which individuals may experience heightened levels of anxiety or fear in a specific communication situation, while trait CA refers to fear and anxiety feelings of an individual that is experienced across different contexts and is attributed to the personality traits of the individual (Daly & McCroskey, 1984). State CA can be attributed to the situation that the individual is placed in, while trait CA is attributed to the personality trait of the individual experiencing the anxiety (Behnke & Sawyer, 1998). While these terms are often viewed as dichotomous, McCroskey and Daly (1984) argue that there is a powerful interaction between the two sources of anxiety, and that the terms should instead be viewed as running along a continuum ranging from the extreme *state* pole to the extreme *trait* pole. Along this continuum, four

distinct points can be identified, each representing a different type of CA: *Situational CA, Person-Group CA, Generalized-Context CA, and Trait-like CA* (Daly & McCroskey, 1984, p.15). Each type of CA will be briefly presented and defined in the subsequent sections of this review.

Situational CA

Situational CA refers to "a transitory orientation toward communication with a given person or group of people" (Daly & McCroskey, 1984, p.18). Situational CA is the most state-like CA in that it is not personality based but rather based on situational constraints imposed on the individual experiencing the anxiety in a given context at a given time. Thus, an individual with situational CA may experience concern when speaking to another individual at one time (e.g. when being accused by the teacher for an incident that occurred) but not another (e.g. when being asked a question by the same teacher in a classroom setting).

Person-Group CA

The second type of CA is person-group CA and represents "a relatively enduring orientation toward communication with a given person or group of people" (Daly & McCroskey, 1984, p.17). This type of CA is a function of the person or group of people the communication apprehensive individual is communicating with and is not attributed to personality, but rather situational constraints. For example, an individual may become highly apprehensive about talking to his or her boss, but may have no apprehension about talking to co-workers. This person-specific CA is distinguished from a more generalized type of CA.

Generalized-Context CA

The third type of CA is generalized-context CA and it is defined as "a relatively enduring, personality-type orientation toward communication in a given type of context" (Daly & McCroskey, 1984, p.16). This view recognizes that individuals can experience high apprehension in one social context and have little or no apprehension in another social context. McCroskey (1984, p.17) identified four generalized oral communication contexts that may cause apprehension: public speaking, speaking in small group discussions, talking in meetings or classes, and speaking in dyadic interactions. Individuals may experience communication apprehension in one generalized context such as during all public speaking situations, but not in other contexts such as talking in class. The distress that these individuals are experiencing when presenting in front of a large group of people is context specific and is likely to be experienced in similar contexts due to the personality characteristics of the individual.

Trait-Like CA

Finally, trait-like CA refers to "a relatively enduring, personality-type orientation toward a given mode of communication across a wide variety of contexts" (Daly & McCroskey, 1984, p.16). An individual with high trait CA will experience fear and anxiety across different oral communication contexts such as talking in a meeting, talking in front of an audience and talking to another individual (McCroskey, 1977). This trait-like CA is highly resistant to change and, thus, individuals experiencing high trait-like CA are likely to experience the same levels of anxiety across time. This trait-like perspective of CA will be the focus of the present study and, hence,

"trait-like CA" and "CA" will be used interchangeably throughout the remainder of this treatise. Research addressing trait CA is diverse and has covered various topics including causes, methods of measurement, effects, and populations. A subsequent exploration of these topics will provide background knowledge of how the CA construct may be applied to specific populations who experience communication disorders.

Causes of CA

Throughout the four decades of CA research, proposed theories about the causes of CA have generally fallen into three categories: social learning, skills acquisition, and genetics. From the onset of research into this topic, the prevailing theory of what causes CA was attributed to the environment in which the child was raised during the early years of his/her life. Based on social learning theory (Bugelski, 1971), CA is acquired through one of two means, namely, reinforcement and modelling (Daly & McCroskey, 1984). Reinforcement theory states that behaviours that are reinforced will be repeated, while behaviours that are not reinforced will be extinguished over time (Bugelski, 1971). If a child is not reinforced for communicating or receives negative reinforcement when he or she attempts to communicate, the result will be a child who exhibits CA. Another way that a child can learn to be communication apprehensive is through modelling.

Modelling theory suggests that children emulate the behaviours and actions of the people in their environment (Bandura, 1977). Parents who exhibit signs of CA such as withdrawal or avoidance behaviours, will teach their child to communicate in a similar manner, resulting in a child who is communication apprehensive (Daly &

McCroskey, 1984). Although this social learning perspective has been the prevailing theory of CA, few studies have found support for this perspective (Ayres, 1988; Beatty, Plax, & Kearney, 1985; Daly & Friedrich, 1981) and most support is based on speculation and analogy (Daly & McCroskey, 1984). In addition, the social learning theory focuses on the behaviours that the children adopt from their environment, but does not explain the cognitive component of CA. More specifically, social learning theory does not address how children learn to become anxious in communication situations. Therefore, the social learning theory interpretation does not adequately address the cognitive element of the CA construct. To address this cognitive component, another proposition brought forth as a possible theory was the skills acquisition theory.

Proponents for the skills acquisition theory suggest that CA is a result of deficits in oral communication skills. According to this theory, individuals experience apprehension in social settings as a result of not being able to produce appropriate responses to situations requiring communication (Beatty & Valencic, 2000). Several studies have found a negative relationship between CA and skills acquisition (Daly & McCroskey, 1984; McCroskey, 1977; McCroskey, Andersen, Richmond, & Wheeless, 1981), while other studies have not found that a relationship exists (Beatty & Valencic, 2000). In addition, most data supporting a relationship is correlational (Beatty & Valencic, 2000; Daly & McCroskey, 1984), prohibiting a clear relationship to the inference of causality. Thus, there is limited support for the skills acquisition theory relative to CA. In contrast to this theory, a biological theory of CA has also been proposed by others.

Beatty, McCroskey and Heisel (1998) have reconceptualized CA from that based on a social learning perspective to that of a biological perspective. Beatty et al. (1998) combined two areas of research to propose this biological theory of CA: research on temperament (Eysenck, 1985) and research on neurobiological systems in the brain (Gray, 1981). Research on temperament (Eysenck, 1985) views the development of personality as the expression of inborn temperament traits. In addition, research on neurobiology (Gray, 1981), has linked these temperament traits to neurobiological systems in the brain. Combining these two areas of research, Beatty et al. (1998) proposed a "communibiological" paradigm of CA (Beatty, McCroskey, & Heisel, 1998).

According to Beatty et al. (1998), CA is the expression of two inborn traits that have underlying neurobiological mechanisms, introversion and neuroticism. Individuals who experience CA exhibit characteristics typical of individuals who exhibit introversion and neurotic temperaments such as those associated with being anxious, depressed, exhibiting feelings of guilt, low self-esteem, in addition to being tense, irrational, shy, moody, and emotional (Eysenck, 1985). They argue that these two traits (neuroticism and introversion) are inborn expressions of neurobiological systems in the brain and, thus, CA is biologically determined, with environmental factors contributing minimally to their manifestation. Several studies support this view of CA (Betty, 2002, p.55; Opt & Loffredo, 2000; Sallinen-Kuparinen, McCroskey, & Richmond, 1991). However, research into the treatment of CA using cognitive restructuring and behavioural modification methods has often resulted in reductions in CA, providing support for the influence that environment may have on

the expression of CA (Dwyer, 2000; Glaser, 1981; McCroskey, 1972). Taken together, the above theories have not provided compelling evidence for the causality of CA. The probable conclusion is that a simple model of the etiology of CA does not exist. The environment and biology probably both have an important role in the development and manifestation of CA, suggesting that a multi-causal model of CA may be more appropriate.

The perspective of a multi-causal model of CA was proposed by Condit (2000) and suggests that many factors including "genes, gene products, physiological and environmental inputs, developmental processes, established biological structures, cognitive processes and inputs, cultural processes, social structural inputs, and codes" contribute to CA development (Condit, 2000). This complex model of CA is likely to adequately describe the etiology of CA. In summary, various theories of CA have been proposed including social learning theories of modelling and reinforcement, skills acquisition theory, communibiological theory and, most recently, a multi-causal view of CA. Reflecting the transition of the conceptualization of the CA construct over the years, different methods of measuring CA have been introduced.

Measurement of Trait CA

Three major approaches to the measurement of CA have been advanced in CA research. These include physiological measures, observers' ratings, and introspective tests (Wheeless, 1971). Although all three measures of CA have been found to be highly reliable individually, research on the intercorrelations of these three measures is comparatively limited (Daly & McCroskey, 1984). Results of studies suggest that these three measurement approaches are evaluating conceptually distinct underlying

constructs. From a conceptual perspective, physiological measures examine arousal states. CA individuals do report experiencing arousal in the form of anxiety. However, the emotional distress subjectively described by high communication apprehensive individuals does not correlate highly with the physiological arousal detected through various objective equipment methods (Wheeless, 1971). Similarly, since CA is operationally defined as a cognitive experience of fear, it can be argued that observer ratings will not capture the internal element of the CA experience. In fact, research suggests that although certain behaviours are often correlated with CA, such as communication avoidance and withdrawal, measuring CA in terms of behavioural observations has limited validity in that there are no specific behaviours that can distinguish highly communication apprehensive individuals from those experiencing low levels of CA (Daly & McCroskey, 1984). Therefore, since the primary focus of CA emerges from consideration of cognitive experiences, the self-report method of measuring CA seems to be the most appropriate and valid method of addressing this construct since it involves asking individuals to rate their feelings of fear or anxiety across different communication contexts. The cognitive experience of CA can thus be measured through introspective methods such as self-report instruments. This introspective approach to the study of CA has been the most widely used method of measurement.

Regarding the self-report method of measuring trait CA, three tools have been exclusively used in research, including the Personal Report of Communication Apprehension (PRCA) (McCroskey, 1978), the Personal Report of Communication Fear (PRCF) (McCroskey et al., 1981), and the Measure of Elementary

Communication Apprehension (MECA) (Garrison & Garrison, 1979). The PRCA is by far the most widely used assessment of trait CA (Booth-Butterfield, Heare, & Booth-Butterfield, 1991; Buhr, Pryor, & Sullivan, 1991; Byles, Forner, & Stemple, 1985; Richmond, McCroskey, & McCroskey, 1989; Rockwell, 2007; Sallinen-Kuparinen et al., 1991). It is a 24-item questionnaire addressing feelings of fear and anxiety when speaking in four communication contexts: meetings, in small groups, in dyadic interactions, and public speaking. Although the PRCA has been used extensively in CA research, and exhibits very high reliability (usually above .90), questions on the PRCA are only applicable to individuals at the high school level and above (Daly & McCroskey, 1984). Hence, the PRCA is not a valid measure of CA for younger, elementary school aged children.

To ameliorate the problem of self-report measures not being available for the younger population, the PRCF was developed to evaluate the CA of children who are preliterate to the junior high school level. Although the PRCF has been found to correlate highly with the PRCA for older children and adults, one issue with the PRCF is that the tool is comprised of many items that are worded negatively (e.g. "I like it when I don't have to talk"), requiring young children to handle double-negatives, a very difficult task for preliterate children (Watson, Monroe, Fayer, & Aloise, 1988). To overcome wording problems, the MECA, a 20-item questionnaire, was developed, using a "faces scale" ranging from smiling faces to frowns (Garrison & Garrison, 1979). Although the MECA has been advocated as the measure of choice for the childhood population, this tool has not been widely used, thus, the opportunity to establish high levels of validity and reliability are limited (McCroskey,

1977). Further use of the MECA applied to the childhood population would provide a better understanding of the CA experiences of elementary school children.

CA of Elementary School Children

Although CA research has been conducted for over four decades, most research has addressed the CA of college students or adults, while CA research on elementary school children has been grossly overlooked (McCroskey, 1970; McCroskey et al., 1981). Identifying the problem of CA in children may have value both from developmental and long-term perspectives. Children identified at an early age to experience high levels of CA may receive treatment earlier, preventing many of the social limitations associated with high CA from occurring. Initial research related to the subject matter of apprehension about communicating in children was directed toward the study of stage fright. Research using observer ratings, introspective tests, and physiological measures (GSR) indicated substantial increase in perceived fright between third graders and sixth graders (Wheeless, 1971). However, stage fright is more accurately conceptualized as state CA, as opposed to trait CA, as the feelings of anxiety are experienced in only one social context. Thus, the research on stage fright provides information about anxiety states as applied to public speaking contexts as opposed to CA across oral communication contexts. Hence, although the concepts of stage fright and CA may be related, findings of this research cannot be validly applied to the study of trait CA in school age children.

To date, four studies have addressed the trait CA of elementary school age children (Comadena & Prusank, 1988; Garrison & Garrison, 1979; Krol-Jersevic, 2004; McCroskey et al., 1981). Overall, these studies did not find a significant

gender difference in CA levels. However, Garrison & Garrison (1979) did find a tendency for girls to be more apprehensive than boys in the elementary school years and less apprehensive than boys during high school. This gender difference may be attributed to the fact that girls tend to be shy and reserved during the elementary school years, while boys tend to be more talkative and easy going. In addition to gender differences, age differences were also investigated in these studies. Three of the studies (Comadena & Prusank, 1988; Garrison & Garrison, 1979; McCroskey et al., 1981) administered CA surveys, the MECA and/or the PRCF to students spanning the entire elementary school grades and found that CA levels increase consistently from the lower grades to the higher grades. In addition, in a large scale study of 5795 elementary and high school students, McCroskey et al. (1981) found that children in kindergarten to grade three reported significantly lower levels of CA than children in the 4-6, 7-9, and 10-12 grades. This increase in CA at the 4th grade level may be attributed to puberty changes as adolescence is marked by a period of highly punitive years during which time feelings of self-consciousness are often prevalent. Taken together, the CA research of elementary school children has been minimal. Further investigation into CA at the elementary school level is warranted as the effects that high levels of CA have on the life experiences of these individuals is often extensive. These life experiences may be particularly negative for adolescents who have communication disorders.

Effects of CA

Research studying the effects that high CA has on the lives of individuals is extensive and often points to a negative outcome in many aspects of the individual's

life. However, it should be emphasized that research in this area is often correlational in nature, being conducted in naturalistic or simulated settings, rather than involving true experimental designs (McCroskey, 1977). Thus, definitive statements of causality cannot be inferred. Additionally, it must be noted that most studies of this nature have been conducted on college students and adults, and thus the impact of high CA on the lives of children, with the exception of very few studies, has not been examined directly. The effects of high CA on the lives of individuals can be categorized into the following dimensions: internal effects, social effects, academic achievement, and perceptions of others.

High CA has many internal effects on the lives of individuals. First, individuals with high levels of CA experience cognitive discomfort, experiencing feelings of fear and anxiety across social contexts. The higher the level of CA, the more discomfort the individual experiences (Daly & McCroskey, 1984). Furthermore, research has indicated that people with high CA exhibit more negative thoughts prior to presenting in front of an audience. Buhr, Pryor, & Syllivan (1991) found that individuals who identified themselves as having high levels of CA, rehearse more negative thoughts in anticipation of a speaking situation. Finally, a moderate negative correlation has been found in a study of college students, teachers and adults, between CA and self-esteem (McCroskey, Daly, Richmond, & Falcione, 1977). Although this study is correlational in nature, the finding does provide us with an understanding of possible negative associations of CA. In particular, individuals with higher levels of CA are more likely to experience lower levels of self-esteem. In addition to these internal

effects of CA, high levels of CA often result in disruption in many aspects of an individual's social life.

The influence of high CA on the social life of individuals often manifests itself in the form of poor communication behaviours. Individuals with high CA often exhibit withdrawal, avoidance, and communication disruption in social situations (McCroskey, 1977). Thus, when put into an oral communication context, individuals with high CA are likely to exhibit withdrawal behaviours such as talking less in a small group setting (McCroskey, 1977), avoidance behaviours such as sitting at the back and sides of the classroom where interaction is least likely to occur (Daly & McCroskey, 1984), and communication disruption behaviours such as making irrelevant comments in the context of an ongoing discussion (McCroskey, 1977). Individuals with high CA often engage in these behaviours to limit the amount of exposure they have to oral speaking situations, thus reducing, and in the situation of communication avoidance, preventing, feelings of distress from being experienced. These patterns of behaviour, in turn, have the potential to negatively influence their social lives. Furthermore, on a more interpersonal level, studies have indicated that people with high CA have up to two times fewer dating partners compared to individuals with low levels of CA (McCroskey & Sheahan, 1978). Taken together, as a result of poor communication strategies, the social life of communication apprehensive individuals may be severely disrupted. Furthermore, these poor communication behaviours often spill over into the school environment, often influencing the academic achievement of individuals with high CA.

Studies addressing the potential influence that CA may have on the academic achievement of people with high CA have found several negative results. Even though research has not been able to identify a meaningful relationship between CA and intelligence, individuals who rate themselves as highly communication apprehensive were found to be more likely to receive lower grades in junior high (McCroskey, 1977) and have lower grade-point averages in college (McCroskey & Andersen, 1976). In addition, two longitudinal studies conducted by Ericson and Gardner (1992), found that students experiencing high CA were significantly more likely to drop out of university than students with low CA. Finally, two studies found high CA individuals to do more poorly on school evaluation tasks involving oral communication than low CA students (Bettini & Robinson, 1990; Blueterryd, Stratton, Donnelly, & Schwartz, 1998). These findings suggest that individuals with high CA experience many limitations in school functioning. Finally, high CA does have implications for the perceptions that others have of individuals found to experience high levels of CA. Thus, these limitations in school achievement may be partially attributed to the perceptions that other people have of the communication apprehensive individual.

Over the years, substantial research has gone into the perceptions that other people have of individuals with high CA. Daly, McCroskey, & Richmond (1977) found that "there was a generally positive linear correlation between the amount of time a person was perceived to talk in a group and other people's perception of their competence, sociability, extroversion, composure, power, social attractiveness, and task attractiveness" (Daley, McCroskey, & Richmond, 1977). Thus, individuals with high

levels of CA who did not talk a lot were often judged by others to possess many negative attributes. In addition to these negative perceptions of individuals who demonstrate high CA, the expectations that other people have of individuals with high CA is also often negative. For example, McCroskey and Daly (1975) conducted a study that examined the expectations that teachers had of a child who was described as high communication apprehensive to expectations that teachers had of a child described as having low levels of CA. Results indicated that the high CA child was expected to "have lower overall academic achievement, lower achievement in all subjects in the elementary school curriculum, have less satisfactory relationships with other students, and have lower probability of success in future education (McCroskey, & Daly, 1976). Taken together, evidence suggests that people with high CA will be perceived more negatively than low CA individuals.

Overall, the breadth of information available about the effects that high CA has on an individual's life portrays a negative picture of the consequences of CA. Individuals with high CA have the potential to be negatively impacted in many aspects of their life, reducing their overall perceived quality of life. One population of individuals that may experience high CA and therefore, may be particularly penalized in many areas of their lives, are individuals with communication disorders. One voice disorder group that may be of interest from an investigative standpoint are individuals diagnosed with a speech disorder due to abnormalities in resonance, a disorder that results from improper closure of the velopharyngeal mechanism.

Velopharyngeal Closure

Velopharyngeal insufficiency (VPI) is a speech/voice disorder associated with dysfunction of the velopharyngeal port. The velopharyngeal port is a mechanism of closure between the oral and nasal cavities (Conley, Gosain, Marks, & Larson, 1997), consisting of the velum (soft palate), posterior pharyngeal wall and lateral pharyngeal walls (Kummer, 2002). During normal velopharyngeal closure, the velum moves in a superior and posterior direction until it makes contact with the posterior and lateral pharyngeal walls (Kummer, 2002). Medial movement of the lateral pharyngeal walls and anterior displacement of the posterior pharyngeal wall, known as Passavant's ridge, may also contribute to velopharyngeal closure (Willging & Kummer, 1999). The coordinated action of several muscles of the soft palate and pharynx contributes, to varying degrees, to the efficient closure of the velopharyngeal mechanism. The most important muscles for achieving velopharyngeal closure are the levator veli palatini muscle, musculus uvulae, and superior constrictor muscles (Ferrand & Bloom, 1997; Smith & Kuehn, 2007). The levator veli palatini, forming a sling along the midline of the nasal surface of the soft palate, serves as the primary elevator of the velum (Willging & Kummer, 1999). The musculus uvulae is located along the midline of the posterior soft palate and also contributes greatly to velopharyngeal closure by forming a bulge on the nasal surface of the velopharyngeal port (Willging & Kummer, 1999). The superior pharyngeal constrictor contributes to the medial movement of the lateral pharyngeal walls and anterior movement of the posterior pharyngeal wall. In addition to these main muscles, other muscles that may contribute to velopharyngeal closure are the tensor veli palatini, superior pharyngeal

sphincter, and palatopharyngeus (Willging & Kummer, 1999). Depending on the relative contribution of the velum, posterior and lateral pharyngeal walls, four different patterns of closure have been identified in normal speaking individuals (Boorman & Sommerlad, 1985). These include: the coronal pattern, in which the velum moves up and back to form a seal, with minor contribution from the lateral pharyngeal walls; the sagittal pattern, in which the lateral pharyngeal walls move together medially between the posterior pharyngeal walls and velum; the circular pattern, in which the velum and lateral pharyngeal walls move equally; and, the circular with Passavant's ridge pattern, where there is movement of the soft palate, posterior, and lateral pharyngeal walls (Ferrand & Bloom, 1997). Ultimately, proper closure of the velopharyngeal port, regardless of pattern, is necessary to achieve normal speech production (see Figure 1).

The end product of speech, which includes the integrated components of one's voice, resonance, and articulation, is achieved through modification of an air stream moving superiorly from the lungs through the vocal tract (Ferrand & Bloom, 1997). Air pressure from the lungs and sound energy from the vocal folds vibrate (resonate) in the oral and/or nasal cavities and are acoustically modified depending on the characteristics of the velopharyngeal port. The opening and closing of the velopharyngeal valve determines the relative balance of sound vibration in the oral and nasal cavities. This feature of speech is referred to as resonance (Kummer, 2002). The velopharyngeal mechanism closes the nasal cavity off from the oral cavity during the production of most consonants and vowels. In English, the only consonants that require the velopharyngeal port to be open are /m, n, ng/ (Ferrand &

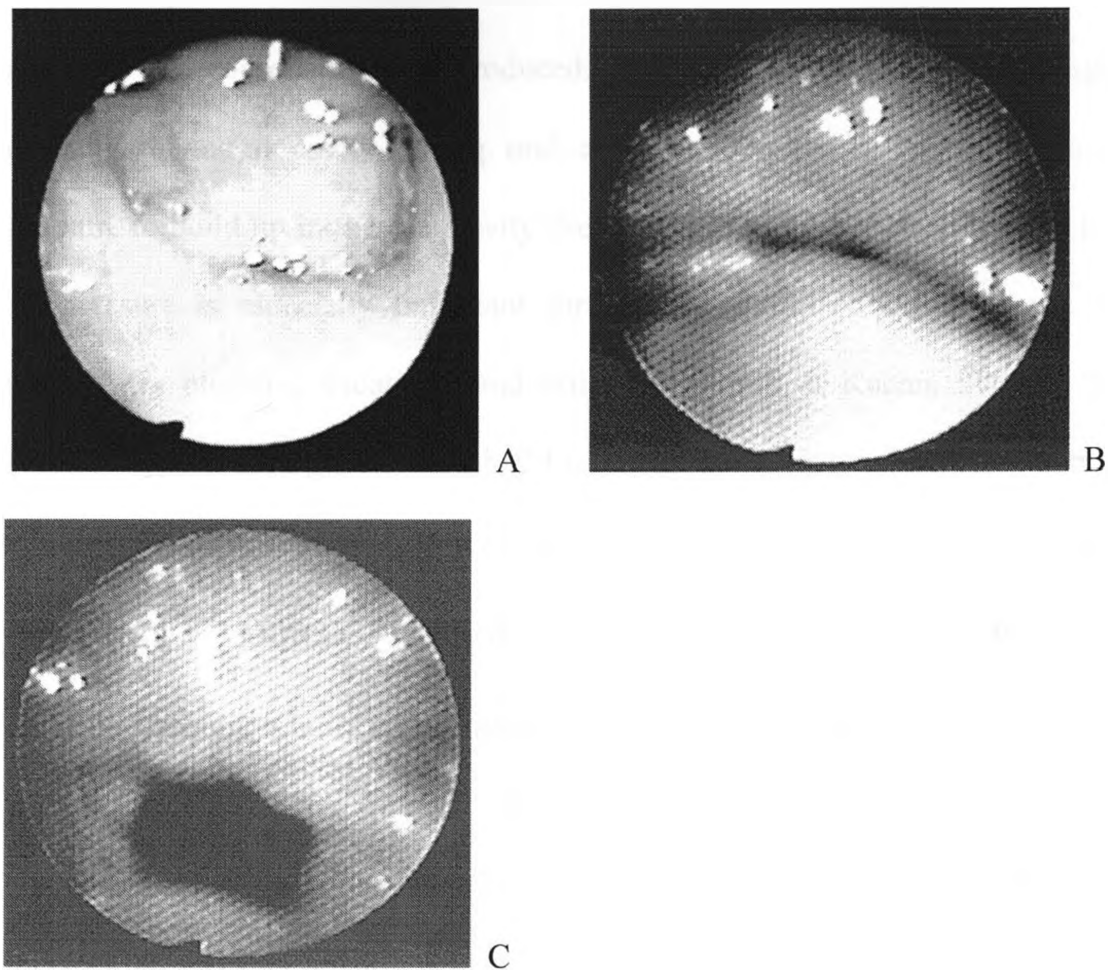

Figure 1. Examples of Normal Velopharngeal Closure (A), Mild Velopharyngeal Insufficiency (B), and Severe Velopharyngeal Insufficiency (C). From: Children's Hospital of Atlanta: www.choa.org (2008).

Bloom, 1997). These are referred to as nasal consonants. Closing of the velopharyngeal port allows air pressure to be redirected anteriorly to the oral cavity, allowing oral consonants to be produced. Prevention of air and sound energy from entering the nasal cavity during oral consonant production allows adequate air pressure to build up in the oral cavity (Ferrand & Bloom, 1997). Adequate intraoral air pressure is especially important for the production of high pressure sounds, particularly plosives, fricatives, and affricates (Smith & Kuehn, 2007). "Plosive sounds (p, b, t, d, k, g) require a build up of intraoral air pressure prior to a sudden release. Fricative sounds (f, v, s, z, sh, th) require a release of air pressure through a small opening. Affricate sounds (tʃ, dʒ) are a combination of a plosive and fricative since they require a build up of intraoral air pressure and then slow release through a narrow opening" (Willging & Kummer, 1999). This speech sound with characteristics of phonation and resonance, is then manipulated by the movement of the tongue and lips, resulting in proper articulation of speech sounds (Ferrand & Bloom, 1997). Overall, normal speech requires appropriate voice, resonance and articulation. Hence, if one of the mechanisms of speech production is disrupted, abnormal speech will result. In particular, if the velopharyngeal port does not achieve adequate closure during appropriate phases of speech production, air will escape into the nasal cavity, resulting in a voice-resonance disorder called velopharyngeal insufficiency (VPI).

Etiology of VPI

Dysfunctions of the velopharyngeal port occur for a variety of reasons and are classified in the literature based on etiology (Conley et al., 1997). Categories of classification of pathogenic mechanisms of the velopharyngeal port include: structural, functional, and dynamic causes (Minami, Kaplan, Wu, & Jobe, 1975). Structural classification of velopharyngeal dysfunction attributes the primary defect to an anatomic abnormality. Examples include having a short soft palate, deep nasopharynx, overt clefting, or other anatomic abnormality (McCarthy, Galiano, & Boutros, 2006). The term used to denote tissue deficiency as the primary cause of velopharyngeal dysfunction is "velopharyngeal insufficiency" (Trost, 1981).

Functional deficits resulting in dysfunction of the velopharyngeal mechanism attributes the primary deficit to be behavioural in nature. Examples include hearing loss, psychoneurosis, and mimicry (Minami et al., 1975). The term used to denote behavioural causes of nasal speech is "functional velopharyngeal insufficiency" (Willging & Kummer, 1999) or "velopharyngeal mislearning" (Kummer, 2001).

Finally, the dynamic category refers to velopharyngeal dysfunction that is attributed to a disruption of motor innervation to the velopharyngeal mechanism at some level (Andres, Bixler, Shanks, & Smith, 1981). Thus, the cause is mainly (neuro)physiologic in nature. Examples include palatal paresis (Conley et al., 1997), abnormal muscle insertion, and cranial nerve defects (Kummer, 2001). The term used to describe nasal speech due to physiologic defects is often termed "velopharyngeal incompetence". Although labels have been given to differentiate different types of velopharyngeal disorders, the literature has often used the terms

interchangeably. The most commonly used generic term for all types of velopharyngeal dysfunction in the literature is "velopharyngeal insufficiency" (VPI) (Willging & Kummer, 1999) and, hence, this term will be used to describe all defects resulting in impairment of the velopharyngeal apparatus throughout the remainder of this thesis.

The majority of published studies have identified most VPI cases to be in the structural category (Conley et al., 1997). In a review of the literature, Conley, Gosain, Marks, & Larson (1997) found the three most common causes of VPI to be overt cleft palate, submucous cleft palate, and adenoidectomy. Overt cleft palate is by far the most common cause of VPI. Approximately 20% of individuals with cleft palate or cleft lip and palate will develop VPI, despite surgical treatment (Willging & Kummer, 1999). VPI may be caused by inadequate muscle structure and function or insufficient velar length (Willging & Kummer, 1999).

The second most common cause of VPI is submucous cleft palate. Submucous cleft palate is characterized by a triad of a "bifid uvula, a furrow along the midline of the soft palate, and a notch in the posterior margin of the hard palate" (Kaplan, 1975). The underlying abnormality contributing to the presentation of VPI is muscle malposition. In this clinical population, the levator veli palatini and other palate muscles are abnormally inserted onto the hard palate (Nasser, Fedorowicz, Ghanaati, Newton, & Nouri, 2008). This muscle malposition results in abnormal activity of the velum. In one study, the incidence of VPI in individuals with submucous cleft palate was reported to be 1 in 9 (Weatherley-White, Sakura, Brenner, Stewart, & Ott, 1972).

Adenoidectomy, the removal of the adenoid tissue, is the third most common cause of VPI. However, the incidence of VPI secondary to an adenoidectomy is estimated to occur infrequently in approximately 1 in 1500 cases. The underlying cause of the risk of VPI following this surgical procedure is the tissue (adenoid) relationship to velopharyngeal closure. It is apparent that in some individuals the location of the adenoid contributes to successful closure of the velopharyngeal apparatus (Robinson, 1992). Thus, removal of the adenoid creates an opportunity in some situations for insufficient postsurgery closure, which subsequently allows for air to escape into the nasal cavity, resulting in symptoms of VPI.

Taken together, velopharyngeal dysfunction is classified based on etiology, with the three common categories being identified as structural, functional, and dynamic. The most common causes of VPI are found in the structural classification. Regardless of cause, individuals with VPI often exhibit specific speech characteristics associated with impairment of the velopharyngeal mechanism.

Characteristics of Speech Associated with VPI

Individuals diagnosed with VPI often exhibit characteristic speech problems as a result of inadequate closure of the velopharyngeal port. Deviant speech characteristics are cited throughout the literature and include: hypernasality, audible nasal air emission, weak or omitted consonants, short utterance length, and compensatory articulation patterns (Conley et al., 1997; Kummer, 2001; McCarthy et al., 2006; Paynter, 1987). Hypernasality occurs when there is too much nasal resonance due to increased access to the nasal cavity during speech production. As a result, hypernasality has a clear influence on speech and frequently results in negative

changes and reductions in the intelligibility and quality of the speech signal. Hypernasality is particularly evident on vowel sounds and during the production of connected speech. Research has indicated several factors that determine the severity of hypernasality including: the movement, timing, and coordination of the velopharyngeal mechanism; articulation; and the size of the velopharyngeal opening (Kummer, 2001). For example, Warren, Dalston, & Mayo (1994) found a direct relationship between the degree of perceived hypernasality and velopharyngeal opening. Results indicated that as hypernasality goes from absent to severe, velopharyngeal opening increases in size (Warren et al., 1994).

In contrast to hypernasality, hyponasality is observed when reduced nasal resonance occurs during nasal consonant production. When hyponasality is severe, nasal consonants (m, n, ng) sound as if they are substituted by their oral phoneme cognates (b, d, g) (Willging & Kummer, 1999). Hyponasality may be caused by a variety of factors that would prevent sound energy from reaching the nasal cavity such as enlarged adenoids, the common cold, a deviated septum, or a midface deficiency (Willging & Kummer, 1999).

Audible nasal air escape may typically occur during the production of high pressure sounds such as plosives, fricatives and affricates (Kummer, 2001). If an opening in the velopharyngeal mechanism is present during the production of high pressure consonants, air will escape through the velopharyngeal port and exit through the nasal cavity. If the opening of the velopharyngeal valve is large, nasal air emission is not likely to be audible. However, a small opening in the velopharyngeal port results in turbulence or a nasal rustle (Kummer, Curtis, Wiggs, Lee, & Strife,

1992). This nasal rustle is a result of friction being created by the small opening as the high air pressure moves through the valve. With higher volumes of air moving through the nasal cavity, a nasal snort may occur during consonant production (Kummer, 2002).

Weak or omitted consonants may occur due to leakage of air pressure through the velopharyngeal orifice. If high pressure air leaks through the velopharyngeal valve during production of high pressure consonants, there will be a reduced amount of intraoral air pressure, resulting in consonants that are weaker in intensity or may be completely omitted (Willging & Kummer, 1999). This reduction may then transfer to the general efficiency of speech and its overall intelligibility.

Short utterance length may also be a symptom of VPI. If the velopharyngeal orifice size is large due to VPI, nasal air escape will result in reduced air pressure in the oral cavity due to an abnormal, rapid loss of air during the act of speech. The reduced air pressure will in turn require increased respiratory effort of the individual during connected speech. The need to take frequent breaths will result in speech that sounds choppy (Kuhlemeier, van den Bergh, & Rijlaarsdam, 2002).

Finally, compensatory articulation patterns may also be observed in those who exhibit VPI. When intraoral air pressure is lost due to nasal air escape, individuals may try to compensate by producing speech sounds in a different manner. Compensatory articulations are usually produced at the level of the larynx or pharynx, before air escapes at the level of the velopharyngeal valve. The most common compensatory productions include glottal stops, pharyngeal stops, and pharyngeal fricatives (Trost, 1981). "A glottal stop involves abrupt adduction of the vocal folds at

the level of the glottis and is usually used as a substitution for a plosive consonant. A pharyngeal fricative is produced by constriction of the vocal tract, or constriction between the retracted tongue and pharynx to create frication, and is usually substituted for fricatives." (Ferrand & Bloom, 1997; Willging & Kummer, 1999). Compensatory articulation is often used to try to mask the sound of nasal air emission (Kummer, 2002). In fact, one study examining the preferences that parents and children have for VPI speech, found that words produced with compensatory articulation was often preferred compared to words produced with nasal air emission (Paynter, 1987). Overall, it is clear that the social acceptability of those who demonstrate one or more of the features associated with VPI may be influenced. As a result, the impact on one's communication capacity can be altered with the potential for varied levels of communication restriction and/or apprehension in situations that demand speech.

As outlined, individuals with VPI may present with various speech characteristics including hypernasality, hyponasality, audible nasal emission, weak or omitted consonants, and compensatory articulation. Documenting the presence and severity of such deficits is an important component of describing VPI. Evaluation of these speech characteristics is achieved through perceptual assessments made by Speech-Language-Pathologists (SLPs). While such assessments are primarily used for identification and description of VPI-related deficits, such data may also be of value relative to a larger conceptualization of one's communication ability and its ultimate social impact. Prior to discussion of these issues, a brief review of perceptual evaluation of VPI will be addressed.

Perceptual Assessment

The initial diagnosis of VPI is often achieved through a perceptual assessment of speech by a SLP or Otolaryngologist (Conley et al., 1997). Perceptual assessment is a subjective evaluation of speech characteristics related to VPI. The presence of nasal air escape or other speech characteristics have important implications for determining the size and function of the velopharyngeal port (Kummer, 2002). The human ear is the ultimate arbiter of speech quality, and, hence, the perceptual assessment is by far the most common diagnostic and outcome measure used for the identification of VPI (Henningsson et al., 2008). Thus, perceptual assessment is the criterion standard for evaluating speech, and such measures if performed with rigor serve as the basis for validation of all instrumental evaluations (Conley et al., 1997; Henningsson et al., 2008). While objective instrumental measures may be of importance in both diagnostic and treatment monitoring efforts, perceptual evaluation remains a critical method of assessment for those suspected or diagnosed with VPI.

Although perceptual assessment is an essential diagnostic and evaluative technique, there is great inconsistency in the methodology used to achieve reliable ratings of speech (Keuning, Wieneke, & Dejonckere, 1999). As a result, there is great variability in the reliability results of studies assessing intrajudge and interjudge reliability (Bradford, Brooks, & Shelton, 1964; Keuning et al., 1999; Watterson, Hinton, & McFarlane, 1996). Methodological variability found in the literature include: rating scales (Dalston & Warren, 1986; Keuning et al., 1999), listener experience (Dalston & Warren, 1986), speech samples (Suwaki, Nanba, Ito, Kumakura, & Minagi, 2008) and speech parameters (Van Demark et al., 1985).

Three different rating scales have been reported in the literature for use in perceptual assessment of speech. These include: the visual analog scale (VAS) (Keuning et al., 1999), direct magnitude estimation (DME) (Suwaki, Nanba, Ito, Kumakura, & Minagi, 2008a), and equal appearing interval scaling (Dalston & Warren, 1986; Hardin-Jones, Brown, Van Demark, & Morris, 1993; Watterson et al., 1996). With the VAS, the listener makes a judgement on the severity of a speech parameter by marking a line along a 100mm scale, representing the perceived level of abnormality of that particular parameter (Keuning et al., 1999; Whitehill, Lee, & Chun, 2002). In a study by Keuning et al. (1999), a VAS scale was used by six judges to assess the hypernasality of speech samples. Results indicated fair-to-good reliability (.56 to .78) for ratings of hypernasality. Upon investigation, however, it was found that judges differed largely in the range they used in providing their ratings, resulting in wide variations in listener judgements. An explanation often hypothesized is that listeners use internal standards that vary from judge-to-judge when rating hypernasality (Keuning et al., 1999). This suggestion also has been raised relative to the perceptual evaluation of a variety of voice abnormalities.

Higher degrees of inter-rater reliability are more likely to result from studies using DME, the second type of scale used in perceptual assessments of speech. In DME the investigator assigns a number to a standard stimulus sample called a modulus. Listeners then rate the speech samples relative to the modulus (Suwaki et al., 2008). According to the results from a study conducted by Whitehill et al, (2002), the DME has been found to be a reliable measure of hypernasality. However, although the DME establishes high inter-rater reliability compared to the VAS scale, this choice of

scale is impractical in the clinical setting (i.e., it is conceptually cumbersome and time-consuming), thus, reducing it functional utility (Suwaki, Nanba, Ito, Kumakura, & Minagi, 2008a; Whitehill et al., 2002).

Finally, the third scale used in perceptual assessments is the equal appearing interval (EAI) scale. The EAI is the most common scale used in perceptual evaluations of velopharyngeal closure. However, there is great variability in the number of points used in each scale from study to study (Dalston & Warren, 1986; Karnell & Van Demark, 1986; Pinborough-Zimmerman, Canady, Yamashiro, & Morales, 1998), consisting of anywhere from a two-point binary scales often used in the assessment of hyponasality (1= hyponasality; 0= no hyponasality), to a seven-point scale (Pigott et al., 2002). Due to the variability in available rating scales, it is not surprising to find varying results on listener test-retest reliabilities from study to study (Keuning et al., 1999; Watterson et al., 1996). Thus, rating scales do have the potential to influence the reliability of perceptual assessments.

In addition to rating scales, perceptual assessment studies have also found inconsistent results regarding the test-retest reliability of judges with and without experience in evaluating speech associated with VPI. In a study addressing hypernasality ratings of listeners varying in degree of clinical experience, intrajudge reliability (ICC) was found to be higher for inexperienced raters (.25) than experienced raters (.14) using EAI methods (Bradford et al., 1964). In contrast, Kuening et al, (1999) found slightly higher intra-rater reliability scores for the experienced listeners compared to the inexperienced listeners. However, the results of this study indicated that the reliability of expert listeners was not much higher than

the reliability of inexperienced listeners, suggesting that substantial clinical experience does not necessarily lead to higher reliability ratings. Thus, other factors may influence reliability of such assessments.

For example, inconsistencies in the reliability of perceptual ratings may also be attributed to the fact that there is no standard protocol of speech samples used to perceptually assess velopharyngeal function. For accurate velopharyngeal assessment, it has been recommended that individuals use connected speech that contains a combination of plosives, fricatives and affricates (Conley et al., 1997; McCarthy et al, 2006; Warren et al., 1994). However, consensus suggests that a broad-based approach to perceptual evaluation may provide the most fruitful avenue of exploration relative to judgement of VPI.

Finally, studies report different parameters when evaluating the speech of individuals with velopharyngeal problems. Some studies only use assessments of hypernasality (Dalston & Warren, 1986), while others rate a variety of speech characteristics and features (Persson, Lohmander, & Elander, 2006; Pigott et al., 2002). However, judgements of speech quality using only one parameter, especially hypernasality, can often lead to inaccurate results (Van Demark et al., 1985). Hypernasality is a multidimensional construct, one that can be strongly influenced by both stimuli and its productive contexts (e.g. words versus sentences versus running speech). Further, the perception of the severity of hypernasality can be influenced by the presence of other speech characteristics such as nasal air emission or compensatory articulation (Van Demark et al., 1985). Therefore, the most appropriate approach to the perceptual assessment of velopharyngeal function,

includes a variety of speech characteristics such as articulation, hypernasality, hyponasality, and intelligibility, in addition to a global rating of velopharyngeal function (Henningsson et al., 2008).

Overall, research interested in assessing interjudge and intrajudge reliability of perceptual assessments of speech often yield conflicting results due to the wide variability in the methodology used in each study. Factors that may contribute to the conflicting findings include rating scales, listener experience, speech samples and speech parameters. However, regardless of the methodological issues, the perceptual assessment of VPI is an invaluable clinical and research tool that is used in the primary diagnosis of VPI. Once VPI is diagnosed, additional measures are used to examine the velopharyngeal port directly. The two main methods of direct examination of velopharyngeal closure patterns include nasopharyngoscopy (endoscopic examination of the nasal surface of the soft palate and the pharynx) and multiview videofluoroscopy (radiological examination during speech) (Conley et al., 1997). A comprehensive assessment of velopharyngeal function will often lead to the application of an intervention that may result in improved physical functioning of the velopharyngeal port. To move further beyond the physical assessment of velopharyngeal functioning, the influence that living with this voice resonance disorder may have on the quality of life of the patient may be of interest from an investigative point of view. In particular, individuals with VPI may experience limitations in social functioning due to the variety of abnormal speech characteristics that they possess, which are often noticeable to a listener. Specifically, an

investigation into the CA of adolescents with VPI may be able to provide information relative to the social functioning of this clinical population.

Statement of Problem

Individuals with CA experience many deficits in social functioning including experiencing feelings of distress and anxiety in various communication contexts such as dyadic interactions, speaking in front of groups, or speaking in a meeting (McCroskey, 1978). While CA is a multi-faceted construct, the net effects of such restrictions are likely to represent variable levels of anxiety and in some instances fear, when one is confronted with certain communication situations. In fact, research suggests that approximately 40% of college students experience sufficient communication apprehension to warrant treatment outside the classroom (Wheeless, 1971). Although most studies are correlational in nature, research indicates that individuals who experience high levels of CA, are more likely to experience negative consequences in their lives including dropping out of school, experiencing low self-esteem, and being perceived as less competent and less attractive by others compared to individuals who have low levels of CA (McCroskey et al., 1977). Although all individuals tend to experience some level of CA at various points in their life, those with communication disorders may be faced with unique challenges throughout their lives. Ultimately, high CA may significantly disrupt an individual's life on both personal and social levels.

Although CA research has been extensive, most research to date has addressed the CA of college students or adults. CA research on college and adult populations has often found that for individuals who report high levels of CA, their perceived anxiety

has been a long, enduring experience, suggesting that CA may first appear in childhood. However, CA research on elementary school children has been overlooked (McCroskey, 1970; McCroskey et al., 1981). Research that has been done on children indicates that a significant increase in CA may be experienced at the 4th grade level, after which, CA levels continue to rise steadily throughout elementary and high school (McCroskey et al. 1981). This increase in CA may be attributed to puberty changes as adolescence is marked by a period of highly punitive years during which time feelings of self-consciousness are often prevalent. Additionally, social penalty in such circumstances is not uncommon with subsequent potential for social isolation. Further investigation of the CA construct at the elementary school level is warranted as the effects of high CA may be extensive and may serve to identify challenges experienced by children relative to communication events and demands.

It is clear that a variety of voice and/or speech disorders may result in changes in one's ability (or desire) to involve themselves in a variety of communication situations. Though some individuals may not find difficulty in meeting their communication demands (or expectations), others find such demands paralyzing, leading to avoidance behaviours or changes in lifestyle in an attempt to limit potential situations of anxiety and apprehension secondary to communication demand (McCroskey, 1977). One area where such deficits may be of particular interest relates to those who experience velopharyngeal insufficiency (VPI). Individuals with VPI exhibit various dysfunctions in speech including hypernasality, nasal air emission, weak or omitted consonants and short utterance length (Kummer, 2002). These limitations in speech production are frequently noticeable to the listener which

does call attention to the disorder. For this reason, the potential for apprehension broadly defined within a myriad of communication situations may be observed.

Research involving individuals with VPI often include attempts to measure the success of interventions to remediate the disorder. In many instances, this is achieved through various objective measures, such as nasometry (Conley et al., 1997), pressure/flow measures and endoscopy, as well as perceptual measures of voice quality (Van Demark et al., 1985). Although these measures provide valuable information relative to the functioning of individuals treated for VPI, they are limited in that the impact that the health condition or disorder (i.e., VPI) has on social communication and communication performance, as well as quality of life may not be considered. Two recent studies (Barr, Thibeault, Muntz, & De Serres, 2007; Boseley & Hartnick, 2004) that did measure quality of life of individuals with VPI indicated that children with VPI do experience reductions in this area. The study by Barr et al, (2007) indicated that children with VPI reported experiencing reductions in their level of quality of life compared to healthy control participants in the areas of "perceptions of speech, swallowing, situational and emotional difficulty, activity limitation, and perception of the patient by others". Thus, it would appear that adolescents with VPI do experience, or certainly hold the potential to experience, limitations in many aspects of their lives. For this reason, measuring CA in this population can provide a more comprehensive understanding of treatment outcome and any limitations that may be experienced which can be attributed to the individual's communication disorder. Thus, the purpose of this study is to gain a better understanding of the impact of living with VPI from the perspective of the individual by measuring the

level of CA that these individuals experience and measuring the relationship between CA and perceptual assessment of speech.

Experimental Questions

The proposed study addressed the following experimental questions:

1) Do adolescents with VPI experience higher levels of CA than adolescents who do not have a speech/voice disorder?

2) What is the relationship between MECA scores and perceptual assessment of speech quality?

Chapter Two

Methods

Participants

Two groups of children between the ages of eight to fourteen years participated in this study. The first group of children comprised the velopharyngeal insufficiency (VPI) group and the second group of children comprised the control group. Children in the VPI group were identified through a review of the medical records of children attending the VPI clinic and/or Cleft Lip and Palate Clinic at the Thames Valley Children's Centre during the period of data collection (April 2008 to June 2008). The inclusion criteria for the VPI group included: children between the ages of eight to fourteen who have been diagnosed by a clinician (Speech-Language-Pathologist and/or Otolaryngologist) to have VPI. Initial exclusion criteria for the VPI group included: children diagnosed with multiple speech, voice, and/or language disorders in addition to VPI, children with facial disfigurements (including children with cleft lip and palate), children with English speaking and reading skills below age appropriate levels, children whose cognitive development is either reported by parents or documented by professional evaluation to be below age appropriate levels, and, children exhibiting signs of acute or recent cold, flu or sinus symptoms during the time of data collection. However, due to the difficulty in finding participants that met all inclusion criteria, it was decided to include participants who may be developmentally delayed or have indicated that they do have a history of sinus problems at the time of data collection. Fourteen children (mean age 10; 2 years, range = 8 to 14) comprised the VPI group.

Children in the control group also included children between the ages of eight to fourteen years, however, these participants had not been diagnosed with VPI or any other voice, speech, or language disorder. Exclusion criteria for children in the control group included: children with facial disfigurements (including children with cleft lip), children with English speaking and reading skills below age appropriate levels, children whose cognitive development is below age appropriate levels according to parental report, and, children exhibiting acute signs of cold, flu or sinus symptoms during the time of data collection. Children in the control group were recruited through personal contacts made by the study investigators. Fourteen children (mean age 12;5 years, range = 8 to 14) comprised the control group. Prior to the initiation of the study, full ethical approval was obtained from the University of Western Ontario (Appendix A) and Thames Valley Children's Centre (Appendix B) Research Ethics Boards.

Procedure

This study was divided into two phases. Phase one of the study involved the children completing a measure of communication apprehension, the MECA, followed by voice recordings of speech phrases used to assess velopharyngeal function. Phase two involved conducting a perceptual assessment of all of the speech samples collected in phase one by two certified and licensed Speech-Language-Pathologists (SLPs) at the University of Western Ontario; both of whom had more than 10 years of clinical experience.

Phase One

For children in the VPI group, during their regularly scheduled appointment at the VPI clinic, parents of eligible children were provided a brief description of the study by the attending physician or SLP at the Thames Valley Children's Centre and asked if they would like to have their child participate. Information was presented directly to parents, as well as through a written letter of information. Consent to participate in the study was also obtained from the child. Following consent of the parent and child, the child and the parent were led to a therapy room at the clinic and were introduced to the study investigator.

For children in the control group, parents of children were contacted through a telephone call, at which time a date was scheduled for data collection. Children were identified through personal contacts of the investigator and research supervisor. The study investigator went to the homes of study participants and set up data collection equipment in a quiet room of the house in order to gather speech samples for later evaluation.

Consent and Collection of Personal Information

The data collection process followed the same sequence of events for both groups of children. First, the study investigator provided the parent and child with a thorough description of the study, informed the parent and child of any risks and benefits associated with the study and advised them that they were under no obligation to participate in the study. Parents and children were then asked to sign a written consent form. A letter of information and a copy of the consent form were given to the parents to take home (Appendix E and F for the VPI group and control

group, respectively). Following consent, demographic and health information of the child were collected. For children in the VPI group, the following information was collected (Appendix G): the child's name, gender, age, grade in school, if English was a native language of the child, type of treatment child has had for VPI, if the child was developing cognitively at an age-appropriate level, if the child has been diagnosed with any other speech/voice/language disorder, and if the child was currently experiencing cold or flu symptoms, or sinus problems. For the control group, the following information was collected (Appendix H): the child's name, age, gender, grade in school, any history of voice disorders, any history of VPI, if the child was a native English speaker, if the child was developing cognitively at an age-appropriate level, and if the child was experiencing flu or cold symptoms, or sinus problems at the time of data collection. If cold or flu symptoms were present, the individual was rescheduled for administration of the study protocol at a different date when symptoms have subsided. Following completion of the information form, each participant was then given a participant code created by a random number that was assigned to each participant for use during the perceptual assessment phase of the study (A number was drawn from a bag containing the numbers 1 to 100). A master list linking the participant code with the participants name was created and stored in a closed cabinet at the University of Western Ontario. Identity of subjects was known only to the investigator and the research supervisor for the project. After collection of personal information, the child was then asked to provide a speech sample according to the study protocol. Parents remained in the room throughout the entire data collection procedure to ensure the child was comfortable.

Administration of the Communication Apprehension Questionnaire

The child was first asked to fill out a 20-item questionnaire assessing the level of communication apprehension that they experience using the Measure of Elementary Communication Apprehension (MECA) [Appendix C]. The MECA uses a "faces scale" ranging from happy faces to frowning faces and requires that the child circle the face, or words underneath the face, that represents how that child feels in the particular situation posed within the questionnaire. Children were administered the survey orally both by the study investigator and the child's parent. The study investigator read out the odd-numbered questions and the parent read out the even-numbered questions. Before completing the instrument, the child was asked an initial question by the study investigator, unrelated to the subject area (e.g. How do you feel when you have to write a test in school?) to ensure that they fully understood how to use the scale. After completion of the questionnaire, the child and parent were given a copy of the MECA along with a fully-addressed stamped envelope and asked to complete the questionnaire again in one to two weeks time and mail the completed surveys back upon completion. Parents were instructed to administer the survey orally to the child. An instruction form was included in the envelope to ensure that parents knew when and how to administer the MECA (Appendix I). Duplicates were used to assess test-retest reliability.

Voice Recording

Following completion of the MECA, the child was then directed to a seat that was situated near voice recording equipment. A dynamic microphone was placed approximately 10cm from the child's mouth. Speech samples were recorded onto a

laptop computer (Gateway, North Sioux City, SD), using commercially available voice recording software (SonaSpeech II-Kay Pentax, Pinebrook, NJ). Participants were asked to produce several speech phrases that were first presented orally by the study investigator. The speech sample consisted of seven standard phrases for velopharyngeal assessment (Conley, Gosain, Marks, & Larson, 1997). These phrases include: 1) "Patty ate apple pie", 2) "Sissy sees the sky", 3) "Go get a cookie for Kate", 4) "She likes high boots", 5) "Puppy, puppy", 6) "Jerry's slippers were blue", and 7) "Stop the bus". All samples were digitized at 44KHz. Each phrase was repeated twice with a two to three second delay between repetitions. A file was created using the child's participant code, followed by their age (e.g. Code 34, age 10). Speech samples were saved under this file, each phrase saved separately.

Phase Two

After completion of phase one, the speech samples were edited using Adobe Audition Software (San Jose, CA). For each speech sample, each of the seven separate speech phrases was reviewed, and the clearest repetition of each speech phrase was chosen. The seven chosen repetitions were compiled into one master speech sample, speech phrase one, followed by speech phrase two, etc., with a two second delay between phrases. Each combined speech sample ran approximately 30 seconds in length and followed the same sequence. A random sample of approximately 15% (n= 3) of the speech samples from the control group and 15% (n=3) of the speech samples from the VPI group were chosen and added on to the end of the list of speech samples to assess intra-rater reliability. This generated a total of

34 speech samples (14 VPI + 14 control + 6 reliability samples) that were presented to listeners in random order for the perceptual assessment phase.

Perceptual Assessment

After the speech samples were created, two SLPs, each with more than 10 years clinical experience, were contacted at the University of Western Ontario and asked to perform perceptual assessments on the 34 speech samples. Each listener was fitted with headphones and seated in a quiet room in front of a computer. Each performed the perceptual evaluation independent from the other. Both listeners were asked to perceptually assess all 34 speech samples using a standard rating protocol, the American Cleft-Palate Association Clinical Data Base Committee Speech Pathology Data Entry Form Revised (ACPA) [Appendix D]. Each listener was given an instruction form for the perceptual assessment (Appendix J) that they read through before initiating the listening task. Listeners were asked to rate each speech sample on eight characteristics: hypernasality, hyponasality, audible nasal emission, velopharyngeal function, articulation proficiency, overall intelligibility, compensatory articulation, and voice quality. Listeners were aware of the child's age but no other personal information was available to them. Listeners were blinded to the group membership of the children who provided the speech samples (VPI or control group). They were allowed to listen to each speech sample an unlimited number of times to provide the most thorough assessment of all speech variables under consideration.

Measurement Instruments

Two measures were used in this study: the Measure of Elementary Communication Apprehension (MECA) and the American Cleft Palate Association

Clinical Data Base Committee Speech Pathology Data Entry Form Revised (ACPA). A brief summary of each instrument is provided below.

Measure of Elementary Communication Apprehension (MECA)

The MECA (Appendix C) is a measure developed by Garrison & Garrison (1979) for the purposes of measuring the experience of communication apprehension in different social situations of elementary school aged children. Development of items on the MECA were derived from a previously validated measure of CA in the adult population, the Personal Report of Communication Apprehension (PRCA), developed by McCroskey et al. (1970). The PRCA has been reported in over 50 studies since its development and is a well validated tool (Byles, Forner, & Stemple, 1985; Rockwell, 2007; Sallinen-Kuparinen, McCroskey, & Richmond, 1991). The MECA is a 20-item measure of CA that employs the Likert-type faces scale. Participants are asked to answer each question by circling one of the following: very happy/I like it a lot, happy/I like it, no feeling/I don't care, unhappy/I don't like it, or very unhappy/I really don't like it. Responses are scored from 1 to 5 with 1 representing "very happy/I like it a lot" and 5 representing "very unhappy/I really don't like it". Higher scores reflect a tendency to experience higher levels of CA. Ten questions are presented with the faces scale in reverse order, to limit response bias and increase the reliability of responses. The MECA has been used in several studies to date (Comadena & Prusank, 1988; Garrison & Garrison, 1979; Krol-Jersevic, 2004; McCroskey, Andersen, Richmond, & Wheeless, 1981)), stating high levels of validity and reliability. The initial validation study of this tool used several validation procedures including expert review of items to assess face and content validity, factor

analysis to assess underlying constructs of the questionnaire and reliability statistics to ensure consistency of responses, with reliability ranging from .76 to .80 (Garrison & Garrison, 1979). Thus, the MECA is the instrument of choice for the purposes of measuring CA in this study population.

American Cleft Palate Association Clinical Data Base Committee Speech Pathology Data Entry Form (Revised) [ACPA]

The ACPA (Appendix D) is a standard measure used by SLPs in North America to assess the velopharyngeal function in children. This instrument consists of an evaluation of 8 characteristics associated with VPI including: hypernasality, hyponasality, audible nasal emission, velopharyngeal function, articulation proficiency, overall intelligibility, compensatory articulation, and voice quality. All voice/speech variables were rated on a six-point scale with the exception of the Velopharyngeal Function variable, which used a three point scale (1= adequate, 2= marginal, 3= inadequate). In addition, all voice/speech variables, with the exception of the Compensatory Articulation variable, used an ordinal rating, with lower scores representing less severe or normal voice characteristics and higher scores representing more severely deviated speech characteristics. In contrast, the compensatory articulation variable was not rated based on severity, but rather each point on the six-point scale represented a type of articulation error (1 = none observed, 2= glottal stop, 3= pharyngeal fricative, 4= pharyngeal stop, 5= mid-dorsal palatal stop, 6= posterior nasal fricative). The two SLPs who participated in the perceptual assessment of the speech samples were familiar with the ACPA prior to commencement of the perceptual assessments. The purpose of using the ACPA in this study was to assess

whether any relationship exists between the physiologic functioning of those exhibiting VPI, by using this standard clinical outcome measure of velopharyngeal function (ACPA), and communication in the social context, by using the MECA.

Data Analysis

Data collected, including scores on the MECA and scores on the perceptual assessment of speech characteristics were analyzed using SPSS 11.0. To answer experimental question one, if adolescents with VPI experience higher levels of CA than adolescents who do not have a speech disorder, a t-test was conducted to assess the differences in total MECA scores between the VPI group and the control group. To answer experimental question two, whether there is any relationship between CA scores and scores on the ACPA, separate Pearson-product moment correlations were calculated for total MECA scores and each of the eight characteristics of voice quality on the ACPA. In addition to these evaluations, the test-retest reliability of the MECA was assessed by calculating the intra-class correlation coefficient (ICC) between initial MECA scores and scores on the instrument completed one to two weeks later. Furthermore, the internal consistency of the MECA was calculated using Cronbach's alpha. In addition to these analyses, listener reliability was also assessed. Inter-rater reliability was measured as percentage agreement calculated point-by-point between Listener 1 and Listener 2. Intra-rater reliability for each of the judges was also measured as percentage agreement calculated point-by-point between assessment one and assessment two for the 15% of samples that were rated twice by each listener. Finally, descriptive statistics including those pertaining to demographic information, health status information, and mean scores and standard deviations of both

instruments were obtained to provide a general description of the study populations and the distribution of scores. For all analyses, a probability value of less than .05 was accepted as significant.

Chapter Three

Results

Participant Demographics and Health Status

Participant demographic and health status information are displayed in Table 1 according to group membership. Fourteen children comprised the VPI group and fourteen children comprised the control group. On average, children in the VPI group were younger than children in the control group [mean ages 10;2 years (range 8-14), and 12;5 years (range 8-14), respectively]. In addition, a perfect gender match was not obtained between the two experimental groups of children; specifically, 6 females and 8 males participated in the VPI group, while 8 females and 6 males participated in the control group.

In addition to demographic information, parents of participants were asked to provide the investigator with information regarding the child's general health status and development (Appendix G and H) at the time of their participation. For children in the control group, one of the child's parents reported that their child was recently recovering from a cold. The other 13 children were not reported to experience cold, flu or sinus symptoms during the time of data collection. In addition, all parents of children in the control group reported that they judged their child's reading and speaking skills, and overall cognitive development to be at an age appropriate level. No child in the control group had been diagnosed with VPI or any other speech and/or voice disorder.

For children in the VPI group, while no parents reported cold or flu symptoms, two parents reported that their child did suffer from seasonal sinus problems that may

Table 1

Participant Demographic Summary

Demographic	Control group (n=14)	VPI group (n=14)
Sex		
Female	8	6
Male	6	8
Age [mean (range)]	12;5 years (8-14)	10;2 years (8-14)
Grade in school [median (range)]	7 (3-9)	5 (2-8)
Cold, flu, or sinus symptoms at time of data collection:		
Yes	1	2
No	13	12
Age appropriate cognitive development:		
Yes	14	10
No	0	4
Age appropriate reading/speaking skills:		
Yes	14	7
No	0	7
Speech therapy for VPI:		
Yes	N/A	13
No	N/A	1
Surgery for VPI:		
Yes	N/A	11
No	N/A	3
If yes, time since surgery [mean months (range)]	N/A	59 (12-120)

have caused minor nasal congestion to be present during the time of data collection. In addition, seven parents reported that their child's English reading and/or speaking skills were not at age appropriate levels, and four parents reported that they believed that their child's cognitive development was delayed to some extent. When the issue of developmental delay was probed further in parents who reported school problems, most parents advised the investigator that their child was not diagnosed with a learning disorder/disability, but that their child's grades were usually in the C and D range and that their child did exhibit some difficulty with reading and writing assignments in school. However, two parents reported that their child had been diagnosed with a learning disorder. One child was diagnosed with Attention Deficit Hyperactive Disorder (ADHD), while the other parent identified a learning disorder but did not identify a diagnosis. However, all were enrolled in mainstream classrooms.

In addition to general health status questions, parents of the children diagnosed with VPI were also surveyed on the child's treatment related to the disorder. Thirteen of the children had speech therapy to help correct their VPI, while eleven children had undergone surgery to improve their velopharyngeal closure. For children who had undergone surgery for their VPI, an average of 59 months (range 12-120) had elapsed since the date of their last surgery. A review of the children's medical records revealed that VPI was primarily caused by: a cleft of the secondary palate (6 children), a submucous cleft palate (5 children), post-adenoidectomy (2 children) and as a result of atrophy of the adenoids (1 child).

Descriptive Statistics

In addition to collection of health and demographic information of study participants, descriptive statistics were also evaluated for scores on the MECA instrument and scores on the perceptual assessment of the speech samples on eight speech characteristics.

MECA Scores

For the MECA instrument, the range of total scores for the VPI and control participants indicated wide variations in CA scores for both groups. Total scores on the MECA ranged between 37 and 74 for children in the VPI group, and between 35 and 68 for children in the control group. The MECA is calculated based on a scale that ranges from 20 to 100. As a result, both groups of children demonstrated a wide distribution of MECA total scores. In addition to the distribution of MECA scores, the means and standard deviations of the scores on the 20-items of the MECA and total scores were calculated for the VPI group and control group. Table 2 illustrates the means and standard deviations of the MECA item and total scores for the control group. Table 3 reveals the means and standard deviations of the MECA item and total scores for the VPI group. For most individual items on the MECA, mean scores for the VPI group were higher (indicating higher levels of CA) than for the control group. In particular, five questions had mean scores that were one scaled point (or more) higher for those in the VPI group when compared to the control group. More specifically, the following questions revealed distinct differences across the two participant groups: 1) Q9: How do you feel when you talk in front of an audience? (respective means of 3.50 and 2.43), 2) Q12: How do you feel after you get up to talk

Table 2

Means and Standard Deviations for Item and Total Scores on the MECA for the Control Group

Question:	1	2	3	4	5	6	7	8	9	10
Mean:	2.57	2.86	2.29	3.21	2.50	2.36	1.86	2.36	2.43	2.14
(SD)	(.94)	(.86)	(.91)	(.58)	(.86)	(1.28)	(.86)	(1.21)	(1.22)	(1.23)

Question:	11	12	13	14	15	16	17	18	19	20	Total
Mean:	2.00	2.21	2.86	2.93	1.71	2.00	2.71	1.64	2.43	2.57	47.64
(SD)	(.68)	(.80)	(1.23)	(1.27)	(.91)	(1.10)	(.61)	(.74)	(.85)	(1.22)	(9.33)

Table 3

Means and Standard Deviations for Item and Total Scores on the MECA for the VPI Group

Question:	1	2	3	4	5	6	7	8	9	10
Mean:	2.07	3.29	2.36	3.29	2.64	2.36	2.50	3.21	3.50	2.57
(SD)	(.83)	(1.07)	(1.01)	(.47)	(1.28)	(.84)	(1.50)	(1.25)	(1.35)	(1.02)

Question:	11	12	13	14	15	16	17	18	19	20	Total
Mean:	2.14	3.57	3.64	4.07	1.93	2.64	2.71	2.36	3.43	3.93	58.21
(SD)	(1.17)	(1.09)	(1.4)	(1.14)	(.73)	(1.15)	(1.20)	(.84)	(1.16)	(1.27)	(10.58)

in front of the class (respective means of 3.57 and 2.21), 3) Q14: How do you feel about giving a speech on television? (respective means of 4.07 and 2.93), 4) Q19: How do you feel when the teacher wants you to talk in class? (respective means of 3.43 and 2.43) and, 5) Q20: How do you feel when you talk in front of a large group of people? (respective means of 3.93 and 2.57). In addition, mean total MECA scores were 10 points higher in the VPI group compared to that of the control group (respective means 58.21 and 47.64). Overall, participants in the VPI group had a tendency to report experiencing higher levels of CA compared to the control participants, adolescents who do not have a speech disorder.

Perceptual Assessment

Speech samples that were provided by the 28 children who participated in this study (14 from the control group and 14 from the VPI group) were submitted to perceptual assessment by two SLPs. An initial assessment of whether the two judges were capable of differentiating between samples produced by the control group and the VPI group was undertaken. Scores assigned to each of the 28 speech samples on the 3-point global rating of velopharyngeal function (1= adequate, 2= marginal, 3= inadequate) were examined. All speech samples from the control group were perceptually assessed as adequate (were given a score of 1) by both SLP raters. For speech samples provided by the VPI group, Listener 1 judged six samples to have adequate velopharyngeal function, seven speech samples to be marginally inadequate and only one speech sample to have inadequate velopharyngeal function. In contrast, Listener 2 judged five speech samples to have adequate velopharyngeal function,

three speech samples to have marginal VPI and six speech samples to have inadequate velopharyngeal function.

Although several of the VPI speech samples were judged to be adequate based on the global assessment of velopharyngeal function, all speech samples from the VPI group were found to exhibit moderate-to-severe degrees of severity on one or more of the other speech characteristics (hypernasality, hyponasality, audible nasal emission, overall intelligibility, articulation proficiency, voice quality). Table 4 presents the scores given to participants in the VPI group on the eight speech characteristics under evaluation. The median score for the seven speech characteristics that are rated using a severity scale are displayed. In contrast, for the compensatory articulation variable, the number of speech samples that were observed to produce each type of articulation error is listed for each listener. Listener 1 had a tendency to judge the seven speech characteristics more severely than Listener 2. Average ratings tended to fall between mild to moderate. For the compensatory articulation variable, Listener 2 reported more instances of articulation errors, particularly in the form of pharyngeal fricatives and posterior nasal fricatives, than did Listener 1. Overall, the VPI speech samples were judged to exhibit mild-to-moderate levels of abnormality. In sum, descriptive statistics of the MECA and ACPA indicate that the VPI population evaluated tended to experience higher levels of CA than the control group, and exhibited mild-to-moderate speech abnormalities. In order to obtain further understanding of the measurement instruments used in this study, the reliability of the MECA and ACPA was also evaluated.

Table 4

Median Scores of Listener 1 and Listener 2 of Speech Characteristics for Speech Samples of Children in the VPI Group (n=14) and Control Group (n=14)

Speech characteristic	VPI Group		Control Group	
	Listener 1	Listener 2	Listener 1	Listener 2
Hypernasality median (rating 1-6)	3	2	1	1
Hyponasality median (rating 1-6)	2	1	1	1
Audible Nasal Emission median (rating 1-6)	3	2	1	1
Overall Intelligibility median (rating 1-6)	2	1	1	1
Articulation Proficiency median (rating 1-6)	2	3	1	1
Voice Quality median (rating 1-6)	2	1	1	1
Velopharyngeal Function median (rating 1-3)	2	2	1	1
Compensatory Articulation (n)				
None observed	11	7	14	14
Glottal stop	0	1	0	0
Pharyngeal fricative	1	3	0	0
Pharyngeal stop	1	0	0	0
Mid-dorsal palatal stop	1	1	0	0
Posterior nasal fricative	0	2	0	0

Reliability

The reliability of the two instruments used in this study, the MECA and the ACPA perceptual evaluation scale were assessed using different measures of reliability. For the MECA, two measures of reliability were calculated, test-retest reliability and internal consistency. For the ACPA, both intra- and inter-judge reliability were calculated.

Reliability of the MECA

Test-retest reliability of the MECA was assessed by calculating the intra-class correlation coefficient (ICC) of two scales: the total MECA scores completed during the time of initial data collection (i.e., at the same time speech recordings were obtained), and the total MECA scores completed approximately one-to-two weeks later. The MECA questionnaire was completed by all 28 participants (14 from the VPI group and 14 from the control group) during initial data collection. However, only 21 of the 28 MECA questionnaires were completed a second time and returned to the investigator, resulting in an overall return rate of 75%. Of the 21 surveys returned, 12 represented children in the control group, while 9 represented children in the VPI group. Calculating the test-retest reliability of responses for these 21 participants resulted in an ICC of .81, indicating good reliability of the MECA. A correlation of .81 between the MECA scores completed at two time intervals indicates that the instrument does measure the CA construct consistently over time.

In addition to calculating test-retest reliability for the MECA survey, the internal consistency of the instrument (20 questions and the total score) was also assessed by calculating Cronbach's alpha on the original data provided by all 28 participants. A

Cronbach's alpha of .74 was found, indicating moderate-to-good internal consistency of the instrument items. Thus, items on the MECA do seem to be examining the same construct. In sum, the test-retest reliability and internal consistency of the MECA indicates good instrument reliability.

Reliability of the ACPA

For the ACPA, reliability assessments included calculating the inter-judge and intra-judge reliability of the perceptual assessment of the speech samples on eight speech characteristics (hypernasality, hyponasality, nasal air emission, overall intelligibility, articulation proficiency, voice quality, velopharyngeal function, and compensatory articulation). Inter-rater reliability was measured as the point-by-point agreement calculated as a percentage between Listener 1 and Listener 2. This assessment of reliability was based on the 28 speech samples (14 from the control group and the VPI group) for the seven speech variables judged for severity. The compensatory articulation variable was not rated on a severity scale but rather, a number was assigned to each speech sample based on what type of articulation error was observed. Percentage agreement for compensatory articulation was therefore calculated based on the number of times both Listener 1 and Listener 2 assigned the same number to the same speech sample (1 = none observed, 2= glottal stop, 3= pharyngeal fricative, 4= pharyngeal stop, 5= mid-dorsal palatal stop, 6= posterior nasal fricative). For the control group, point-by-point agreement was high, reaching 100 percent agreement within one scale value on all of the speech characteristics. No compensatory articulation errors were observed in the control group. For the VPI group, the point-by-point agreement ranged between 14% (2/14) and 64% (9/14) and

percent agreement within one scale value ranged between 71% (10/14) and 93% (13/14). Agreements on the hypernasality and articulation proficiency variables were the lowest and reliability of the velopharyngeal function scale scores were the highest. For speech samples that were judged to exhibit compensatory articulation patterns, no agreement was found between Listener 1 and Listener 2 on which articulation error was present for all of the fourteen VPI samples. Again, the point-by-point percentage agreement and that determined within one scale value between Listener 1 and Listener 2 are displayed in Table 5 for the VPI speech sample for the seven speech variables rated on severity scales. Overall, the inter-judge reliability ranged from poor-to-excellent depending on the speech characteristic under assessment.

Intra-judge reliability was assessed by comparing the perceptual assessment scores on the speech characteristics of 6 speech samples (3 randomly drawn from the control group and three randomly drawn from the VPI group) that were repeated at the end of the original set of samples presented for perceptual assessment. Intra-judge reliability was assessed both for Listener 1 and Listener 2. For Listener 1, point-by-point agreement ranged from 50 to 100% and between 83 to 100% when agreement within one scale value on the seven severity ratings was calculated. For Listener 2, percent agreement also ranged from 50 and 100% and there was 100% agreement for ratings within one scale value on the seven severity ratings. For both listeners, hyponasality was the least reliable measure, and the velopharyngeal function rating was judged most consistently. In addition, 100% agreement was found for both Listener 1 and Listener 2 on all six samples for the compensatory articulation variable. Intra-rater

Table 5

Inter-judge Reliability (in %) for VPI Speech Samples (n=14), (Point-by-Point and Within One-Scale Value), for Each Speech Variable

Speech characteristic	Point-by-point agreement	+/- One scale value
Hypernasality	29	79
Hyponasality	64	86
Audible Nasal Emission	36	71
Velopharyngeal Function	64	93
Articulation Proficiency	14	79
Overall intelligibility	36	86
Voice Quality	36	71

Note. Compensatory articulation was not included in the table because it was not rated on a severity scale and few samples were judged to exhibit any form of articulation error.

percentage agreement (point-by-point) and those determined within one scale value for Listeners 1 and 2 are displayed in Table 6. Overall, Listener 2 was more reliable than Listener 1.

In sum, the reliability of the ACPA and MECA were assessed. Test-retest reliability and internal consistency of the MECA instrument indicate good reliability. For the ACPA, although inter-judge reliability varied from poor-to-good, depending on the speech characteristic in question, intra-judge reliability was good-to-excellent. Thus, the ACPA and MECA show promise as useful research tools. The psychometric properties of the MECA and ACPA allow for more certainty when interpreting the results of the statistical tests used to address the experimental questions of this study: whether there is a difference in the level of CA that children in the VPI group experience compared to a control group of children, and, whether a relationship exists between MECA scores and the eight speech characteristics of voice quality for children in the VPI group. Each experimental question will be addressed below.

Group Differences in Total MECA Scores

An independent samples t-test was conducted to assess whether a significant difference was found between children in the VPI group and children in the control group on total MECA scores. Results of the t-test revealed a statistically significant difference in mean total MECA scores between the two experimental groups. This difference was found to be statistically significant at the $p < 0.01$ level (see Table 7). Children in the VPI group reported higher levels of CA (M and SD = 58.21 and 10.58, respectively), compared to children in the control group (M and SD = 47.64

Table 6

Intra-judge Reliability (in %), for Speech Samples (n=6), (Point-by-Point and Within One-Scale Value), for Each Speech Variable

Speech characteristic	Listener 1	Listener 2
Hypernasality	67 (83)	83 (100)
Hyponasality	50 (100)	50 (100)
Audible Nasal Emission	83 (100)	83 (100)
Velopharyngeal Function	100 (100)	100 (100)
Articulation Proficiency	50 (100)	67 (100)
Overall Intelligibility	83 (100)	100 (100)
Voice Quality	83 (100)	100 (100)

Note. Percentage agreement within one scale value is presented in parentheses; compensatory articulation was not included in the table because it was not rated on a severity scale;

Table 7

Differences in Mean MECA Scores Between the VPI group and Control Group as Determined by an Independent t-test

Group	Mean	SD	t	df	Sig. (two-tailed)
VPI	58.21	10.58			
Control	47.64	9.33			
VPI vs. Control	10.57	1.25	2.805	26	.009

and 9.33, respectively). A 10-point difference in mean scores was found between the two groups. This finding represents the first empirical support for the hypothesis that children who have VPI on average, experience higher levels of apprehension when communicating orally in different social contexts compared to children who do not have a speech/voice disorder. This experience of higher CA may be attributed to the noticeable abnormalities in various components of speech that children with VPI exhibit. To investigate this association, a correlational analysis was subsequently conducted to determine if there is any relationship between the MECA scores of VPI children and ratings of their speech quality.

Relationship between MECA Scores and ACPA Scores

The second experimental question posed in this study was whether there is any association between MECA scores of VPI children and perceptual assessments of their speech quality. To answer this question, separate Pearson-product moment correlations were calculated for total MECA scores of children in the VPI group and each of the seven speech characteristics represented on the ACPA. However, as mentioned previously, the compensatory articulation characteristic is not measured on an ordinal scale, but rather the presence of different types of articulation speech errors are assigned a different number from 1 to 6. Higher scores on the compensatory articulation scale do not indicate more severe articulation errors. Thus, this speech characteristic was not included in the correlational analysis. Thus, a total of seven Pearson-product moment correlations were conducted, correlations between the total MECA scores of the VPI group and ratings of each of the seven remaining speech characteristics on the ACPA for VPI speech samples. These correlations and their

level of significance are displayed in Table 8. Pearson-product moment correlations revealed correlations ranging from r = -.02 (total MECA scores and voice quality) to r = .44 (total MECA scores and velopharyngeal function). However, only one correlation was found to be statistically significant, the correlation between total MECA scores and velopharyngeal function. A fair positive correlation of .44 between total MECA scores and velopharyngeal function was found to be statistically significant. To investigate whether this relationship was linear, a scatter plot was produced (see Figure 2). This scatter plot revealed a linear relationship between MECA scores and scores on the velopharyngeal function variable. Thus, the present data suggest that as children move from the adequate category to the marginal and inadequate categories of velopharyngeal function, children report higher levels of CA. Based on auditory-perceptual judgments of the velopharyngeal function of VPI children made by SLPs, a prediction can be made that children who are judged to be inadequate will tend to rate their communication apprehension levels to be higher than children judged to have marginal or adequate velopharyngeal function. No other prediction can be made based on correlations found between total MECA scores and measures of hypernasality, hyponasality, nasal air emission, articulation proficiency, overall intelligibility, and voice quality. In sum, a fair positive relationship was found between total MECA scores and the auditory-perceptual assessment of velopharyngeal function. No other statistically significant relationships were found.

In conclusion, a series of descriptive and statistical analyses were conducted and results were obtained. Information presented includes: demographic and health status information of the VPI and control group, descriptive information regarding

Table 8

Pearson-Product Moment Correlations between Total MECA Scores and Speech Variable Score for VPI Group

	Total MECA Scores	Hypernasality	Hyponasality	Nasal Air Emission	Velopharyngeal Function	Articulation Proficiency	Overall Intelligibility	Voice Quality
Total MECA Scores	1	.298	.097	.316	.439*	.034	.104	-.015
Hypernasality		1	-.159	.715**	.653**	.109	.286	.285
Hyponasality			1	.028	-.133	.091	.365	.378*
Nasal Air Emission				1	.519**	-.009	.401	.309
Velopharyngeal Function					1	.080	.079	.084
Articulation Proficiency						1	.462*	.226
Overall Intelligibility							1	.446*
Voice Quality								1

* Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed)

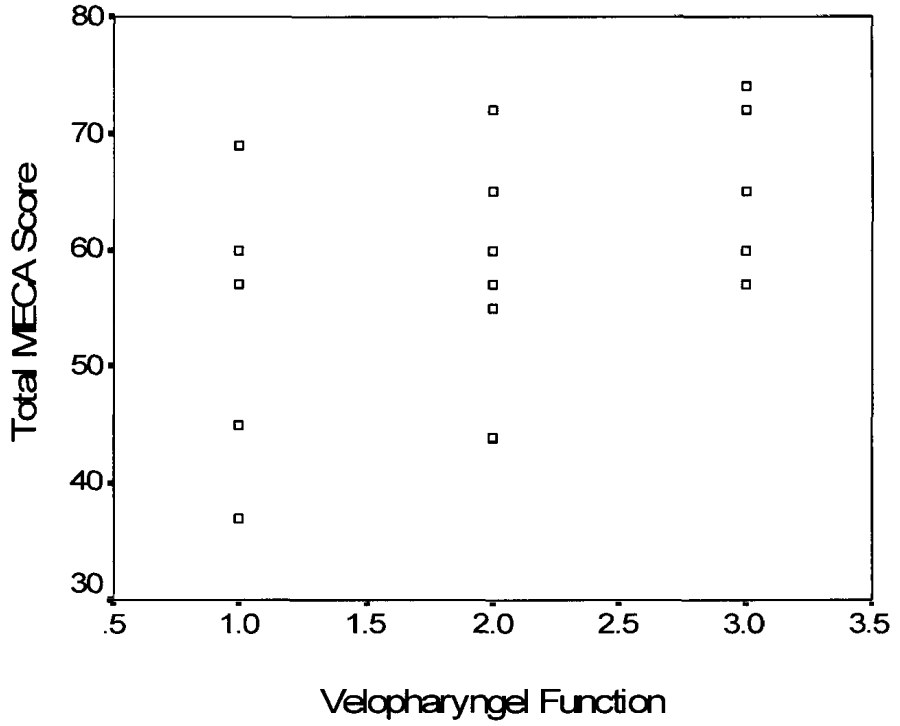

Figure 2. Scatter plot of Total MECA scores versus Velopharyngeal Function scores for VPI group.

MECA scores and ACPA scores, analyses of the reliability of the MECA and ACPA. In addition, statistical analyses were used to determine if a difference in mean MECA scores between children in the VPI group and control group existed, and whether there is any relationship between MECA total scores and auditory-perceptual assessments of speech characteristics. Results revealed good test-retest reliability and internal consistency of the MECA, poor-to-good inter-judge reliability and good intra-judge reliability of scores on the ACPA. Furthermore, a statistically significant difference was found for mean total MECA scores between children in the VPI group and children in the control group, and a fair positive relationship was found between MECA scores and auditory-perceptual assessments of velopharyngeal function scores.

Chapter Four

Discussion

The purpose of the present study was to evaluate the experience of communication apprehension (CA) in adolescents who have been diagnosed with velopharyngeal insufficiency (VPI). Specifically, this study was conducted in two phases. Phase one included 14 children who had been diagnosed with VPI (VPI group) and 14 healthy children not diagnosed with VPI (control group). Both groups of children were administered the MECA, a validated 20-item measure of CA; this measure was also completed a second time approximately one-to-two weeks later to assess test-retest reliability. In addition, both groups of children provided voice recordings of seven standard speech phrases used to assess velopharyngeal function. Phase two of the study involved perceptual evaluation of the 28 speech samples provided by the adolescents in phase one (i.e, 14 per group). This involved perceptual judgments of eight speech characteristics: hypernasality, hyponasality, audible nasal emission, articulation proficiency, overall intelligibility, compensatory articulation, voice quality, and velopharyngeal function (ACPA) [see Appendix D]. Three randomly selected speech samples from the VPI group and three from the control group were also evaluated perceptually on the eight speech characteristics to assess intra-judge reliability. Information gathered from both phases of the study was used to answer the following experimental questions:

1) Do adolescents with VPI experience higher levels of CA than adolescents who do not have a speech/voice disorder?

2) What is the relationship between MECA scores and the perceptual assessment of speech quality?

The subsequent sections of this discussion will address the results of this investigation with special consideration given to the existing literature. This will include: the reliability of the MECA, the reliability of the ACPA measure, group differences in MECA scores, and the relationship between MECA scores and the perceptual assessment of speech. Finally, clinical implications and suggestions for future research will be presented.

Reliability of the MECA

Within this study, two reliability measures of the MECA instrument were assessed, test-retest reliability and internal consistency. Test-retest reliability was assessed by calculating an intra-class correlation coefficient (ICC) between total MECA scores completed at the time of initial collection and the subsequent measure obtained one-to-two weeks later. Calculating the test-retest reliability of the MECA resulted in an ICC of .81, indicating good test-retest reliability. This ICC (.81) is consistent with the test-retest reliability of .80 for the MECA reported by Garrison and Garrison (1979) in their validation study on a large scale population of elementary school children (n=2375). No other studies have evaluated the test-retest reliability of the MECA due to its limited use in research. However, the consistency of the reliability scores between this study and the validation study do provide promising results pointing to the stability of this measure in evaluating trait CA in the adolescent population and, thus, provides more evidence for the reliability of this measurement instrument in the current work.

Although the present study did find good results for the test-retest reliability of the MECA, one limitation that may have influenced the result of this reliability statistic is that a response rate of 100% was not achieved for the second completion of this survey. Although multiple attempts were made to participants at home to remind them to complete and return the second copy of the MECA, only 21 out of 28 participants returned a second copy , a response rate of only 75%. Furthermore, of the 21 returned questionnaires, 12 came from the control group and only 9 from the VPI group. Thus, due to the small sample size of this study, completion of a second copy of the MECA from the other 7 participants may have altered the ICC reported in this study. The reason for not achieving 100% response rate may be attributed to the fact that data were collected during the early summer months when activities and vacations may have interfered with its completion. Future attempts to increase the response rate of the second MECA may yield higher return rates if the study had been conducted at other times of the year. In addition, the return rate of surveys from participants in the VPI group may have been increased if more emphasis was given to the significance of the study. However, and as noted, although a perfect response rate was not obtained, the test-retest reliability of .81 reported is comparable to that found in the validation study of the MECA (Garrison and Garrison, 1979), providing increased confidence in this reliability statistic. Overall, the present study does seem to provide a stable measure of trait CA of the adolescent population. To further understand the reliability of the MECA, the internal consistency of this questionnaire was also assessed.

The internal consistency of the instrument (20 questions and the total score) was assessed by calculating Cronbach's alpha on the original data provided by all 28 participants. A Cronbach's alpha of .74 was found, indicating moderate-to-good internal consistency of the items. This measure of internal consistency was found to be comparable to the internal consistency scores reported in the validation study (Garrison & Garrison, 1979) where internal reliability scores of .76 to .84 were reported. However, the internal consistency of .74 found in this study is somewhat smaller than ratings of internal reliability found in a recent study using the MECA to measure the CA in 85 Grade 1 and Grade 2 children (Krol-Jersevic, 2004); these researchers indicated a Cronbach's alpha ranging from .84 to .88. In viewing these differences, it is of interest to note that in the present study the MECA was administered to a broader age range of children. Thus, the internal consistency of .74 reported in the current study may be more representative than the internal reliability reported by Krol-Jersevic (2004). However, this suggestion is tentative based on the smaller sample size in the current study.

In addition, the internal reliability of the MECA found in the present study is somewhat lower compared to internal consistency scores reported in studies using other measures of CA including the PRCA and PRCF. The PRCA is the most widely used measure of CA with reported internal reliabilities of over .90 (McCroskey, 1978; McCroskey et al.,1981; Pribyl, Keaten, Sakamoto, & Koshikawa, 1998). However, the PRCA is a measure of adult CA and, therefore, results cannot be adequately compared. The internal consistency measure of .74 of the MECA also is comparable to internal consistency ratings reported for another measure of CA, the PRCF, when

administered to children at the preliterate to junior high level. For example, results of a study by McCroskey et al. (1981) reported internal consistency scores between .70 (for younger children) and .90 (for older children) for the PRCF. Taken together, although not reporting the highest level of internal consistency, results of the present study have indicated a moderate-to-good rating of .74 for the internal consistency of the MECA. Thus, items on the MECA do seem to be examining the same underlying construct of CA. In sum, the test-retest reliability and internal consistency of the MECA indicates good instrument reliability, providing confidence for use of this measure in the present study. In addition to measuring the reliability of the MECA, the consistency of scores on the ACPA, the second measure used in this study, was also evaluated.

Reliability of the ACPA

In addition to reliability assessments of the MECA, the present study also evaluated the reliability of the ACPA as a measure of speech. Two measures of reliability were assessed, inter- and intra-judge reliability. Inter-judge reliability was assessed by evaluating the percent agreement (point-by-point, exact agreement and within one scale value) of two SLPs who evaluated all 28 speech samples (14 from the control group and 14 from the VPI group). Fifteen % of the samples (3 samples from each group), also were presented at the end of the perceptual evaluation of the initial 28 speech samples to assess intra-rater reliability. Inter and intra-judge reliability of the control group speech samples was high, reaching 100% agreement within one scale value. Thus, the control group was consistently judged by both Listener 1 and Listener 2 to have normal scores on all eight speech characteristics.

In contrast, great variability in inter- and intra-judge reliability was found for speech samples of the VPI group. For inter-rater reliability, the point-by-point agreement ranged between 14% (2/14) and 64% (9/14) and percent agreement within one scale value ranged between 71% (10/14) and 93% (13/14) [see Table 5]. Intra-rater reliability scores also demonstrated great variability across speech parameters (see Table 6). For Listener 1, point-by-point agreement ranged from 50 to 100% and between 83 and 100% (+/- one scaled value) on the seven severity ratings. For Listener 2, percent agreement also ranged from 50 and 100%, with 100% agreement within +/- one scaled value on severity ratings. Thus, large inter- and intra-judge variability was observed for the VPI speech samples across speech parameters, with greater agreement found for intra-judge reliability compared to inter-judge reliability.

Results of this study are consistent with other studies investigating the inter- and intra-rater reliability of perceptual assessments (Bradford, Brooks, & Shelton, 1964; Keuning, Wieneke, & Dejonckere, 1999; Persson, Lohmander, & Elander, 2006; Watterson, Hinton, & McFarlane, 1996). For example, in a study by Persson et al. (2006), perceptual assessments of five speech variables (velopharyngeal impairment, hypernasality, audible nasal airflow, weak pressure consonants and articulation) were evaluated by three judges to assess speech samples of children with isolated cleft palate. Inter-rater reliability was reported to be poor-to-good (point-by-point % agreement between 44-93% and between 75-98% agreement within one scale value). In addition, intra-rater reliability scores were also found to vary, but showed higher levels of reliability. Intra-rater agreement in the study by Persson et al (2006) was reported to range between 58 and 92 % (exact) and between 92- 100% within one

scale value. Other studies have reported similar trends (Van Demark & Hardin, 1986; Warren, Dalston, & Mayo, 1994). Thus, results of the present study are comparable to findings from other studies addressing the issue of reliability of perceptual assessments of speech characteristics associated with VPI. This finding lends strength to the current perceptual data which in turn allows for greater validity in the context of their relationship to MECA scores.

It has been hypothesized that the underlying reason for the variability reported in reliability ratings between listeners is that judges use internal standards that vary from judge-to-judge (Keuning et al., 1999). Several studies have provided evidence for this conclusion. First, ratings of intra-rater reliability have consistently been reported to be higher than ratings of inter-rater reliability (Persson et al., 2006; Warren et al., 1994; Watterson et al., 1996). Second, when assessing speech of those with VPI, experienced listeners are not necessarily more reliable than inexperienced listeners (Bradford et al., 1964; Keuning et al., 1999). Finally, higher reliability scores have been found in studies using DME rating scales, studies in which speech samples are rated relative to a standard referent or "modulus" (Whitehill et al., 2002). Thus, variability in a judge's internal standard seems to be a critical underlying factor for the variability in reliability scores found in perceptual assessment of speech. However, other reasons for the variability in reliability scores across studies have been addressed in the literature and point to the inconsistency in the methodology used to achieve reliable ratings of speech. These include variability in rating scales (Dalston & Warren, 1986; Keuning et al., 1999), listener experience (Dalston & Warren, 1986), speech samples (Suwaki et al, 2008a) and parameters under

evaluation (Van Demark et al., 1985). Future research may yield more reliable results if judgments of speech quality are based on a consensus between listeners. Despite these factors, overall, the present study found poor-to-good inter-rater reliability and good-to-excellent test-retest reliability for the perceptual assessment of the VPI speech samples.

When investigating the particular perceptual parameters assessed in this study, certain variables were judged more consistently than others. For example, hypernasality and articulation proficiency received the lowest inter-rater reliability, while hyponasality rating received the lowest intra-judge reliability. For the hypernasality rating, a point-by-point agreement of 29% (79% within +/-one scaled value) was found between Listener 1 and Listener 2. The relatively poor inter-rater reliabilities of the hypernasality variable are consistent with results of other studies. For example, Persson et al. (2006) also reported hypernasality to receive the lowest inter-rater reliability compared to ratings of hyponasality, weak pressure consonants, audible nasal emission, and compensatory articulation. In the study by Persson et al. (2006) inter-rater agreement was reported to be somewhat higher than in the present study, ranging between 44 and 93% point-by-point and between 75 and 98% within one scale value. Other studies have also reported low inter-rater reliabilities for the hypernasality measure (Paal, Reulbach, Strobel-Schwarthoff, Nkenke, & Schuster, 2005; Watterson et al., 1996). Ratings of hypernasality often yield inaccurate results because it is a multidimensional perceptual feature (Watterson et al, 2007). Hence, this construct can be strongly influenced by both stimuli and its productive contexts (e.g., words versus sentences versus running speech). Further, perception of the

severity of hypernasality can be influenced by the presence of other speech characteristics such as nasal air emission or compensatory articulation (Van Demark et al., 1985), so common to those with velopharyngeal deficits. As a result, it is not surprising to have found relatively poor inter-rater reliability for the hypernasality variable in the present study.

In addition to the hypernasality rating, articulation proficiency also was found to have poor levels of inter-rater agreement (point-by-point agreement of 14% and 79% within one scale value). One reason for this finding may be attributed to the fact that there is inconsistency in the definition of articulation proficiency from one listener to the next. Inconsistency in the use of terminology has been found throughout the literature (Sell, 2005) and, thus, may be the reason for the inconsistency in listener judgments in the present study.

For ratings of intra-rater reliability, the hyponasality variable was the least reliable measure. Although 100% agreement +/- one value was found for most of the speech variables, including the hyponasality parameter, a point-by-point agreement of only 50% was found for both Listener 1 and Listener 2 for the hyponasality variable in the present study. The reason that the hyponasality variable received low point-by-point intra-judge agreement may be due to the fact that the speech samples did not include nasal consonants. If hyponasality is present, nasal consonants (/m/, /n/, /ng/) are substituted for their oral phoneme cognates (/b/, /d/, /g/) (Willging & Kummer, 1999). However, since the speech phrases in the present study did not include nasal consonants, listeners were not able to adequately assess hyponasality. Future research

must include nasal consonants in the speech samples to increase the reliability of this measure and to obtain a more comprehensive picture of speech performance.

In contrast to the parameters that received the lowest reliability scores, the highest agreement was found for ratings of velopharyngeal function. The global rating of velopharyngeal function resulted in the highest inter- and intra-rater reliability scores. One reason for this finding may be that the velopharyngeal functioning scale is a global measure of speech quality and was rated on a 3-point scale (1= adequate, 2= marginal, 3=inadequate). Therefore, there was less chance for this 3-point scale to result in inconsistency. In contrast, the other seven measures were rated on a six-point scale, thus, creating greater opportunity for inconsistency. It is thus, not surprising that the velopharyngeal functioning scale reached 93% inter-rater agreement and 100% intra-rater point-by-point agreement. Other studies have also indicated high inter- and intra-rater reliabilities for the global rating of velopharyngeal function (Persson et al., 2006; Van Demark & Hardin, 1986).

In summary, because of the critical importance of understanding measurement variables, the reliability of the ACPA and the MECA were assessed in the present study. Test-retest reliability and internal consistency of the MECA instrument indicate good reliability. For the ACPA, although inter-judge reliability varied from poor-to-good, depending on the speech characteristic in question, intra-judge reliability was good-to-excellent. Thus, the ACPA and MECA show promise as useful research tools. These findings also lend credibility to the notion of linking these two measures to assess the impact of VPI on CA. Consequently, the psychometric properties of the MECA and ACPA allow for more certainty when

interpreting the current results of whether there is a difference in the level of CA that children in the VPI group experience compared to a control group of children, and, whether a relationship exists between MECA scores and the eight speech characteristics of voice quality for children in the VPI group. These topics will be addressed subsequently.

Group Differences in MECA Scores

The first experimental question addressed in this study was whether a difference existed between the levels of CA that adolescents with VPI experience compared to a healthy control group of adolescents who do not have the resonance disorder. To answer this question, a t-test was conducted to assess if a statistical difference could be detected between mean total MECA scores of children in the VPI group compared to mean total MECA scores of children in the control group. Results of the t-test indicated a statistically significant difference ($p<0.01$) in mean total MECA scores between the two experimental groups. On average, children in the VPI group reported higher levels of CA compared to children in the control group. The mean total MECA score for the VPI group and control group was calculated to be 58.21 (SD = 10.58) and 47.64 (SD = 9.33), respectively (see Tables 2 and 3). Thus, on average, the VPI group reported CA scores that were 10-scaled points higher than the control group. However, the standard deviations of mean MECA scores were large for both groups of children, reflecting large variability in CA scores. In fact, the range of total MECA scores for both groups of children was large. The total scores on the MECA ranged between 37 and 74 for children in the VPI group and between 35 and 68 for controls. It should be noted that the MECA is calculated based on a

scale that ranges from 20 to 100; thus, this distribution reflects wide variability in ratings of CA and shows that no floor or ceiling effects were found in this study.

Due to the relative normal distribution of MECA scores found in the present study, the total mean scores for the two experimental groups were compared to normative data reported in prior validation studies (Garrison & Garrison, 1979). In their study, the MECA was administered to 2,375 students between Grade 1 and Grade 12. From the study by Garrison & Garrison (1979), the mean MECA score for children in Grades 2 to 9 (reflecting the grades of children administered the MECA in the present study) was calculated to be 56.40 (SD = 6.48). CA research has often divided CA scores into three levels: high CA is defined as scores one standard deviation or more above the mean, moderate CA as scores within one standard deviation of the mean, and low CA as scores one standard deviation or more below the mean (Pribyl et al., 1998). Applied to the normative data established by Garrison and Garrison (1979), low CA would correspond to total MECA scores of 49.92 or lower, moderate CA would correspond to scores between 49.92 and 62.88, and high CA would correspond to scores of 62.88 and higher. Thus, applying the normative data to mean total MECA scores calculated in the present study, children in the control group on average would be categorized as reporting low CA and children in the VPI group would be categorized as reporting experiencing moderate levels of CA.

Overall, the present data suggest that children in the VPI group belong to a separate category of CA, reporting higher CA than children in the control group. One can speculate that the difference in CA between the two groups may be attributed to the perceptible abnormality in speech found in children who have VPI.

In addition to calculation of the mean difference in MECA scores between the two groups of children, descriptive statistics for mean MECA scores (and standard deviations) for all 20 questions on the MECA were also evaluated (see Tables 3 and 4). Results of this analysis indicated five questions where mean scores were one scale point (or more) higher in the VPI group compared to those in the control group. These questions included: 1) Q9: How do you feel when you talk in front of an audience?, 2) Q12: How do you feel after you get up to talk in front of the class?, 3) Q14: How do you feel about giving a speech on television, 4) Q19: How do you feel when the teacher wants you to talk in class?, and, 5) Q20: How do you feel when you talk in front of a large group of people? All of these questions refer to situations involving large audiences and public speaking situations. Thus, it would appear that individuals in the VPI group have a tendency to feel more concerned and apprehensive in public speaking situations that often have a relatively greater evaluative component. Children in the VPI group may experience higher perceived CA than children in the control group due to fear of negative evaluation, or being ridiculed in front of large groups of people. This higher level of CA may be attributed to the speech deviations that these individuals demonstrate, abnormalities that are often quite noticeable to the listener. It can be speculated, that VPI children may experience less CA in situations involving smaller groups of people, peers, and friends as there is a greater chance that individuals in these categories are more accepting and used to the quality of speech produced by VPI children. In fact, research suggests that even though a clinician (SLP or otolaryngologist) may identify abnormal speech characteristics associated with VPI, the child's speech may be

acceptable to the family and friends (Shelton & Trier, 1976; Van Demark et al., 1985). Thus, VPI children may feel more comfortable communicating orally with individuals with whom they are familiar. In addition, these social contexts are less punitive in that mistakes made in these contexts will not have as many consequences as mistakes made in contexts involving speaking in front of large audiences. Taken together, children in the current VPI group reported significantly higher levels of CA than children who do not exhibit a VPI related speech disorder. However, several differences between the experimental groups could have potentially influenced the results of this study.

To attribute the cause of higher CA levels to the presence of VPI alone, all other demographic information for both experimental groups should ideally be identical except for the presence or absence of the disorder. However, in most research efforts, this level of purity in samples is not achieved. This is the case in the present study. Some factors that may have influenced the results of the study include the age and gender differences between the two groups, the presence of cognitive delay in several children in the VPI group, and the generally limited variability in the severity of the speech disorder found in the VPI group. First, on average, children in the VPI group were younger than children in the control group [mean ages 10; 2 years (range 8-14), and 12; 5 years (range 8-14), respectively]. In addition, a perfect gender match was not obtained between the two experimental groups of children; specifically, 6 females and 8 males participated in the VPI group, while 8 females and 6 males participated in the control group. Previous research administering the PRCF, a measure of child CA, have indicated that children in the kindergarten to Grade 3 group report lower

CA scores than children in the upper elementary years, after which CA scores steadily increase through the elementary and high school years (McCroskey et al., 1981). In addition, Garrison and Garrison (1979) did find a tendency for girls to be more apprehensive than boys in the elementary school years and less apprehensive than boys during high school. Taken together, because children in the VPI group were younger and there were more boys than girls in this experimental group, future research using perfect age- and gender-matches may find an even larger discrepancy between total MECA scores of the VPI group compared to the control group. However, although age- and gender-matching was imperfect, the general age grouping of both children who served in the VPI and control groups was of greater importance relative to the questions posed in this study. That is, being able to collect data from children of relative age and grade-matchings likely provides a more essential index of performance relative to the questions posed in the study.

In addition to these discrepancies in age- and gender-matching between the experimental groups, several children in the VPI group also experienced some developmental delay according to their parents. Specifically, parents of 7 children in the VPI group reported that their child's English reading and/or speaking skills were not at age appropriate levels, and four parents reported that they believed that their child's cognitive development was delayed to some extent (see Table 1). However, only two children were formally diagnosed with a learning disorder, and all children were enrolled in mainstream classrooms. To ensure that children understood the survey, an initial question unrelated to the subject area (e.g. How do you feel when you have to write a test in school?) was asked to ensure that the child understood how

to use the faces scale. Thus, it was not likely that children with learning difficulties did not understand the measurement instrument. However, the presence of learning difficulties may have influenced the child's ratings of CA, presenting a potential confounding variable. A child who has difficulties learning in school may experience more apprehension in social contexts that require oral communication. Yet excluding children with school difficulties would result in a very small sample size, thus the inclusion of these children.

Finally, the limited variability in the severity of the speech disorder found in the VPI group may have implications for CA scores. The group of VPI children who participated in this study did represent the etiology of VPI according to the variability found in research, such that the three most common causes of VPI (overt cleft palate, submucous cleft palate, and adenoidectomy) are represented in this experimental group (Conley et al., 1997). However, on average, children in the VPI group tended to fall in the mild-moderate category of severity when perceptually assessed on all seven severity speech characteristics. Thus, if a sample of children who represented more diverse levels of severity on perceptual assessments were administered the MECA and compared against a control group, much higher levels of CA may be reported. Despite this lack of great diversity in the VPI group, it is still promising to find a difference in CA scores between these two groups of individuals. In sum, children in the VPI group reported a significantly higher level of CA than children in the control group. This finding is the first to confirm the potential relationship between social communication concerns and levels of speech abnormality associated with VPI using a validated measure of CA. As a result, the potential utility of the

MECA as a screening and/or monitoring tool may be of value with those who experience VPI related speech deficits.

Relationship Between Perceptual Assessment and MECA Scores

The second experimental question addressed in this study was whether a relationship exists between total MECA scores and perceptual assessment scores of speech characteristics of children in the VPI group. To answer this question, Pearson-product moment correlations were calculated for total MECA scores of children in the VPI group and each of the seven speech characteristics rated on an ordinal scale, represented on the ACPA. As previously mentioned, the compensatory articulation variable was not measured on an ordinal scale and, hence, it was not included in the correlational analysis. Pearson-product moment correlations revealed correlations ranging from r = -.02 (total MECA scores versus voice quality scores) to r = .44 (total MECA scores versus velopharyngeal function scores) [see Table 8]. However, only one correlation was found to be statistically significant, that between total MECA scores and velopharyngeal function. Upon investigation, several reasons may exist for this result. First, the velopharyngeal function variable was measured on a 3-point scale (1= adequate, 2= marginal, 3= inadequate) compared to the other six variables that were measured on a 6-point scale. Thus, the possibility of a greater number of speech samples being assigned to each of the three categories on the velopharyngeal functioning parameter may have allowed for greater representation of all the dimensions of this variable. Thus, as there are more cases assigned to each level of functioning, there was a greater chance for a correlation to be found. The difference in number of points on the scale may have contributed to the different

outcome found in the correlational analysis between MECA scores and the other six speech variables.

In contrast to the velopharyngeal function variable, the other six variables judged based on severity were measured on a 6-point scale, providing less opportunity for each level of the scale to be represented. In addition, on average, children in the VPI group were judged to exhibit between mild-moderate levels of severity for each speech characteristic. Thus, a wide distribution of severity was not witnessed in this study, making it difficult for clear correlations to be established. Additional correlations may be established with a larger sample size of VPI children and a more diverse population of children, representing different degrees of severity for each of the seven speech parameters. Thus, the present data suggest that as children move from the adequate category to the marginal and inadequate categories of velopharyngeal function, children report higher levels of CA. Therefore, a link does seem to exist between perceptual assessment of speech in VPI children and their reported experience of CA. However, perceptual assessment ratings on all speech parameters have been shown to yield inconsistent inter-rater and intra-rater reliability (Bradford et al., 1964; Keuning et al., 1999; Persson et al., 2006; Watterson et al., 1996). Even though the velopharyngeal function scale has been reported to provide the highest inter- and intra-rater reliability compared to the other speech characteristics (Persson et al., 2006; Van Demark & Hardin, 1986), repetitions of findings in future studies will provide more convincing results.

In addition, even though no other correlations were established between CA scores and perceptual assessment scores on the other speech characteristics, the relationship

of the velopharyngeal function variable to the other speech characteristics indicates that possible relationships do exist, but that these have yet to be discovered. The global perception of velopharyngeal function is influenced by the presence and/or absence of the other seven speech characteristics, namely: voice quality, overall intelligibility, hypernasality, hyponasality, compensatory articulation, articulation proficiency and nasal air emission (Kummer, 2001; Van Demark et al., 1985). As a result, it is likely that correlations between CA scores and the other seven speech characteristics exist but cannot be inferred based on the current findings.

Based on auditory-perceptual judgments of the velopharyngeal function of VPI children made by SLPs, a prediction can be offered that children who are judged to be inadequate from the perspective of VPI will tend to rate their CA levels higher than children judged to have marginal or adequate velopharyngeal function. However, the correlation of .44 is only fair (Portney & Watkins, 2000), indicating a need to investigate this relationship further. In sum, a relationship has been identified between clinician auditory-perceptual judgments of velopharyngeal function and patient reported scores on the experience of CA. Results of this study would appear to have several direct clinical implications.

Clinical Implications

Research on the lives of individuals who have identified themselves as exhibiting high CA has found many negative effects of CA. These effects include experiencing cognitive discomfort across social contexts (Daly & McCroskey, 1984), potentially experiencing lower levels of self-esteem (McCroskey et al, 1977), experiencing limitations in social functioning including withdrawal behaviors and avoiding social

situations (McCroskey, 1977; McCroskey et al., 1977), receiving lower grades in school (McCroskey & Andersen, 1976), and being perceived by others more negatively than individual with low CA (McCroskey & Daly 1976). Overall, the potential consequences for individuals who experience high levels of CA are extensive, limiting the social functioning of the individual and ultimately reducing their quality of life. Thus, results of the present study have important clinical implications.

Results of this study indicate that, on average, adolescents with VPI experience higher levels of CA compared to adolescents who do not have a speech/resonance disorder. The present study reports average CA scores that fall within the moderate CA category for children with VPI. Although results of this study need further confirmation, results do suggest that awareness needs to be made that potential limitations in social functioning exist in children who have VPI. Thus, efforts should be made to try to identify individuals with high CA (perhaps through completion of a simple self-report measure such as the MECA), so that treatment and/or complementary intervention may be offered and or provided to those children and their families. Research into the treatment of CA has found that cognitive-behavioral therapy has yielded the most successful results for alleviation of this problem (Wheeless, 1971). Clearly, the SLP may play a key role in the identification of individuals with high CA within the VPI population and results did find that a relationship exists between MECA scores and the perceptual assess of velopharyngeal function. Thus, as SLPs are more often than not responsible for the auditory-

perceptual evaluation of VPI, they may play a critical role in identifying individuals with high levels of CA.

Based on results of the correlational analysis, a prediction can potentially be made about the relative level of CA that VPI children may be experiencing based on the perceptual assessment of velopharyngeal functioning. Thus, individuals judged to have inadequate velopharyngeal functioning may be probed further to ensure their speech disorder is not negatively impacting their social life. That is, if CA is increased, assumptions concerning social "comfort" may be raised along with the potential restrictions one might experience in such situations. Of course, future research needs to be conducted to further delineate the relationship between CA, VPI, and perceptual assessment of speech quality. However, awareness that a larger communication problem (i.e., apprehension in the context of communication situations) may exist in individuals with VPI is the first step to providing a venue for helping children who fall in the high CA category to seek help, in order to live a more fulfilling and satisfying life.

Directions for Future Research

Future research should include replication and extension of this study. First, replication of the study is warranted to validate the findings of the present study. Ideally, additional research should seek to include a larger sample of children with VPI. In addition, an age- and gender-matched control group would be ideal to provide more conclusive results. Finally, a more diverse sample of VPI children, those who exhibit varying degrees of each of the eight speech characteristics, would provide more data from which to conduct a correlational analysis could be pursued.

In particular, children who exhibit severe deficits relative to each of the speech characteristics would be beneficial in surveying. This would permit a more comprehensive means of determining whether a systematic relationship between VPI deficits, speech abnormalities, and CA exists. According to trends established in the present study, children perceptually evaluated as exhibiting severe abnormalities in speech parameters may be experiencing even higher levels of CA relative to children with less severe speech abnormalities.

In addition to replication of study findings, future research efforts may include extending the assessment of CA to VPI children with cleft lip, cleft lip and palate and various other facial disfigurements. Identifying differences among children with facial anomalies compared to children without visual facial disfigurements may provide interesting insights into the different communication experiences of various groups of VPI children.

Furthermore, other research may include assessing the relationship between self-reported CA scores and ratings of speech quality from the perspective of the parent and/or child. Results of this study may provide insight into the relationship between CA and social acceptability of speech. Similarly, efforts to explore the relationships of such variables to peer groups of these children would appear to be a very valuable area for future exploration. It is clear that the social milieus in which children participate on a daily basis must be considered in the larger context of CA. For example, and at least at face value, it may be anticipated that social penalty would be less prominent with adults than with age-matched peers. As a result, the ability to assess the interaction between children relative to CA would appear to be an

important concern. However, at present, such data are unavailable and the ability to gather such information, even at a preliminary level of exploration is most worthy.

Finally, addressing the correlation between the MECA and more global measures of social functioning may provide a greater understanding of the CA construct. In addition, assessing the agreement between self-report and parent proxy reports of the MECA may provide interesting results. That is, findings may provide information regarding whether the cognitive experience of CA may be reported accurately by a parent and/or proxy. Overall, the CA construct applied to children who have communication disorders, in particular children with VPI, is a new area of research that has moved research on the VPI population beyond the physical functioning domain and instead explores fundamental areas of an individual's life that is worth investigating. Thus, the goal of this research endeavor is to provide information on the broader life experiences of adolescents with VPI.

Summary and Conclusions

The purpose of the present study was to evaluate the CA of adolescents with VPI. In particular, the study sought to answer two questions: 1) whether a difference in total MECA scores exists between adolescents diagnosed with VPI and a healthy control group that does not have a voice/speech disorder, and 2) whether there is a relationship between MECA scores and perceptual assessments of speech samples rated on eight specific speech characteristics. In addition, the reliability of the MECA and the ACPA were also evaluated. To test the reliability of the MECA, two measures of reliability were assessed, test-retest reliability and internal consistency. Results indicated good test-retest reliability and moderate-to-good internal

consistency. Two measures of reliability were used to assess the consistency of the ACPA, inter- and intra-rater reliability. Inter-rater reliability ranged between poor-to-good, depending on the speech characteristic being assessed, and intra-rater reliability was good to excellent. Both the MECA and ACPA proved to be reliable measures for the purposes of this study.

Results of the t-test indicated a statistically significant difference in mean total MECA scores between the VPI group and control group. The VPI group reported experiencing higher levels of CA compared to the control group, reporting a 10-point difference in mean scores. In addition results of the Pearson correlations indicated a statistically significant fair positive correlation between total MECA scores and the velopharyngeal functioning variable. Overall, results of the study do indicate a higher level of CA reported by adolescents in the VPI group compared to a healthy control group. Results of the study have clinical implications for the SLP. Future research should include a replication of the present study with a larger sample size and extension of this research to children with facial anomalies. In summary, the present data appear to offer insights into the important area of VPI and concerns of communication apprehension. This work provides initial support for work that explores the influence and impact of speech resonance disorders in children. Consequently, the ability to further conceptualize speech disorders and how such deficits relate to the larger issue of communication in children would seem to be an important and productive area of continued empirical efforts.

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Appendix A

Office of Research Ethics
The University of Western Ontario
Room 00045 Dental Sciences Building, London, ON, Canada N6A 5C1
Telephone: (519) 661-3036 Fax: (519) 850-2466 Email: ethics@uwo.ca
Website: www.uwo.ca/research/ethics

Use of Human Subjects - Ethics Approval Notice

Principal Investigator: Dr. P.C. Doyle
Review Number: 14006E **Review Level:** Expedited
Review Date: February 13, 2008
Protocol Title: Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insufficiency
Department and Institution: Communication Sciences & Disorders, University of Western Ontario
Sponsor:
Ethics Approval Date: March 20, 2008 **Expiry Date:** December 31, 2008
Documents Reviewed and Approved: UWO Protocol, Letter of Information and Consent (VPI group), Letter of Information and Consent (Control Group).
Documents Received for Information:

This is to notify you that The University of Western Ontario Research Ethics Board for Health Sciences Research Involving Human Subjects (HSREB) which is organized and operates according to the Tri-Council Policy Statement: Ethical Conduct of Research Involving Humans and the Health Canada/ICH Good Clinical Practice Practices: Consolidated Guidelines; and the applicable laws and regulations of Ontario has reviewed and granted approval to the above referenced study on the approval date noted above. The membership of this REB also complies with the membership requirements for REB's as defined in Division 5 of the Food and Drug Regulations.

The ethics approval for this study shall remain valid until the expiry date noted above assuming timely and acceptable responses to the HSREB's periodic requests for surveillance and monitoring information. If you require an updated approval notice prior to that time you must request it using the UWO Updated Approval Request Form.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the HSREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of monitor, telephone number). Expedited review of minor change(s) in ongoing studies will be considered. Subjects must receive a copy of the signed information/consent documentation.

Investigators must promptly also report to the HSREB:

a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to this office for approval.

Members of the HSREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the HSREB.

Chair of HSREB: Dr. John W. McDonald

Ethics Officer to Contact for Further Information			
☐ Janice Sutherland (jsutherland@uwo.ca)	☐ Jennifer McEwen (jmcewen4@uwo.ca)	☐ Grace Kelly (grace.kelly@uwo.ca)	☐ Denise Grafton (dgrafton@uwo.ca)

This is an official document. Please retain the original in your files.

cc: ORE File
LHRI

Appendix B

Thames Valley Children's Centre

Our Clients at their Best
779 Base Line Road E.
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Auto Attendant 519 685 8700
Fax 519 685 8689
www.tvcc.on.ca

17 March 2008

Dr. Philip Doyle
Professor, Field Chair
Voice Production and Perception Laboratory
Elborn College Room #2200
London ON N6G 1H1

Re: Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insuffifiency

Dear Dr. Doyle

On 17 March 2008, Thames Valley Children's Centre's (TVCC) Research Advisory Committee reviewed your application for the above-named project. I am happy to inform you that the Committee has approved your application. Congratulations!

The Committee thought that your study was important and will be of considerable value to speech language pathologists and to children with voice disorders and their families. The Committee did have a few suggestions for your consideration.

Regarding methodology, the Committee suggested that you might want to ensure that all speech stimuli are randomized so that the otolaryngologist is less inclined to know the identity of the participants. It was also suggested that the otolaryngologist not be made aware of the age of each participant. The Committee wondered if it might be better for the MECA to be administered by parents at both points in time, to decrease bias.

With respect to study inclusion criteria, the Committee suggested that you might want to include a standardized measure of cognitive functioning rather than using parents' reports.

Committee members noted that a one-way analysis of variance was not the most appropriate type of statistical analysis to employ in your study. To compare two groups on communication apprehension, the Committee explained that a paired t-test should be used, because the participants have been individually matched. It was also suggested that test-retest reliability of the MECA should be assessed within each group (if that is the goal) using the Pearson product moment correlation rather than an intra-class correlation. The Committee also thought that it would have been helpful if power estimates had been provided.

The Committee hopes that the above comments will be helpful to you as you proceed with your study.

Once the Research Program has received a copy of an ethics approval letter for your study from the University of Western Ontario, you may contact Anne Dworschak-Stokan and have her begin recruitment of study participants.

At the completion of your project in June 2008, we would appreciate it if you would (1) present your research findings to the TVCC staff members, (2) provide us with a copy of your final report, and any articles that come out of the study, and information about any presentations that you make.

Please contact Linda Smith in June 2008 to make arrangements for your presentation. We will help you set a date, and will book a room and any audio-visual equipment you will need.

If you have any questions, please do not hesitate to contact me.

The Committee extends their best wishes for a successful project!

Yours sincerely

Janette
Researcher, Research Program
Chair, Research Advisory Committee

Cc: Brent Duncan, Director, CATSS
Karen Horgan, Director, CCIR, Privacy Officer
Anne Dworschak-Stokan, Speech Language Pathologist, CATSS

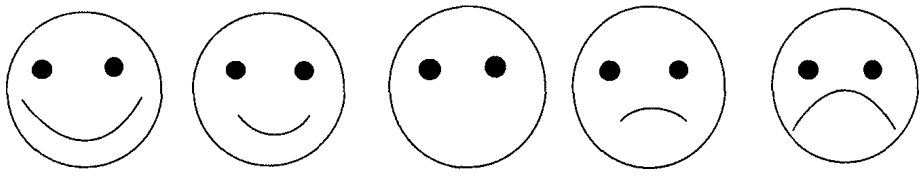
Appendix C

MEASURE OF ELEMENTARY COMMUNICATION APPREHENSION (MECA)

Unique Identifier: _____ Date: _____ Participant Code: _____

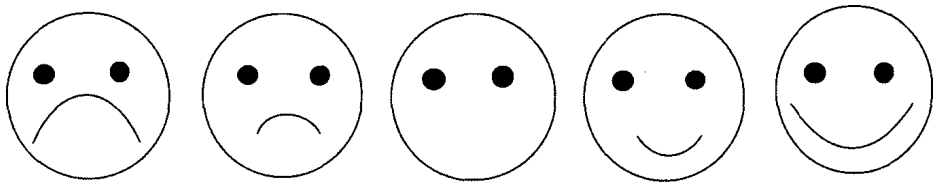
Instructions: This instrument consists of 20 questions concerning your feelings about communicating in different situations. Please mark the answer that applies to you by circling one of the following answers: **very happy/I like it a lot, happy/I like it, no feeling/I don't care, unhappy/I don't like it** or **very unhappy/I really don't like it.** There are no right or wrong answers. Just record the first answer that comes to mind.

1) How do you feel when you talk to teachers or your principal?



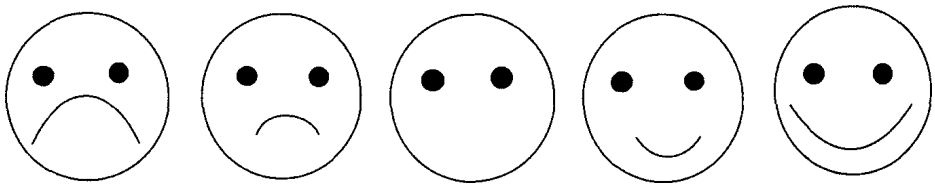
very happy I like it a lot | **happy I like it** | **no feeling I don't care** | **unhappy I don't like it** | **very unhappy I really don't like it**

2) How do you feel about talking to someone you don't know very well?



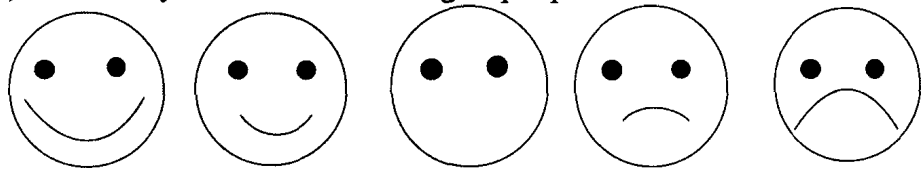
very unhappy I really don't like it | **unhappy I don't like it** | **no feeling I don't care** | **happy I like it** | **very happy I like it a lot**

3) How do you feel when you hold something and talk about it?



very unhappy I really don't like it | **unhappy I don't like it** | **no feeling I don't care** | **happy I like it** | **very happy I like it a lot**

4) How do you feel about talking to people who aren't close friends?



very happy
I like it a lot

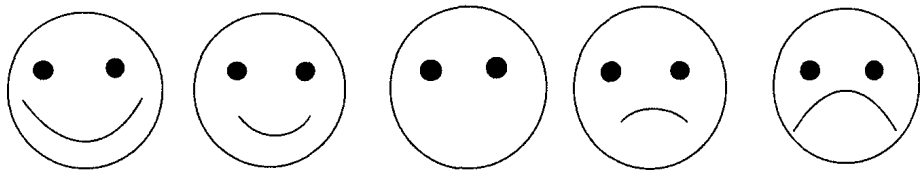
happy
I like it

no feeling
I don't care

unhappy
I don't like it

very unhappy
I really don't like it

5) How do you feel about talking when you have a new teacher?



very happy
I like it a lot

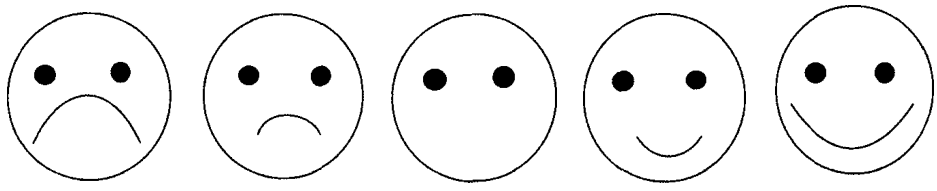
happy
I like it

no feeling
I don't care

unhappy
I don't like it

very unhappy
I really don't like it

6) How do you feel about talking a lot when you are on a bus?



very unhappy
I really don't like it

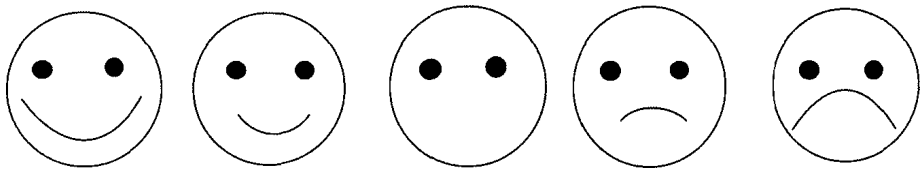
unhappy
I don't like it

no feeling
I don't care

happy
I like it

very happy
I like it a lot

7) How do you feel when you are picked to be a leader of a group?



very happy
I like it a lot

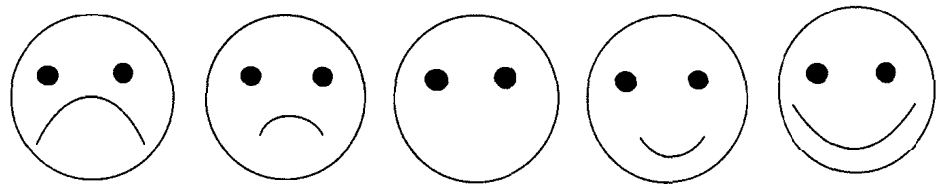
happy
I like it

no feeling
I don't care

unhappy
I don't like it

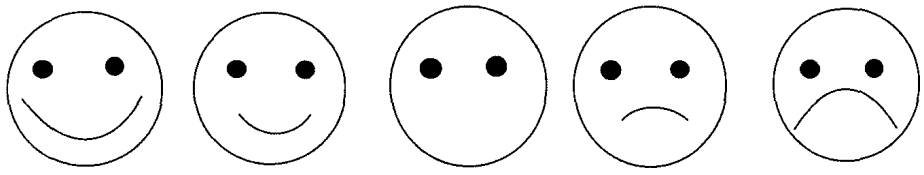
very unhappy
I really don't like it

8) How do you feel about talking a lot in class?



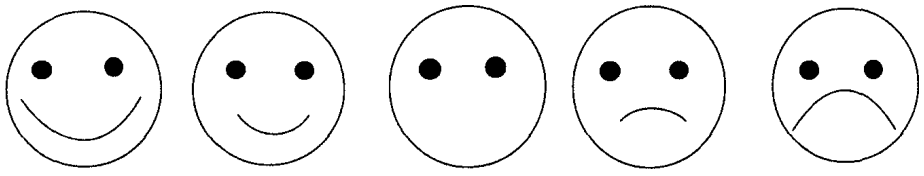
very unhappy I really don't like it | **unhappy I don't like it** | **no feeling I don't care** | **happy I like it** | **very happy I like it a lot**

9) How do you feel when you talk in front of an audience?



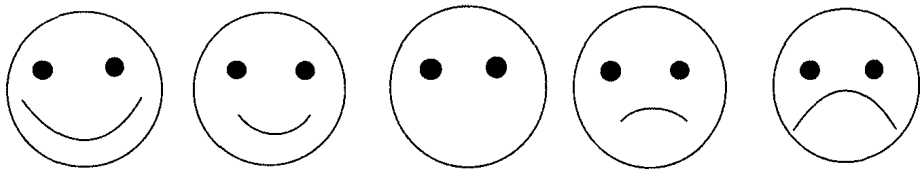
very happy I like it a lot | **happy I like it** | **no feeling I don't care** | **unhappy I don't like it** | **very unhappy I really don't like it**

10) How do you feel about talking to other people?



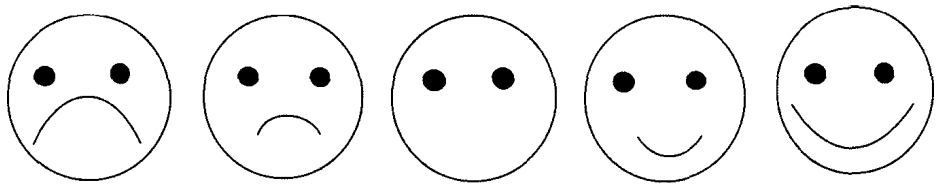
very happy I like it a lot | **happy I like it** | **no feeling I don't care** | **unhappy I don't like it** | **very unhappy I really don't like it**

11) How do you feel about trying to meet someone new?



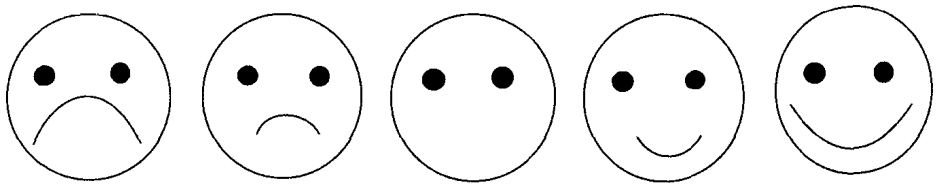
very happy I like it a lot | **happy I like it** | **no feeling I don't care** | **unhappy I don't like it** | **very unhappy I really don't like it**

12) How do you feel after you get up to talk in front of the class?



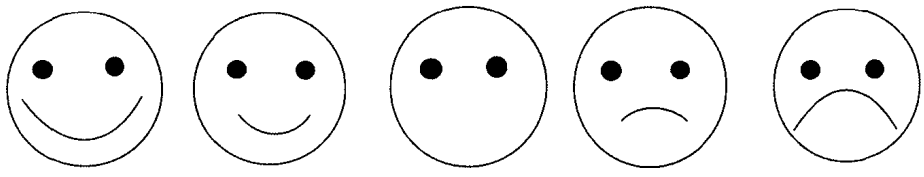
very unhappy **I really don't like it** | **unhappy** **I don't like it** | **no feeling** **I don't care** | **happy** **I like it** | **very happy** **I like it a lot**

13) How do you feel when you know you have to give a speech?



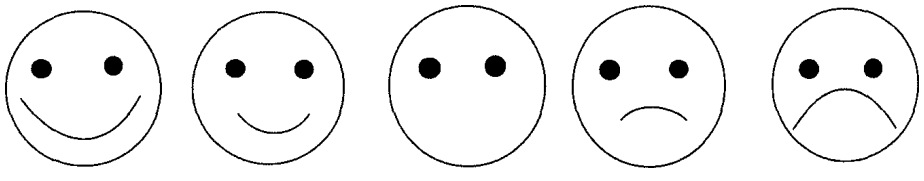
very unhappy **I really don't like it** | **unhappy** **I don't like it** | **no feeling** **I don't care** | **happy** **I like it** | **very happy** **I like it a lot**

14) How do you feel about giving a speech on television?



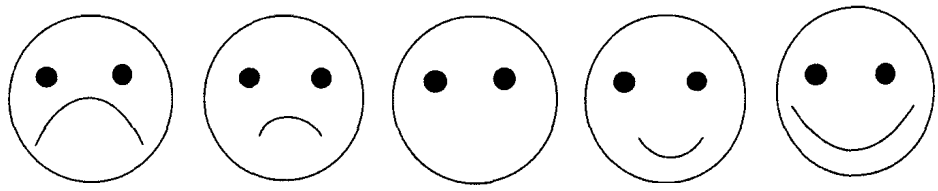
very happy **I like it a lot** | **happy** **I like it** | **no feeling** **I don't care** | **unhappy** **I don't like it** | **very unhappy** **I really don't like it**

15) How do you feel about talking when you are in a small group?



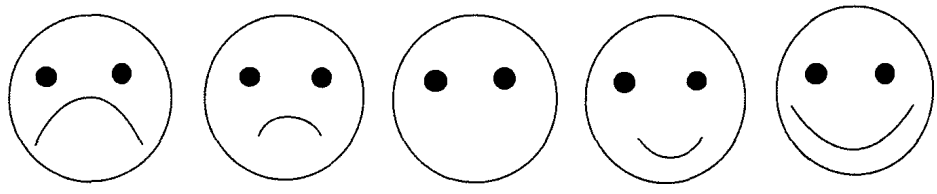
very happy **I like it a lot** | **happy** **I like it** | **no feeling** **I don't care** | **unhappy** **I don't like it** | **very unhappy** **I really don't like it**

16) How do you feel when you have to talk in a group?



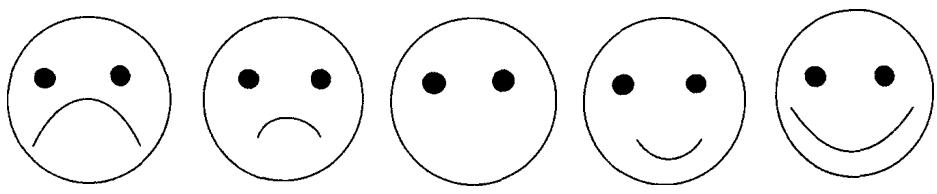
very unhappy **I really don't like it** | **unhappy** **I don't like it** | **no feeling** **I don't care** | **happy** **I like it** | **very happy** **I like it a lot**

17) How do you feel when the teacher calls on you?



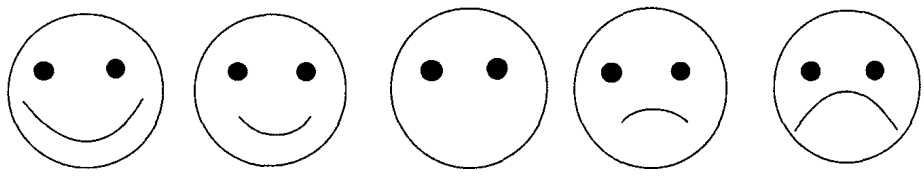
very unhappy **I really don't like it** | **unhappy** **I don't like it** | **no feeling** **I don't care** | **happy** **I like it** | **very happy** **I like it a lot**

18) How do you feel about talking to all of the people who sit close to you?



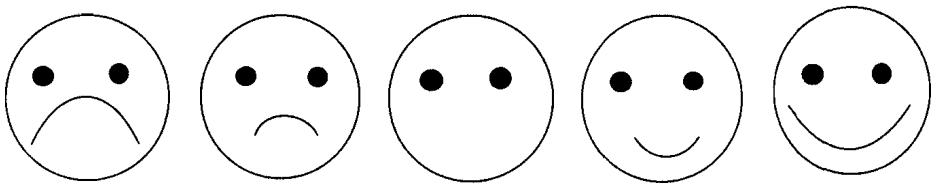
very unhappy **I really don't like it** | **unhappy** **I don't like it** | **no feeling** **I don't care** | **happy** **I like it** | **very happy** **I like it a lot**

19) How do you feel when the teacher wants you to talk in class?



very happy **I like it a lot** | **happy** **I like it** | **no feeling** **I don't care** | **unhappy** **I don't like it** | **very unhappy** **I really don't like it**

20) How do you feel when you talk in front of a large group of people?



very unhappy I really don't like it	unhappy I don't like it	no feeling I don't care	happy I like it	very happy I like it a lot

Appendix D

American Cleft-Palate Association Clinical Data Base Committee
SPEECH PATHOLOGY DATA ENTRY FORM (REVISED)

Participant Code: Patient Age: Date: Clinician:

1. Hypernasality

1= normal
2= mild
3= mild-moderate
4= moderate
5= moderate-severe
6= severe

2. Hyponasality

1= normal
2= mild
3= mild-moderate
4= moderate
5= moderate-severe
6= severe

3. Audible Nasal Emission

1= normal
2= mild
3= mild-moderate
4= moderate
5= moderate-severe
6= severe

4. Velopharyngeal Function

1= adequate
2= marginal
3= inadequate

5. Articulation Proficiency

1= normal
2= mild
3= mild-moderate
4= moderate
5= moderate-severe
6= severe

6. Overall Intelligibility

1= normal
2= mild
3= mild-moderate
4= moderate
5= moderate-severe
6= severe

7. Compensatory Articulation

1= none observed
2= glottal stop
3= pharyngeal fricative
4= pharyngeal stop
5= mid-dorsal palatal stop
6= posterior nasal fricative

8. Voice Quality

1= normal
2= mild abnormality
3= mild-moderate abnormality
4= moderate abnormality
5= moderate-severe abnormality
6= severe voice abnormality

Note any additional observations in the space below:

Appendix E

LETTER OF INFORMATION/ CONSENT

An Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insufficiency

INTRODUCTION

Your child is invited to participate in a research study. Your child was identified for this study because they are: between the ages of 8-14 years and have been diagnosed with velopharyngeal insufficiency (VPI). This study will be conducted by the following investigators: Dr. Philip C. Doyle, Professor at the University of Western Ontario, Dr. Murad Husein, Pediatric Otolaryngologist at Victoria Hospital, Anne Dworschak-Stokan, Speech Language Pathologist at Thames Valley Children's Centre, and Agnieszka Dzioba, a graduate student at the University of Western Ontario.

The purpose of this study is to assess the level of apprehension or concern that children with VPI experience when they are communicating orally in different social situations including interacting with peers or talking to a large group of people. In addition, this study is interested in assessing whether there is any relationship between how a speech clinician rates a child's voice quality with VPI and the child's ratings of the level of communication apprehension that they experience.

PROCEDURES

This study will take place in a quiet therapy room at the Thames Valley Children's Centre or the H.A. Leeper Speech and Hearing Clinic located in Elborn College, University of Western Ontario. Approximately 40 children will be taking part in this study, 20 children who have been diagnosed with VPI and 20 children who do not have the problem and will serve as the control group. The control group will be recruited from the community via a telephone call made to personal contacts of the study investigators. If you agree to have your child participate, Agnieszka Dzioba will ask you to fill out an information form regarding your child including their name, age, grade in school, type of treatment they received for their VPI, and their current general health status. This information is necessary in order to ensure that all inclusion and exclusion participant criteria are met for this study. Your child will then be asked to fill out a 20 item questionnaire called the MECA, which measures the level of apprehension or anxiety that your child may experience in various oral communication situations including interacting with peers and talking to teachers. This questionnaire requires your child to use a face scale, where a sad face represents not liking a specific situation and a happy face represents a situation in which your child likes to communicate. The MECA will be administered orally by Agnieszka Dzioba. Secondly, your child will be asked to provide us with voice recordings. The investigator will present a series of speech phrases that your child will repeat. The

voice recordings will be collected in order for your child's voice to be evaluated on various voice characteristics by Anne Dworschak-Stokan (co-investigator). The investigator will rate the quality of your child's voice and results will be used to assess if there is any relationship between voice quality and the experience of communication apprehension. The procedures will take approximately 20 minutes to complete. You are encouraged to stay with your child during the entire data collection process. After completion of both the MECA and the voice recordings, you will be given a copy of the MECA along with a pre-addressed stamped envelope to have your child complete the questionnaire again in one to two weeks time and mail the completed surveys back. One telephone call by the investigator will be made to remind participants to complete the survey approximately 2 weeks after data collection. A copy of this Letter of Information/Consent will be given to you to keep.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. You may choose for your child not to take part in this study, refuse to answer any questions or if you decide to let your child take part, you may withdraw your child from the study at any time with no effect on their future care.

RISKS AND BENEFITS

There are no risks involved in this study. Benefits of the study include gaining a more comprehensive understanding of treatment outcome for children with VPI. Assessing the communication apprehension of these children will provide valuable information about the potential impacts of living with VPI on feelings of concern when communicating in various social settings. In addition to the advancement of knowledge of VPI, this study may also have implications for treatment. Results of the study may help identify individuals with high communication apprehension, indicating a need for treatment/therapy to help relieve these symptoms and consequently, help children with VPI achieve a higher quality of life. Parking is free at the Thames Valley Children's Centre.

CONFIDENTIALITY

The investigators involved in this study will keep your child's identity and study information confidential. Your child will not be personally identified in any capacity as a result of participation in this study. All identifiable information will be stored in a locked cabinet at the Voice Production and Perception Lab, Elborn College. Only study investigators will have access to the data. All identifiers will be removed from the data prior to storing information on a password protected computer.

FURTHER INFORMATION

If you have any questions about this study please contact:

Agnieszka Dzioba

If you have any questions about the conduct of this study or your rights as a research subject you may contact Dr. David Hill, Scientific Director, Lawson Health Research Institute.

An Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insufficiency

Principal Investigator: Dr. Philip C. Doyle

CONSENT TO PARTICIPATE

I have read the Letter of Information/Consent, have had the nature of the study explained to me and I agree to have my child participate. All questions have been answered to my satisfaction.

Name of Parent (Please Print)	Signature of Parent	Date

I have read the Letter of Information/Consent, have had the nature of the study explained to me and I agree participate. All questions have been answered to my satisfaction.

Name of Child (Please Print)	Signature of Child	Date

Name of Person Obtaining Consent	Signature of Person Obtaining Consent	Date

Appendix F

Western

Thames Valley Children's Centre

LETTER OF INFORMATION/ CONSENT

An Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insufficiency

INTRODUCTION

Your child is invited to participate in a research study. Your child was identified for this study because they are: between the ages of 8-14 years and have not been diagnosed with velopharyngeal insufficiency (VPI), a speech disorder that is created when oral air leaks through the nose during speech, or any other speech or voice disorder. Individuals with VPI have been diagnosed by a physician at the Thames Valley Children's Centre. If, at the time of data collection, the investigator suspects a participant assigned to the control group may be exhibiting characteristic signs of VPI, the participant will be excluded from the study. This study will be conducted by the following investigators: Dr. Philip C. Doyle, Professor at the University of Western Ontario, Dr. Murad Husein, Pediatric Otolaryngologist at Victoria Hospital, Anne Dworschak-Stokan, Speech Language Pathologist at Thames Valley Children's Centre, and Agnieszka Dzioba, a graduate student at the University of Western Ontario.

The purpose of this study is to assess the level of apprehension or concern that children with VPI experience when they are communicating orally in different social situations such as communicating with peers or when talking to a large group of people when compared to children without this disorder. A group of children without VPI will be used in this study for the purpose of investigating whether there are any differences in the experience of communication apprehension between children with VPI and those without, and which may be related to the presence or absence of this problem. In addition to the evaluation of communication apprehension, this study is interested in assessing whether there is any relationship between how a speech clinician rates a child's voice quality and the child's ratings of the level of communication apprehension that they experience.

PROCEDURES

The study will take place at the H.A. Leeper Speech and Hearing Clinic located in Elborn College, University of Western Ontario. Approximately 40 children will be taking part in this study, 20 children who have been diagnosed with VPI and 20 children who do not have the problem. Agnieszka Dzioba will ask you to fill out an information form regarding your child including their name, age, grade in school, and their current general health status. This information is necessary in order to ensure that all inclusion and exclusion participant criteria are met for this study. The inclusion criteria for the healthy control group includes children: between the ages of 8 to 14 years with no history of voice disorders, including VPI; children who exhibit age appropriate cognitive development, including age appropriate English speaking

and reading skills; and children with no report of cold or flu or sinus problems during data collection time. The exclusion criteria for the control group includes: children who are less than 8 or greater than 14 years old; children diagnosed with VPI or other voice disorders; developmentally delayed children; children with reading and speaking skills below age appropriate levels; and children who exhibit signs of cold or flu or sinus problems during data collection time. After completion of the information form, your child will be asked to fill out a questionnaire asking to rate their level of communication apprehension. This questionnaire will be administered orally by Agnieszka Dzioba. Secondly, your child will be asked to provide us with voice recordings. The investigator will present a series of speech phrases that your child will repeat. The procedures will take approximately 20 minutes to complete. You are encouraged to stay with your child during the entire data collection process. After completion of both the MECA and the voice recordings, the parent will be given a copy of the MECA along with a pre-addressed stamped envelope to have the child complete the questionnaire again in one to two weeks time and mail the completed surveys back. One telephone call by the investigator will be made to remind participants to complete the survey approximately 2 weeks after data collection. A copy of this Letter of Information/Consent will be given to you to keep.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. You may choose for your child not to take part in this study, refuse to answer any questions, or if you decide to let your child take part, you may withdraw your child from the study at any time.

RISKS AND BENEFITS

There are no risks involved in this study. Benefits of the study include gaining a more comprehensive understanding of treatment outcome for children with VPI. Assessing the communication apprehension of these children compared to those without the problem will provide valuable information about the potential impacts of living with VPI on feelings of concern when communicating in various social settings. In addition to the advancement of knowledge of VPI, this study may also have implications for treatment. Results of the study may help identify individuals with high communication apprehension, indicating a need for treatment/therapy to help relieve these symptoms and consequently, help children with VPI achieve a higher quality of life. Parking costs at the H.A. Leeper Speech and Hearing Clinic at Elborn College for the time it takes to complete the study will be reimbursed to the parents of study participants.

CONFIDENTIALITY

The investigators involved in this study will keep your child's identity and study information confidential. Your child will not be personally identified in any capacity as a result of participation in this study. All identifiable information will be stored in a locked cabinet at the Voice Production and Perception Lab, Elborn College. Only study investigators will have access to the data. All identifiers will be removed from the data prior to storing information on a password protected computer.

FURTHER INFORMATION
If you have any questions about this study please contact:
Agnieszka Dzioba

If you have any questions about the conduct of this study or your rights as a research subject you may contact Dr. David Hill, Scientific Director, Lawson Health Research Institute.

An Evaluation of Communication Apprehension in Adolescents with Velopharyngeal Insufficiency

Principal Investigator: Dr. Philip C. Doyle

CONSENT TO PARTICIPATE
I have read the Letter of Information/Consent, have had the nature of the study explained to me and I agree to have my child participate. All questions have been answered to my satisfaction.

Name of Parent (Please Print)	Signature of Parent	Date

I have read the Letter of Information/Consent, have had the nature of the study explained to me and I agree participate. All questions have been answered to my satisfaction.

Name of Child (Please Print)	Signature of Child	Date

Name of Person Obtaining Consent	Signature of Person Obtaining Consent	Date

Appendix G

INFORMATION FORM

Please provide the following health care information regarding your child:

Child's Name: _____ Male Female (please circle)

Age: _____ Grade in School: ____

Please circle either **Yes** or **No** for the following questions:

Has your child received any of the following treatments for velopharyngeal insufficiency?
a) speech therapy Yes No
b) surgery Yes No .....if yes, time since last surgery (in months) : _____
c) other (please specify)_____

Do you feel that your child's cognitive development is at an age-appropriate level? Yes No

Do you feel that your child's reading and speaking skills are at an age-appropriate level? Yes No

Has your child been diagnosed with any other voice disorders in addition to velopharyngeal insufficiency? Yes No.....if yes, please specify: _____
_____

Is your child currently experiencing any cold or flu-like symptoms, or do they have sinus problems? Yes No

Participant Code:

Appendix H

INFORMATION FORM

Please provide the following health care information regarding your child.

Child's Name: _____ Male Female (please circle)

Age: _____ Grade in School: ____

Please circle either **Yes** or **No** for the following questions:

Has your child ever been diagnosed with a voice disorder? Yes No

if yes, does your child currently have a voice disorder? Yes No

Has your child ever been diagnosed with velopharyngeal insufficiency? Yes No

Do you feel that your child's cognitive development is at an age-appropriate level? Yes No

Do you feel that your child's reading and speaking skills are at an age-appropriate level? Yes No

Is your child currently experiencing any cold or flu-like symptoms, or do they have sinus problems? Yes No

Participant Code:

Appendix I

Dear Parents,

Please have your child complete the MECA survey one to two weeks from the date of initial meeting and data collection. Completion of the survey a second time will provide data that will be used to assess the reliability (or consistency) of this instrument. The date that your child first completed the survey was _____.

Please follow these instructions when administering the MECA survey to your child:

1) Take out the enclosed MECA questionnaire and write down the date (the "Unique Identifier and/or "Participant Code" will already be completed for you).

2) Give the MECA to your child and provide them with a pen or pencil to complete the survey. Allow them to sit in a comfortable, quiet place. Please ensure that your child feels comfortable and ensure that you are not looking at your child's answers.

3) Please read the following survey instructions and questions out loud to your child. Maintain a neutral tone when reading the questions to your child. Give your child time between questions to circle their answer.

PLEASE READ OUT LOUD:

"Measure of Elementary Communication Apprehension"

"Instructions: This instrument consists of 20 questions concerning your feelings about communicating in different situations. Please mark the answer that applies to you by circling one of the following answers: **very happy/I like it a lot, happy/I like it, no feeling/I don't care, unhappy/I don't like it** or **very unhappy/I really don't like it.** There are no right or wrong answers. Just record the first answer that comes to mind."

"Question One: How do you feel when you talk to teachers or your principal?"

"Question Two: How do you feel about talking to someone you don't know very well?"

"Question Three: How do you feel when you hold something and talk about it?"

"Question Four: How do you feel about talking to people who aren't close friends?"

"Question Five: How do you feel about talking when you have a new teacher?"

"Question Six: How do you feel about talking a lot when you are on a bus?"

"Question Seven: How do you feel when you are picked to be a leader of a group?"

"Question Eight: How do you feel about talking a lot in class?

"Question Nine: How do you feel when you talk in front of an audience?"

"Question Ten: How do you feel about talking to other people?"

"Question Eleven: How do you feel about trying to meet someone new?"

"Question Twelve: How do you feel after you get up to talk in front of the class?"

"Question Thirteen: How do you feel when you know you have to give a speech?"

"Question Fourteen: How do you feel about giving a speech on television?"

"Question Fifteen: How do you feel about talking when you are in a small group?"

"Question Sixteen: How do you feel when you have to talk in a group?"

"Question Seventeen: How do you feel when the teacher calls on you?"

"Question Eighteen: How do you feel about talking to all of the people who sit close to you?"

"Question Nineteen: How do you feel when the teacher wants you to talk in class?"

"Question Twenty: How do you feel when you talk in front of a large group of people?"

4) After completion of the survey, please place the survey back in the self-addressed stamped envelope and send by mail.

Thank you for your time and participation!

Appendix J

Perceptual Assessment Instructions

Your task is to assess the voice and speech characteristics of 34 speech samples. You will rate each sample on 8 speech characteristics using the American Cleft-Palate Association Speech Pathology Data Entry Form (ACPA). The ACPA uses interval scales to assess 8 characteristics of velopharyngeal functioning: hypernasality, hyponasality, audible nasal emission, velopharyngeal function, articulation proficiency, overall intelligibility, compensatory articulation, and voice quality. The 34 speech samples consist of voice recordings of adolescents between the ages of 8 to 14 who belong to one of two groups: 1) the velopharyngeal insufficiency (VPI) group which consists of children who have been diagnosed with VPI, and do not present with any other voice disorder; and 2) a normal control group of children who have not been diagnosed with VPI or any other voice disorder. Each speech sample consists of a voice recording of an adolescent repeating 7 standard speech phrases. Each of the seven phrases is presented once, and follows the same sequence of repetition, running approximately 30 seconds in length. The speech phrases include: 1) "Patty ate apple pie"; 2) "Sissy sees the sky"; 3) "Go get a cookie for Kate"; 4) "She likes high boots"; 5) "Puppy, puppy"; 6) "Jerry's slipper's were blue"; and 7) "Stop the bus". A file has been created for each sample on the computer. Each file is titled according to the code that was randomly assigned, followed by the participant's age (e.g. "Code 35, age 10"). The file list will be ordered according to the participant code.

The perceptual assessment package that was given to you consists of 34 copies of the ACPA, one to be used for each speech sample. Each page is double-sided and page numbered. At the top of each page the "participant code" and "patient age" fields have been filled in for you. The ACPA package has also been ordered according the participant code, corresponding to the list of speech samples on the computer. For each speech sample, please perform the following:

1) On the computer, click on the file corresponding to the "participant code" and "participant age" written on the top corner of the first page of the ACPA (i.e. Code 1, age 11). This should be the first file in the list.
2) Once you click on this file, an icon (e.g., "p1-7") will appear. Click on this icon. Once you click on it, the speech sample will open in a multimedia player program.
3) Press play and listen to the voice recording. Feel free to listen to the speech sample as many times as you feel is necessary to make an adequate judgment of each of the 8 parameters.
4) For each of the 8 parameters, circle the number that best corresponds to your perception of the individual's sample for any given parameter.
5) Once you have finished assessing the first voice sample, click on the window at the bottom of the screen with the file name "Code 1, age 11". Once you are at this window, click the "up" arrow at the top of the window to return to the previous window containing the list of all the speech samples.

6) Next, click on the second sample in the list ("Code 2, age 12") which should correspond with the participant code and participant age on the second page of the ACPA package, and perform a perceptual assessment of the second speech sample.
7) Continue to repeat steps 1) through 6) until you have completed all 34 samples. Once you have completed perceptual assessments of all samples, please return the ACPA package to the investigator.

Thank you for your time and participation!!