PSYCHOSOCIAL STATUS OF CHILDREN WITH AUDITORY PROCESSING DISORDER

By

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For Carl—faithful friend and inspiring mentor—may your legacy live on in part through me and through this work. For my children, Anna Joy and Josiah Peter—for helping to teach me about the importance of Life's everyday moments—Mommy's big paper is finally finished now. And mostly for Brian—"How can I tell you that I love you, but I can't think of right words to say?"
FAYTC—N

To God be the glory.

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Children with hearing loss often exhibit reductions in psychosocial status compared to children with normal hearing status. It is reasonable to assume that children with other perceptual difficulties, such as Auditory Processing Disorder (APD) also may experience reduced psychosocial function. However, there remains a paucity of data examining the psychosocial health of children with APD. This investigation examined relationships between APD and psychosocial status, with an aim to add to the scholarship on non-auditory factors that may influence quality of life of children with APD.

Participants consisted of nineteen children (ages 9.5 - 17.8 years; M = 11.9 years) diagnosed with APD (APD group) and twenty children with no such diagnosis in a gender- and age-matched (M = 12.8 years) group (normal group). Extensive auditory and auditory processing test batteries were administered to confirm or rule out APD. Inclusion criteria for both groups included normal hearing status, non-verbal cognitive function, and attention abilities. Normal group criteria also included no medical or academic disability, passing a language screening and no history of language impairment. The participants and their mothers completed appropriate versions of the Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP-A), the Behavioral Assessment System for Children-Second Edition (BASC-2) and the Social Skills Rating System (SSRS).

Group differences on questionnaire subscales means were analyzed by independent sample *t*-tests or the Mann Whitney U test for ordinal data. Statistical significance was defined by $p < 0.05$ (two-tailed). The participant's Emotional Feeling and Overall Health COOP-A subscales and the BASC-2 Emotional Symptoms Index differed, with the APD group reporting increased reported psychosocial problems. Parent reports differed on the following: the COOP-A Pain, School Work, and Emotional Feeling subscales; the BASC-2 Externalizing, Internalizing, Behavioral Symptoms Index and Adaptive Skills Index subscales; and the SSRS Responsibility, Externalizing Problem Behaviors and Internalizing Problem Behaviors subscales. Parents reported increased problems on these scales for children with APD. Eta-squared values for all significant findings indicated moderate to large effect sizes, suggesting findings may be generalized to other children in this age group. Post-hoc analyses yielded no significant gender or age between-groups differences, except for a moderately strong positive correlation (R = .53) between age and responsibility as measure by the SSRS Parent Rating Form. No between-group differences were found on any subscale for APD children with (N = 9) or without (N = 10) a confirmed or suspected language disorder.

CHAPTER 1
INTRODUCTION

The major sequelae of sensorineural hearing loss (SNHL) are reductions in speech perception and communicative function. Because of these perceptual and communication difficulties, children with even minimal degrees of hearing loss often exhibit reductions in psychosocial health status compared to children with normal-hearing status. Specifically, children with SNHL often exhibit lower social and emotional health status. Social and emotional difficulties of children with hearing loss have been reported in areas such as increased depression, physical aggression, withdrawal, loneliness, and decreased self-esteem and academic attainment (Bess, Dodd-Murphy & Parker, 1998; Hicks & Tharpe, 2002; Davis, Elfenbein, Schum & Bentler, 1986; Davis, Shepard, Stelmachowicz, & Gorga, 1981; Henggeler, Watson & Whelan, 1990; Knutson & Lansing, 1990; Maxon, Brackett & van den Berg, 1991). It is reasonable to assume that children with other speech-perceptual difficulties, such as Auditory Processing Disorder (APD), also may experience reduced psychosocial function.

To support this assumption the Technical Report: (Central) Auditory Processing Disorders, by the Working Group on Auditory Processing Disorders of the American Speech-Language-Hearing Association (ASHA, 2005) recently reported:

> In addition to the language and academic difficulties often associated with (C)APD, some individuals with (C)APD have a higher likelihood of behavioral, emotional, and social difficulties. Communication deficits and associated learning difficulties may adversely impact the development of self-esteem and feelings of self-worth. (p. 3)

The authors of the technical report further advise that there is no evidence that (C)APD is the cause of severe psychological or sociopathic problems, nor are milder emotional or social difficulties necessarily diagnostic of (C)APD, yet "whenever significant psychosocial concerns are present in an individual with (C)APD, the individual should be referred to the appropriate specialist for evaluation and follow-up" (p. 3). However, as the lack of references in this area of

the report suggests, there currently is a paucity of data regarding the exact nature and extent of the psychosocial difficulties in children with APD. In order for audiologists and other professionals to obtain a more complete understanding of the social and emotional health of children with APD, additional research and study is needed.

According to the Report of the Consensus Conference on the Diagnosis of Auditory Processing Disorders in School-Aged Children (Jerger & Musiek, 2000), "APD may be broadly defined as a deficit in the processing of information that is specific to the auditory modality" (p. 468). More specifically, according to the ASHA Working Group (2005), "(Central) Auditory Processing [(C)AP] refers to the efficiency and effectiveness by which the central nervous system (CNS) utilizes auditory information" (p. 2). Auditory Processing Disorder (APD) refers to CNS processing difficulties of auditory information as characterized by reduced performance in one or more of the following areas: sound localization, sound lateralization, auditory discrimination, auditory pattern recognition, speech perception in the presence of competing and/or degraded acoustic signals, and temporal auditory processes.

The prevalence of APD among school-aged children in the United States is estimated to be approximately 2 to 3% (Chermak & Musiek, 1997). The identification, diagnosis, and treatment of APD in children is important for several reasons, including co-morbidity and confusion with language impairment, dyslexia and other reading problems, behavioral problems, attention deficit disorders, and academic underachievement or failure. Again, according to the ASHA Working Group (2005), "(C)APD can lead to or be associated with difficulties in learning, speech, language (including written language involving reading and spelling), social, and related functions" (P. 3). Furthermore, other reports suggest untreated APD commonly leads to reduced communication (Smaldino & Crandell, 2004), which in turn can have psychosocial impacts such

as loneliness, social anxiety, depression, anger, and fear (Crandell, 1998). Reduced communication also has been shown to lead to reductions in physical health and psychosocial health status as well as overall quality of life (Bess, Dodd-Murphy & Parker, 1998; Crandell, 1993).

The use of self-report surveys is a well-accepted procedure to examine psychosocial health (DeBruin, Diederiks, DeWitte, Stevens & Philipsen, 1994; Nelson, Wasson, Kirk, Keller, Clark, Dietrich, Stewart, & Zubkoff, 1987; Nelson, Landgraf, Hays Wasson & Kirk, 1990). There is evidence that self-report surveys are effective in evaluating the health status of people across a variety of cultures and chronic conditions (Bronfort & Bouter, 1999; Gilbertson & Langhorne, 2000; McFall, Arambula Solomon & Smith, 2000). Numerous psychosocial health surveys have been designed for use with pediatric or adolescent populations that examine specific dimensions of social and emotional functioning. Two such examples of these surveys are the Social Skills Rating System (SSRS) (Gresham and Elliot, 1990), and the Behavioral Assessment System for Children, Second Edition (BASC-2) (Reynolds and Kamphaus, 2004). Both the SSRS and the BASC-2 utilize self-report questionnaires designed for use by teachers, parents, and/or students.

The SSRS provides information on the positive and negative social skill behaviors of students. The SSRS has both parent and child versions, which may be used singly or in combination in order to provide a complete profile of a student's social function. SSRS data can be utilized in order to inform parents, teachers, and other support personnel of social skills behaviors in and out of the classroom as well as possible underlying causes.

The BASC-2 provides a profile of adaptive and maladaptive behaviors and emotions of children and adolescents. BASC-2 data are often used by school and clinical psychologists when making educational and psychological diagnoses and determining possible disability

classifications in schools. The Parent Rating Scales (PRS) of the BASC-2 are used to measure both adaptive and problem behaviors in community and home settings in 14 subcategories, which combine into composite scales. The Self-Report of Personality (SRP) scale of the BASC-2 measures 16 subcategories of attitudes and emotions of students as they rate themselves.

Few brief self-report questionnaires that specifically examine overall quality of life have been designed or adapted for use with a pediatric or adolescent population (Elkayam and English, 2003). One exception is the Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP-A; Wasson, Kairys, Nelson, Kalishman & Baribeau, 1994). The COOP-A was designed to be used by primary care physicians in their offices as a screening tool to evaluate the overall quality of life of adolescents. The COOP-A charts are designed to assess physical, emotional, and social dimensions of function (Nelson, et al, 1987; Wasson, Kairys, Nelson, Kalishman & Baribeau, 1994).

Recently, the COOP-A has been utilized in two research studies to investigate the overall health status of children with varying degrees of hearing loss. Bess, Dodd-Murphy, and Parker (1998) reported on findings after the COOP-A was administered to 32 sixth- and ninth-grade children with minimal SNHL, conductive hearing loss, and other (e.g., mixed) types of hearing loss, and to 591 children with normal hearing. Children with hearing loss reported a trend of greater dysfunction than those with normal hearing on 9 of 10 COOP-A subscales in both the sixth- and the ninth-grade levels. Using a Mantel-Haenszel Chi-square test, statistically significant differences were found between groups of 6th-graders for the energy domain, and between groups of 9th-graders on the stress and behavior domains. Further statistical analysis by examination of only high scores of 4 or 5 on the various subtests of the COOP-A, indicated that the children with hearing loss displayed lower self-esteem and energy than their sixth-grade

peers and lower social support, higher stress and lower self-esteem than their ninth-grade peers. These higher self-ratings were chosen for further investigation, as the authors of the COOP-A (Wasson, Kairys, Nelson, Kalishman & Baribeau, 1994) have suggested that scores of 3, 4 or 5 on each chart indicate that children may be at risk for greater dysfunction in that area.

Similarly, Hicks and Tharpe (2002) examined the health status of ten children between the ages of 6 and 11 years with either mild-to-moderate or high-frequency SNHL, and ten age- and grade-matched counterparts with normal hearing. While no statistical significance between groups was found, the authors noted that the percentage of the group of children with hearing loss that rated themselves as 3 or higher (more dysfunction) on the COOP-A charts was greater compared to their peers with normal hearing in seven of nine subscale questions administered. These trends suggest more self-reported social and emotional problems in the children with hearing loss than in their counterparts with normal hearing. However, the small sample size utilized in the study affected its statistical findings and and limited generalization to most children with hearing loss. The authors also postulated, as the majority of the study participants with hearing loss utilized personal amplification devices, that the students' stress and fatigue levels from energy expended on speech perception in adverse listening situations may have been reduced by remediation of their disability and handicap through their use of amplification.

With the previous findings in mind, Kreisman, Crandell and Hall (2004) utilized the COOP-A in a preliminary study to determine if any psychosocial difficulties similar to those exhibited by children with hearing loss also existed in children with APD. As the COOP-A is intended to be a screening instrument only, any significant findings were considered to be pilot data leading into future arenas of research. Ten children (6 male, 4 female) with APD and their parents participated in the study. Subjects in the APD Group ranged in age from 9;11 to 14;6

with a mean age of 11 years 7 months. For comparative purposes, the data from the Hicks and Tharpe (2002) study groups were utilized: 1) the HL Group consisted of ten children (age range 6 to 11 years, *M* = 8;1) with either mild to moderate SNHL or high-frequency SNHL ; and 2) the Normal Hearing (NH) Group consisted of 10 children (age range 6 to 11 years, *M* = 7;11) with no hearing or auditory difficulties. Following a thorough hearing and auditory processing evaluation, the charts of the COOP-A were administered to the participants in the APD Group and their parents. The children were asked to answer the ratings on the instrument independently, and utilizing slightly modified instructions for the purposes of the investigation, the parents of the participants were asked to complete the COOP-A by responding to each chart via their perception of the most accurate answer for their child. When mean ratings and percentage of ratings considered "At-Risk" (3, 4 or 5) were analyzed, results for the Kreisman, Crandell and Hall (2004) study suggested that children with APD experience greater psychosocial dysfunction than their peers without APD across a number social and emotional content areas relating to quality of life. Specifically, the APD Group exhibited significantly higher ratings on the COOP-A Emotional Feeling and Family subscale charts than did children in the comparison NH Group. In addition, the parents of the participants with APD reported greater psychosocial difficulties than did their children on all but one of the COOP-A subscale charts.

With the exception of these preliminary findings, there remains a paucity of data examining the psychosocial function of children with APD. The present investigation aimed at further exploring hypothesized emotional and/or social difficulties that may be present in this population. The results would add to the knowledge base of the audiology community working with children who have APD regarding possible non-auditory factors that may be influencing their quality of life.

Data from two groups of students were compared. The experimental group of children consisted of nineteen pediatric participants between the ages of 9.5 and 17.8 years with a diagnosis of APD (APD group). A corresponding gender- and age-matched group consisted of twenty children had no such diagnosis, nor any other medical or academic disability (normal group). The study was conducted in two locations. Data for 17 APD subjects and 16 normal subjects were collected in the auditory laboratory at Towson University in Maryland. Data for two children from the APD group and four children from the normal group were collected at the University of Florida in Gainesville. Following a diagnostic audiometric, cognitive, linguistic, and APD battery that placed the children into one of the two investigational groups, the pediatric participants and their accompanying parents completed the COOP, the SSRS, and the BASC-2 questionnaires. Standard two-group comparison procedures were conducted to explore differences between groups on psychosocial subscale scores. Post-hoc analyses were also conducted to examine differences between gender and age of the pediatric participants of both groups as well as linguistic function status of the APD group. Implications of findings and results are discussed.

CHAPTER 2
REVIEW OF LITERATURE

Auditory Processing Disorders—Definitions and Diagnostic Importance

While the management of auditory processing disorders has received much attention in the audiology community within the last 30 years, the concept of difficulties in the dispensation of auditory information beyond the level of the peripheral hearing system can be followed back much farther in the literature of the field of communication sciences and disorders (Wertz, Hall & Davis, 2002). Myklebust (1954) noted several disturbances of auditory function, including auditory agnosia, aphasia, and other lesions in the auditory cortex that appeared to arise from central nervous system pathways. He viewed receptive aphasia as a deficiency in the interpretation of auditory impulses, while what he referred to as "central deafness" was essentially a disturbance in the delivery of auditory impulses to higher cognitive centers of the brain (p.153). In another 1954 publication, Bocca, Calearo and Cassinari described a procedure they used to uncover "hidden auditory" losses in the patients with temporal lobe tumors, by use of distorted speech. Kimura (1961) also described auditory perceptual deficits witnessed in persons with unilateral temporal-lobe damage by utilizing dichotic speech stimuli and provided a model to explain the underlying physiology of the central auditory nervous system as it related to dichotic speech perception. Much more work in the field of auditory neuroscience from then until now has also provided extensive evidence for the biological underpinnings of this somewhat elusive diagnostic area (Abbs & Sussman, 1971; Jerger, Thibodeau, Martin, Mehta, Tillman, Greenwald, Britt, Scott & Overson, 2002; Kraus & Disterhoff, 1982; Kraus, McGee, Carrell, King, Tremblay, & Nicol, 1995; Musiek, Baran & Pinheiro, 1994).

Katz (2002) defined auditory processing simply and eloquently as "what we do with what we hear." In a more technical definition, Jerger & Musiek (2000) stated that: "APD may be

broadly defined as a deficit in the processing of information that is specific to the auditory modality" (p. 468). Even yet more specifically, according to the ASHA Working Group (2005), "(Central) Auditory Processing [(C)AP] refers to the efficiency and effectiveness by which the central nervous system (CNS) utilizes auditory information" (p. 2). Auditory processing disorder (APD) refers to CNS processing difficulties of auditory information as characterized by reduced performance in one or more of the following areas: sound localization, sound lateralization, auditory discrimination, auditory pattern recognition, speech perception in the presence of competing and/or degraded acoustic signals, and temporal auditory processes. (ASHA, 1996; ASHA, 2005). Further, Chermak, Bellis and Musiek (2006; also Musiek, Bellis & Chermak, 2005) define APD as a "primarily modality-specific perceptual dysfunction that cannot be attributed to peripheral hearing loss or to higher-order, global cognitive, supramodal attention, or memory, language-based or related disorders" (p. 4).

The identification, diagnosis, and treatment of APD in children is important for appropriate management. In the diagnostic process, APD must be differentiated from co-existing disorders including language impairment, dyslexia and other reading problems, behavioral problems, attention deficit disorders, and academic underachievement or failure (ASHA, 2005; Jerger & Musiek, 2000; Musiek & Chermak, 1995). Indeed, reports suggest untreated APD commonly leads to reduced communication function, which in turn can have psychosocial impacts such as loneliness, social anxiety, depression, anger, and fear (Crandell, 1998).

Psychosocial Implications of Hearing Loss in Children and Adolescents

While there is a paucity of research into the psychosocial implications of APD, the psychosocial implications of hearing loss of varying degrees and configurations have been explored in children and adolescents (Davis et al.,1986; Culbertson & Gilbert,1986; Gilman, Easterbrooks, & Frey, 2004; Henggeler, Watson & Whelan,1990; Maxon, Brackett & van den

Berg, 1991 Elkayam & English, 2003). The following is a review of some of the experimental research conducted with an aim to describe emotional and social correlates for hard-of-hearing children.

Davis et al. (1986) examined the psychosocial function of children with mild to moderate sensorineural hearing loss. Forty children with sensorineural hearing loss were studied. The forty children who served as participants were divided into 3 experimental groups based on their three-frequency pure-tone averages (PTAs). Group A was comprised of those participants whose PTAs were 44 dBHL or less (n = 16); Group B included those participants who PTA's were between 45 and 60 dBHL (n = 15); and Group C was composed of the remaining participants, whose PTAs were 61 dBHL or greater. The Missouri Children's Picture Series, or MCPS (Sines, Pauker & Sines, 1974) and the Child Behavior Checklist, or CBC (Achenbach & Edelbrock, 1983) served as the instruments used to examine psychosocial function. The MCPS measured self-reported personality characteristics of the participants. Results on the MCPS showed that scores across the 3 groups of children with hearing loss were statistically greater than test norms derived from data on children with normal hearing on the scales of aggression and somatization. These findings suggest that children with hearing loss are more likely to exhibit aggressive behaviors and to express corporeal complaints than their peers with normal hearing. On the CBC, a parental rating scale, participants with hearing loss produced patterns of greater impulsivity and aggressive behaviors, as well as more social isolation and academic difficulties, as compared to the instrument's normative data set.

Culbertson and Gilbert (1986) examined the self-concepts and classroom behaviors of a group of 25 children with unilateral sensorineural hearing loss. Subjects in the experimental group ranged from 6 to 13 years of age and had pure-tone averages no better than 45 dB HL for

at least three years in their impaired ear. The participants were matched by age, gender, and socioeconomic status to the 25 children with normal hearing included in the control group. The Piers-Harris Children's Self-Concept Scale (Piers & Harris, 1984) and the Behavior Rating Scale (BRS; Culbertson, 1986) were given to both groups following an evaluation that included cognitive and academic measures. The BRS, an unpublished scale at the time of the study, was comprised of positive and negative descriptors in the following five categories: attention to academic tasks, peer relations and social confidence, dependence-independence, emotional lability, and organization. While Culbertson (1986) found no significant differences in self-concept between groups on the Piers-Harris measurement, trends of differences were revealed between the groups in four of the five behavioural categories of the BRS. For the categories of dependence-independence, attention to task, emotional ability and peer relations, the children with unilateral hearing loss were rated by their teachers as having a greater percentage of negative behaviours than the children with normal hearing. Limitations of the Culbertson (1986) study include the lack of statistical analysis of data, and the absence of data from a scale with published validity and reliability measures. However, the trends suggest that teachers of children with only unilateral hearing loss rate them as displaying more negative behavioural characteristics in the classroom.

Henggeler, Watson and Whelan (1990) compared the peer-relations of 35 adolescents with normal hearing to 35 adolescents with hearing loss who were enrolled in self-contained classes for the hearing-impaired that utilized a Total Communication approach. The parents of both groups of participants were given the Revised Behavior Problem Checklist (RBPC; Quay & Peterson, 1987), the Social Competence Scale of the CBC, or SBS-CBC (Achenbach & Edelbrock, 1983), and the Missouri Peer Relations Inventory (MPRI; Borduin, 1989). The

adolescents in the normal hearing group and the adolescents with hearing loss with sufficient language skills also completed the MPRI. Results indicated that parents of the adolescents with hearing loss rated their children's peer relationships as higher in aggression and lower in emotional bonding than did the parents of the children with normal hearing. However, the adolescents with hearing loss themselves, in contrast to their parents' reports, rated their relationships as lower in aggressive tendencies than their peer participants with normal hearing.

Maxon, Brackett and van den Berg (1991) studied the self-perception of social skills in 41 students with hearing loss enrolled in mainstream educational settings as compared to 22 peers with normal hearing. Utilizing an instrument specifically designed with the linguistic needs of students with hearing loss in mind, the Social Awareness Measure (Maxon, Brackett & van den Berg, 1983), students in both groups rated themselves on various measures of socialization. The 50 items on the Social Awareness Measure were designed to be simple statements utilizing concrete vocabulary accompanied by pictorial representations. These 50 items were further divided into 14 sub-category variables. The individual items were presented to the students in an interview format, and the students were asked to choose an alternative on a five point Likert scale for each item that best corresponded with how frequently the statement was true for them, from "never" to "always". Results for the 14 variables on the Social Awareness Measure were analyzed according to hearing status, gender, and age by analysis of variance (ANOVA) measures. Significant findings for children with hearing loss included increased reports of physical aggression and general verbal interactions than their peers with normal hearing, and fewer reports of verbal emotional expression and verbal aggression. Age and gender effects were also demonstrated.

Elkayam and English (2003) modified the adult versions of the Self Assessment of Communication (SAC) and the Significant Other Assessment of Communication (SOAC) (Schow & Nerbonne, 1982) for use with an adolescent population in order to determine its potential for use by educational audiologists as a personal adjustment counseling tool. The significant others employed in this study were friends with normal hearing with whom the 15 participants with hearing loss identified as having at least one class in common and as having interaction with outside school. Once both the SAC and the SOAC were completed, the first investigator met with the adolescent with hearing loss to discuss answers provided by both respondents in an informational and personal adjustment counselling session. The follow-up meetings with respondents were audio-taped and subsequently transcribed. A qualitative analysis of the recurring themes of the sessions utilizing a file-card protocol was conducted independently by each of the investigators and then compared for consistency. Five themes identified in the investigation were: 1) The Inherent Isolation of Hearing Loss; 2) Identity and Self-Concept; 3) Cosmetics and Other Hearing Aid Issues; 4) Problem Solving; and 5) Self-Acceptance.

Use of SSRS in Children with Communication and/or Sensory Impairments

Buhrow, Hartshorne and Bradley-Johnson (1998) examined both parent and teacher ratings of the social competence of children who were blind. Twenty mainstreamed elementary-school students who met the criteria for "legal" blindness were evaluated by both a parent and a teacher on the Parent Rating Scale and the Teacher Rating Scale of the SSRS, respectively. Parent and teacher ratings were compared via independent sample t-tests to the SSRS standardization norms acquired from 1021 teachers and 812 parents of children with sight. Results for the parents of the blind children indicated significantly lower rating on the Assertion Subscale as compared to the normative ratings. The teachers of the blind children also rated them significantly lower than

the normative ratings from the sighted normative sample on the Cooperation subscale. Other overall and subscale ratings were not significantly different between groups.

Koning and Magill-Evans (2001) utilized the SSRS parent-, teacher- and self-rating forms to evaluate social skills in twenty-one boys aged 12-15 identified with Asperger Syndrome as compared to twenty-one boys matched on age who were recruited from local schools. Significant differences (at the $p < .001$ level) between the experimental and the control groups were found via MANOVA analysis for all three rater sets for the Total Skill Ratings on the SSRS. Additionally, significant differences were found between groups for the Assertion, Cooperation, and Self-Control subscales of the parent and teacher rating forms, and the Responsibility subscales of the parent form. Aside from the Overall Social Skill self-ratings, the only subscale rating for the children that reached statistical significance was Assertion. This study confirms the use of the SSRS in a group of children who commonly experience language and social skill interaction difficulties. It also highlights the importance of obtaining ratings from the child with the suspected difficulties as well as observers such as their parents or teachers, as perceptions vary based on experience and environment of observation.

Cartledge, Cochran and Paul (1996) utilized an early version of the SSRS Self-Report (SSRS-S; Gresham & Elliot, 1990) to evaluate social competence between three groups of adolescents (ages 12 to 21 years) with hearing loss enrolled in varying educational settings. The first group of students attended a residential school for the hearing impaired which utilized a Total Communication approach, the second group of adolescents with hearing loss were enrolled in a public school Total Communication program, and the third group of adolescents with hearing loss attended a public school program which utilized an Oral approach. Of the 72 adolescents who participated in the study, 35 participants were in the residential school group, 19

participants were in the public school oral program group, and 18 of the participants were enrolled in the public school Total Communication program. It should be noted, however, that the two groups of students enrolled in the public school programs spent the majority of their school days in self-contained classrooms for the hearing impaired. Additionally, the majority of the female participants (70.2%) were in the public school groups, and the majority of the younger children (80.6%) attended the residential school. Findings on the SSRS-S varied by educational setting, gender, and age, with students in the two mainstreamed educational settings indicating significantly greater social competence ratings than the group of participants in the residential program. Cartledge, Cochran and Paul (1996) suggested that either the students with public schools groups a greater chance to evaluate themselves in a more challenging "mainstream" environment in light of their peers with hearing loss within their self-contained classroom, or that perhaps the students that were more socially competent to begin with were placed in the public schools. However, as older students and female students tended to rate themselves more highly than younger students and male students, the analysis must interpreted with caution as gender and age variables were not uniform among the groups.

Use of the BASC in Children with Language Impairment

Redmond (2002) evaluated and discussed the differences of five commonly used behavioral rating scales for use with children with language impairment. The Louisville Behavior Checklist—Revised, the Revised Behavior Problem Checklist, the Achenbach System (Child Behavior Checklist and Teacher Report Form), the Conners Rating Scales—Revised, and the BASC were compared and contrasted. Normative data for children with speech/language or other learning disorders were either not presented or not incorporated in the normative sets available for the Louisville Behavior Checklist—Revised, the Achenbach System (Child Behavior Checklist and Teacher Report Form) or the Conners Rating Scales—Revised. The

Revised Behavior Problem Checklist had separate clinical norms available as established on a sample of 158 children with learning disabilities, and the BASC reported that 1.9% of their total normative sample was comprised of children with speech and/or language disorders. While current prevalence data for speech and language disorders is closer to 6 to 8% of the general population, the BASC was the only rating system of those evaluated to employ a measure to guard against excessively negative ratings. As students with speech/language disorders may be regularly suspected as having socio-emotional disorders, Redmond (2002) cautions that frequently the behavioral scales utilized may have inherent instrument bias, thus invalidating the ratings. The use of multiple informants, the evaluation of differences across situations, and the collection of local norms was recommended.

Use of COOP-A in Children with Hearing Loss

In their 1998 study, Bess, Dodd-Murphy, and Parker also reported on findings for the COOP for 32 sixth- and ninth-grade children with minimal SNHL, conductive hearing loss, and other (e.g., mixed) types of hearing loss, and for 591 children with normal hearing. Children with hearing loss reported a trend of greater dysfunction than those with normal hearing on 9 of 10 COOP subscales in both the sixth- and the ninth-grade levels. Using a Mantel-Haenszel Chi-square test, statistically significant differences were found between groups of 6th-graders for the energy domain, and between groups of 9th-graders on the stress and behavior domains of the COOP. Further statistical analysis by examination of only high scores of 4 or 5 on the various subtests of the COOP indicated that the children with hearing loss displayed lower self-esteem and energy than their sixth-grade peers and lower social support, higher stress and lower self-esteem than their ninth-grade peers. These higher self-ratings were chosen for further investigation, as the authors of the COOP (Wasson et al., 1994) have suggested that scores of 3, 4 or 5 on each chart indicate that children may be at risk for greater dysfunction in that area.

Hicks and Tharpe (2002) also examined the health status of ten children between the ages of 6 and 11 years with either mild-to-moderate or high-frequency SNHL, and ten age- and grade-matched counterparts with normal hearing. While no statistical significance between groups was found, the authors noted that the percentage of the group of children with hearing loss that rated themselves as 3 or higher (more dysfunction) on the COOP charts was greater compared to their peers with normal hearing in seven of nine subscale questions administered. These trends suggest more self-reported social and emotional problems forchildren with hearing loss than their counterparts with normal hearing. The authors also postulated, as the majority of the study participants with hearing loss utilized personal amplification devices, that the students' stress and fatigue levels from energy expended on speech perception in adverse listening situations may have been reduced by remediation of their disability and handicap through their use of amplification. However, the small sample size utilized in the Hicks and Tharpe (2002) study affected statistical findings and limited the conclusions.

Use of COOP-A in Children with APD

Kreisman, Crandell and Hall (2004) utilized the COOP-A in a preliminary study to determine if any psychosocial difficulties similar to those exhibited by children with hearing loss also existed in children with APD. As the COOP-A is intended to be a screening instrument only, the primary purpose of the pilot was to explore possible future arenas of research. Ten participants were included in the pilot study. Participants consisted of children between 9 years, 11 months and 14 years, 6 months old (M = 11;7). Standard peripheral auditory testing was conducted, including pure-tone air conduction thresholds from 250 to 8000 Hz in octave intervals, tympanometry, and distortion product otoacoustic emissions. Also, each participant had a history of English as a first language, normal growth and development, and was free from significant medical problems. The diagnosis of APD was made with a diagnostic evaluation

battery protocol based on guidelines delineated by the Report of the Consensus Conference on the Diagnosis of Auditory Processing Disorders in School-Aged Children (Jerger & Musiek, 2000). An APD was defined by scores two standard deviations below the mean for at least one ear on at least two different APD test battery procedures.

Following completion of the audiometric testing, children included in the study completed a speech perception task, and subsequently were assessed with the COOP-A questionnaire. In accordance with the COOP-A protocol (Wasson et al., 1994), the examiners instructed each child to select the category (1 through 5) that most closely matched the child's own perception of how they functioned on each subscale chart (e.g. Emotional Feelings, School Work, Pain). Whenever possible, all questionnaires were administered verbally to the subjects in a face-to-face interaction with the investigators. The students either responded verbally, by circling the corresponding number, or simply by pointing to the desired category on the chart. When it was not possible to complete the COOP-A in a face-to-face manner due to time constraints, parents were given the questionnaire with instructions for their child to complete it at home, and return the instrument by mail to the investigators. Using a slightly modified instruction set for the purposes of the present investigation, the parents of the children with APD were also asked to complete the COOP-A. Their instructions were to complete the ratings independently, by responding to each chart via their perception of the most accurate answer for their child.

Results from the Kreisman, Crandell and Hall (2004) pilot study are shown in Figures 2-1, 2-2, and 2-3. Specifically, Figure 2-1 presents the mean ratings for each COOP-A question for the experimental group (children with APD) compared to the mean ratings of children with hearing loss (HL) and the mean ratings of children with normal hearing without APD (NH). The results for the HL and NH control groups were derived from nationally-reported data (Hicks &

Tharpe, 2002). The mean age for the HL group was 8 years, 1 month, and the mean age for the NH group was 7 years, 11 months. Of the twelve COOP-A charts administered, only eight corresponded to those reported in Hicks and Tharpe (2002), due to the utilization of slightly differing versions of the instrument. The eight COOP-A questions evaluated for the HL versus NH groups were: Physical Fitness, School Work, Family, Emotional/Feelings, Self-Esteem, Overall Health, Energy, and Pain. Mean ratings for the APD group were greater than those for the NH group on six of eight subscales (School Work, Emotional/Feelings, Family Communication, Self-Esteem, Overall Health, and Pain), suggesting greater psychosocial dysfunction for the experimental group than the control group. Additionally, the APD group mean ratings were greater than or equal to those of the group of children with hearing loss on six of eight subscales, specifically: Physical Fitness, Emotional/Feelings, Family, Self-Esteem, Energy and Pain.

Figure 2-2 displays the percentage of children in each group responding to a given COOP-A question with a score of 3 or greater. A self-reported score of 3, 4 or 5 on any COOP-A question indicates that a child may be at-risk for difficulties in that area (Wasson, et al, 1994). The APD group percentages for 3 to 5 ratings were greater than or equal to their NH counterparts on seven of eight subscale questions, specifically: Physical Fitness, School Work, Emotional/Feelings, Family, Self-Esteem, Overall Health, and Pain. These pilot data again suggest more psychosocial dysfunction by screening the data categorically for the experimental group with APD than the NH controls. Figure 2-3 displays the mean ratings for each COOP-A question for the experimental group (children with APD) compared to the mean ratings of their parents for the various content areas.

In summary, preliminary findings suggested a trend for children with APD to exhibit greater difficulties than their counterparts with normal hearing for a number of psychosocial dimensions (e.g., self-esteem, family communication, school work, emotional/feelings and overall health). The outcomes of the pilot study also suggested that the parents of children with APD rate their children as having greater psychosocial difficulties than the children rate themselves across a wide variety of psychosocial domains. The findings were limited, however, as the experimental APD group was small (n = 10), and the compared hearing-impaired and normal-hearing peer groups without APD were derived from nationally published, non-local data with largely different mean ages. This research was a direct precursor to the present study.

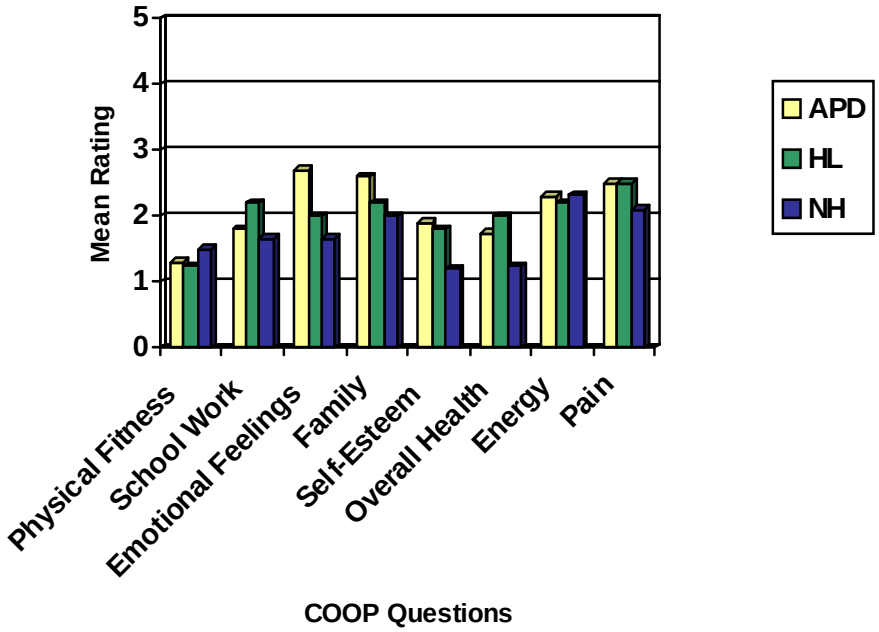

Figure 2-1: Mean ratings across eight COOP subscales by children with auditory processing disorders (APD), children with hearing loss (HL) and children with normal hearing (NH). Data for the HL and NH groups were derived from Hicks & Tharpe (2002). Self-ratings offered were from 1 to 5, with 1 representing the best function and 5 representing the most dysfunction for each question area.

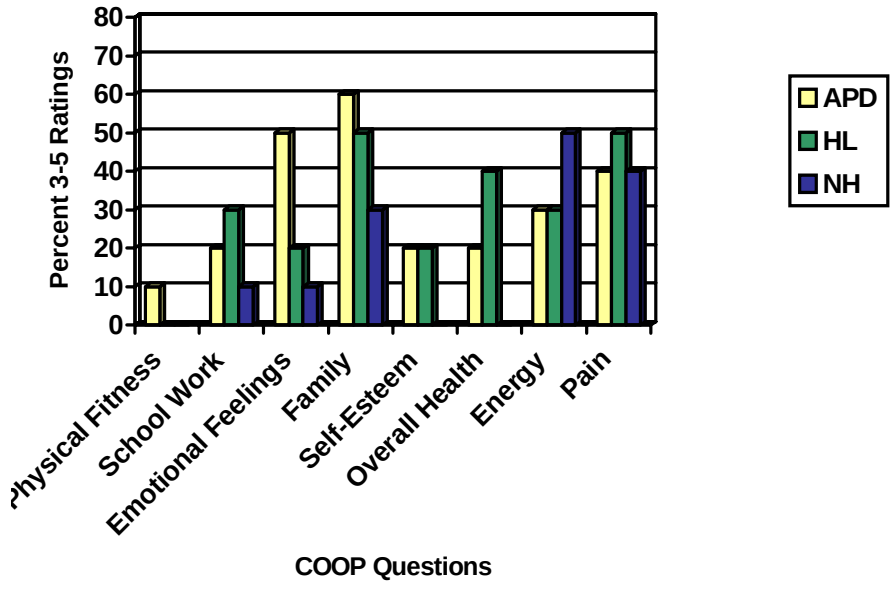

Figure 2-2: Percentage of children with auditory processing disorders (APD), children with hearing loss (HL) and children with normal hearing (NH) scoring 3, 4 or 5 on any COOP subscale, suggesting the child was at-risk for problems in that area. Data for the HL and NH groups were derived from Hicks & Tharpe (2002).

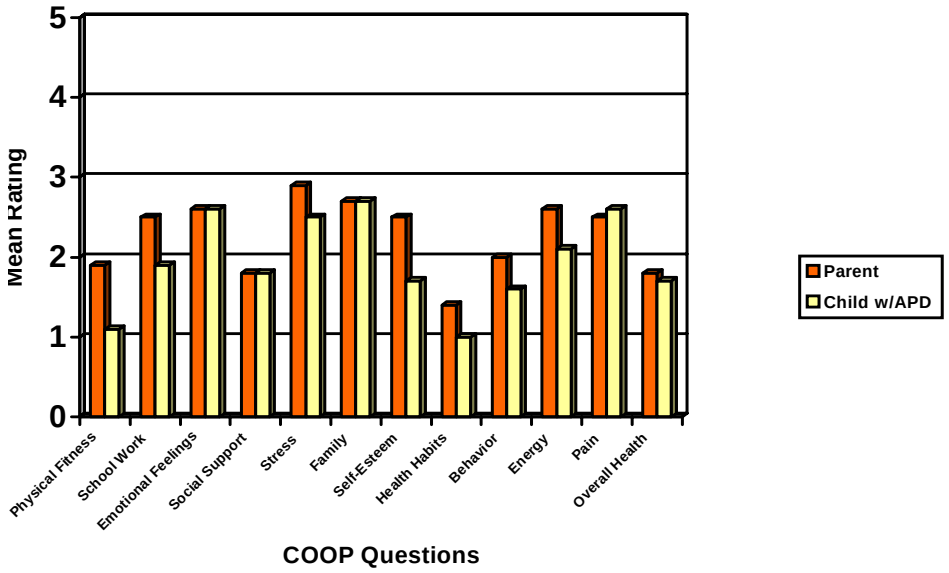

Figure 2-3: Mean ratings across twelve COOP-A subscales by children with auditory processing disorders and their parents. Ratings offered were from 1 to 5, with 1 representing the best function and 5 representing the most dysfunction for each question content domain.

CHAPTER 3
METHODS

Participants

Thirty-nine children served as participants in this study. They were divided into two groups. The group of interest consisted of nineteen volunteer pediatric participants between ages 9.5 and 17.8 years with a diagnosis of APD (APD group). A corresponding gender- and age-matched volunteer group (normal group) consisted of twenty children with no evidence of APD nor any other medical or academic disability. Criteria for diagnosis of APD are described below.

All participants met the following criteria:

- Age between 10 and 18 years, +/- 6 months;
- Pure-tone air conduction hearing threshold levels equal to or better than 15 dB hearing level (HL) at all frequencies tested (250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz), bilaterally;
- A score of 90 to100% on monosyllabic word recognition testing in quiet at an intensity level of 40 dB sensation level (SL) re: 3-frequency pure-tone average (PTA) of air conduction thresholds at 500, 1000 and 2000 Hz;
- Normal middle ear function as indicated by tympanometry;
- Average or above intellectual function for age as measured by the Raven's Standard Progressive Matrices (Raven, 1976), the Matrices Sub-Test of the Kaufman Brief Intelligence Test-Second Edition (K-BIT 2; Kaufman & Kaufman, 2004), or documented by another full-scale intelligence assessment completed by a licensed psychologist within a time period of 2 years;
- Negative history of attention deficit disorder or attention deficit hyperactivity disorder as determined by parental report and normal performance on the Auditory Continuous Performance Task (ACPT; Keith, 1994a), or attention skills within normal limits as documented per previous evaluation by a licensed psychologist within a time period of two years (the reader is directed to Chermak, Hall & Musiek, 1999; Chermak, Somers & Seikel, 1998; and Chermak & Musiek, 1997 for further discussion of the differential diagnosis of APD and ADD);
- English as a primary language as reported by the participant's parent;

- Normal growth and development and no history of significant medical problems via parental report on the APD Parent/Patient Survey. A copy of this form can be found in Appendix A.

In addition, all participants in the normal group had a history normal language development as indicated by parent report and verified by the Clinical Evaluation of Language Fundamentals—Fourth Edition (CELF-4) Screening Test. The CELF-4 Screening Test also was administered to the participants of the APD group if they did not initially present with a diagnosis of language disorder via parent or clinical report in order to identify a comprehensive profile of these participants. The participants evaluated for inclusion in the APD group and the normal group that did not pass the CELF-4 Screening Test were referred for a comprehensive diagnostic language evaluation by a speech-language pathologist. The study was conducted in two locations. Two participants from the APD group and four children in the normal group were tested at the University of Florida in Gainesville, whereas the remaining participants (17 APD, 16 Normal) were tested at Towson University in Towson, Maryland.

Prior to participating in the study, each child's accompanying parent was required to sign an Informed Consent Form (ICF) approved by the University of Florida Institutional Review Board (IRB) if the participant was enrolled in the study in Gainesville, FL, and/or an ICF approved by the Towson University IRB if the participant was enrolled in the study in Towson, Maryland. Additionally, each pediatric participant was required to indicate a willingness to participate in the study via a Child Assent Script approved by the respective IRBs. A copy of the University of Florida Informed Consent Form and Child Assent Script is found in Appendix B, and a copy of the Towson University Informed Consent Form is found in Appendix C. The study was not blind in that all participants and their parents knew which study group (APD or normal) they were being included during their completion of the questionnaires. All participants received free hearing and auditory processing evaluations as well as a comprehensive written

report, trial use of a suitable FM system when appropriate, and a $20 Target Gift Card upon completion of the research protocol.

Diagnosis of APD

An APD for a child was defined by scores two standard deviations below the mean for at least one ear on at least two different procedures of the APD test battery. Following is a brief summary of test administration and analysis for each of the assessments included in the APD battery. Further details on test procedures are available from the sources cited for each assessment.

The Synthetic Sentence Index with Ipsilateral Competing Message (SSI-ICM; Wilson & Strouse, 1998; Noffsinger, Wilson & Musiek, 1994; Feeney & Hallowell, 2000) is comprised of a closed set of ten nonsense sentences that have been constructed to approximate English syntactic sentence structure. The nonsense sentences are presented against a background of an ipsilateral noise competition comprised of a narrative discourse. Participants are required to identify the nonsense sentences presented, given a numbered reference list from which to choose.

The Staggered Spondaic Word (SSW) Test (Katz, 1963; Katz, 1986) presents a series of two spondees to the listener, first to one ear and then to the other, with the second part of the first spondee and the first part of the second spondee presented simultaneously to opposite ears. The listener is asked to repeat both spondees in the order in which they are presented.

The Dichotic Digits, Double Pairs Test (Audiology Illustrated, 1994; Musiek, 1983) involves the presentation of a two numbers between 1-9 (except seven) to both ears at the same time. The listener is asked to repeat the words from both ears in each set, in whatever order they choose (free recall).

The Frequency Pattern Sequence test (Audiology Illustrated, 1994; Musiek, 1994) involves the presentation of a series of groups of three different pitches. The listener is first asked to

report the patterns verbally (e.g., HIGH-LOW-HIGH), and then to report the presented patterns by humming in repetition.

The Duration Pattern Sequence test (Audiology Illustrated, 1994; Musiek, 1994) presents of a series of groups of three different length tones. The listener is asked to report the patterns verbally (e.g., LONG-SHORT-LONG).

The Auditory Random Gap Detection Test (RGDT; Keith, 2000b) is a test in which two tones are presented at varying time intervals. The listener is asked to report if they hear one tone or two beeps in order to determine how close together the two sounds can be heard and still differentiated.

If a participant scored two standard deviations below normal limits on one of the six diagnostic auditory processing measures described above, the SCAN-C or SCAN-A Competing Words, Auditory Figure Ground and Filtered Words subtests would also be administered. The SCAN-C: Test for Auditory Processing Disorders in Children—Revised (Keith, 2000a) or SCAN-A: Test for Auditory Processing Disorders in Adolescents and Adults (Keith, 1994b) Competing Words Subtest involves the presentation of an open set of different monosyllabic words to both ears at the same time. The listener is asked to repeat the words coming first into the right ear, then into the left

The Filtered Words Subtest of the SCAN-C: Test for Auditory Processing Disorders in Children—Revised (Keith, 2000a),or SCAN-A: Test for Auditory Processing Disorders in Adolescents and Adults (Keith, 1994b) is a task in which speech is filtered above 500 Hz so that certain frequencies are absent. The listener is asked to repeat the words presented from an open set.

The Auditory Figure-Ground Subtest of the SCAN-C: Test for Auditory Processing Disorders in Children—Revised (Keith, 2000a) or SCAN-A: Test for Auditory Processing Disorders in Adolescents and Adults (Keith, 1994b) requires the listener to repeat words against a background of competing multi-talker babble.

Psychosocial Measures

The Social Skills Rating System (SSRS; Gresham and Elliot, 1990), the Behavioral Assessment System for Children-Second Edition (BASC-2; Reynolds and Kamphaus, 2004), and The Dartmouth Primary Care Cooperative Charts for Adolescents (COOP-A; Wasson et al., 1994) were utilized to assess psychosocial status. These questionnaires were utilized because previous investigations have shown them to be valid for these purposes in children with hearing loss or other communication disorders (Koning & Magill-Evans, 2001; Cartledge, Cochran & Paul, 1996; Redmond, 2002; Bess, Dodd-Murphy & Parker, 1998; Hicks & Tharpe, 2002; Kreisman, Crandell & Hall, 2004). The COOP-A pilot study (Kreisman, Crandell & Hall, 2004) provided preliminary findings suggesting the use of the charts to be appropriate for use with children with APD and their parents. Thus it was used in the present investigation. The selection of the other two instruments investigation was based on the desire for more robust, standardized comprehensive assessments of emotional and social function in children which matched with the normative ages of the COOP-A (10-18 years), had both self-report and parent rating forms, and yielded subscale measurements that would lend themselves to comparable analysis across instruments.

The Social Skills Rating System (SSRS)

The SSRS provides information on the positive and negative social skill behaviors exhibited by students in and out of the classroom (Gresham and Elliot, 1990). The SSRS was standardized on a sample of 4170 children in the United States. The SSRS items are rated

according to both perceived frequency (Never, Sometimes, or Very Often) and importance (Not Important, Important, or Critical). The Social Skills Scale of the SSRS contains five subscales that measure positive social behaviors. The five subscales incorporated into the Social Skills Scale of the SSRS are Cooperation, Empathy, Assertion, Self-Control, and Responsibility. The Problem Behaviors Scale of the SSRS measures behaviors that can interfere with the development of positive social skills. The three subscales incorporated into the Problem Behaviors Scale of the SSRS are Externalizing Problems, Internalizing Problems, and Hyperactivity. Internal consistency is high for SSRS roms and levels, with median coefficient alpha reliability scores of .90 and .84 for the Social Skills and Problem Behaviors Scales, respectively. Test-retest reliability coefficients ranged from .77 to .84 for parents and .52 to .66 for students on the Social Skills subscales, suggesting adequate to good stability on repeated measurements with the SSRS over time. The information that the SSRS provides can be utilized in order to suggest possible interventions for students with problems learning or demonstrating appropriate social skills behaviors by examination of their causes.

The Behavioral Assessment System for Children-Second Edition (BASC-2)

The BASC-2 provides a profile of adaptive and maladaptive behaviors and emotions of children and adolescents ages 2 through 21 years (Reynolds and Kamphaus, 2004). The BASC-2 has forms designed specifically for use by parents with a different section designed for use by the students themselves. The General norm sample of the BASC-2 was conducted on 4800 parents and 3400 children. 2.1% of the standardization population of the BASC-2 was comprised of children with language impairment. The Parent Rating Scales (PRS) of the BASC-2 are used to measure both adaptive and problem behaviors in both the community and home settings in 14 subcategories utilizing a four-choice response format. Examples of subcategories of the PRS include Adaptability, Anxiety, Leadership, Depression, Functional Communication, and

Withdrawal. Internal consistency of the PRS composite scores as measured by coefficient alpha are between .90 and .95. PRS test-re-test reliability is also high, with estimates for the composite scores from .78 to .92. The Self-Report of Personality (SRP) scale of the BASC-2 has been reported to provide insight into a child's own thoughts and feelings. The SRP is a self-report questionnaire that measures 16 subcategories of attitudes and emotions including Attitude to School, Locus of Control, Interpersonal Relations, Social Stress, and Self-Esteem. Internal consistency of the SRP composite scores as measured by coefficient alpha are also high, ranging between .83 and .96. SRP test-re-test reliability is also high, with estimates in the upper .70s to low .80s. The BASC-2 is widely used by school and clinical psychologists in determining Individuals with Disabilities Education Act (IDEA) and Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV) classifications.

The Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP-A)

The COOP-A is a quality of life screening instrument designed for use with individuals between ages 10 and 20 years (Wasson et al., 1994). The COOP-A charts are designed to screen across physical, emotional, and social dimensions of functioning in an individual. The COOP-A consists of a series of pictographic self-rating charts that are designed to represent function of one of 12 content areas. The twelve subscale charts included in the COOP-A are: Physical Fitness, Energy, Pain, School Work, Behavior, Stress and Emotional Feelings, Social Support, Family, Self Esteem, Health Habits I, and Overall Health. Each individual chart consists of a question and five illustrative alternatives from which an individual may choose an answer most appropriate for him or herself based on a five-point Likert scale wherein 5 represents the greatest dysfunction and 1 represents the least dysfunction. An example question on the Family chart of the COOP-A is: "During the past month, how often did you talk about your problems, feeling or

opinions with someone in your family?" Corresponding alternatives from which to choose are as follows: 1 = All of the time, 2 = Most of the time, 3 = Some of the time, 4 = A little of the time, and 5 = None of the time. Wasson, Kairys, Nelson and colleagues (1994) indicated that average test-retest correlations ranged from .71 to .80 for the Physical Fitness, Emotional Feelings, School Work, Social Support, Family Communication and Health Habits, and Cronbach's alpha test for internal consistency-reliability was between .60 and .94 for those six dimensions.

Procedures

Audiological Assessment

The first thirty-nine children who met the inclusion criteria as stated above and agreed to serve as subjects were included as participants. Participants were recruited from the Department of Communication Sciences and Disorders/University of Florida Speech and Hearing Clinic (UFSHC), the University of Florida Department Of Communicative Disorders Speech and Hearing Center at Shands Hospital, the Speech-Language-Hearing Clinic (TUSLHC) and the Center for Amplification, Rehabilitation and Listening (CARL) at Towson University. Participants also were recruited from self-referrals following advertisements in local parent magazines and educational newsletters, as well as flyers distributed at informational events for parents, educators and other professionals seeking more information on speech, language, and auditory disorders in children. A copy of the recruitment flyer is found in Appendix D. The 39 children who met the other inclusion criteria to be participants first underwent pure-tone audiometry. The pure-tone air conduction test consisted of octave intervals from 250 through 8000 Hz, as well as the interoctaves 3000 and 6000 Hz. Hearing sensitivity was tested in sound-treated booths using a calibrated Grason-Stadler, Inc. Version 61 (GSI-61) two-channel clinical audiometer and either Etymotic Research version 3A EAR-Tone Insert Earphones (ER-3A) or TDH-50 supra-aural audiometric earphones. Participants were be required to have pure-tone air

conduction thresholds better than or equal to 15 dB HL at all frequencies (250 through 8000 Hz) tested in both ears in order to participate in the study. Word recognition performance was assessed utilizing the NU-6 Ordered by Difficulty Version II lists presented via compact disc presentation (Auditec of St. Louis, 1980; Hurley & Sells, 2003). In order to be included in the study, participants were required to have a percent correct score of 90 to100% on these monosyllabic word tasks in quiet at 40 dB SL re: the average of their pure-tone air conduction thresholds at 500, 1000 and 2000 Hz (PTA).

Tympanograms and acoustic reflex thresholds were obtained via a GSI-33 or GSI Tympstar Middle Ear Analyzer. Both groups of participants were required to have normal middle ear function, as defined by middle ear peak pressure values between -150 to +100 decaPascals (daPa), static compliance of 0.3 to 1.4 milliliters (ml), and ear canal volume of 0.6 to 1.5 cubic centimeters (cm^3) in both ears. Distortion product otoacoustic emissions (DPOAE) measurement was conducted using either an Otodynamics ILO 92 v.6 DPOAE System or a Grason Stadler Audera DPOAE system. The ILO v.6 device was configured using the Diagnostic 65/55 stimulus and the Diagnostic configuration.

Intellectual Assessment

All participants (except four who had previous documentation of average or above-average intelligence as tested by a licensed psychologist within a two-year time period) were given either the Raven's Standard Progressive Matrices (*n* = 1) (SPM; Raven, 1976) or the Matrices sub-section assessment of the Kaufman Brief Intelligence Test-2nd Edition (*n* = 34) (K-BIT 2; Kaufman & Kaufman, 2004) in order to screen for normal non-verbal intellectual functioning. The scores on the Raven's SPM and the K-BIT 2 are highly correlated with non-verbal intelligence measures on more comprehensive measures of intelligence as well as with each other. The Raven's SPM was initially chosen for use in the present research study, but was

abandoned for the K-BIT 2 due to improved time and ease administration and scoring. Participants were tested individually in a quiet room in the UFSHC, the TUSLHC or the CARL, utilizing the Raven's SPM testing booklets or the K-BIT 2 test kit, and following the administration procedures as outlined in the respective test manuals. Answers were recorded by the test administrator on the corresponding answering sheets, and scored accordingly. The results on the Raven's SPM were compared to Table SPM9, Smoothed Summary Norms for Children and Young People in the United States of America. Scores at or above the 25th percentile were considered to be average or above average intellectual function for the Raven's SPM. The results on the K-BIT 2 were compared to the Nonverbal portion of Table B.1: Verbal and Nonverbal Standard Scores, Confidence Intervals and Percentile Ranks. Standard scores at or above 85 for the corresponding age group were considered to be average or above average intellectual functioning for the K-BIT 2.

Language Assessment

Language screening of all participants was conducted via the CELF-4 Screening Test (Semel, Wiig & Secord, 2003). Participants were tested individually in a quiet room, using the CELF-4 Screening Test booklet, and following the administration procedures as outlined in the CELF-4 Manual. All participants who did not pass the CELF-4 Screening Test were referred for a comprehensive language evaluation by a speech-language pathologist. Prospective normal participants who did not pass the CELF-4 Screening Test were not included in the study.

APD Assessment

APD assessment was conducted in a single-walled sound-treated booth (Industrial Acoustics Company) using a calibrated GSI-61 clinical audiometer and ER-3A insert earphones. The following APD procedures, as described above, were administered to all of the study participants:

- Synthetic Sentence Index with Ipsilateral Competing Message (SSI-ICM);
- Staggered Spondaic Word (SSW) test;
- Dichotic Digits, Double Pairs test;
- Frequency Pattern Sequence test, both verbal and hummed response modes;
- Duration Pattern Sequence test;
- Auditory Random Gap Detection Test (RGDT).

Any participant who did not have previous clinical documentation of attention within normal limits underwent assessment with the Auditory Continuous Performance Task (ACPT). In addition to the above procedures, any participant who was considered for inclusion in the APD group for the study due to results two standard deviations below the mean on any of the six diagnostic APD procedures previously mentioned also completed the SCAN-C or SCAN-A: Test for Auditory Processing Disorders in Children—Revised, Competing Words Subtest, Filtered Words Subtest and Auditory Figure-Ground Subtest.

Standard administrative and scoring procedures, as outlined in the manuals for each APD test, were followed. As previously detailed, an APD diagnosis was made if a child scored two standard deviations below the mean on at least two different APD test procedures for at least one ear, with at least one of the failed procedures from the diagnostic assessments other than the SCAN-A or SCAN-C subtests (ASHA, 2005).

Psychosocial Assessment

Psychosocial assessment of all thirty-nine participants included in the study was conducted via the SSRS, the BASC-2, and the COOP-A questionnaires. All participants were tested individually in quiet rooms of the UFSHC, the TUSLHC or the CARL. Administration procedures as outlined in the respective test manuals were followed. The accompanying parents of the participants were asked to complete their appropriate questionnaires independently, utilizing a pencil and paper version of the assessments. For the SSRS and the BASC-2 questionnaires, parents were asked to complete the questionnaires according to the printed

instructions. For the COOP-A, the parents were asked to respond to each chart according to their perception of their participating child's function in each given area. They were instructed to ask questions of the investigator if any item was unclear.

The same examiner administered the questionnaires to all pediatric participants in both sites. When written or verbal language disorders were previously diagnosed or were suspected due to parental report or below-criterion performance on the CELF-4 Screening Test, pediatric participants were given the psychosocial test assessments in an interview format. In order to minimize any possible effects of the interviewer on the response pattern of the participant, the examiner sat beside the participant at a table, utilizing the questionnaire as a mutual reference point. Pediatric participants were instructed to respond to each individual item on the questionnaires either by verbal or pointed responses, and the examiner recorded the child's responses accordingly on the questionnaire's corresponding answer sheet. When no language disorders were suspected, the participant was given a choice as to whether they would like the examiner to read the questions, or if they would like to complete the questionnaires on their own. When independent completion was chosen, test instructions were given for standard self-administration procedures, with the examiner available in the room to answer questions. All participants were encouraged to answer as openly as possible, according to what they believed to be true for themselves, and only the subject's final response to any given item was recorded. Additionally, all participants were reassured that the confidentiality of their responses would be maintained, and that their parents would not know of their responses to the questionnaires unless discussed with them first. In order to discourage any conscious or unconscious influence in the pediatric participants' responses, parents were discouraged from being present in the room during psychosocial assessment of their children.

Statistical Analyses

Statistical analyses were conducted to explore differences between groups on psychosocial subscale scores. Multivariate analysis of variance (MANOVA) procedures were initially explored as a means of examining the differences between the two groups across the three different psychosocial assessment subscales. However, upon preliminary review the data were found to violate the assumptions of multivariate normality and linearity, and thus were not appropriate for the MANOVA analysis procedure. Standard two-group analysis procedures were utilized instead, comparing each group on each subscale of the three instruments.

T-tests were completed on the continuous scales (SSRS and BASC-2) while a non-parametric equivalent (Mann-Whitney U test) was completed for comparison of the COOP-A ordinal data. Statistical significance was defined by $p < 0.05$ (two-tailed) for all tests. Due to the relatively small group sizes, eta-squared and r-square values were calculated for the continuous and ordinal data, respectively, to assess effect sizes and magnitudes of the differences between groups as a measure of generalizability of the findings. Pallant (2005) indicated that eta-squared "represents the proportion of variance in the dependent variable that is explained by the independent variable" (p. 208). Eta-squared was calculated by the following formula:

$$\frac{t^2}{t^2 + (N1 + N2 - 2)}$$

For the COOP-A subscale charts, r-square values (Z-value of Mann-Whitney U divided by the square root of N) were calculated (Rosenthal, 1991). Effect sizes were interpreted based on the following classification guidelines (Cohen, 1988): .010 to .059= small effect, .060 to .139 = moderate effect, .140 and above = large effect.

The creators of the COOP-A suggested the utilization of a dichotomous categorization into "Average" (ratings of 1 or 2) or "At-Risk" (ratings of 3, 4 or 5) assemblages by practitioners in

order to determine possible need for further follow-up on the particular content area represented by each subscale chart (Wasson et al, 1994). Thus, chi-square tests for independence were conducted between groups on the proportion of Average or At-Risk classifications for each subscale chart. Again, statistical significance was defined by $p < 0.05$ (two-tailed) for the Pearson chi-square values. As Rosenthal and Rosnow (1991, p. 51) assert that "very usable χ^2 values can be obtained even with expected frequencies as low as 1, so long as the total number of independent observations (N) is not too small" and "corrections for continuity may do more harm than good," no corrections were employed when analyzing this data.

Post-hoc analyses were also conducted to examine any possible differences between gender and age of the pediatric participants of both groups as well as linguistic function status of the APD group. The Spearman Rank Order Correlation (rho) test for non-parametric data and Pearson product-moment correlation coefficients (r) for continuous variables were utilized in order to evaluate possible correlations between subscale scores and age. To assess differences between genders and mean ratings on the composite subscales of the BASC-2 and the SSRS, independent-samples *t*-tests were conducted. The non-parametric equivalent, the Mann-Whitney U, was utilized in order to assess differences between gender and mean rank of the COOP-A subscales.

Post-hoc analyses also were conducted on all subscales of each of the three psychosocial questionnaires (COOP-A, SSRS, and BASC-2), comparing the results for the pediatric participants in the APD group with confirmed or suspected language impairment (language-impaired APD subgroup, $n = 9$) to those of the pediatric participants in the APD group with normal language function (language-normal APD subgroup, $n = 10$). The parent responses on the three psychosocial instruments for the two APD subgroups were also compared. As with the

normal v. APD group comparisons, statistical analyses for all composite subscales of the BASC-2 and subscales of the SSRS were conducted utilizing independent-samples *t*-test measures, and the Mann-Whitney U test for non-parametric data was utilized for analysis of the COOP-A subscale charts. Statistical significance was defined by $p < 0.05$ (two-tailed).

CHAPTER 4
RESULTS

Descriptive data were compiled for gender, age, linguistic function status, grade level, and type of school (public, private, and home) between the normal and APD groups. A summary of descriptive statistics can be found in Table 4-1. Preliminary analyses were completed to determine if any differences existed between the normal and APD groups on age or gender. Results indicated that there was no age difference between the normal group (M = 12.79, SD = 2.347) and the APD group [M = 11.93, SD = 2.093; $t(37) = -1.199$, $p = .238$]. A chi-square test for independence was conducted between groups on the proportion of males and females, with statistical significance defined by $p < 0.05$ (two-tailed) for the Pearson chi-square values. No difference on gender was found ($\chi^2 = .265$, $n = 39$). As two parents in the normal group did not complete their questionnaires by the time of this publication, their data could not be included. All parent raters ($n = 37$) were female (i.e. mothers).

Initial descriptive findings were evaluated in order to ensure comparable peripheral hearing status between groups. Audiometric results were within normal limits (pure-tone thresholds ≤15 dB HL) for all participants in both groups at 250, 500, 1000, 2000, 3000, 4000, 6000 and 8000 Hz per inclusion criteria. Mean audiometric findings for both groups are displayed in Figure 4-1, and means and standard deviations for both groups by frequency are detailed in Table 4-2. Tympanometric results were also within normal limits for all participants in both groups per inclusion criteria. Mean tympanometric data are detailed for right and left ears of both the groups in Table 4-3. Mean diagnostic distortion product otoacoustic emissions (DPOAEs) were within normal limits for both groups. However, a small and equivalent proportion of participants in each group had DPOAE amplitudes below normal limits for one or more test frequencies. Graphs of compiled DPOAE findings with means for the participants tested at Towson

University for the APD group are shown in Figure 4-2 and for the normal group are shown in Figure 4-3. Using the diagnostic auditory processing test battery criterion, a student was diagnosed with an auditory processing disorder if findings for at least one ear were two standard deviations below the mean on at least two different procedures. A summary of results on the APD test battery for those students who were included in each group is shown in Table 4-4.

Statistical analyses were conducted on each of the three instruments (COOP-A, BASC-2, and SSRS), as determined a priori, comparing the results for the pediatric participants in the APD group to those of the pediatric participants in the normal group, and comparing the results of the parents of the participants in the APD group to those of the parents of the participants in the normal group. Statistical analyses were completed using SPSS 13.0 for Windows (Chicago, IL: SPSS Inc.). See Table 4-5. for a summary of findings and Table 4-6 for details of statistical results between pediatric participant groups. See Table 4-7 for a summary of findings and Table 4-8 for details of statistical results between parent groups, as described below. In addition, a summary of statistically significant findings for both children and adults can be found in Table 4-9.

Child-Completed Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP-A)

Recall that each individual chart of the COOP-A is its own subscale screener and consists of a question and five illustrative alternatives from which an individual may choose the most appropriate answer. Ratings for each chart are based on a five-point Likert scale wherein 1 represents the least dysfunction and 5 represents the greatest dysfunction in any given domain. The Mann-Whitney U test for non-parametric data was utilized in order to compare Sum of Ranks for all subscale charts on the COOP-A due to the ordinal nature of the data, and r-square values were caluculated to assess effect sizes. Additionally, as the creators of the COOP-A

suggested the utilization of a dichotomous categorization into "Average" (ratings of 1 or 2) or "At-Risk" (ratings of 3, 4 or 5) assemblages by practitioners in order to determine possible need for further follow-up (Wasson et al, 1994), chi-square tests for independence were conducted between groups on the proportion of Average or At-Risk classifications for each subscale chart. See Table 4-10 for a summary of findings for proportions of students considered "At-Risk" from both groups for each subscale chart.

Physical Fitness Subscale Chart

The Physical Fitness subscale chart for the COOP-A asks the question, "During the past month, what was the hardest physical activity you could do for at least 10 minutes?" Results indicated no difference between the two groups ($p = .417$). The effect size was small ($r^2 = .017$). The mean ranks were 21.25 and 18.68 for the normal and APD groups, respectively. The Pearson chi-square value was .136, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Pain Subscale Chart

The Pain subscale chart of the COOP-A poses the question, "During the past month, how often were you bothered by pains such as; backaches, headaches, cramps or stomachaches?" Results indicated no difference between the APD group and the normal group ($p = .319$). The effect size was small ($r^2 = .025$). The mean ranks were 18.33 and 21.76 for the normal and APD groups, respectively. The Pearson chi-square value was .648, suggesting no difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Stress Subscale Chart

The Stress subscale chart of the COOP-A poses its question this way: "During the past month, how much stress or pressure do you feel from other people? (family, friends, teachers,

other grown-ups or other kids)" Results suggested no difference between the two groups for this subscale (p = .145). However, the effect size was moderate (r^2 =.055). The mean ranks were 17.55 and 22.58 for the normal and APD groups, respectively, suggesting a trend for the APD group to report more problems with stress. Further, in contrast to the results of the Mann-Whitney U analysis, the Pearson chi-square value was .034, suggesting a difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups. Further review indicates there to be 80% of the normal group ratings falling in the "Average" category versus 47.4% of the APD group, and 20% of the normal group ratings falling in the "At-Risk" category versus 52.6% of the APD group. These findings also indicate a greater proportion of students within the APD group rate themselves as "At-Risk" for problems with stress than do students in the normal group.

School Work Subscale Chart

The School Work subscale chart of the COOP-A asks, "During the last month you were in school, how did you do?" Results suggested no difference between the APD group and the normal group (p = .131). The effect size was moderate (r^2 = .058). The mean ranks were 17.55 and 22.58 for the normal and APD groups, respectively. The Pearson chi-square value was .134, suggesting no difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Emotional Feelings Subscale Chart

The Emotional Feelings subscale chart of the COOP-A asks the question, "During the past month, how often did you feel anxious, depressed, irritable, sad or downhearted and blue?" Results indicated a difference between the APD group and the normal group (p = .011) with a large effect size (r^2 = .165). Recall that with the Mann-Whitney U for the COOP-A, the group with the greater mean rank represents the group with greater reported psychosocial difficulties

for that subscale chart. The mean rank for the normal group was 17.55 and the mean rank for the APD group was 22.58, indicating greater reported difficulties on the Emotional Feelings subscale for the APD group. However, the Pearson chi-square value was .095, suggesting no statistically significant difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Behavior Subscale Chart

The Behavior subscale chart of the COOP-A poses the question, "During the past month, compared to other kids your age, has your behavior caused problems for you or other persons?" Results suggested no difference between the two groups for this subscale ($p = .261$) with a small effect size ($r^2 = .032$). The mean ranks were 18.20 and 21.89 for the normal and APD groups, respectively. There was no difference between the APD and normal groups for the proportion of participants classified as "Average" or "At-Risk" (Pearson chi-square value of .267).

Social Support Subscale Chart

The Social Support subscale chart of the COOP-A asks, "During the past month, if you needed someone to listen or to help you, was someone there for you?" Results suggested no difference between the APD group and the normal group ($p = .106$). In contrast to this non-significant finding, the effect size was moderate ($r^2 = .067$), with the mean rank for the normal group at 17.40 and the mean rank for the APD group at 22.74. The effect size indications suggest a trend for the participants in the APD group to rate themselves as having more difficulties with social support than their counterparts in the normal group. The Pearson chi-square value was .267, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups. This is possible as though the proportions of participants that fall into the 2 categories may not be related, the effect size

calculation (r^2) is based on the ranks of the ratings for each group, and so may differ from the nominal analysis that the Pearson chi-square value provides.

Self-Esteem Subscale Chart

The Self-Esteem subscale chart of the COOP-A poses the question, "During the past month, how often have you felt badly about yourself?" There was no difference between the two groups for this subscale (p = .189). The effect size was small (r^2 = .044). The mean ranks were 18.38 and 21.71 for the normal and APD groups, respectively. The Pearson chi-square value was .184, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and Normal groups.

Family Subscale Chart

The Family subscale chart of the COOP-A asks, "During the past month, how often did you talk about your problems, feelings or opinions with someone in your family?" For this subscale, there was no difference between the APD group and the normal group (p = .336). The effect size was small (r^2 = .024). The mean rank for the normal group was 18.38 and the mean rank for the APD group was 21.71. The Pearson chi-square value was .421, confirming no difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Health Habits I

The Health Habits I subscale chart of the COOP-A poses its question this way: "During the past month, how often did you do things that are harmful to your health such as:

- smoke cigarettes or chew tobacco
- have unprotected sex
- use alcohol including beer or wine?"

There was no difference between the APD group and the normal group (p = .330). The effect size was small (r^2 = .024). The mean ranks were 20.48 and 19.50 for the normal and APD

groups, respectively. The Pearson chi-square value could not be determined as all ratings for both groups were constant within the "Average" classification.

Overall Health Subscale Chart

The Overall Health subscale chart of the COOP-A asks the question, "During the past month, how would you rate your health?" There was a difference between the APD group and the normal group (p = .037) with a moderate effect size (r^2 = .111). Recall that with the Mann-Whitney U for the COOP-A, if there is a statistically significant difference, the group with the greater mean rank represents the group with greater reported psychosocial difficulties for that subscale chart. The mean rank for the normal group was 16.53 and the mean rank for the APD group was 23.66, indicating lower reported overall health on this subscale chart for the APD group. Despite the findings on the Mann-Whitney U, the Pearson chi-square value was .060, suggesting no statistically significant difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Energy Subscale Chart

The Energy subscale chart of the COOP-A asks, "During the past month, how often did you feel tired?" There was no statistically significant difference between the two groups for this subscale (p = .220), and the effect size was small (r^2 = .039). The mean ranks were 21.98 and 17.92 for the normal and APD groups, respectively. There was also no statistically significant difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups (Pearson chi-square value of .060).

Social Skills Rating System (SSRS), Student Forms

The items on the Student Forms of the SSRS are rated on a three-point Likert scale according to perceived frequency, where "Never" = 0, "Sometimes" = 1, and "Very Often" = 2. The four subscales incorporated into the Social Skills Scale for the Student Forms (Elementary

and Secondary Level) of the SSRS measure positive social behaviors, with higher ratings indicating greater self-perceived skill. The four Student Form Social Skills subscales are Cooperation, Assertion, Empathy and Self-Control. To assess differences between group mean ratings on the subscales of the SSRS, independent-samples *t*-tests were conducted and eta-squared values were calculated to assess effect sizes.

Cooperation Subscale

The Cooperation subscale of the SSRS asks students to rate how often they complete social behaviors that are presented, such as: "I finish classroom work on time." For the Cooperation subscale for the SSRS Student Forms (combined Elementary and Secondary ratings), there was no difference between scores for the normal group (M = 15.53, SD = 2.695) and the APD group [M = 14.68, SD = 2.451; $t(36) = 1.008$, $p = .320$]. The magnitude of the differences in the means was small (eta squared = .026).

Assertion Subscale

The Assertion subscale of the SSRS asks students to rate how frequently they complete associated social behaviors, for example: "I start talks with class members." For the Assertion subscale for the SSRS Student Forms, there was no difference between scores for the normal group (M = 13.95, SD = 3.677) and the APD group [M = 14.84, SD = 2.035; $t(37) = -.943$, $p = .353$]. The effect size of the differences in the means was small (eta squared = .023).

Empathy Subscale

The Empathy subscale of the SSRS asks students to rate how often they complete social behaviors that are presented, such as: "I feel sorry for others when bad things happen to them" and "I listen to my friends when they talk about problems they are having." For the Empathy subscale for the SSRS Student Forms (combined Elementary and Secondary ratings), there was no significant difference between scores for the normal group (M = 16.45, SD = 2.743) and the

APD group [M = 16.47, SD = 2.435; $t(37)$ = -.028, p = .977]. The magnitude of the differences in the means was very small (eta squared = .00002).

Self-Control Subscale

The Self-Control subscale of the SSRS asks students to rate how frequently they complete associated social behaviors, for instance: "I control my temper when people are angry at me." For the Self-Control subscale for the SSRS Student Forms, there was no difference between scores for the normal group (M = 12.80, SD = 3.270) and the APD group [M = 12.80, SD = 3.270; $t(37)$ = .917, p = .365]. The effect size of the differences in the means was small (eta squared = .022).

Behavioral Assessment System for Children-Second Edition (BASC-2), Self-Report Forms

The items on the Self-Report Forms of the BASC-2 are rated according to either a true/false forced choice paradigm, or a four-point Likert scale according to self-reported frequency of "Never," "Sometimes," "Often," or "Almost Always." The five composite subscales of the BASC-2 that are incorporated into the Self-Report Forms utilized (both the Self-Report—Child and the Self-Report—Adolescent) are School Problems, Internalizing Problems, Inattention/Hyperactivity, Emotional Symptoms Index, and Personal Adjustment. To assess differences between group mean ratings on the composite subscales of the BASC-2, independent-samples t-tests were conducted and eta-squared values were calculated to assess effect sizes.

School Problems Composite Subscale

The School Problems composite subscale asks students to rate their thoughts, feelings and behaviors for such content areas as attitude to school, attitude to teachers, and the structure of the educational process. High scores on the School Problems composite subscale are indicative of a pattern of overall dissatisfaction with the schooling process. For the School Problems composite

subscale, there was no difference between scores for the normal group (M = 121.55, SD = 30.490) and the APD group [M = 121.26, SD = 27.974; $t(37) = .031$, $p = .976$]. The magnitude of the differences in the means was extremely small (eta squared = .00003).

Internalizing Problems Composite Subscale

The Internalizing Problems composite subscale of the BASC-2 asks students to rate themselves for such content areas as locus of control, social stress, sense of inadequacy and depression. High self-reported scores on the Internalizing Problems composite subscale are indicative of a pattern of overall emotional difficulties and inwardly directed distress (Reynolds & Kamphaus, 2004). For the Internalizing Problems composite subscale Self-Report Forms, there was no significant difference between scores for the normal group (M = 297.45, SD = 36.523) and the APD group [M = 309.16, SD = 36.090; $t(37) = -1.006$, $p = .321$]. The effect sizes of the differences in the means was small (eta squared = .027).

Inattention/Hyperactivity Composite Subscale

The Inattention/Hyperactivity composite subscale of the BASC-2 asks students to rate their behaviors for such difficulties as being too noisy and difficulty standing still. High self-reported scores on this composite subscale are indicative of a pattern of overall impulsivity and attention difficulties, and may warrant further evaluation considering the possibility of an Attention Deficit Disorder or Attention Deficit/Hyperactivity Disorder diagnosis. For the Inattention/Hyperactivity composite subscale Self-Report Forms, there was no difference between scores for the normal group (M = 97.50, SD = 14.870) and the APD group [M = 102.11, SD = 17.355; $t(37) = -.891$, $p = .378$]. The magnitude of the differences in the means was small (eta squared = .021).

Emotional Symptoms Index Subscale

The Emotional Symptoms Index subscale of the BASC-2 combines content items from both the Internalizing Problems and Personal Adjustment composite subscales and is specific to the Self-Report forms of the BASC-2. Content areas include sense of inadequacy, social stress, anxiety, depression, self-reliance and self-esteem. High self-reported scores on the Emotional Symptoms Index composite subscale can be indicative of a global pattern of serious broad-based emotional disorders (Reynolds & Kamphaus, 2004). There was a significant difference between the normal group (M = 274.10, SD = 25.805) and the APD group [M = 294.47, SD = 32.404; $t(37) = -2.071$, $p = .045$]. The magnitude of the differences in the means was moderate (eta squared = .158). As the mean for the APD group exceeded that of the normal group, statistical analysis indicates greater reported emotional problems for the APD group.

Personal Adjustment Composite Subscale

The Personal Adjustment composite subscale of the BASC-2 includes content areas that assess behaviors which may lead to positive outcomes, such as self-acceptance and social support. Low self-reported scores on the Personal Adjustment subscale may suggest poor peer or parental relationships, and poor coping strategies. For this subscale, there was no difference between scores for the normal group (M = 211.60, SD = 23.270) and the APD group [M = 202.00, SD = 31.050; $t(37) = 1.006$, $p = .280$]. The effect sizes of the differences in the means was small (eta squared = .031).

Parent-Completed Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP-A)

For the COOP-A, the parents were asked to respond to each chart according to their perception of their participating child's function in each given area. Each individual chart of the COOP-A given to the parents was identical to those given to their children, and acts as its own

subscale screener. Parents were asked to complete their ratings on the COOP-A independently via paper and pencil format, but were encouraged to ask questions of the investigator if any item was unclear. Ratings for each chart are based on a five-point Likert scale wherein 1 represents the least dysfunction and 5 represents the greatest dysfunction in any given area. The Mann-Whitney U test for non-parametric data was utilized in order to compare Sum of Ranks for all subscale charts on the COOP-A due to the ordinal nature of the data, and r-square values were calculated to assess effect sizes (Rosenthal, 1991). Additionally, chi-square tests for independence were conducted between groups on the proportion of Average or At-Risk classifications for each subscale chart, with statistical significance defined by $p < 0.05$ (two-tailed) for the Pearson chi-square values. See Table 4-11 for a summary table of findings for proportions of students that parents consider to be "At-Risk" from both groups for each subscale chart.

Physical Fitness Subscale Chart

Results for the Physical Fitness subscale chart for the COOP-A suggested that parents perceived no statistically significant difference between the two groups ($p = .986$). The effect size was very small ($r^2 < .0005$). The mean ranks were 19.03 and 18.97 for the normal and APD groups, respectively. The Pearson chi-square value was .677, confirming no statistically significant difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Pain Subscale Chart

Results for the Pain subscale chart suggested a significant difference between the parental ratings for the APD group and the normal group ($p = .032$), with a moderate effect size ($r^2 = .125$). Recall that with the Mann-Whitney U for the COOP-A if there is a significant difference in results, the group with the greater mean rank represents the group with greater parental reports

of psychosocial difficulties in their children for that subscale. The mean rank for the normal group was 15.28 and the mean rank for the APD group was 22.53, indicating greater parental reports of pain for the children in the APD group. The Pearson chi-square value was .004, indicating the parents reported a significant difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups. Additional review indicates there to be 94.4% of the normal group parent ratings in the "Average" category versus 52.6% of the APD group, and 5.6% of the normal group ratings falling in the "At-Risk" category versus 47.4% of the APD group parent ratings. Based on these findings, more parents of children within the APD group rate their children as "At-Risk" for problems with pain than parents of students in the normal group.

Stress Subscale Chart

Results of the parent-completed Stress subscale chart of the COOP-A suggested that no difference exists between the two groups ($p = .151$). In contrast to this non-significant finding, the effect size was moderate ($r^2 = .056$), and the mean ranks were 16.61 and 21.26 for the normal and APD groups, respectively. The effect size indications suggest a trend for the parents of participants in the APD group to rate their children as having more difficulties with stress than their counterparts in the normal group. The Pearson chi-square value was .219, however, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups. Recall that this apparent discrepancy between the chi-square statistic and the effect size is possible because the r-squared calculation is based on the ranks of the ratings for each group, and so may differ from the nominal analysis that the Pearson chi-square value provides.

School Work Subscale Chart

Findings for the School Work subscale chart suggested a significant difference between the parental reports for the APD group and the normal group (p = .033), with a moderate effect size (r^2 = .122). The mean rank for the normal group was 15.39 and the mean rank for the APD group was 22.42, indicating greater parental reported difficulties for the APD group on the School Work subscale. However, the Pearson chi-square value was .238, suggesting no difference exists for the proportion of participants classified as "Average" or "At-Risk" for the School Work subscale chart between groups. Again, the discrepancies between the categorical analysis and the ordinal analyses may be explained by the nature of the data that is being analyzed here.

Emotional Feelings Subscale Chart

The Emotional Feelings subscale chart of the COOP-A asks the question, "During the past month, how often did you feel anxious, depressed, irritable, sad or downhearted and blue?" There was a difference between parental ratings of the APD group and the normal group (p = .023), with a large effect size (r^2 = .140). The mean rank for the normal group was 15.56 and the mean rank for the APD group was 22.26, indicating greater parent-reported difficulties on the Emotional Feelings subscale for the children in the APD group. In contrast to these Mann-Whitney U findings, the Pearson chi-square value was .087, suggesting no difference exists for the proportion of participants classified as "Average" or "At-Risk" between the APD and normal groups.

Behavior Subscale Chart

Results for the Behavior subscale chart of the COOP-A suggested no difference between the two groups for this subscale (p = .159). In contrast to this non-significant finding, the effect size was moderate (r^2 = .054), and the mean ranks were 16.89 and 21.00 for the normal and APD groups, respectively. The effect size indications suggest a trend for the parents of participants in

the APD group to rate their children as having more difficulties with behavior than their counterparts in the normal group. The Pearson chi-square value was .157, however, suggesting no difference for the proportion of participants parent ratings classified as "Average" or "At-Risk" for the Behavior subscale chart between the APD and normal groups.

Social Support Subscale Chart

For the Social Support subscale chart, there was no difference between parental ratings of the APD group and the normal group (p = .325), with a small effect size (r^2 = .026). The mean rank for the normal group was 17.50 and the mean rank for the APD group was 20.42. The Pearson chi-square value was .324, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" per parent ratings between the APD and normal groups.

Self-Esteem Subscale Chart

Results of the parent-completed Self-Esteem subscale chart of the COOP-A suggested no difference between the two groups for this subscale (p = .054) though a trend was evident. The mean rank for the normal group was 15.75 and the mean rank for the APD group was 22.08, suggesting a non-statistically significant trend toward greater parent-reported difficulties on the Self-Esteem subscale chart for the children in the APD group. The magnitude of the differences between mean ranks was moderate (r^2 = .100). Lending additional support to the weight of this trend, the Pearson chi-square value was .009, indicating a significant difference exists for the proportion of participants classified as "Average" or "At-Risk" per parental ratings between the APD and normal groups. Further review indicates there to be 100% of the normal group ratings falling in the "Average" category versus 68.4% of the APD Group, and 0% of the normal group ratings falling in the "At-Risk" category versus 31.6% of the APD group. These findings indicate that a higher proportion of parents of students in the APD group rate their children as "At-Risk" for problems with self esteem than do parents of students in the normal group.

Family Subscale Chart

For the Family subscale chart, there was no difference between the parent ratings of the APD group and the parent ratings of the normal group (p = .694), with a very small effect size (r^2 = .004). The mean rank for the normal group was 18.33 and the mean rank for the APD group was 19.63. The Pearson chi-square value was .331, suggesting no difference for the proportion of participants classified as "Average" or "At-Risk" per parent ratings between the APD and normal groups on the Family subscale chart.

Health Habits I

Results for the Health Habits I subscale chart suggested no difference between parental ratings of the APD group and the normal group (p = 1.000). The mean rank was 19.00 for both the normal and APD groups. The Pearson chi-square value could not be determined as all ratings for both groups were constant within the "Average" classification.

Overall Health Subscale Chart

For the Overall Health subscale, there was no difference between the parent ratings of the APD group and the parent ratings of the normal group (p = .122). In contrast to this non-significant finding, the effect size was moderate (r^2 = .065), and the mean ranks were 16.47 and 21.39 for the normal and APD groups, respectively. The effect size indications suggest a trend for the parents of participants in the APD group to rate their children as having poorer overall health than their counterparts in the normal group. The Pearson chi-square value was .316, however, suggesting no significant difference for the proportion of participants that parent ratings classified as "Average" or "At-Risk" between the APD and normal groups.

Energy Subscale Chart

For the Energy subscale chart of the COOP-A, there was no difference between the parental ratings of the two groups for this subscale (p = .585), with a very small effect size (r^2 =

.008). The mean ranks were 19.86 and 18.18 for the normal and APD groups, respectively. The Pearson chi-square value was .316, suggesting no difference for the proportion of participants that parent ratings classified as "Average" or "At-Risk" between the APD and normal groups.

Social Skills Rating System (SSRS), Parent Forms

The items on the Parent Forms of the SSRS are rated on a three-point Likert scale according to parent observed frequency of social behavior occurrence, where "Never" = 0, "Sometimes" = 1, and "Very Often" = 2. The four subscales incorporated into the Social Skills domain for the Parent Forms (Elementary and Secondary Level) of the SSRS measure positive social behaviors, with higher ratings indicating greater parent-perceived social skill. The four Parent Form Social Skills subscales are Cooperation, Assertion, Responsibility and Self-Control. The Problem Behaviors domain includes three subscales that measure behaviors which may negatively impact social skill development and function. Both the Elementary and Secondary Level Parent Forms of the SSRS include Externalizing and Internalizing Problem Behavior subscales. Additionally, the Elementary Level Parent Form of the SSRS includes the Hyperactivity subscale in the Problem Behavior domain. Due to slight group differences in age, the Hyperactivity subscale of the Problem Behavior domain was not statistically examined in the present study. To assess differences between group mean ratings on the included Parent Form subscales of the Social Skill and Problem Behavior domains of the SSRS, independent-samples *t*-tests were conducted and eta-squared values were calculated.

Cooperation Subscale

The Cooperation subscale of the SSRS asks parents to rate how often they believe their children complete social behaviors that are presented, such as: "Keeps room clean and neat without being reminded." For the Cooperation subscale for the SSRS Parent Forms (combined Elementary and Secondary ratings), there was no difference between scores for the normal group

(M = 13.33, SD = 2.449) and the APD group [M = 12.44, SD = 2.555; $t(32) = 1.043$, $p = .305$]. The magnitude of the differences in the means was small (eta squared = .033).

Assertion Subscale

The Assertion subscale of the SSRS asks parents to rate how frequently they believe their children complete associated social behaviors, for example: "Makes friends easily." Results for the Assertion subscale for the SSRS Parent Forms indicated no difference between scores for the normal group (M = 16.00, SD = 2.574) and the APD group [M = 16.00, SD = 2.82; $t(32) < .0005$, $p = 1.000$]. The effect size of the differences in the means was extremely small (eta squared < .0005).

Responsibility Subscale

The Responsibility subscale of the SSRS asks parents to rate how frequently their children complete social behaviors that are presented, such as: "Reports accidents to appropriate persons" and "Asks permission before using another family member's property." There was a significant difference between the normal group (M = 16.94, SD = 1.924) and the APD group [M = 14.78, SD = 3.173; $t(28.016) = 2.477$, $p = .020$]. The magnitude of the differences in the means was large (eta squared = .158). Recall that within the Social Skills domain of the SSRS, if there is a significant difference, the group with the lower mean rank represents the group with fewer parentally-reported social skills for the associated subscale. As the mean for the normal group exceeded that of the APD group, statistical analysis indicates greater reported social skills on the Responsibility subscale for the normal group.

Self-Control Subscale

The Self-Control subscale of the SSRS asks parents to rate how frequently they believe their children complete associated social behaviors, for instance: "Responds appropriately when hit or pushed by other children." For the Self-Control subscale of the SSRS Student Forms, there

was no difference between scores for the normal group (M = 16.11, SD = 2.494) and the APD group [M = 14.67, SD = 2.590; $t(34) = 1.704$, $p = .097$]. However, the effect size of the differences in the means was moderate (eta squared = .079), suggesting a trend in the data that parents reported the children in the APD group to have fewer self-control social skills than the children in the normal group.

Externalizing Problem Behavior Subscale

The Externalizing Problem Behavior subscale of the SSRS asks parents to rate how frequently their children complete behaviors that may interfere with social skills performance, such as: "Gets angry easily" and "Fights with others." There was a difference between the normal group (M = 2.00, SD = 1.749) and the APD group [M = 3.22, SD = 1.768; $t(34) = -2.085$, $p = .045$]. The magnitude of the differences in the means indicated a moderate effect size (eta squared = .113). Recall that within the Problem Behaviors domain of the SSRS, if there is a significant difference, the group with the lower mean rank represents the group with fewer parentally-reported negative behaviors for the associated subscale. The mean for the APD group exceeded that of the normal group, with statistical analysis indicating greater reported externalizing problem behaviors on this subscale for the APD group.

Internalizing Problem Behavior Subscale

The Internalizing Problem Behavior subscale of the SSRS asks parents to rate how frequently their children exhibit behaviors such as anxiety, sadness and poor self-esteem that may interfere with social skills performance. Example items included in Parent Forms for this subscale are: "Appears lonely" and "Acts sad or depressed." There was a significant difference between the normal group (M = 2.50, SD = 1.790) and the APD group [M = 4.33, SD = 2.425; $t(34) = -2.580$, $p = .014$]. The magnitude of the differences in the means indicated a large effect size (eta squared = .164). As the mean for the APD group exceeded that of the normal group,

statistical analysis indicates that parents reported increased internalizing problem behaviors on this subscale for the APD group.

Behavioral Assessment System for Children-Second Edition (BASC-2), Parent Rating Scales

The items on the Parent Rating Composite Scales of the BASC-2 are rated on a four-point Likert scale according to self-reported frequency of "Never," "Sometimes," "Often," or "Almost Always." The four composite subscales of the BASC-2 that are incorporated into the Parent Rating Scales utilized (both the PRS-Child and the PRS-Adolescent) are Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills. To assess differences between group mean parental ratings on the composite subscales of the BASC-2, independent-samples *t*-tests were conducted and eta-squared values were calculated.

Externalizing Problems Composite Subscale

The Externalizing Problems composite subscale of the BASC-2 asks parents to rate their child's behaviors for the following content areas: hyperactivity, aggression, and conduct problems. High scores on the Externalizing Problems composite subscale are indicative of parental perceptions of obvious disruptive behaviors in their children. For the Externalizing Problems composite subscale, there was a significant difference between scores for the normal group (M = 134.22, SD = 13.524) and the APD Group [M = 151.50, SD = 19.518; $t(34) = -3.087$, $p = .004$]. The magnitude of the differences was large (eta squared = .219). The mean of the APD group exceeded that of the normal group, indicating greater parental reports of externalizing problem behaviors for the children in the APD group.

Internalizing Problems Composite Subscale

The Internalizing Problems composite subscale of the BASC-2 Parent Rating Scales asks parents to rate their children for such content areas as anxiety, depression and somatization. As

with the Self-Report forms, high scores for the Internalizing Problems composite subscale are indicative of a pattern of inwardly directed distress. For the Internalizing Problems composite subscale Parent Rating Scales, scores for the normal group (M = 136.83, SD = 12.491) and the APD group [M = 167.22, SD = 31.454; $t(34) = -3.810$, $p = .001$] differed. The magnitude of the differences was large (eta squared = .299). As the mean for the APD group exceeded that of the normal group, statistical analysis indicates that parents reported increased internalizing problem behaviors on this subscale for the APD group.

Behavioral Symptoms Index Subscale

The Behavioral Symptoms Index subscale of the BASC-2 is specific to the Teacher and Parent Rating Scales of the BASC-2. Content areas include: Hyperactivity, Aggression, Depression, Atypicality, Withdrawal and Attention Problems. High ratings on this subscale may be indicative of a global pattern of psychosocial problem behaviors. There was a significant difference between the normal group (M = 270.78, SD = 25.316) and the APD group [M = 320.33, SD = 40.359; $t(28.584) = -4.413$, $p < .0005$]. The magnitude of the differences was very large (eta squared = .364). The mean for the APD group exceeded that of the normal group, and statistical analysis confirmed greater parental reports of psychosocial problem behaviors for the APD group.

Adaptive Skills Composite Subscale

The Adaptive Skills composite subscale of the BASC-2 includes content areas that assess behaviors which may lead to positive outcomes, such as leadership, communication skills and emotional expression. Low parental ratings on this subscale may suggest poor adaptability and coping strategies, inappropriate social interactions, or difficulty with activities of daily living. For the Adaptive Skills composite subscale, there was a significant difference between scores for the normal group (M = 260.94, SD = 22.784) and the APD group [M = 237.06, SD = 32.809;

$t(34) = 2.537$, $p = .016$]. The magnitude of the differences was large (eta squared = .159). Examination of the means reveals that the mean of the APD group was lower than that of the normal group, indicating parental reports of lower adaptive skills for the children in the APD group.

Summary of Statistically Significant Findings Across Instruments

In summary, three of twenty-one subscales were found to have statistically significant different results upon comparison of the participants in the APD group to those of the participants in the normal group, with the participants in the APD group reporting greater psychosocial problems than their counterparts in the normal group. The subscales that were found to be different were the Emotional Feelings and Overall Health subscales of the COOP-A, and the Emotional Symptoms Index of the BASC-2.

Twelve of twenty-two subscales were found to have significantly different results for parental ratings between groups. Statistical comparison indicated differences for the Pain, School Work, Emotional Feelings and Self-Esteem subscale charts of the COOP-A, all four composite subscales of the BASC-2 (Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills), and the Responsibility, Externalizing Problem Behaviors and Internalizing Problem Behaviors of the SSRS. Again, for all significant findings, parents of participants in the APD group reported more psychosocial problems for their children than did the parents of children in the normal group. A summary of significant findings for parent and participant ratings can be found in Table 4-9.

Post-Hoc Analyses

Post-hoc analyses were conducted in order to determine the possible effects of age and gender on any statistically significant findings or trends. Post-hoc analyses were also conducted between the language-impaired and language-normal subgroups of the APD group parental and

self-ratings for all subscales on all three psychosocial questionnaires utilized, employing the same methods of statistical analysis reported for the between group (APD vs. Normal) examinations as previously detailed.

Reported Psychosocial Function and Age

COOP-A and age correlation results

The analysis of age on the self-completed Stress subscale chart of the COOP-A yielded a Spearman rho value of .046, (n = 39, p = .782), indicating no correlation. The analysis of age on child-completed COOP-A Emotional Feeling subscale yielded a Spearman rho value of -.003 (n = 39, p = .986), indicating no correlation. The analysis of age on the ratings for the child-completed COOP-A Overall Health subscale chart yielded a Spearman rho value of .299 (n = 39, p = .064), indicating a small to medium positive correlation between increasing age and increasing self-reports of poor overall health. Statistical analysis of age on the parent-completed COOP-A Pain subscale chart Pain subscale yielded a Spearman rho value of -.032, (n = 37, p = .850), indicating no significant correlation. The analysis of age on the parent-completed School Work subscale chart of the COOP-A yielded a Spearman rho value of -.076, (n = 37, p = .654), indicating no correlation. The analysis of age on parent-completed COOP-A Emotional Feeling subscale yielded a Spearman rho value of -.007 (n = 37, p = .969), indicating no correlation. The analysis of age on the ratings for the parent-completed COOP-A Self-Esteem subscale chart yielded a Spearman rho value of -.240 (n = 37, p = .153), indicating a small correlation between increasing age and decreasing parental reports of self-esteem problems in their children.

SSRS and age correlation results

The analysis of age on the ratings for the parent-completed SSRS Responsibility subscale yielded a Pearson's r value of .534 (n = 36, p = .001), indicating a strong correlation between increasing participant age and parental reports of higher responsibility skill levels in their

children. The analysis of age on the parental ratings for the Externalizing Problem Behaviors subscale of the SSRS yielded a Pearson's *r* value of -.294 ($n = 36$, $p = .082$), indicating a small to medium correlation between increasing participant age and parental reports of higher responsibility skill levels in their children. The analysis of age on the Internalizing Problem Behaviors subscale of the SSRS Parent Form indicated a small negative correlation between the two variables ($r = -.098$, $n = 36$, $p = .569$). These findings suggest a trend for parents to rate their children as displaying fewer internalizing problem behaviors, such as anxiety or sadness, as they grow older.

BASC-2 and age correlation results

The analysis of age on the BASC-2 Self-Report Emotional Symptoms Index composite subscale indicated no significant correlation between the two variables ($r = -.021$, $n = 39$, $p = .899$). The analysis of age on the Externalizing Problems composite subscale of the BASC-2 Parent Rating Scales indicated no statistically significant correlation between the two variables ($r = -.086$, $n = 36$, $p = .616$). The analysis of age on the Internalizing Problems composite subscale of the BASC-2 Parent Rating Scales indicated no statistically significant correlation between the two variables ($r = -.014$, $n = 36$, $p = .934$). The analysis of age on the BASC-2 Parent Rating Scales' Behavioral Symptoms Index composite subscale indicated a small correlation between the two variables ($r = -.123$, $n = 36$, $p = .473$). These findings suggest a trend for parents to rate their children as having fewer negative behavioral symptoms as they grow older. The analysis of age on the BASC-2 Parent Rating Scales' Adaptive Skills composite subscale indicated a small positive correlation between the two variables ($r = -.148$, $n = 36$, $p = .387$). These findings suggest a trend for parents to rate their children as having more positive adaptive skills, such as coping or communication skills, as they grow older.

Summary of age correlation results across instruments

In summary, there were a few correlations associated with age across the various significant findings of the psychosocial subscales. On the COOP-A, there was a moderate correlation for children to report lower overall health as they advanced in age, and a small correlation between increasing age of the child and decreasing parental reports of self-esteem problems in their children. On the BASC-2, there were small correlations associated with parents reporting fewer negative behavioral symptoms and increased adaptive skills as their children grew older. And on the SSRS, there was a small negative correlation for parental reports of internalizing problems, a small to moderate negative correlation for parental reports of externalizing problems, and a strong positive correlation for parental reports of greater responsibility skills for older children. A summary of all correlation findings for the various psychosocial subscales assessed may be found in Table 4-12.

Reported Psychosocial Function and Gender

COOP-A and gender comparison of mean rank results

No statistically significant findings for gender differences were observed for any of the examined COOP-A subscales. Results on the child-completed Stress subscale chart yielded p = .866, the Emotional Feelings subscale chart yielded p = .647, and the Overall Health subscale chart yielded p = .424. Results on the parent-completed Pain subscale chart yielded p = .545, the School Work subscale chart yielded p = .803, the Emotional Feelings subscale chart yielded p = .562, and the Self Esteem subscale chart yielded p = .960.

SSRS and gender comparison of means results

Results on the Responsibility subscale of the SSRS Parent Forms yielded p = .548, the Externalizing Problem Behaviors subscale yielded p = .873, and the Internalizing Problems

Behaviors subscale yielded $p = .540$. No significant findings for gender differences were observed for any of the examined SSRS subscales.

BASC-2 and gender comparison of means results

No significant gender differences were observed for any of the BASC-2 composite subscales of interest. Results on the self-report Emotional Symptoms Index composite subscale yielded $p = .632$. The BASC-2 Parent Report forms' Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index and Adaptive Skills composite subscales yielded $p = .210$, $p = .783$, $p = .460$, and $p = .110$, respectively.

Summary of gender analyses results across instruments

To summarize, no gender differences were observed for any of the subscales of interest. A summary of all *p*-values on gender for the various psychosocial subscales assessed is found in Table 4-13.

Comparisons Between Language-Normal and Language-Impaired Subgroups with APD

Preliminary analyses were completed to determine if any statistically significant differences existed between the language-impaired and language-normal APD subgroups on age or gender. Results indicated that there was no significant difference between age for the language-normal subgroup ($M = 12.20$, $SD = 1.865$) and the language-impaired APD group [$M = 11.69$, $SD = 2.352$; $t(17) = .517$, $p = .612$]. A chi-square test for independence was conducted between the two APD subgroups on the proportion of males and females, with statistical significance defined by $p < 0.05$ (two-tailed) for the Pearson chi-square values. No significant difference on gender was found ($\chi^2 = .498$, $n = 19$).

Statistical significance levels were not reached for any of the parent- or child-completed instrument subscales, suggesting comparable psychosocial function across content areas for the children with and without language impairment who have APD. See Tables 4-14 and 4-15 for a

summary of statistical results between APD linguistic subgroups for participants and their parents, respectively.

Table 4-1: Number of subjects in the APD and normal groups for various demographic characteristics.

		APD Group (*n* = 19)	Normal Group (*n* = 20)
Gender	Male	9	6
	Female	10	14
Age (in years)	Mean	11.93	12.79
	Range	9.6–17.8	9.6-16.9
Grade Level	4	3	2
	5	7	4
	6	4	2
	7	2	2
	8	1	4
	9	0	2
	10	0	1
	11	2	2
	12	0	1
Language Disorder	Normal	10	20
	Impaired	9	0
Type of School	Public	9	7
	Private	8	8
	Home	2	5

Table 4-2: Mean pure-tone air-conduction thresholds (*M*) and standard deviations (s.d.) across frequencies for each ear (RE = right ear; LE = left ear) of both groups.

Frequency (Hz)		250		500		1000		2000		3000		4000		6000		8000	
Ear		RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE	LE
APD group	*M*	7.8	6.6	7.5	6.3	6.6	7.5	4.4	4.1	2.2	2.8	4.1	4.4	4.6	5.0	4.1	2.8
	s.d.	5.0	4.7	4.0	6.1	4.9	4.0	6.4	5.2	5.8	6.3	5.5	6.4	6.0	6.5	8.4	9.9
Normal group	*M*	6.9	7.2	5.6	5.3	5.0	6.4	4.4	5.8	2.2	1.9	2.8	3.9	4.1	2.6	4.2	3.3
	s.d.	5.6	3.5	5.8	4.9	4.6	4.1	4.4	5.0	4.2	5.1	6.1	4.3	6.6	5.8	6.8	6.7

Table 4-3: Mean tympanometric data for APD and normal groups.

	APD Group (*n* = 19)		Normal Group (*n* = 20)	
	Right Ear	Left Ear	Right Ear	Left Ear
Ear Canal Volume (cm^3)	1.10	1.10	1.24	1.22
Peak Pressure (daPa)	3.55	1.32	14.50	5.75
Static Compliance (ml)	0.65	0.66	0.80	0.78

Table 4-4: Number of participants 2 standard deviations or more below mean on assessments used in the APD test battery for both the APD and normal groups.

	APD Group (*n* = 19)	Normal Group (*n* = 20)
Staggered Spondaic Word test	17	3
Dichotic Digits, Double Pairs	8	0
Frequency Pattern Sequence test	14	1
Duration Pattern Sequence test	16	1
Random Gap Detection test	7	0
Synthetic Sentence Index: Ipsilateral Competing Message	6	0
SCAN: Auditory Figure-Ground Subtest	5	0
SCAN: Competing Words Subtest	5	0
SCAN: Filtered Words Subtest	0	0
Auditory Continuous Performance Test	0	0

Table 4-5: Mean ranks (*m*) and sum of ranks (*U*) for the COOP-A and means (*M*) and standard deviations (s.d.) for the SSRS and BASC-2 for children's psychosocial self-reports ratings for the APD group and the normal group.

Children's Self-Reports Scale	Subscale	APD group		Normal group	
COOP-A		*m*	*U*	*m*	*U*
	Physical Fitness	18.68	355.00	21.25	425.00
	Pain	21.76	413.50	18.33	366.50
	Stress	22.58	429.00	17.55	351.00
	School Work	22.58	429.00	17.55	351.00
	Emotional Feelings	24.34	462.50	15.88	317.50
	Behavior	21.89	416.00	18.20	364.00
	Social Support	22.74	432.00	17.40	348.00
	Self-Esteem	22.26	423.00	17.85	357.00
	Family	21.71	412.50	18.38	367.50
	Health Habits I	19.50	370.50	20.48	409.50
	Overall Health	23.66	449.50	16.53	330.50
	Energy	17.92	340.50	21.98	439.50
BASC-2		*M*	s.d.	*M*	s.d.
	School Problems	121.26	27.974	121.55	30.490
	Internalizing Problems	309.16	36.090	297.45	36.523
	Emotional Symptoms Index	293.47	32.404	274.10	25.805
	Inattention/Hyperactivity	102.11	17.355	97.50	14.870
	Personal Adjustment	202.00	31.050	211.60	23.270
SSRS		*M*	s.d.	*M*	s.d.
	Cooperation	14.68	2.451	15.53	2.695
	Assertion	14.84	2.035	13.95	3.677
	Empathy	16.47	2.435	16.45	2.743
	Self-Control	11.89	2.865	12.80	3.270

Table 4-6: Statistical findings for children's psychosocial self-reports.

Children's Self-Reports						
Scale	Subscale	*t*-value	*df*	*Z*-value	*p*	Effect Size
COOP-A						*r*-sq
	Physical Fitness	n/a	n/a	-0.812	0.417	0.017
	Pain	n/a	n/a	-0.996	0.319	0.025
	Stress	n/a	n/a	-1.458	0.145	0.055
	School Work	n/a	n/a	-1.509	0.131	0.058
	Emotional Feelings	n/a	n/a	-2.533	0.011*	0.165
	Behavior	n/a	n/a	-1.125	0.261	0.032
	Social Support	n/a	n/a	-1.615	0.106	0.067
	Self-Esteem	n/a	n/a	-1.315	0.189	0.044
	Family	n/a	n/a	-0.961	0.336	0.024
	Health Habits I	n/a	n/a	-0.975	0.330	0.024
	Overall Health	n/a	n/a	-2.082	0.037*	0.111
	Energy	n/a	n/a	-1.227	0.220	0.039
BASC-2						eta-sq
	School Problems	0.031	37	n/a	0.976	0.00003
	Internalizing Problems	-1.006	37	n/a	0.321	0.027
	Emotional Symptoms Index	-2.071	37	n/a	0.045*	0.104
	Inattention/Hyperactivity	-0.888	37	n/a	0.378	0.378
	Personal Adjustment	1.096	37	n/a	0.280	0.280
SSRS						eta-sq
	Cooperation	1.008	36	n/a	0.320	0.026
	Assertion	-0.943	29.94	n/a	0.353	0.023
	Empathy	-0.028	37	n/a	0.977	0.00002
	Self-Control	0.917	37	n/a	0.367	0.022

*= $p < 0.05$

Table 4-7: Mean ranks (m) and sum of ranks (U) for the COOP-A and means (M) and standard deviations (s.d.) for the SSRS and BASC-2 for parental psychosocial ratings for the APD group and the normal group.

Parental Reports Scale	Subscale	APD group		Normal group	
COOP-A		*m*	*U*	*m*	*U*
	Physical Fitness	18.97	360.50	19.03	342.50
	Pain	22.53	428.00	15.83	275.00
	Stress	21.26	404.00	16.61	299.00
	School Work	22.42	426.00	15.39	277.00
	Emotional Feelings	22.26	423.00	15.56	280.00
	Behavior	21.00	399.00	16.89	304.00
	Social Support	20.42	388.00	17.50	315.00
	Self-Esteem	22.08	419.50	15.75	283.50
	Family	19.63	373.00	18.33	330.00
	Health Habits I	19.00	361.00	19.00	342.00
	Overall Health	21.39	406.50	16.47	296.50
	Energy	18.18	345.50	19.86	357.50
BASC-2		*M*	s.d.	*M*	s.d.
	Externalizing Problems	151.50	19.518	134.22	13.524
	Internalizing Problems	167.22	31.454	136.83	12.491
	Behavioral Symptoms Index	320.33	40.359	270.78	25.316
	Adaptive Skills	237.06	32.809	260.94	22.784
SSRS		*M*	s.d.	*M*	s.d.
	Cooperation	12.44	2.555	13.33	2.449
	Assertion	16.00	2.828	16.00	2.574
	Responsibility	14.78	3.173	16.94	1.924
	Self-Control	14.67	2.590	16.11	2.494
	Externalizing Problem Behaviors	3.22	1.768	2.00	1.749
	Internalizing Problem Behaviors	4.33	2.425	2.50	1.790

Table 4-8: Statistical findings for parent psychosocial reports.

Parental Reports						
Scale	Subscale	*t*-value	*df*	*Z*-value	*p*	Effect Size
COOP-A						r-sq
	Physical Fitness	n/a	n/a	-0.017	0.976	0.000
	Pain	n/a	n/a	-2.151	0.032*	0.125
	Stress	n/a	n/a	-1.437	0.151	0.056
	School Work	n/a	n/a	-2.126	0.033*	0.122
	Emotional Feelings	n/a	n/a	-2.279	0.023*	0.140
	Behavior	n/a	n/a	-1.408	0.159	0.054
	Social Support	n/a	n/a	-0.985	0.325	0.026
	Self-Esteem	n/a	n/a	-1.927	0.054	0.100
	Family	n/a	n/a	-0.393	0.694	0.004
	Health Habits I	n/a	n/a	0.000	1.000	0.000
	Overall Health	n/a	n/a	-1.548	0.122	0.065
	Energy	n/a	n/a	-0.546	0.585	0.008
BASC-2						eta-sq
	Externalizing Problems	-3.087	34	n/a	0.004*	0.219
	Internalizing Problems	-3.810	22.23	n/a	0.001*	0.299
	Behavioral Symptoms Index	-4.413	28.58	n/a	0.000*	0.364
	Adaptive Skills	2.537	34	n/a	0.017*	0.159
SSRS						eta-sq
	Cooperation	1.043	32	n/a	0.305	0.033
	Assertion	0.000	32	n/a	1.000	0.000
	Responsibility	2.477	28.01	n/a	0.020*	0.158
	Self-Control	1.704	34	n/a	0.097	0.079
	Externalizing Problem Behaviors	-2.085	34	n/a	0.045*	0.113
	Internalizing Problem Behaviors	-2.580	34	n/a	0.014*	0.164

* = $p < 0.05$

Table 4-9: Compiled statistically significant ($p < 0.05$) findings across psychosocial scales for children and parents.

Children's Self-Reports						
Scale	Subscale	*t*-value	*df*	*Z*-value	*p*	Effect Size
COOP-A						r-sq
	Emotional Feelings	n/a	n/a	-2.533	0.011	0.165
	Overall Health	n/a	n/a	-2.082	0.037	0.111
BASC-2						eta-sq
	Emotional Symptoms Index	-2.071	37	n/a	0.045	0.104

Parental Reports						
Scale	Subscale	*t*-value	*df*	*Z*-value	*p*	Effect Size
COOP-A						r-sq
	Pain	n/a	n/a	-2.151	0.032	0.125
	School Work	n/a	n/a	-2.126	0.033	0.122
	Emotional Feelings	n/a	n/a	-2.279	0.023	0.140
BASC-2						eta-sq
	Externalizing Problems	-3.087	34	n/a	0.004	0.219
	Internalizing Problems	-3.810	22.23	n/a	0.001	0.299
	Behavioral Symptoms Index	-4.413	28.58	n/a	0.000	0.364
	Adaptive Skills	2.537	34	n/a	0.017	0.159
SSRS						eta-sq
	Responsibility	2.477	28.02	n/a	0.020	0.158
	Externalizing Problem Behaviors	-2.085	34	n/a	0.045	0.113
	Internalizing Problem Behaviors	-2.580	34	n/a	0.014	0.164

Table 4-10: At-risk (3-5 ratings) findings on COOP-A by children's self-reports by subscale chart for both groups.

Subscale	APD	Normal	Difference	Significance
	% At Risk	% At Risk	% At Risk	(Chi-Square)
Physical Fitness	10.53	0.00	10.53	0.136
Pain	42.11	35.00	7.11	0.648
Stress	52.63	20.00	32.63	0.034*
School Work	21.05	5.00	16.05	0.134
Emotional Feelings	31.58	10.00	21.58	0.095
Behavior	15.79	5.00	10.79	0.267
Social Support	15.79	5.00	10.79	0.267
Self-Esteem	26.32	10.00	16.32	0.184
Family	57.89	45.00	12.89	0.421
Health Habits I	0.00	0.00	0.00	constant
Overall Health	42.11	15.00	27.11	0.060
Energy	47.37	70.00	-22.63	0.151

* = $p < 0.05$

Table 4-11: At-risk (3-5 ratings) findings on COOP-A by parental reports by subscale chart for both groups.

Subscale	APD	Normal	Difference	Significance
	% At Risk	% At Risk	% At Risk	(Chi-Square)
Physical Fitness	15.79	10.00	5.79	0.677
Pain	47.37	5.00	42.37	0.004*
Stress	47.37	25.00	22.37	0.219
School Work	26.32	10.00	16.32	0.238
Emotional Feelings	26.32	5.00	21.32	0.087
Behavior	10.53	0.00	10.53	0.157
Social Support	5.26	0.00	5.26	0.324
Self-Esteem	31.58	0.00	31.58	0.009*
Family	36.84	20.00	16.84	0.331
Health Habits I	0.00	0.00	0.00	constant
Overall Health	15.79	5.00	10.79	0.316
Energy	26.32	35.00	-8.68	0.414

* = $p < 0.05$

Table 4-12: Summary of correlation findings for age and statistically significant ($p < 0.05$) psychosocial subscales for children and parents.

Children's Self-Reports Scale	Subscale	Correlation Statistic	
COOP-A		Spearman's rho	
	Emotional Feelings	-0.003	
	Overall Health	0.299	**
BASC-2		Pearson's R	
	Emotional Symptoms Index	-0.021	
Parental Reports Scale	**Subscale**	**Correlation Statistic**	
COOP-A		Spearman's rho	
	Pain	-0.032	
	School Work	-0.076	
	Emotional Feelings	0.007	
	Self-Esteem	-0.240	*
BASC-2		Pearson's R	
	Externalizing Problems	-0.086	
	Internalizing Problems	-0.014	
	Behavioral Symptoms Index	-0.123	*
	Adaptive Skills	0.148	*
SSRS		Pearson's R	
	Responsibility	0.534	***
	Externalizing Problem Behaviors	-0.294	**
	Internalizing Problem Behaviors	-0.098	*

Note: * = small correlation, ** = moderate correlation, *** = strong correlation

Table 4-13: Summary of findings for gender and statistically significant ($p < 0.05$) psychosocial subscales for children and parents.

Children's Self-Reports Scale	Subscale	*p*-value
COOP-A		Mann-Whitney U
	Emotional Feelings	0.647
	Overall Health	0.424
BASC-2		*t*-test
	Emotional Symptoms Index	0.632
Parental Reports Scale	**Subscale**	***p*-value**
COOP-A		Mann-Whitney U
	Pain	0.545
	School Work	0.803
	Emotional Feelings	0.562
	Self-Esteem	0.960
BASC-2		*t*-test
	Externalizing Problems	0.210
	Internalizing Problems	0.783
	Behavioral Symptoms Index	0.460
	Adaptive Skills	0.110
SSRS		*t*-test
	Responsibility	0.548
	Externalizing Problem Behaviors	0.873
	Internalizing Problem Behaviors	0.540

Table 4-14: Statistical findings across psychosocial scales for children's self-ratings in language-impaired versus language-normal APD subgroups.

Children's Reports					
Scale	Subscale	*t*-value	*df*	*Z*-value	*p*
COOP-A					
	Physical Fitness	n/a	n/a	-0.698	0.485
	Pain	n/a	n/a	-1.462	0.144
	Stress	n/a	n/a	-0.723	0.470
	School Work	n/a	n/a	-1.232	0.218
	Emotional Feelings	n/a	n/a	-0.552	0.581
	Behavior	n/a	n/a	-0.315	0.753
	Social Support	n/a	n/a	-1.125	0.261
	Self-Esteem	n/a	n/a	-0.482	0.630
	Family	n/a	n/a	0.000	1.000
	Health Habits I	n/a	n/a	0.000	1.000
	Overall Health	n/a	n/a	-0.305	0.760
	Energy	n/a	n/a	-0.218	0.827
BASC-2					
	School Problems	1.525	17	n/a	0.146
	Internalizing Problems	0.672	17	n/a	0.511
	Emotional Symptoms Index	1.093	17	n/a	0.291
	Inattention/Hyperactivity	-1.113	17	n/a	0.281
	Personal Adjustment	-0.187	17	n/a	0.854
SSRS					
	Cooperation	-0.771	17	n/a	0.451
	Assertion	0.536	17	n/a	0.599
	Empathy	0.911	15.21	n/a	0.377
	Self-Control	0.270	17	n/a	0.270

Table 4-15: Statistical findings across psychosocial scales for parent ratings of children in language-impaired versus language-normal APD subgroups.

Parental Reports Scale	Subscale	*t*-value	*df*	*Z*-value	*p*
COOP-A					
	Physical Fitness	n/a	n/a	-0.414	0.679
	Pain	n/a	n/a	-0.588	0.556
	Stress	n/a	n/a	-0.611	0.541
	School Work	n/a	n/a	-0.087	0.930
	Emotional Feelings	n/a	n/a	-0.478	0.633
	Behavior	n/a	n/a	-0.185	0.853
	Social Support	n/a	n/a	-1.219	0.223
	Self-Esteem	n/a	n/a	-0.387	0.699
	Family	n/a	n/a	-0.256	0.798
	Health Habits I	n/a	n/a	0.000	1.000
	Overall Health	n/a	n/a	-0.576	0.565
	Energy	n/a	n/a	-0.149	0.882
BASC-2					
	Externalizing Problems	1.399	16	n/a	0.181
	Internalizing Problems	0.106	16	n/a	0.917
	Behavioral Symptoms Index	0.734	16	n/a	0.473
	Adaptive Skills	0.854	16	n/a	0.406
SSRS					
	Cooperation	-1.082	14	n/a	0.297
	Assertion	-0.334	15	n/a	0.743
	Responsibility	0.405	16	n/a	0.691
	Self-Control	1.449	16	n/a	0.167
	Externalizing Problems Behaviors	-0.466	16	n/a	0.648
	Internalizing Problem Behaviors	-0.127	16	n/a	0.901

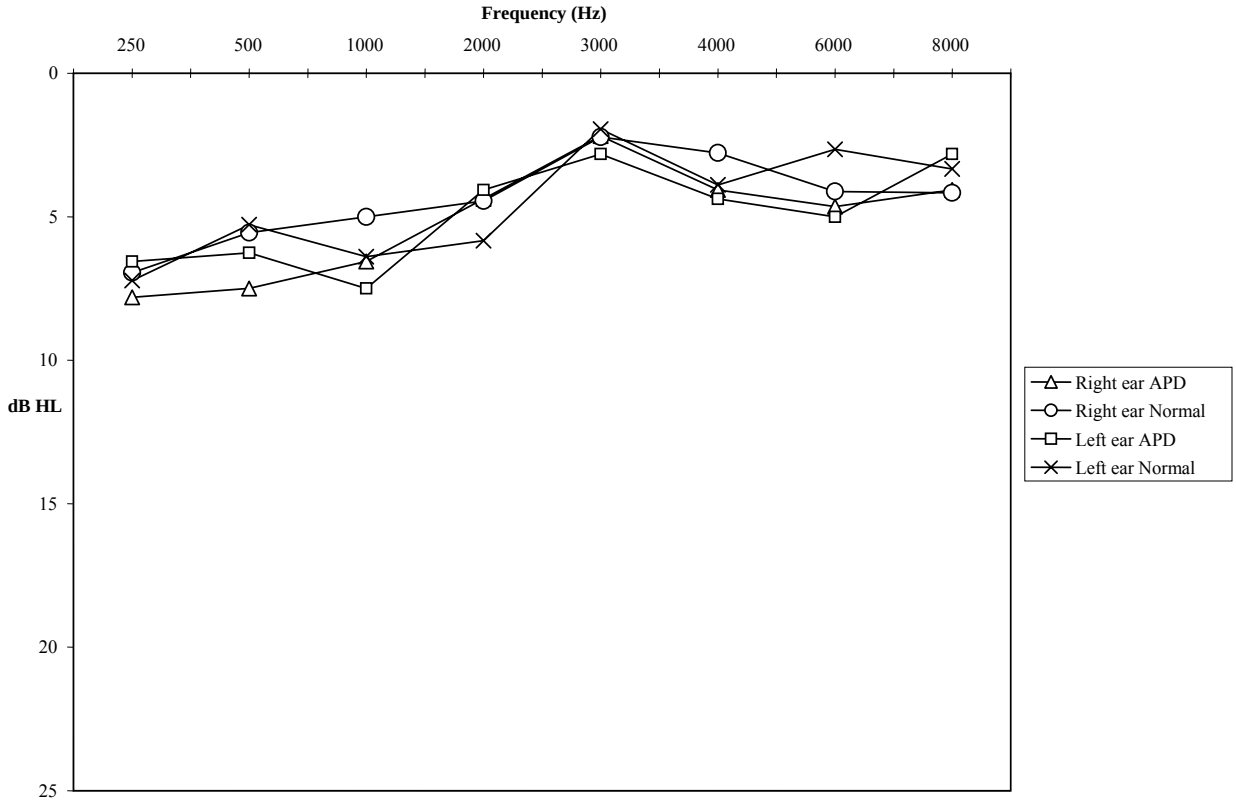

Figure 4-1: Mean audiometric results for right and left ears of participants in the APD and normal groups.

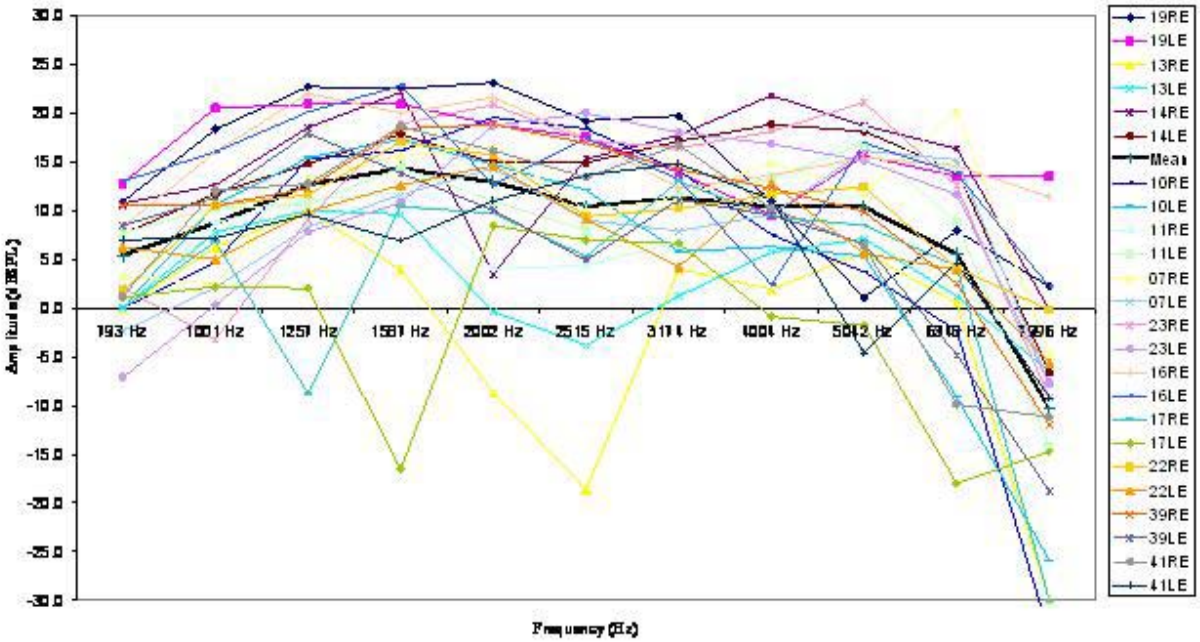

Figure 4-2: Compiled Towson University APD group DPOAE data with mean group data line in bold. Each line represents the DPOAE findings for each ear (RE or LE accordingly in legend label) for each participant (first two digits of legend label represent subject identification number) in the APD group.

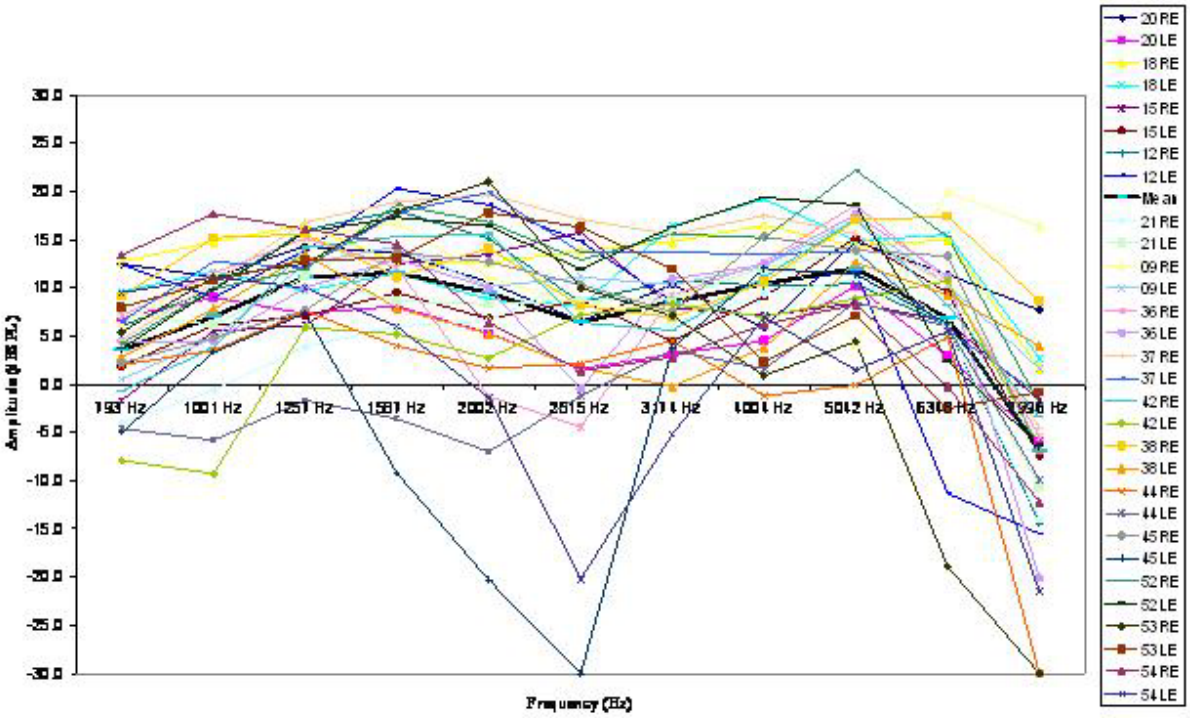

Figure 4-3: Compiled Towson University normal group DPOAE data with mean group data line in bold. Each line represents the DPOAE findings for each ear (RE or LE accordingly in legend label) for each participant (first two digits of legend label represent subject identification number) in the normal group.

CHAPTER 5
DISCUSSION

The purpose of this study was to examine the psychosocial status of children with APD, with an aim to increase the knowledge base of the community of professionals working with these children regarding possible non-auditory factors that may be influencing their quality of life. The investigation was designed to compare the self- and parent reports of children with APD to those of a gender- and age-matched peer group without APD on three psychosocial questionnaires (COOP-A, SSRS, and BASC-2).

Thirty-nine children served as participants for this research study. APD was confirmed for nineteen participants enrolled in the experimental group, while twenty participants with no evidence of APD by formal assessment were enrolled in the normal group. Thirty-seven mothers of the participants served as parental raters (19 in the APD group and 18 in the normal group). Following a comprehensive diagnostic evaluation of peripheral and central auditory function, as well as screening assessments of auditory attention, language and intellectual function, the participants and their parents were asked to complete the COOP-A, BASC-2, and SSRS questionnaires. Statistical analyses were conducted via two-group comparison methods for ratings on the three instruments. Overall, the major finding from this study is that children with APD exhibit psychosocial difficulties similar to or greater than children without APD. For several subscales of the psychosocial instruments, findings for both the APD child and parent groups differed from those for the normal group.

Children's Self-Reported Psychosocial Status

There were significant differences between groups on the participant's self-completed Emotional Feeling ($p = .011$) and Overall Health ($p = .037$) subscales of the COOP-A, and the Emotional Symptoms Index for the BASC-2 ($p = .045$), with the APD group reporting more

difficulties than the normal group. Recall that the COOP-A is a screener, and each chart is its own subscale. In other words, the Emotional Feeling subscale is a single chart, and as such, received a single rating between 1 and 5. The COOP-A is very quick and its validity as a screener has been demonstrated. However, the COOP-A is only a screener, and does not hold the weight of more rigorous and thorough comprehensive assessments, such as the BASC-2 or the SSRS. Though the data from screeners should not be used to represent important qualities, the COOP-A was utilized in this study because previously published had suggested its appropriateness for use with children who had auditory deficits, and because it was going to be used in combination with two other psychometrically sound psychosocial assessments. Since there are only two subject groups, one can simply examine and compare the mean ratings to determine the direction and interpretation of the findings. The mean ratings for the APD group were higher than the normal group for all significant subscales, indicating the children in the APD group reported more problems than the children without APD.

The Emotional Symptoms index of the BASC-2 is specific to the children's self-report version, that is, this index is not included in the parent's version. It combines content items from both the Internalizing Problems and Personal Adjustment composite subscales, including areas such social stress, anxiety, depression, and self-esteem. High self-reported scores on the Emotional Symptoms Index composite subscale can reflect a global pattern of serious broad-based emotional disorders (Reynolds & Kamphaus, 2004). Children who display APD are more likely to display negative emotional symptoms than normal children. This finding draws a parallel with the significant COOP-A finding on the Emotional Feeling subscale chart, providing further evidence that the APD group reported more emotional symptoms than the normal group.

For the three statistically significant subscales based on children's psychosocial reports, there was a large effect size (r^2 = .165) for the Emotional Feelings subscale of the COOP-A. The Overall Health subscale chart of the COOP-A (r^2 = .111) and the Emotional Symptoms Index of the BASC-2 (eta squared = .104) were characterized by moderate effects. The strength of these effect sizes enhances the ability for their interpretation to be generalized to a larger population of children in this age group with APD.

An additional analysis of "Average" (ratings of 1 or 2) versus "At-Risk" (ratings of 3, 4 or 5) on the COOP-A responses was completed in order to determine the proportion of children who would be identified as needing further follow-up on the particular content area represented by each subscale chart (Wasson et al., 1994). The reader is again directed to Table 4.7 and Figure 4.6 for summaries of findings for proportions of students considered "At-Risk" from both groups for each subscale chart. The only statistically significant difference was found in the Stress domain (χ^2 = .034). The differences between the significant subscales found when utilizing the Mann-Whitney U procedures versus the chi-square analysis may be resolved by analyzing the inherent distinctions between the two statistical methods. The Mann-Whitney U test is evaluating mean rankings of the 1-5 ratings on the subscale charts, while the chi-square procedure works only with the nominal categories of "Average" or "At-Risk." Therefore, on the Stress subscale chart, for example, the mean ranks were 17.55 and 22.58 for the normal and APD groups, respectively, and the Mann-Whitney U analysis suggested that no statistically significant difference exists between the two groups for this subscale (p = .145); however when broken down into the dichotomous nominal categories the chi-square analysis was significant (χ^2 = .034) for a greater proportion of children with APD to be considered at-risk for problems in this area.

Parental Perceptions of Psychosocial Status

Statistically significant differences by parent report were found on subscales of all three psychosocial instruments utilized in the present investigation: the Pain, School Work, and Emotional Feeling subscale charts of the COOP-A; the Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index and Adaptive Skills Index subscales of the BASC-2; and the Responsibility, Externalizing Problem Behaviors and Internalizing Problem Behaviors subscales of the SSRS.

The COOP-A was designed as a self-rating scale for use by pre-teens and adolescents when working with primary care physicians in their practices. Parents of subjects in this investigation, however, were asked to complete the COOP-A according to their perceptions of their child's psychosocial status for the various charts. These directions were also given to parents completing the COOP-A during a pilot investigation of psychosocial characteristics of children with APD (Kreisman, Crandell & Hall, 2004), and they proved to be a useful modification. In the pilot study, parents tended to corroborate their children's self-perceptions. In the present investigation, findings suggest that parents report more social and emotional difficulties for their children with APD than parents of the children with normal auditory abilities. Statistically significant differences were found between groups with moderate to large effect sizes for the Pain ($p = .032$, $r^2 = .125$), School Work ($p = .032$, $r^2 = .122$), and Emotional Feeling subscale charts ($p = .032$, $r^2 = .140$

Pearson chi-square tests for independence on the proportion of "Average" (ratings of 1 or 2) versus "At-Risk" (ratings of 3, 4 or 5) responses on the COOP-A were again completed in order to determine the proportion of children who would be identified by their parents as potentially needing further follow-up in a particular content area. Statistically significant differences were found in the Pain ($\chi^2 = .004$) and Self-Esteem ($\chi^2 = .009$) domains. These

findings once again indicate a greater tendency for parents of children with APD to report at-risk function for their children in these areas.

On the comprehensive behavioral questionnaire the BASC-2, parents of children with APD reported significantly more problems for all four composite subscales. There were large effect sizes for all findings: Externalizing Problems ($p = .004$), Internalizing Problems ($p = .001$), Behavioral Symptoms Index ($p < .0005$) and Adaptive Skills Index ($p = .017$). Additionally, parents of children with APD reported significantly more social skills difficulties for their children on the SSRS forms than parents of the children in the normal group on 3 of the 6 subscales measured, with moderate to large effect sizes: Responsibility Skills ($p = .020$), Externalizing Problem Behaviors ($p = .045$), and Internalizing Problem Behaviors ($p = .014$).

Taken in combination, these findings from parental reports on the three psychosocial instruments utilized in the study indicate an overall pattern of parental concern regarding reduced emotional health status, poor or inappropriate behaviors, and difficult adaptations to school that their children may be experiencing. Interestingly, parents reported over three times as many significantly differing subscales as their children. There may be several possible explanations for this difference in perceptions for children versus parents. Could it be that the children with APD are underreporting their emotional and social problems? Or, are parents overly-sensitive to the difficulties of their children, and perhaps over-reporting difficulties? Educational audiologists and others who interact on a regular basis with children diagnosed with APD can attest to the frequent subjective challenges, difficulties and delicacies involved with working with their parents, often much more so than the children themselves. Parents of children with APD can appear at times to be: demanding, judgmental, insensitive, overly-sensitive, anxious, depressed, overwhelmed, guilt-ridden, beleaguered, and fatigued. Could it be that part of the

reason these parents may come across to professionals with any or all of the above traits is because they are reflecting some of the psychosocial problems they perceive their children to be experiencing?

Language Function Status of the APD Group

A somewhat unexpected finding uncovered on post-hoc analysis was the lack of statistically significant differences on any subscale between children in the APD group who had a confirmed or suspected language disorder ($n = 9$) versus those with no evidence of language disorder ($n = 10$). While interpretation of this negative finding should be guarded due to the small size of the subject sample, it suggests that APD may impact psychosocial function of children more than other communication disorders. In many ways, and to many professionals who work with children with communication disorders, auditory processing would appear to be invariably linked with language function, and language function intrinsically linked with psychosocial status. It is reasonable to assume that poor speech perception inevitably leads to disordered language reception or expression, poor reading or writing abilities, and a poor ability to effectively communicate and, therefore, that psychosocial function is similarly impacted by all of these disorders. However, the recent work of Wible, Nicol and Kraus (2005), based on research with auditory evoked potentials, challenges the presumed correlation of brainstem and cortical auditory processing disorders with language-impairment. That is, the connection between auditory processing and language function may not be as clear-cut or unambiguous as one might suspect.

Limitations of this Study

This study has several limitations. First and foremost, it cannot be overstated that the COOP-A, while an effective screening instrument for quality of life concerns in adolescents when used in primary care physicians' offices, is not a psychometrically appropriate tool for

research. Further, as the study participants and their parents were not blinded to the categories in which they were included, it is very possible that their answers to the items on the psychosocial questionnaires were influenced by their feelings regarding their group status. As the study participants were recruited in a voluntary fashion, with contact initiated by most of the parents of the children with APD due to their concerns about their child's communication status, their group type was typically known from the outset and a halo effect may have impacted their responses. The study may have stronger implications if the parents and children participating could be blinded to their group status. Additionally, all subscales were analyzed by two-tailed statistical analysis procedures. While the use of the two-tailed procedures helped in guarding against Type I errors and inflation of results, additionally significant findings on psychosocial may have been observed by utilizing a one-tailed statistical design for those psychosocial areas that were hypothesized to be poorer in children with APD.

In additional to the design limitations, there were limitations regarding participants involved in the study as well. Data were collected and analyzed for a relatively small number of participants meeting the inclusion criterion and available to the investigator when the study was conducted. While moderate to strong effect sizes suggest that findings can be generalized to a larger population, statistical power would be greatly enhanced by a larger number of subjects. Also, due to the normative standards for the COOP-A, no participant below the age of 10 years could be included in the study. As many children are referred for comprehensive APD evaluations in first, second or third grades, the study would have more implications for school age children with APD if the age criterion could be stretched down as young as 7 years or even younger.

In addition to these limitations, the present research findings are restricted geographically to two essentially suburban college-town areas within the eastern United States. Further, while socio-economic status (SES) was indirectly monitored for consistency between groups, it was not overtly controlled, nor was racial or ethnic background. Finally, the absence of father and teacher ratings limits the findings to those of the mothers and the participants themselves, leaving out two important observers who may have remarkable viewpoints on the psychosocial status of these children.

Clinical Implications

The findings of this investigation confirm that children with APD experience emotional and social difficulties of significance when compared with their non-APD peers. Audiologists who provide diagnostic auditory processing evaluations need to be aware of, and to be able to provide informational counseling regarding, not only the communicative disorders associated with the diagnosis of APD, but also the psychosocial difficulties that these children may be harboring. Additionally, audiologists should be ready and willing to provide appropriate nonprofessional personal adjustment counseling within their scope of practice for these children with APD and their families, or to refer patients and their parents to appropriate professions for counseling. Just as English (2002) asserts that audiologists can and should be key professionals that may be able to help provide a "safety net" for children with hearing loss as they "(and their parents) face challenges in their psychosocial and emotional development" (p. 15), so too should audiologists be able to provide similar support for comparable difficulties faced by children with APD. Indeed, as Sanders (1993) pointedly pronounces, audiology programs should be held accountable regarding their ability to provide services for the whole child with auditory difficulties, as "It is the impact of the communication/learning handicap on the child's sense of self-worth and well-being that most severely limits the quality of his life" (p. 373).

Although the findings of the present investigation suggest that the COOP-A may provide for audiologists a clinically valuable and feasible measure of how a child with APD views his/her functional health across a broad range of content areas, it should be reiterated that it is not suitable for use as a research tool on its own. The COOP-A may also be utilized by parents to report their perceptions of the same issues regarding their child's quality of life. The COOP-A chart method is a quick, easy-to-use screening tool that appears to have validity for a brief indication of quality of life concerns in children aged 10 to 18 years with APD. In addition to a screening measure such as the COOP-A, audiologists should also consider the use of more rigorous psychosocial assessments such as the BASC-2 or the SSRS with their patients, from which they may find outcomes in children with APD that may also warrant nonprofessional counseling follow-up by audiologists, or even suggest referral for further evaluation and/or intervention by medical or psychological professionals.

Future Research

This study provides a springboard for much future research on the relation between psychosocial function and auditory processing disorders. Indeed, research is already underway by the author and colleagues to examine possible improvement in psychosocial function with the utilization of frequency modulation (FM) assistive listening technologies. Determination of the impact of age of identification and/or age of intervention or remediation on psychosocial status of children with APD is also needed. As the great majority (17 of 19) of experimental participants in the present investigation were formally diagnosed with APD within 6 months of their completion of this study, and none of them were younger than 9.5 years at their time of participation, it is highly probable that the psychosocial difficulties they and their mothers reported had changed over time. Inter-reporter differences (especially parent versus child) could

also be explored in future investigations to determine effective strategies for accurately defining psychosocial status for children with APD.

Possible differences in the psychosocial characteristics of children with APD versus language impairment also require further investigation due to conflicting research findings, hypotheses and subjective reports concerning the link between auditory processing and language. Futher elucidation of this relationship might be gained by evaluating the psychosocial status of children with a primary diagnosis of language impairment, as well as investigation of the various APD sub-categorizations (e.g. organizational deficits, integration deficits, auditory figure-ground deficits, temporal processing deficits and decoding deficits).

APPENDIX A
APD PARENT/PATIENT SURVEY

APD Parent/Patient Survey

Patient Name: _____

Date of Birth: _____ **Age:** _____ **Gender:** _____

Parent Name: _____

Address: _____

Contact #: _____ **Referred by:** _____

Please answer the following questions. We will review the responses on the date of the hearing evaluation.

	Yes	No	Maybe
• handedness? right or left (circle correct answer)			
• easily distracted?	___	___	___
• inattentiveness to sounds?	___	___	___
• problems paying attention to sounds?	___	___	___
• problem localizing where sound is coming from?	___	___	___
• problems hearing in noise or when others are talking?	___	___	___
• complains about loud sounds in the environment?	___	___	___
• confuses directions or can't follow demands?	___	___	___
• reverses words, numbers, letters, etc?	___	___	___
• asks speakers to repeat (e.g. Says "What?" or "Huh?")?	___	___	___
• coordination problems?	___	___	___

Please continue on reverse side of sheet…

	Yes	No	Maybe
• musically inclined?	___	___	___
• ear infections as a child?	___	___	___
• ventilation tubes inserted for ear infections?	___	___	___
• noises in ear (e.g. seashore sound, ringing)?	___	___	___
If yes, examples: _____			
• intensive care nursery after birth?	___	___	___
• learning disability?	___	___	___
• speech and/or language disorder?	___	___	___
• attention deficit (hyperactivity) disorder (ADD/ADHD)?	___	___	___
If yes, treated with medication?	___	___	___
• others in family with language/hearing problems?	___	___	___
• How many hearing tests has your child had? (circle)		1 2 3 4 5 >5	

Comments: _____

_____

_____

_____

APPENDIX B
UNIVERSITY OF FLORIDA INFORMED CONSENT FORM

Date:

Dear _____:

At present, various research projects are being conducted in the Department of Communication Sciences and Disorders at the University of Florida to help us better understand the communicative difficulties experienced by individuals. I am a Clinical Professor at the University of Florida and would like to ask your cooperation in one such project: a study of how Frequency Modulation (FM) systems affect speech perception and emotional health in children with auditory processing difficulties. FM devices consist of a microphone and a small speaker (s). The speaker's voice, for example the teacher, is sent via radio signal from the microphone to the speaker that is placed near the listener (the student). FM devices are commonly used in noisy environments to ensure optimal speech understanding.

If you (and your child) consent to have your child be a participant in this investigation, your child will first be seen for a complete hearing evaluation (listening to tones and words, and measurements of how the ear is functioning) either at the Department of Communicative Disorders at Shands Hospital or the Department of Communication Sciences and Disorder/University of Florida Speech and Hearing Clinic at Dauer Hall. And you will be asked to complete a case history form. Such tests are routinely done at both facilities to help us determine if an individual has a hearing loss. Your child will then receive one or more auditory tests to determine how the brain is processing or using special types of sounds, including words, sentences, and sequences of high and low pitch tones. These tests are typically given to children to assess their abilities to process, or listen to, auditory information. Each of these tests will require your child to listen to tones or words presented in one or both ears.

After the hearing and auditory processing tests, your child will then be seen at the Department of Communication Sciences and Disorders at the University of Florida and asked to listen to sentences (Hearing in Noise Test-HINT) with and without use of a Frequency Modulation (FM) system. The words and sentences will be presented in quiet and in a background of noise. The noise will be as loud as normal conversational speech.

Following these tests, you and your child will be given questionnaires [The Dartmouth Primary Care Cooperative Information Project Charts for Adolescents (COOP), The Behavioral Assessment System for Children, Second Edition (BASC-2), The Social Skills Rating System (SSRS), The Listening Inventory for Education (LIFE), and The Screener Instrument for Targeting Educational Risk (SIFTER)] that will help the investigators to understand how each child learns best and give us more information relating to their emotional and social health. The questionnaires will be presented in a face-to-face interview format whenever possible. Your child may either respond to the questions verbally, by marking their desired response, or simply by pointing to their desired response.

Auditory evoked cortical responses, such as the Auditory Late Response and the P300, will be measured in participants who are fit with an FM system. This is necessary to document

electrophysiological changes in auditory processing of speech stimuli. These are completely non-invasive procedures in which brain activity is recorded in response to auditory stimuli. These measures are obtained routinely for diagnostic purposes in both of the participating speech and hearing centers.

Your child will be at no risk during this experiment. All of the above procedures and instrumentation for this research are routinely used in clinical and/or research procedures at the Department of Communication Sciences and Disorders and Department of Communicative Disorders. All procedures are considered non-invasive in nature, in that there will be no sort of shots or other instruments used that will break or puncture the skin. There should be minimal discomfort during this investigation. All loudness levels used in this investigation are below the Occupational Safety & Health Administration (OSHA) allowable levels. OSHA is a governmental institution that regulates loudness levels and protects individuals from suffering from noise induced hearing loss. Their allowable levels are 85 decibels and below for an 8 hour time period. Our noise testing level is conducted at 65 decibels and takes less than 1 hour.

In addition to the information obtained from these evaluations, whenever feasible and approved by the School Board of Alachua County the participants' results on the Florida Comprehensive Assessment Test (FCAT) will be included in analysis of your child's academic performance. The FCAT is administered to students in Grades 3-11. It consists of two basic components: criterion-referenced tests in mathematics, reading, science, and writing, and norm-referenced tests in reading and mathematics. Performance of individual students is measured against national norms. Permission will be obtained from the Alachua County School Board prior to use of these test results.

All test results and information obtained from this investigation will be kept confidential to the extent provided by law. All forms and information pertaining to participants will be coded by an identification number. Names of participants will appear in a master roster to be kept only by myself. Upon completion of this investigation, the master roster will be destroyed. In all probability, there will be publications and presentations of the results of this study. Most scientific reports and publications present results such as this in statistical form, and in some instances, case studies are presented. In either case, your child's identity will be kept confidential to the extent provided by law.

You are free to withdraw your child's consent and discontinue participation at any time prior to completion of this investigation. Your child's participation or non-participation will not affect any treatment or services you are receiving at Communicative Disorders or Communication Sciences and Disorders. None of the records obtained from this study will go into your child's record. In addition, there will be no direct benefit to your child from this study. However, your child will receive the above-mentioned hearing evaluations and compensation of $10.00 for parking and travel fees.

Throughout the study, the researchers will notify you of new information that may become available and might affect your decision to remain in the study. If you wish to discuss the

information above or any discomforts you may experience, you may ask questions now or call the Principal Investigator listed at the bottom of this form.

If you agree to have your child participate in this investigation, please fill out the bottom of this form.

I have read the information contained in this form and give my consent to have my child participate in the research project outlined there.

Signature of Participant: _____

Name (please print): _____

Address: _____

Birthdate: _____ Telephone: _____

Signature of Investigator: _____

Signature of Witness: _____

If you have any questions regarding this study, please feel free to contact me at the telephone number and address below. Questions or concerns about the research participants' rights can be directed to the UFIRB, PO Box 112250, University of Florida, Gainesville, FL 32611-2250 Phone: (352) 392-0433.

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APPENDIX C
TOWSON UNIVERSITY INFORMED CONSENT FORM

TOWSON UNIVERSITY
INFORMED CONSENT FORM

Title of Study: Speech Perception and Psychosocial Function in Children with Auditory Processing Disorders

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Purpose of the Study:

The purpose of this study is to examine the social and emotional health in children who have auditory processing disorders and the effects of frequency modulated (FM) systems on their speech understanding and quality of life. Frequency modulated systems are a type of technology used to improve speech understanding in difficult or noisy listening environments such as within a classroom. An auditory processing disorder is a weakness in the ability to understand speech and other sounds, such as tones, in different listening conditions. Assessment of auditory processing deficits goes beyond the simple hearing test to evaluate how quickly and accurately sounds are processed.

Participants:

Young adults (ages 10 to18) who are native English speakers, have normal hearing, and are free from significant medical problems, including attention deficit disorder, may qualify for these study groups:

Group 1: Young adults who have auditory processing disorder.
Group 2: Young adults who have language disorder.
Group 3: Young adults with normal auditory processing and language abilities.

Procedures:

Participants who qualify for the study will first be seen for a complete hearing evaluation (listening to tones and words, and measurements of how the ears are functioning) at the Towson University Speech-Language-Hearing Clinic. Such tests are routinely done at the Speech-Language-Hearing Clinic to help us determine if an individual has a hearing loss. Participants will also undergo a screening evaluation for language disorders, and a standardized non-verbal intelligence task. Participants will then receive one or more auditory tests to determine how the brain is processing or using special types of sounds, including words, sentences, and sequences of high and low pitch tones. These tests are typically given to children to assess their abilities to process, or listen to, auditory information. Each of these tests will require the participant to listen to tones or words presented in one or both ears. The parents of the participants will be asked to complete a case history form.

After the hearing and auditory processing tests, the participant will be asked to listen to sentences and words with and without a Frequency Modulation (FM) system on. FM devices consist of a microphone and a small speaker(s). The speaker's voice, for example the teacher, is sent via radio signal from the microphone to the speaker that is placed near the listener (the student). FM devices are commonly used in noisy environments to ensure optimal speech understanding. The words and sentences will be presented in quiet and in a background of noise. The noise will be as loud as normal conversational speech. Following these tests, the participants and their parents will be given questionnaires that will help the investigators to understand how each child learns best and give us more information relating to their emotional and social health.

All audiological and speech perception testing will either be completed by an Audiologist who holds a Certificate of Clinical Competence from the American Speech-Language-Hearing Association (ASHA) and holds a valid License in the State of Maryland, or by a Towson University Doctor of Audiology (Au.D.) student under the direct supervision of a Certified and Licensed Audiologist. All audiological and speech perception testing will take place inside a sound treated booth. The evaluations will be conducted over two sessions on one day (morning and afternoon) with each session lasting about 2-3 hours. A one-hour lunch break will be provided, and if participants appear tired at any other stage during testing, they will also be offered breaks

Benefits:

It is hoped that the results of this study will have beneficial effects in identifying the social and emotional health of young adults with auditory processing disorders, and provide valuable insight into potential improvements in speech perception that may be obtained by an FM system.

Risks:

There are no known risks associated with participation in this study. Standard audiological testing and questionnaire techniques will be employed. The sound intensity levels will be carefully monitored, and will be no louder than the level of normal conversational speech. Should the assessment become distressing to the participant, it will be terminated immediately.

Cost Compensation:

1. Each participant will receive a free hearing and auditory processing assessment with comprehensive written report.
2. When appropriate, a recommendation for a fitting and trial use of a suitable FM system will be made.
3. Each participant will be paid $20.00 for their completion of the study.

Rights as a Participant:

1. Subject's participation in this study will remain strictly confidential. Only the principal investigator will have access to the identities of the subjects and information associated with their identities. Any data collected through the computer system will be labeled using a code number which will be randomly assigned to the subject. This computer will be password protected and all other information related to the study will be held in a locked cabinet in the Principal investigator's office. Although the information gathered may be published or presented, at no time will identifying information regarding subjects be used.
2. Participation in this study is voluntary. At any time prior to or during the study, the participant or his/her parent/guardian are free to discontinue participation. A decision not to participate or to withdraw from the study will have no effect on the individual's status or any current or future services he/she may be receiving at the Towson University Speech-Language-Hearing Clinic or any other clinic or school.
3. The participant or their parent/guardian are free to ask questions regarding the study and/or the test procedures. These questions will be answered by the investigator.
4. If any questions should arise regarding this study, please contact the principal investigator, Ms. Nicole Kreisman, Instructor in Audiology, at phone (410) 704-3617 or the Institutional Review Board Chairperson, Dr. Patricia Alt, Office of University Research Services, at phone (410) 704-2236.

Informed Consent:

1. I agree to my child's participation in a scientific study entitled "Speech Perception and Psychosocial Function in Children with Auditory Processing Disorders."
2. I understand the information given to me. I have received answers to all questions regarding this study.
3. To the best of my knowledge, there are no physical or mental issues present that would pose a risk while participating in this study.
4. I understand that participation is voluntary and that I may discontinue participation in this study at any time by informing the principal investigator.
5. I understand that I will receive a signed copy of this consent form.

_____ _____

Parent/Guardian Signature Date

____Affirmative agreement/assess of subject, _____

I certify that the informed consent form procedure was followed and all questions regarding this study were answered.

_____ _____

Principal Investigator Date

IRB Approval Number 06-A038 on 31-Jan-2006

APPENDIX D
RESEARCH PARTICIPANT RECRUITMENT FLYER

Young Adults (ages 10-18) Needed for a Study of Sound Processing

Title of Study: Speech Perception and Psychosocial Function in Children with Auditory Processing Disorders

Principal Investigator: Nicole V. Kreisman, M.A., CCC-A

Purpose of the Study: To examine the social and emotional health in children who have auditory processing and language disorders and the effects of frequency modulated (FM) systems on their speech understanding and quality of life.

Participants Needed: Young adults (ages 10 to18) who are native English speakers, have normal hearing, and are free from significant medical problems, including attention deficit disorder, may qualify for these study groups:

Group 1: Young adults who have auditory processing disorder.
Group 2: Young adults who have language disorder.
Group 3: Young adults with normal auditory processing and language abilities.

Procedures: The evaluations will be conducted over two sessions on one day (morning and afternoon) with each session lasting about 2-3 hours, by a Certified and Licensed Audiologist or a Doctor of Audiology (Au.D.) student under direct supervision of the Audiologist. Participants who qualify for the study will first be seen for a complete hearing and auditory processing evaluation at the Towson University Speech-Language-Hearing Clinic.

Next, participants will be asked to listen to sentences and words with and without a Frequency Modulation (FM) system on. FM devices consist of a microphone and a small speaker(s). FM devices are commonly used in noisy environments to ensure optimal speech understanding. Following these tests, participants and their parents will be given questionnaires that will help the investigator to understand how each child learns best.

Risks: There are no known risks associated with participation in this study. Testing is painless and standard audiological testing and questionnaire techniques will be employed. All sounds presented will be carefully monitored, and will only be as loud as conversational speech.

Compensation:

4. Each participant will receive a free hearing and auditory processing assessment with a comprehensive written report.
5. When appropriate, a recommendation for the fitting and trial use of a suitable FM system will be made.
6. Each participant will be paid $20.00 for their completion of the study.

If interested please contact:
Nicole V. Kreisman, M.A., CCC-A
Instructor in Audiology at Towson University

Approved by the Institutional Review Board (IRB) of Towson University on 31-Jan-2006

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BIOGRAPHICAL SKETCH

Nicole VanCleave Kreisman was born and raised in Des Moines, Iowa. She received her Bachelor of Arts in Communicative Disorders from the University of Northern Iowa, and her Master of Arts in Audiology and Speech-Language Pathology from the University of Memphis. She has worked as a clinical and educational audiologist for over 10 years. She began her doctoral work at the University of Florida in 2002. She has been privileged to work in the classroom and the clinic with Doctor of Audiology (Au.D.), Master of Audiology (M.Aud.), and undergraduate students at the University of Florida (Gainesville, FL), the University of Canterbury (Christchurch, New Zealand), and Towson University (Towson, MD). She has a son (Josiah), a daughter (Anna), and an incredible husband (Brian).