

NEURODEVELOPMENTAL PROFILES
FOR A SAMPLE OF CHILDREN ORIGINALLY DIAGNOSED
WITH ADHD

A DISSERTATION

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ADHD symptomatology. Results indicate no significant effects for age or gender. Examination of sample score profiles on the NEPSY indicate a similar pattern of neurodevelopmental weaknesses within each of the three groups. These patterns of weaknesses may manifest as behaviors that mimic those of ADHD, and may be the impetus for a misdiagnosis of the child as such. This may also support, however, the theory that ADHD exists along a continuum, with varying degrees of manifested impairment.

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CHAPTER I

INTRODUCTION

Although a number of studies suggest evidence of the strong role of parenting in the development of child psychopathology, little research has been conducted on the specific aspects of the parent-child relationship. Facets of this relationship may exacerbate or be exacerbated by the existence of a clinical condition such as ADHD. This issue presents a distinct need to examine the aspects of the parent-child relationship in order to determine an appropriate course of treatment based upon the strengths of the relationship, and the weaknesses that may be remediated.

Difficulties associated with disorders of attention, impulsivity, and hyperactivity in children have been considered the most chronic behavior disorders throughout the history of the study of pediatric psychology. These difficulties have also been the largest singular source of referrals to pediatric mental health institutions (Barkley, 1981). In the Diagnostic and Statistical Manual of Mental Disorders-fourth edition (DSM-IV) (1994), the American Psychiatric Association describes ADHD as a neurological disorder characterized by three primary traits: impulsiveness, inattentiveness, and hyperactivity. Certain individuals with ADHD may present as dreamy or withdrawn, whereas others may be restless, fidgety, or emotionally labile. Despite the attention this disorder has received, there is much controversy regarding its prevalence, classification, and overlapping symptomatology, as well as its very existence.

There are several theories regarding the classification of ADHD. Many theorists

assert that ADHD exists along a continuum that resembles a bell-shaped curve, suggesting a variance in the degree of disability. Several research studies have addressed the issue of overlapping behaviors between ADHD and other difficulties such as mood disorders and behavioral issues. One of the greatest obstacles to effective treatment of many of these disorders is the level of familiarity with ADHD acknowledged by both professionals and lay people. This familiarity predisposes adults to overlook emotional and behavioral issues that are completely unrelated to difficulties with attention.

Studies indicate that clinicians that accept the medical model, for example, tend to underrate the impact of psychosocial situations (such as the parent-child dyad) when assessing children with ADHD (Overmeyer, Taylor, Blanz, & Schmidt, 1999). Further, physicians who are familiar with ADHD tend to diagnose and treat children for that disorder rather than other disorders with overlapping symptoms such as anxiety. Empirical findings indicate the need to not only consider a possible comorbid condition when assessing children, but also the need to examine family psychiatric history as well as family system functioning in diagnostic assessments (McClellan, Rubert, Reichler, & Sylvester, 1990).

Although there are many behavioral assessment tools in existence, the difficulty of comorbid conditions remains. Many theorists postulate that a “pure” sample of children with only ADHD is impossible to find due to the high incidence rate of comorbidity with other disorders such as learning disabilities, anxiety, depression, and other behavioral disorders. Development of instruments such as the Behavioral Assessment System for Children (BASC) (Reynolds & Kamphaus, 1992) allows

practitioners access to more data regarding symptomatology. Despite an increased ability to identify symptoms, the difficulty of differential diagnosis remains an obstacle in standardized assessments of ADHD. Determining an accurate diagnosis allows for the most appropriate course of treatment to be provided. This prevents issues such as overmedication or unnecessary medication of the child.

CHAPTER II

REVIEW OF THE LITERATURE

ADHD

The basic tenet underlying ADHD stems from the original idea that the disorder was either innate or the result of brain damage. The prognosis was poor, regardless of the etiology of the problem. Emphasis was placed upon a broad range of difficulty with activity level, inattention, learning problems, speech difficulties, and motor impairment. Several terms have been used by professionals and the American Psychiatric Association (APA) to describe the group of symptoms related to ADHD, beginning with “Minimal Brain Dysfunction” (MBD) in 1902 (Barkley, 1990). Terminology for ADHD grew as the study of the disorder increased. “Organic driveness” emerged in 1917, followed by “restlessness syndrome” in 1957, and “Hyperkinetic Reaction of Childhood” in 1968. Most recently, Attention Deficit/Hyperactivity Disorder has been the accepted term (APA, 1994). For purposes of this study this term will be used to refer to all three subtypes of the disorder as classified by the DSM-IV (APA, 1994).

As the science of psychology has matured, the focus on ADHD has shifted from activity level to inattention and impulsivity, and eventually has returned to activity level. Interestingly, the symptoms described for MBD in 1902 are surprisingly similar to those listed in the DSM-IV for ADHD. Statistics from that time period indicate that the incidence rate for MBD was a 3:1 male to female ratio, the age of onset was by eight years, it was accompanied by low-average to average intelligence, and minor physical difficulties were

also common. At this time, still described the common behavioral characteristics of MBD as emotional lability, little inhibition, difficult to discipline, inattentive, and overactive.

The current male to female ratio for ADHD is reported to range from 2:1 to 10:1. Age of onset must be seven years, with symptoms persisting at least six months. These symptoms must be compared to developmental norms, and must occur in two or more domains. Ratings by teachers indicate the existence of the disorder in 10-20 percent of all school children, while parent ratings indicate the prevalence rate is approximately 30 percent (Barkley, 1990). As male children tend to exhibit externalizing behaviors more often than females, they are more likely to be referred and diagnosed with the disorder. With multimethod treatment approaches, the prognosis for children with ADHD is good, with many symptoms decreasing by puberty. These population base rates have also been robust when examining them cross-culturally, although ADHD is more likely to be diagnosed in the United States than in other countries (Searight & McLaren, 1998). This discrepancy may be due to differences in diagnostic criteria as well as cultural differences in family healthcare-seeking behaviors.

The high incidence rate of ADHD behaviors in the general population creates a greater ambiguity regarding the syndrome's presence or absence. This is further confounded by a high comorbidity rate with learning disabilities (LD), anxiety, depression, conduct disorder (CD), and oppositional defiant disorder (ODD). The presence of comorbid disorders may mimic or mask ADHD symptomatology. Several studies attempting differential diagnosis have been unsuccessful in separating ADHD from other disorders such as ODD with comorbid ADHD. While ADHD is viewed as a neuropsychological disorder, ODD is

thought to arise from family interactions. When given cognitive and family functioning measures, no significant differences could be found between children with ADHD and those with ODD (Searight & McLaren, 1998).

A consistently heated area of debate is the actual nature of ADHD.

Neuropsychological aspects have generally been accepted as playing a key role in the behaviors of disordered attention. Early descriptions of ADHD suggested a neurological etiology with the term “minimal brain dysfunction”. During the 1980’s the focus on ADHD was in descriptive diagnosis rather than causality, but current research suggests neuropsychological and neurophysiological factors in the disease. Barkley (1997) described a model for ADHD stressing a core deficit in behavioral inhibition and response patterns. These cognitive and metacognitive weaknesses have been linked to the orbital frontal brain and the dorsolateral prefrontal regions that are responsible for behavioral inhibition and working memory, respectively. More controversial is the extent to which environment has an effect upon the behavioral manifestations of these deficits.

In 1997, Quay suggested that ADHD is the result of an underactive behavioral inhibition system (BIS). Ideally, the BIS responds to conditioned punishing stimuli by focusing attention on environmental cues relevant to avoidance and extinction and reducing response output. Individuals with ADHD have dysfunction in this system, and therefore cannot cease responding regardless of the presence or absence of reinforcement. This would render traditional strategies in parenting and classroom management ineffective with children who have ADHD.

Internalizing symptoms of ADHD can be attributed to unique aspects of the parent-child dyad that have a negative interaction pattern. Children who exhibit internalized symptoms of ADHD tend to endorse their parents as less accepting than those of controls. Observers found these parents to be less granting of psychological autonomy than controls as well (Siqueland, Kendall, & Steinberg, 1996). Data supports the theory that the core schemata around which children organize their information processing are formed through early learning processes via communication with the family. In children with internalized symptomatology, these communications are characterized by negative messages about the children themselves, the world, or the future. An overall characteristic of parents of internalizing children is over-intrusiveness via extreme control. This control would lead to a distinct lack of autonomy for the child, which begins the pattern of negative interaction within the dyad (Rubin & Mills, 1990).

The overt symptoms of inattention and overactivity are attributed to impairment of self-regulation and executive function. This impairment indicates dysfunction in the frontal lobe of the brain, which is responsible for the regulation of these functions. Frontal lobe dysfunction in behavior has only recently become the focus of scientific investigation.

Neurodevelopmental Perspectives

Recent advances in the study of developmental neurobiology indicate a reactive component in the problem behavior of children. Neurochemical changes in the prefrontal cortex (PFC) during stressful periods may cause an imbalance in this region that renders a child unable to govern his/her behavior. The PFC is used for working memory, which

guides the individual in the use of appropriate behavior. Through the use of representational ability, humans are able to effectively guide behavior. This frees the individual from responding to the immediate environment by inhibiting reaction to distracting stimuli. The PFC, in essence, helps the individual filter, plan, organize, and inhibit behavior.

An interesting aspect of ADHD is that individuals with the disorder do not demonstrate deficiencies in attention across all domains at all times. A common misconception is that the ability to focus sustained attention on a singular task eliminates the possibility of an accurate ADHD diagnosis: this vein of thought is grossly inaccurate. Individuals who remain on task in one setting may be completely unable to focus in another situation. Children with ADHD often have difficulty attending to stimuli in school, yet can play a video game for hours. These behavioral discrepancies lead to the discussion of the role of motivation in attention and impulse control. If an individual becomes off-task, then motivation has been shifted to something more salient. This links the construct of motivation to the mechanisms of attention, impulse control, and sustained behavior. Due to increased dopaminergic activity at the synapse during specific behaviors, the reinforcement is immediate, and therefore the behavior is sustained. Engaging in the behavior generates stimulation and interest. This mechanism for focusing behavior appears to be controlled by phylogenetically older brain structures. Individuals with ADHD are as capable of sustaining attention as normals when motivation stems from reward. This is in contrast to the impulsive behaviors associated ADHD, which are not affected by the presence of reward or punishment (Searight & McLaren, 1998).

There remains, however, another category of sustained behavior: this behavior concerns tasks that include a delay. Delayed reinforcement tasks lead to the exploration of higher-level, complex cognitive functioning. Certain behaviors require the formulation of a goal, and the development of plans to achieve it. Possible consequences of behaviors must also be evaluated. Obviously, these types of behaviors require a considerable amount of self-direction as well as self-monitoring. These activities rely on phylogenetically newer brain structures and specific frontal lobe functions. Frontal lobe functions that are pertinent to this discussion are as follows:

1. Attention to the environment and tasks
2. Self-motivation and direction
3. Goal formulation and planning
4. Response/behavioral inhibition
5. Assessment/anticipation of consequences and outcomes
6. Programming of complex adaptive behaviors
7. Self-monitoring and correcting behaviors
8. Integrating sensory and affective (social cognition) input with behavior

Behavioral deficits tend to emerge in children when situations require the application of executive function strategies. Most neurologic data indicates that there is frontal lobe dysfunction in individuals with true ADHD. Several research studies have indicated that specific brain wave differences in the frontal cortex become dramatically pronounced when children with ADHD are challenged with academic tasks. In brain

mapping studies, children with ADHD displayed lowered beta activity in the frontal cortex at baseline as compared to normals. Presentation of an academic task further decreased the beta activity in the ADHD children (Lubar, 1991). These findings suggest that individuals with ADHD experience the same deficits as those with orbital frontal lobe impairment.

Quay (1997) presented ADHD children's response patterns, magnetic resonance imaging (MRI) patterns, and responses to methylphenidate as support for his theory regarding dysfunction in the septohippocampal area, which is connected to the frontal cortex. The MRI studies found that children with ADHD have a smaller corpus callosum in the rostrum and rostral body, which correlates significantly with previous research regarding impulsivity and hyperactivity (Searight & McLaren, 1998). Further research with children with ADHD indicated that when striatal regions of the child's brain are hypoperfused with blood flow, primary sensory and sensorimotor areas are highly perfused (Lou, Henriksen, Bounh, and Nielsen, 1989). This indicates that when areas of the brain responsible for attention are experiencing low activity, areas controlling motor response experience overactivity. Methylphenidate has been shown to increase striatal activity, increasing attention and subsequently reducing uninhibited response patterns as well. Although these findings are intriguing, there remains a controversy over the etiology of this disorder. The factor analytic loading of inattention and hyperactivity suggest that this disorder may be multiply determined. There is, however, a general acceptance that ADHD is a disorder of the central nervous system in which dopaminergic activity is interrupted.

Current neurobiological research indicates that even mild psychological stress can cause a “functional lesion” of the PFC (Arnsten, 1999). This can be interpreted that behavioral disorders may be the manifestation of patterns of neural firing. These patterns are dependent upon the functional balance of neurotransmitter substances as they are distributed within relevant regions of the brain (Koziol & Stout, 1994). The distribution of neurotransmitters and their patterns of neural firing can “imitate” what is observed in patients with documented brain lesions. Interrupting a neural network chemically can generate similar behavior.

During stress, catecholamines are released into the peripheral and central nervous systems. In the brain, this impairs the working memory function of the PFC, and is most evident during periods of stress over which the individual perceives little control (Arnsten & Goldman-Rakic, 1998). Dopaminergic activity also plays a significant role in this process. Electrophysiological recordings indicate that PFC neuronal function can be interrupted by the overstimulation of D1 receptors. Neurochemical research indicates that large amounts of D1 agonist causes the abolition of the calcium currents that convey signals along the dendrites. This in effect “strangles” any information being transferred from dendrite to soma and erodes responses of working memory that should be guiding behavior (Zahrt, Taylor, Mathew, & Arnsten, 1997).

The activity of the neurochemicals to take the PFC “offline” during moments of stress may have had distinct evolutionary value. However, these functions may be maladaptive in aspects of human society, where PFC regulation is required for socially appropriate behavior such as in the classroom. If PFC imbalance were greater when the

individual feels a lack of control over the stressful situation, this would explain how parental stress and negative parent-child interactions could be linked to problem behaviors in children.

The mechanism for attention is not compartmentalized in one area of the brain. Individuals with attention disorders have brain activity that is unified, although inefficient and dysfunctional. Disordered behavior is the result of the interaction of various brain systems. The striatum is responsible for the integration of sensory input and motor output: dysfunction in this area can result in a marked inability to filter out irrelevant stimuli. The striatum is comprised of the caudate and the putamen, which have a role in complex human behaviors that include sensory and motor components. The striatum somehow serves to provide a template by which an individual can compare novel experiences to stored information. Dysfunction of this area would severely limit the retrieval of appropriate behaviors from the individual's repertoire. Frontal-striatal dysfunction would cause a deficit in the sensory-motor gating system. Subsequently, this could result in active responses to stimuli that should not elicit behaviors. As this area of the brain is the last to develop, not reaching maturity until adolescence, children will display more profound manifestations of dysfunction in the frontal lobe (Harnishfeger & Bjorklund, 1994).

Despite the prevalence of ADHD, and the evidence of its link to frontal lobe dysfunction and imbalance, diagnosis and treatment of the disorder remain complex issues. This issue is further confounded by disagreement among professionals in regard to the etiology and pathology of the disorder. Clinicians who adhere to a physiological view

of ADHD may discount familial factors in both the etiology and pathology of the disorder.

Due to the impact that ADHD symptoms have upon unaffected individuals, the disorder is known as one of “disruptive behavior” (Goldstein, 1999). Unlike other disruptive behavior disorders, ADHD reflects more behavioral limitations as a result of incompetence or developmental impairment as opposed to purposeful noncompliance. In spite of this lack of overt noncompliance, children with ADHD often bring upon a negative, reinforcing interaction pattern with adults in their lives. This leads to the expected complaints of parents and teachers in regard to behaviors manifested by children with ADHD.

An additional confound to effective treatment of children with ADHD is the externalization of responsibility exhibited by many individuals with the disorder. They frequently blame circumstances or other people for difficulties in their lives. This defensiveness appears to typify a specific cognitive style. Concrete thinking, which focuses on the present, is the marker for this mode of cognition. In non-clinical populations, this cognitive style is closely linked with specific parenting styles. Authoritarian parenting and permissive parenting can be linked to the development of an external locus of control in children because of the disruption of initial feelings of self-efficacy each style may cause (Baumrind, 1967).

There is much disagreement and speculation as to what causes this set of childhood difficulties. Furthering this disagreement is the fact that each child presents with ADHD uniquely in terms of the manifestation of the disorder (Goldstein &

Goldstein, 1990). Many researchers posit that ADHD is a disturbance of the reward system, a learning disability, or a self-regulatory disorder (Goldstein, 1999).

Increasingly, many researchers are acknowledging the possible effects the parent-child relationship may play in the etiology/pathology of ADHD as well as the effect ADHD has upon the relationship itself.

Medicalization

Medicalization occurs when one diagnoses and treats individuals in non-disordered states (Barsky & Borus, 1995). Distress has become increasingly medicalized in Western cultures, in that what was once tolerated as discomfort has become symptom clusters in need of medical attention. Many symptom groups have grown into syndromes with unclear etiology which gain acceptance through the media and word of mouth.

Examples of culturally created illnesses are “sick building syndrome”, “food hypersensitivity”, and “chronic fatigue”. As with ADHD, these syndromes have an unclear etiology and significant symptom overlap with non-clinical distress. In recent history, society has decreased in its tolerance of self-limiting conditions associated with diminished performance in social, work, and school settings (Searight and McLaren, 1998).

In 1995, Barsky and Borus asserted the presence of a growing industry that is actively promoting a medical model approach to minor physiological deviance and distress. As is common with many somatic symptoms, ADHD behaviors are nearly always present within the non-clinical population. The high incidence of reported cases of ADHD combined with the prevalence of inattentive and hyperactive behaviors in the

classroom provide the means for perpetuating this trend. Availability of literature on ADHD increases parents' and teachers' sensitivity to "symptoms" and results in increased referrals and physician visits. ADHD is most often treated by primary care physicians who do not provide for a psychological evaluation, and often prescribe medication on the first office visit.

Stimulant therapy, which is the exclusive treatment for a large majority of children with ADHD, is likely to occur without family therapy, psychoeducational assistance, or behavioral intervention. Current data indicates that methylphenidate often benefits non-ADHD individuals, therefore, physicians and parents alike may be reinforced in their ADHD diagnoses. The immediate gratification provided by stimulant therapy tends to be the impetus for physicians repeatedly offering the ADHD diagnosis. Other externalizing behavioral disorders such as CD or ODD require extensive behavioral therapy for improvement. This is also a valid point when addressing issues of family dysfunction and its role in the etiology of non-clinical disordered behavior.

Sontag (1978) asserted that disorders capture popular attention when they reflect current cultural anxieties. The illness becomes a "social metaphor" emerging from the projection of society's collective fears. The metaphoric meaning is somewhat unclear for ADHD. It is possible that ADHD reflects concerns about the erosion of the family and family values. Difficulties in the public education system may also play a role in this phenomenon. Inattention, concentration difficulties, and distractibility may actually be linked to a syndrome, but may also be perceived in children, adolescents, and adults who simply cannot contend with increased demands for performance coupled with decreases

in social support. This would hold especially true for children who are experiencing discord or dysfunction within the family system.

Family Systems Perspectives:

Most of the concepts that guide experience are developed within the context of the family system. The family also develops conceptions of each of its members. Therefore, both the individual's and the family's conceptions of health and abnormality are relevant when inspecting the associations between health, pathology, and the family unit. The family unit is composed of members who have mutual obligations to provide emotional and material support (Turk & Kerns, 1992). The family does not comprise all of the individuals' experiences, as children and adults acquire information from peers, coworkers, the media, and so on. The family does play a major role, however, in the development of attitudes and behaviors; adaptive and dysfunctional alike.

When professional help is sought for dysfunction, families remain responsible for managing treatment within the confines of the home. Moreover, mothers appear to evaluate symptoms of their children by comparing them to other family members (Turk & Kerns, 1992). Proponents of the family systems theory consider the family as a set of objects working together. According to this perspective, what is important is the relationship or interaction between the family members themselves, with emphasis on the modes of communication.

A key trait of a system is the need to maintain a balanced state. This homeostasis is the family's attempt to maintain equilibrium in the forces between the individual members. A change in one family member requires an adjustment on the part of all of the

other members in order to facilitate maintenance of the status quo. This is evident in children's reactions to parental psychopathology and parental response to children's disorders. When the patient becomes well, the illness that provided the homeostatic balance is no longer present. This results in the disturbed system shifting out of its precarious balance.

Families also function with the maintenance of "family myths". These concern each member of the family, their roles, and the mutual interactions of each one of them (Ferreira, 1963). As forerunners in the effects of the family system upon health, Minuchin and his colleagues (1975) examined modes of family interaction and how maladaptive modes may have an etiological or facilitative role in disorders and symptoms in children. Grolnick (1972) reported that families with rigid structures create their own constant stress because the members cannot adapt to new situations. This difficulty with change may initiate or perpetuate non-clinical disordered behavior in children as part of a maladaptive coping repertoire. This is further exacerbated by the fact that these families also exhibit a high degree of overprotectiveness. This results in a retardation of autonomy and competence as well as inhibition of personal control and problem solving abilities. In this type of system, a marked avoidance of conflict is also evident. A family system may promote a healthy condition, or may constitute the condition that precipitates the illness itself in that it fosters maladaptive thoughts and coping behaviors.

The impact that an individual's functioning has upon the family appears to be related to the roles the members play in the family and the previous level of systemic function (Turk & Kerns, 1992). For example, the mother or mother figure plays the

primary role in determining family decision-making styles, utilization of health-care services, and health beliefs held by the family. As was noted, the identified patient may serve a role by becoming the focus of attention, which prevents other family conflicts from being addressed. The family member who experiences the symptoms contributes to the family's beliefs about the degree to which the illness/wellness threatens homeostasis. The discrete structural features of the family as well as the stage in family's life cycle will affect the nature of the system's response to disordered behavior.

A transactional model of the family system highlights the level of the goodness of fit between the individual, the family, and environmental demands. Discrepancies between demands upon the family and its individual members constitute stress. The way a family perceives its potential responses to external and internal demands can result in the experience of stress (Turk & Kerns, 1992). In general, a transactional model views the family as both the recipient and perpetrator of stress, where the family's reaction to demands is also the shaper of the experience. Coping with stress is not limited to internal cognitive processes. Coping may be defined as efforts that are both cognitive and behavioral to manage demands that exceed an individual's resources.

Many researchers agree that parental behavior and other aspects of the family system may account for some of the differences observed within the ADHD population, such as the developmental course of the disorder. A developmental approach to child psychopathology is the idea that the original problem becomes evident at a very young age, and is exacerbated by qualities of the earliest parent-child relationship (Campbell, 1997). This view appears solid when regarding the intense need of infants and toddlers

for parental support and guidance in order to meet the challenges of healthy development.

Parents can skillfully help their children navigate complex issues such as the development of autonomy, or they can hinder progress, leaving their child lacking in areas of self-regulation. Variations in parental warmth, support, and control are major factors in determining how well toddlers will succeed in developmental transitions (Campbell, 1990).

Where parenting has direct effects upon the development of young children, several aspects of the family system are important to consider. Marital conflict, maternal depression, and stressful life events have a profound effect upon the child because they create tension in the home and have a disruptive effect upon parenting (Davies & Cummings, 1994). Factors within the family system and especially within the parent-child dyad have been proven not only to affect psychological functioning in children. Further, these factors also prolong the symptoms of dysfunction in a predictable, significant manner (Goldstein, 1999). Stability of problem behaviors over time does not lend a clear vision of why some children continue to have difficulties while others tend to “grow out” of them. Examination of parent variables as well as indicators of family stress/dysfunction will aid in this endeavor.

A significant area for consideration is the quality of the mother-child relationship: maternal sensitivity and responsiveness to the infant, in particular. Caregiver response to infants' distress and social initiations are integral components for the development of self-efficacy, a sense of well-being, and success at later social relationships. Several key studies have indicated that healthy attachment relationships in infancy lead to compliant

and prosocial behavior later in childhood (Campbell, 1997). When appropriate responses are given, infants with difficult temperaments can begin to regulate their own distress. Harsh, controlling responses may serve to exacerbate the infant's difficulty in controlling negative affective states (Calkins, 1994).

As important as warmth and involvement are in infancy, support and limit setting are more so in toddlerhood. At this stage of development, children begin to exercise autonomy as they experience their emerging sense of self. Parents of toddlers must maintain a balance of timely, supportive, and skilled interventions for behavior management in order to teach effective self-monitoring and regulation. Clear limits should be set which are explained at the child's level of understanding and balanced with warmth and acceptance (Campbell, 1997). Often, the normal behavioral manifestations of the developing self are viewed as problematic. This may be due to an incompatibility between the child's temperament and the adults' parenting strategies. These particular interpersonal struggles may also be the result of inappropriate parental expectations in regard to child development. This allows the parent-child interactions to set the stage for a future relationship of cooperation or one of conflict. Through recent studies, it has become evident that parent-child interactions and emotional involvement are highly important in the development of self-control and the internalization of societal behavioral expectations (Kochanska, 1991). Parents have a major role in instilling values and standards in their children: these standards are then internalized by the child who begins to act accordingly.

Current research supports the idea that quality of parent-child interactions as well as parenting style work in tandem as antecedents to either oppositional or compliant behavior. Several studies have examined mother-toddler dyads in naturalistic settings in order to determine children's assertiveness, defiance, compliance, and maternal management strategies. Generally, these studies indicate that less harsh, less power-oriented parenting strategies are associated with more assertiveness on the part of a child as well as a greater willingness to comply. Conversely, when mothers issue stern commands, leaving no room for discussion, toddlers tend to display more anger and defiance (Campbell, 1997). Sequential analyses in many of these studies indicated that a mother's use of negative control is most often followed by defiance. Moderate control, however, is followed by increased compliance.

Emotional understanding, cooperative play, and empathy are characteristic of children raised in environments where positive parental involvement is paired with clear explanations and appropriate limit setting. This style of parenting is similar to the "authoritative" subtype described by Baumrind (1967). This parenting style incorporates high warmth, high involvement, and very clear limit setting. Studies indicate that this type of parenting is ideal for early social development by facilitating the internalization of moral values, prosocial behavior, and an internal locus of control.

The child's temperament must "fit" with the parents' management style in order to achieve optimal child development. Certain researchers assert that many types of "dysfunction" may be the result of a disharmonious relationship between a child with an adverse (yet normally occurring) temperament and an incompatible environment (Carey,

1998). Rubin and Mills (1990) suggested that difficulties between parents and children may arise from an interaction of temperamental dispositions in the child, socialization experiences with the parents, and the home setting itself (e.g., family stress). These investigators posited that a temperamental wariness in infancy may lead to less responsive parenting due to difficulty in soothing the infant. An insecure attachment relationship may then develop which hinders the child's exploration of the environment, especially in novel situations. An over-controlling parent may then try to "take over" for the child in a highly directive manner that leads to over-control. In the home setting, this could provide the framework for the development of consistent, negative parent-child interactions.

The significant effects of parent-child interactions are evident in the child's manifested behavior. The effects of family stress are observable in this domain as well. Generally speaking, higher rates of stressful events, higher levels of maternal psychopathology, and marital conflict are significantly correlated with behavior problems in children (Campbell, 1997). Based upon previous studies, it appears intuitive that the very symptoms of maternal depression (less responsive, uninvolved parenting, more negative affect, less limit setting) would predispose the child to increased noncompliant behavior (Cummings & Davies, 1994). Having a depressed parent may increase the child's likelihood of receiving an ADHD diagnosis, independent of other mediating factors such as a comorbid condition (McClellan, et al., 1990). The perceived stress of the primary caregiver would therefore have a direct effect upon the quality of parent-child interactions, and subsequently, child problem behavior.

The quality of the parent-child interaction has not only been shown to predict future behavior difficulties, but may also predict the persistence with which these problems remain throughout the child's development (Pierce, Ewing, & Campbell, 1999). In fact, behavior difficulties present in pre-school are shown to escalate by middle childhood in the presence of dysfunctional mother-child dyads. This dyad is also predictive of comorbid conditions, which are a distinct issue in the diagnosis and treatment of ADHD. Certain investigators posit that ADHD exists so often with a comorbid condition (such as Oppositional Defiant Disorder) that a "pure" sample of ADHD children would actually be atypical (Stahl & Clarizio, 1999). In these cases, psychologists may regard the initial presenting symptoms of ADHD as being expressed secondarily to the other disorder, such as anxiety or depression (McClellan, et al. 1990).

Current research indicates that Parent-Child Relationship Inventory scores of children diagnosed with ADHD have significant within-group variability (Strahan, 2002). In 2002, Laurel Strahan found that roughly one third of an ADHD sample met DSM-IV criteria for that disorder. Utilization of the Attention Deficit Disorders Evaluation Scale (ADDES) screening tool served to separate the children with clinical ADHD from the rest of the sample. The Behavioral Assessment System for Children (BASC) was utilized to differentiate children with clinical disorders such as anxiety and depression from the sample as well. The remaining, non-clinical group was compared to the rest of the sample using scores on the PCRI. Results indicated that the non-clinical group varied significantly from the rest of the sample on several of the PCRI subtests. Ironically, this subgroup did not vary from the norming sample. This refuted the hypothesis that the

overlap in their behavior with those who had “true” ADHD was due to dysfunction in the parent/child relationship.

Although it has become relatively clear why the parents of children with ADHD and other clinical disorders would endorse high levels of dysfunction, there remains the issue of the Non-Clinical group. The children in the sample were identified as having ADHD by a physician, yet manifested relatively low levels of behavior which correlates with ADHD symptomatology. Further, these children did not exhibit behaviors of other clinical disorders that overlap with ADHD, and are often misdiagnosed as such. It had been hypothesized that these children were acting as if they had ADHD due to difficulties within the parent-child dyad. When examined empirically, results indicated that these children were more similar in profile to the norming sample than to the clinical members of their own sample. They were so close to the norming sample, in fact, that there was scarcely a discernable difference. Why then, were these children identified as having ADHD? Further assessment of cognitive and neuropsychological differences may hold the answer to this question. If these children have differences in learning styles or in patterns of neurocognitive functioning, this may explain why they were initially misdiagnosed. This could also prevent unnecessary medication and ensure more appropriate treatment of such children in the future.

RATIONALE:

The question as to why the refined sample was identified as having ADHD, remains unanswered by examination of the parent/child dyad. A recurrent theme in the literature review of this study had been the existence of neurocognitive and

neurodevelopmental differences in children with ADHD. The etiology and nature of the deficits in children with ADHD are most likely as varied as those of many common learning disabilities. Not only do the neurocognitive deficits create a mosaic that is unique to each child, but the outward manifestations may do so as well. It is the unavoidable fact of individual differences that makes the effective treatment of human beings, at times, a daunting task. The empirical evidence and general acceptance of a neurodevelopmental basis for ADHD merits the inspection of these processes in children identified with the disorder. If the pattern of neurodevelopmental deficits for ADHD overlaps with other neurocognitive difficulties, then children without ADHD may be misdiagnosed as such. When neurocognitive weaknesses manifest in behaviors that mimic a specific disorder, accurate diagnoses and treatment become difficult. It is hypothesized that a pattern of deficits in executive and/or language functioning that is not related to ADHD may manifest in diminished performance on tasks of this nature. Therefore, the refined Non-Clinical group should not differ significantly from the rest of the sample originally diagnosed with ADHD on NEPSY subtests. A deficiency in the ability to succeed in executive functioning and language tasks may manifest itself in academic and social behaviors that mimic those of ADHD. This could result in a child whose mosaic of weaknesses is similar to those of children with ADHD being identified as having the disorder when he/she does not.

CHAPTER III

METHODS

This investigation is one of several studies that comprise a larger, master project. Basic orientation to the participants, procedures, and instruments will be offered. Following an overview of the master project, a description of the current project will be provided.

Master Project

The Participants for the master program were volunteers for a research project conducted by a multidisciplinary team at Texas Woman's University (TWU). The goal of this project was to conduct a series of studies investigating issues in differential diagnosis between ADHD and central auditory processing disorder (CAPD). The initial project in this series was a collaborative effort between the TWU psychology and audiology departments seeking to delineate the relationship between the two disorders in school-age children.

The participant group consisted of 166 children and their parent/legal guardians. Participation was solicited via advertisement in local newspapers, parenting magazines, physicians' offices, and project brochures. A telephone interview screened participants through an intake process to verify DSM-IV ADHD or CAPD diagnostic status prior to testing. The study targeted children between the ages of 8 and 11 years who had a preexisting diagnosis of either ADHD or CAPD. This age group was selected due to the high incidence of ADHD in this age group, and the age norms available for

instrumentation.

Instrumentation

The following is a list of the assessment tools utilized in the master project: Woodcock-Johnson Tests of Cognitive Ability; Receptive One Word Picture Vocabulary Test; Attention/Executive Function Domain subtests of the NEPSY, Wechsler Individual Achievement Test (WIAT) screener; Cognitive Assessment System, Behavior Assessment System for Children - Self Report Form. The children were also given auditory screenings to determine the presence of hearing impairment.

Parents were asked to complete the following instruments during their child's test session: Behavior Assessment Scale for Children-Structured Developmental History and Parent Rating Scale; Attention Deficit Hyperactivity Disorders test; Attention Deficit Disorders Evaluation Scale-Home Version; Attention Rating Scale with demographic questionnaire, Parenting Stress Index, and Parent/Child Relationship Inventory. The parent was also asked to give the teacher of his/her choice the following forms for completion: Behavior Assessment System for children-Teacher Response Form and Attention Deficit Disorders Evaluation Scale - School Form.

Master Project Inclusion Criteria

The telephone intake served as the preliminary attempt to screen out children with limited levels of intellectual functioning. The children were also required to be free of any major handicapping conditions such as severe motor impairment, permanent/peripheral hearing loss, and articulation difficulties. The children were required to be free from stimulant medication at the time of the testing session. As a

further control for confounding variables, only children with English as their primary language were accepted for the study. Parental endorsement of DSM IV criteria as well as an ADHD or CAPD diagnosis were required for participation.

Master Study Procedures

The team of researchers for the master study was comprised of doctoral level graduate students involved in data collection for the project, with each examining a subcomponent of the data. Testing was generally conducted over the course of two sessions; one for psychological assessment, and one for audiological work-up. The psychological portion of the testing had an administration time of approximately 4.5 hours, with breaks permitted when needed. Parents were charged a \$20.00 fee to compensate for the cost of materials and to encourage return for the second portion of the testing. The parents were given a feedback form regarding their child's performance and were able to participate in group debriefing/feedback sessions.

Description of Current Study

The current study sought to examine specific NEPSY subtest score profiles for children who were originally diagnosed with ADHD, yet did not present with the disorder when assessed with traditional measures of behavior ratings. It was hypothesized that certain neurodevelopmental deficits were responsible for the manifestation of behaviors that may mimic ADHD, and therefore be mistaken as such. The author hypothesized that if a child has similar patterns of neurocognitive deficits, then he/she may be diagnosed as having ADHD, regardless of etiological factors. The independent variables were the group categorizations created by assessment of ADHD behaviors and BASC scores as

will be discussed in the instrumentation section. Dependent measures were the Language and Executive Functioning domain subtest scores from the NEPSY.

The original sample ($n=164$) was composed of 98% of the 166 children who participated in the master study. The decision to exclude the remaining children was based on specific criteria. As the measures utilized in this study were completed by individuals other than the children, exclusion criteria for the children was liberal. Two children were excluded from due to their age exceeding study limits, resulting in a .012% attrition rate.

The remaining sample was comprised of 105 males (64.6%) and 59 females (35.9%), most of whom were Caucasian (88.6%). The children had an age range from 7.9 years to 12.0 years (MEAN=9.9, SD=1.2). The median family income for the sample was in the range of \$60,000 to \$75,000. The majority of the children lived with a biological parent (64.3%), with 12.5% living in a single parent home. Children living in step-families comprised 10.7% of the sample, and children who were adopted comprised 8.9%. Living arrangements specified as “other” contributed to 3.6% of the sample.

In order to refine a non-clinical sample, scores on various parent/teacher response forms were examined. Explicit criteria were delineated in order to accurately include only those children who did not present with a diagnosable disorder. Children were considered as having ADHD if they were rated with any of the following scores on standardized parent and teacher response questionnaires:

- 1.) ***Attention Deficit Disorders Evaluation Scale (ADDES)***: Total score more than 1 standard deviation below the mean. ($T < 40$), on either the home or school

form.

For purposes of this study, this group will be referred to as “ADHD”.

2.) **Behavioral Assessment Scales for Children (BASC)**: “Clinically Significant” Attention Problems or Hyperactivity Subtest Scores ($T > 70$) on both Parent and Teacher response forms. For purposes of this study, this group will be referred to as “ADHD”.

Children were considered as having a diagnosable clinical disorder if they received “Clinically Significant” scores ($T > 70$) on any of the remaining clinical scales in both the parent and teacher response sets on the BASC. For purposes of this study, this group will be referred to as “Clinical”.

Refined Sample

As a result of standardized exclusion procedures, 107 children (64%) were removed from the original sample. Sixty seven children met DSM-IV criteria for ADHD, and 40 children reached “clinically significant” levels for other disorders. The resulting sample ($n=57$) is assumed to have neither ADHD nor any of the other clinical disorders assessed by the BASC, such as anxiety and depression. The sample consists largely of Caucasian children (89.8%). One child (.016%) who participated in the study was African-American, one child was Asian-American, and four children (.067%) were Mexican-American. The age range of the children was 8.1 years to 11.11 years (MEAN=9.9, SD=1.3). The median family income for the sample was in the \$65,000 to \$70,000 range. The majority of the sample lived with a biological parent (64.3%), with (12.5%) of the children living in single-parent households. Blended and step-families comprised (10.7%) of the sample, and 8.9% comprised of the children who had been

adopted. “Other” living arrangements comprised 3.6% of the sample.

The ultimate goal of the current study is to determine if there is a distinct pattern of neurodevelopmental deficits within this sample, and if so, are the outward manifestations of those deficits similar enough to be mistaken for one another? Significant differences can be identified and utilized when designing non-medical intervention plans for children.

Instrumentation

Assessment Tools Utilized for Categorization

Attention Deficit Disorders Evaluation Scale (ADDES):

The McCarney & Bauer ADDES is designed to provide a measure of the three dimensions of ADHD: inattention and hyperactivity/impulsivity. The ADDES provides a Home form and a School form to be completed by a parent/caregiver and a teacher, respectively. This instrument utilizes the DSM-IV criteria for ADHD in the question stems. As an ADHD diagnosis requires that persistent symptoms be present in two or more domains, utilizing both the parent and the teacher forms is imperative for appropriate and ethical use of this tool. Large samples of children ages 4-20 were utilized in the norming of this instrument, resulting in acceptable levels of validity and reliability.

Behavior Assessment Scale for Children system (BASC SRP, PRS, TRF):

The BASC (Reynolds & Kamphaus, 1992) is an assessment tool that uses a multimethod, multidimensional inventory to examine behavior and self-perceptions of children. The system includes response form for parents, teachers, and children ages 4-18. Results indicate the levels of adaptive functioning and clinical significance for

various aspects of behavior and personality. An average internal consistency coefficient of .80 is reported for all developmental levels.

The Parent Rating Scales (BASC-PRS) generate an index of functioning, the Behavioral Symptoms Index (BSI). The BSI is comprised of the following categories: externalizing problems, internalizing problems, school problems and adaptive behaviors. Atypical behaviors and withdrawal are also components of the BSI, but they do not contribute to composite scores. Attention difficulties are also assessed by the PRS, which is useful when attempting a global assessment of attention disorders.

The BASC-PRS is interpreted through the comparison of the child's profile to clinical norms. The scoring system generates T-scores (MEAN=50, SD=10), and percentiles. This facilitates the classification of the composite scores. Excluding adaptive behaviors, T-scores for that fall in the 60-69 range are in the at-risk classification. Any symptom T-score above 70 is considered clinically significant, and requires attention. The PRS also provide validity safeguards that alert the assessor in the presence of response sets (bias), poor reading comprehension, poor reality testing, or failure to follow the directions on the form.

Specific subscales that were analyzed from the PRS for this study were the following:

- | | |
|------------------|-----------------------|
| 1. Hyperactivity | 5. Withdrawal |
| 2. Aggression | 6. Attention Problems |
| 3. Anxiety | 7. Adaptability |
| 4. Depression | 8. Social Skills |

The Teacher Rating Form (BASC-TRF) generates a comparative index of functioning for the following categories: externalizing problems, internalizing problems, school problems, and adaptive behaviors. Attention Problems are also assessed by the TRF, and this is also useful when conducting a global assessment for ADHD.

The TRF is interpreted by comparing the child's profile to clinical norms. The scoring system generates T-scores as well as percentiles. These scores allow for classification of the derived composite scores. Scores in the 60-69 range are categorized as "at-risk". Any symptom T-score above 70 is considered "clinically significant", and requires intervention. The TRF is equipped with validity safeguards that will alert the assessor to the presence of response bias, poor reality testing, failure to follow the directions, and poor reading comprehension.

Specific subscales that were analyzed from the PRS for this study were the following:

- | | |
|------------------|-----------------------|
| 1. Hyperactivity | 5. Withdrawal |
| 2. Aggression | 6. Attention Problems |
| 3. Anxiety | 7. Adaptability |
| 4. Depression | 8. Social Skills |

Dependent Measures:

NEPSY: A Developmental Neuropsychological Assessment (Korkman, Kirk, & Kemp, 1998).

The NEPSY is a comprehensive instrument designed to assess the neurodevelopmental progress of preschool and school-age children. This instrument consists of a series of neuropsychological subtests that may be used in a variety of combinations. This broad collection of subtests is designed to assess neuropsychological development in five functional domains: Attention/Executive Function; Language; Sensorimotor Functions; Visuospatial Processing; and Memory and Learning. For purposes of this study, the following subtests will be utilized: Attention/Executive - Tower and Auditory Attention and Response set, Language - Phonological Processing and Speeded Naming.

The Tower (Tower) subtest examines the executive functions of planning, monitoring, self-regulation, and problem solving. The child is asked to move three colored balls to targeted positions on three pegs in a preset number of moves. There are several rules that the child must follow while executing this task. The Auditory Attention and Response Set (AARS) task is a continuous performance test of the child's ability to be vigilant while maintaining selective auditory attention. The task also assesses the child's ability to make a cognitive shift, to maintain a complex mental set, and to monitor responses to matched and contrasting stimuli.

The Language domain subtest of Phonological Processing (PP) assesses the child's capacity to identify words from segments and form a whole from the parts. The

child is asked to identify a picture from an orally presented word segment. The second portion of the task assesses the level of ability for phonological segmentation at the level of letter sounds and small word segments. The child is asked to create new words by omitting a word segment or phoneme or by substituting one phoneme for another. The Speeded Naming (SN) subtest examines the child's ability to access and rapidly produce words with which he/she is familiar. The items are named by size, shape, and color.

The NEPSY is interpreted through the comparison of the child's scores to age-matched, clinical norms. The scoring system generates standard scores (Mean=10, S.D.=3). Scores that fall more than one standard deviation below the mean may indicate a weakness in that domain. Likewise, scores that fall more than one standard deviation above the mean may indicate a relative strength for that domain.

CHAPTER IV

FINDINGS

RESULTS

When examining the NEPSY score pattern for the refined sample, MANOVA yielded no significant main effects for age or gender (Table I and Table II). There were no interaction effects present for the independent variables either. Comparison of the Clinical, ADHD, and Non-Clinical groups yielded no significant main effects or interactions between the samples. Independent t-tests of group means on each subtest were examined for significant differences. The t-test procedure resulted in no significant differences found between the ADHD and the Non-Clinical groups. As was hypothesized, the performance of these two groups were similar enough to be mistaken for one another. Subtest means for the three sample subgroups are available in Table III. The values for the NEPSY subtests between the two groups are as follows: PP: ($t = .77$), AARS: ($t = .80$), Tower: ($t = .44$), and SN: ($t = .95$). Further support for the idea of symptom overlap is provided by the independent t tests between the Non-Clinical group and the Clinical group, which had similar score patterns as well. Upon statistical analysis, the NEPSY subtest scores were not significantly different between these two groups. The similarity was not as great as those of the ADHD and Non-Clinical groups, but were as follows: PP: ($t = .39$), AARS: ($t = .06$), Tower: ($t = .06$), SN ($t = .45$). Finally, the differences between the Clinical and ADHD groups were examined via independent sample t tests. No significant differences were found for these groups on any of the

NEPSY subtests. Independent sample t scores were as follows: PP: ($t = .22$), AARS: ($t = .08$), Tower: ($t = .19$), and SN: ($t = .08$). The similarity in performance between all three groups may explain why differential diagnosis is so difficult using superficial behavior rating scales.

Although MANOVA indicated no significant differences between age groups or genders within the Non-Clinical sample, each child presented with an extreme amount of scatter in his/her score profile. Descriptive statistics were derived for the refined sample in order to examine age and gender differences in score patterns (Tables I and II). Independent sample t-tests were run in order to compare the performance of the refined sample on the four NEPSY subtests to that of the other subgroups. As the scores were presented for the NEPSY in standard score format (MEAN=10, SD= 3), the criterion of greater than one standard deviation above or below the mean will be considered as a strength or weakness, respectively. These scores will be explained below, and may be found in Table III. Results indicate that all three subgroups scored within normal limits for the specified subtests.

The mean standard score for the refined sample on the Auditory Attention Response Set (AARS) was 9.4. This indicates an average ability level in the area of vigilance and sustained attention for select auditory stimuli. Some of these children may struggle with the ability to make a cognitive shift smoothly from one set to another. Deficits in this area could manifest in behaviors such as the inability to attend to verbal instruction, difficulty with executing multi-step tasks, lack of self monitoring/self-correcting, and resistance to changes in activity such as beginning a new subject in the

classroom. These skills are an integral part of success in the traditional classroom, where functional executive processing is required on most tasks. These behavior patterns may also be interpreted by adults as oppositional, and may foster a negative feedback loop between the child and the teacher.

On the Phonological Processing (PP) subtest, the refined sample had a mean score of 8.72. If phonological processing is impaired, comprehension of spoken language also suffers. These types of disorders present a profound difficulty in reading acquisition and a myriad of other learning difficulties. Impairment of phonological processing may be the result of a lack of instruction, and can often be remediated through practice on those types of tasks. Many times the deficit manifests as a primary problem with language comprehension while phonological discrimination ability remains intact. This would present in behaviors such as inability to follow instructions, which could be mistaken as non-compliance. This would be due to the fact that the child can repeat the command even though he/she is unable to execute it. As a result of a profound lack of comprehension, the child may also feel bewildered by the verbalizations of others and will appear dreamy: a marker for stereotypical ADHD behaviors.

On the Speeded Naming (SN) subtest, the refined sample achieved a mean standard score of 9.67. If semantic memory can not be accessed in a rapid fashion, a child is at a disadvantage in the classroom. Performance on tasks that require immediate recall (such as things memorized for spelling, multiplication, and vocabulary) will be greatly hindered by even a slight deficit in this area. Again, the child may appear dreamy as

he/she strives to access the piece of information requested. Combined with an inability to focus due to executive function trouble, the problem becomes compounded.

An interesting result was found on the Tower subtest in the Attention/Executive Function domain. The children in the refined sample had a mean standard score of 10.21 for this subtest. This task requires planning, self-monitoring, self-regulation, and problem solving skills. The only verbal direction is made by the assessor at the start of each task, and as needed to remind the child of the rules. It appears that the absence of constant the auditory stimuli (which are present during the AARS subtest) allows the child some freedom from distraction. This sample obtained a score that was lower than that of the norming sample, but it was not significantly lower. Adults who wish to facilitate learning and increase performance with these children may use the Tower subtest as a model for certain lessons. If the presence of constant verbal instruction diminishes performance on planning and executive function tasks, perhaps an alternative approach might be effective. This could include the use of periods without verbalizations by the teacher, and a more clear explanation of the assignment when asking the child to perform problem-solving tasks.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The results indicate that there is a common level of general neuropsychological functioning within the original sample. This neurodevelopmental makeup is extremely similar in the ADHD and the Non-Clinical subgroups. Children who have this mosaic of neurodevelopmental functioning in the aforementioned domains may appear to have a behavior disorder, when in reality they do not. These findings may also support the assertion that ADHD exists on a continuum in the form of a bell-shaped curve. The etiology of the disorder may be a similar neurocognitive makeup. This neurodevelopmental pattern may manifest itself in varying degrees of disordered behavior, and at times may elude accurate diagnosis due to the variability in outward manifestations. This could possibly explain why roughly one third of the original sample met criteria neither for ADHD nor for a clinically diagnosable disorder. This finding reiterates the profound burden ethical professionals shoulder in regard to the appropriate treatment of children suspected of having ADHD. A socioemotional assessment as well as a thorough neuropsychological work-up should be conducted in order to achieve accurate differential diagnoses. More importantly, this type of screening process would permit professionals to provide appropriate, ethical treatment for children struggling with any number of disorders, deficits, and weaknesses. Further research might help to design a repertoire of assessment tools that could be utilized in constructing individually tailored batteries to aid in differential diagnosis for each child.

TABLE I

Mean NEPSY Standard Scores by Age for Non-Clinical Sample

AGE	Phonological Processing	Auditory Attention/ Response Set	Tower	Speeded Naming
8	7.27	8.36	9.27	9.27
9	8.36	9.27	10.36	8.82
10	9.58	10.25	10.83	10.38
11	8.64	8.91	9.64	9.36

STANDARD SCORE MEAN = 10
STANDARD SCORE STANDARD DEVIATION = 3

TABLE II

Mean NEPSY Standard Scores by Gender for Non-Clinical Sample

GENDER	Phonological Processing	Auditory Attention/ Response Set	Tower	Speeded Naming
F	9.18	9.65	10.47	10.06
M	8.53	9.35	10.10	9.50

TABLE III

Mean NEPSY Standard Subtest Scores for Original Sample by DSM-IV Diagnosis

Subgroup	Auditory Attention/ Response Set	Phonological Processing	Speeded Naming	Tower
Non-Clinical	9.44	8.72	9.67	10.21
ADHD	9.34	8.87	9.70	9.82
Clinical	8.50	8.21	8.41	9.12

STANDARD SCORE MEAN = 10
STANDARD SCORE STANDARD DEVIATION = 3

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