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**Attention Deficit Hyperactivity Disorder:
An exploratory analysis of treatment utilization**

A Thesis

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By

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Abstract

Attention Deficit Hyperactivity Disorder: An exploratory analysis of treatment preferences
Margaret Howley

Attention Deficit Hyperactivity Disorder is a chronic and pervasive disorder. Medication as well as psychosocial treatment has proven effective in managing the symptoms of ADHD in children. Research has found that the symptoms of hyperactivity and impulsivity decrease with age while the symptoms of inattention stay stable over time. The current analysis will consider whether treatment for ADHD is concurrent with this trend in symptom presentation as well as whether gender plays a role in treatment utilization. It is hypothesized that children diagnosed with ADHD combined type will receive more treatment with medication than psychosocial treatment and treatment overall will decrease with age in accordance with the waning of hyperactive symptoms. It is also hypothesized that children diagnosed with ADHD inattentive type will receive more psychosocial treatment than treatment with medication, as their symptoms are not as externalizing and disruptive. However, the use of treatment (medication and psychosocial) will increase with age as the symptoms of Inattention become more apparent. The analysis will also consider differences in medication use in terms of gender.

CHAPTER 1: BACKGROUND AND LITERATURE SURVEY

1.1 General

Attention-deficit hyperactivity disorder (ADHD) is a chronic and pervasive disorder typically presenting in early childhood. The symptoms generally include inattentiveness, distractibility, impulsiveness and impairments in executive functioning that are functionally significant.

Symptoms also may include increased behavioral and verbal impulsivity and hyperactivity. It is estimated that the prevalence rate of ADHD is between 3% and 7% (Diagnostic and Statistical Manual of Mental Disorders).

Weiss and Hechtman (1993), found that the interpersonal problems associated with ADHD persist into adulthood in 75% of children diagnosed. Furthermore, juvenile problems and antisocial personality may occur in 23% to 45% of children (Barkley et al., 2004) and 20-27% of children may have substance use disorders (Fischer, Barkley, Smallish, & Flethcer, 2002).

1.2 Symptoms

Children diagnosed with ADHD display symptoms of inattention relative to matched controls. Inattentiveness has been found to result from a lack of persistence of effort. Children diagnosed with ADHD display difficulties in sustaining effort in tasks with minimal appeal or little immediate consequences (Barkley, 1997). As a result, these children are drawn toward activities with more immediate rewards. Children diagnosed with ADHD therefore, shift their task more than a child without a diagnosis of ADHD (Barkley, 1997).

Impulsiveness is another symptom of ADHD that is associated with a deficiency in inhibiting behavior when appropriate. Children diagnosed with ADHD displaying impulsive behavior typically jump into activities quickly and fail to consider the consequences of their actions (Barkley, 1998). When presented with a task that involves working toward a larger goal and delayed gratification, the child will typically opt for a situation with a smaller reward and

immediate gratification due to a lack of consideration for the consequences of their actions (Barkley, 1998).

Hyperactivity is another symptom of ADHD. This refers to excessive levels of activity that are developmentally inappropriate. While working on tasks at school these children diagnosed with ADHD typically are out of their seat, restlessly moving their arms and legs, playing with objects with no relation to the task and talking out of turn (Fischer, Barkely, Edelbrock, 1990). The symptoms of hyperactivity are significantly more apparent than in children of equivalent age without a diagnosis of ADHD (Barkley, 1998).

There are currently three subtypes that further define a diagnosis of ADHD. Attention Deficit Hyperactivity Disorder hyperactive/impulsive subtype refers to children that dominantly display hyperactive and impulsive symptoms. Similarly, ADHD inattentive subtype refers to children that dominantly display inattentive symptoms. Lastly, ADHD combined type refers to children that display both inattentive and hyperactive symptoms at a clinically significant rate.

For a child to receive a diagnosis of ADHD, functional impairment must be present in at least two settings. These settings may include, school, work, home or any other activities in which the child may engage. The child must also display clinically significant impairment in social, academic or occupational functioning.

1.3 Gender

Research has shown that the prevalence of Attention Deficit Hyperactivity Disorder is much higher among males than females although the exact proportion varies somewhat across studies. Gadow, Sprafkin, & Nolan (2001), found the prevalence rates to be 4% in girls and 8% in boys in the preschool age group. While in the 6-12-year-old age period rates have been found to range from 2-4% in females and 6-9% in males (Breton et al., 1999). At the Children's Hospital of Philadelphia Center for the Management of ADHD, where the data for the current analysis was collected, the ratio of males to females diagnosed with ADHD is 3 to 1.

There is also evidence that males with ADHD display different symptoms than females diagnosed with ADHD. Abikoff and colleagues (2002), found that girls with ADHD tend to show less severe symptoms of inattention and hyperactive-impulsive behavior, especially in school. Brown, Abramowitz, Dadan-Swain, Eckstrand, & Dulcan (1989) studied clinic referred children and found that females are more socially withdrawn and exhibit more internalizing symptoms than males. Berry, Shaywitz, & Shawitz (1985), found that hyperactive females had lower verbal IQ scores, had more problems with mood, and were more likely to have language disability. Barkley (1998) found that the most reliable difference between males and females is that males diagnosed with ADHD are more likely to develop Oppositional Defiant Disorder and Conduct Disorder.

1.4 Age

ADHD is a chronic condition that is pervasive through childhood, adolescence and adulthood. However, Hart, Lahey, Loeber, Applegate & Frick (1995) found that the symptoms of hyperactivity and impulsivity decrease with age while inattentive symptoms stay stable. Participants included one hundred six clinic-referred boys diagnosed with ADHD. The annual assessments were conducted for 4 years. The results of the study found that inattention declined from the first to second assessment and then remained stable while hyperactivity and impulsivity symptoms decreased consistently with age. Although symptoms of ADHD decrease with age, research has shown the symptoms do not normalize (Biederman, Faraone, Taylor, Sienna, Williamson & Fine, 1998). The current investigation will consider the difference in the type of treatment utilized in terms of age. Three age groups will be considered: Three - 5 years old, 6 – 8 years old and 9 – 11 years old. The analysis considered the choice to utilize medication in conjunction with psychosocial treatment verse solely utilizing psychosocial treatment between the age groups.

1.5 Treatment

1.5.1 Medication

Froehlich, Lanphear, Epstein, Barbaresi, Katusic and Kahn (2007), considered 3,082 children and found that less than half of the children meeting the criteria for ADHD reported receiving regular treatment.

The most commonly prescribed medication for children with ADHD is Central Nervous System stimulants. CNS stimulants raise the level of activity, arousal, or alertness of the Central Nervous System (DuPaul, Barkley & Connor 1998). Safer, Zito & Fine (1996) estimated that annually, 1.5 million children of school-aged population may be using stimulant medication for behavior management. The three most common types of stimulant medication are: Methylphenidate (Ritalin), Adderall, dextroamphetamine and Concerta. More recently, stimulant medication has become available in extended-release forms, lasting up to 12 hours. Once-daily stimulants have become increasingly popular in the treatment of ADHD as the sustained effects are ideal for a full day of school (Mash & Barkley, 2006).

Research has shown stimulant medication to be effective for many children with a diagnosis of ADHD. Behavioral improvements produced by stimulants include sustained attention, reduction of task irrelevant activity and improved impulse control, particularly in settings requiring behavioral restraint (Solanto et al., 2001). Furthermore, both overt and covert aggression has been shown to decrease in children taking stimulant medication (Connor, Glatt, Lopez, Jackson, & Melloni, 2002). Barkley (1977) reviewed more than 120 studies and found between 73% and 77% of children treated with stimulant medication were considered to show improvement in their behavior. DuPaul & Rappaport (1993) looked at thirty-one children diagnosed with Attention Deficit/Hyperactivity Disorder. They found that 75% of the children displayed improvement to the point of no longer statistically deviating from the behavior of control children without ADHD. Safer, Zito & Fine (1996) found a consistent improvement in academic and social functioning in about 50% to 90% of children when taking stimulant

medication. Another study found significant increases in scores on an IQ test when children diagnosed with ADHD were taking stimulant medication (Gimpel, et al. 2005). Vitiello and colleagues (2007) considered the effectiveness of methylphenidate in preschoolers when utilized over a 10-month period. Ninety-five children completed the 10-month treatment. The results revealed that with careful monitoring and gradual increases in dosage the preschoolers' behavior improved (Vitiello, et al. 2007).

Stimulant medication is effective in treating many children diagnosed with ADHD but it has been shown that 20% to 30% of children put on stimulants may not display any behavioral change. In some cases behavior may, in fact, worsen in response to medication (DuPaul, Barkley & Connor, 1998). Elia & Rappaport (1991) found that children whose symptoms are not controlled by a certain type of stimulant medication may respond more favorably to another stimulant medication and found that close to 90% of children eventually respond to medication if they try another after finding one to be ineffective. Johnston, Pelham, Hoza & Sturges (1988) found that of 21 children, about a third displayed a deterioration of behavior (beyond baseline) in the evening after receiving stimulant medication during the day. Furthermore, Richters, and colleagues (1995) suggest that stimulant medication provides dramatic short-term effects on the core clinical symptoms of ADHD but has been less reliable in bringing about long term improvement.

A fourteen-month MTA study considered 579 children between the ages of seven years old and nine years old that had been diagnosed with ADHD. The study included four treatment groups: Behavioral Treatment, Medication Management, Combined Behavioral Treatment and Medication Management and a control group. The researchers concluded that supervised Medication Management was the most effective in treating children diagnosed with ADHD (MTA Group, 1999).

Strattera is a non-stimulant medication approved in 2003 for the use in treating ADHD in children 6 years of age and older. The effectiveness of Strattera has been established in over 10

large scale randomized controlled clinical trials. The samples included 3,264 children and adolescents, and 471 adults (Kratochvil et al., 2001, Michelson et al., 2003, Spencer et al., 1998). These clinical trials found Straterra to be effective as well as safe in the treatment of ADHD. Research has found that Straterra reduces the symptoms of inattention and hyperactivity-impulsivity in over 70% of cases (Michelson, et al. 2001).

1.5.2 Psychosocial Treatment

Psychosocial approaches have been utilized in the treatment of ADHD as well. Family-based interventions have been found to be effective in treating children with ADHD. Family-based treatment provides parents with instructions in implementation of behavior modification techniques that typically revolve around social learning principles. The theory behind this type of treatment is that parent training will lead to a change in parenting style which will in turn treat a child's ADHD symptoms (Chronis, Jones, Raggi, 2006). Anastopolous, Shelton, DuPaul, & Guevermont (1993) found that parent training also improves parental reports of stress, which in turn may lead to more effective treatment of the child's ADHD symptoms by the parent. Pelham et al. (1988) found that parent training led to improvements in the child's social behavior as well as social acceptance. The literature reveals that parent training is a valuable way of treating the symptoms of ADHD.

Another approach to treating children diagnosed with ADHD is to use a school-based intervention. Similar to parent training, teachers are educated in the use of behavior modification techniques. Teachers are taught techniques such as praise, planned ignoring, effective commands, time out and the use of daily report cards (Pelham, Wheeler, & Chronis, 1998). The daily report card is an important aspect of school-based intervention as goals are set and the child is rewarded at home if the goals are met. The goals and reinforcement are tailored to the child's specific developmental level (Pelham, 2002). Dupaul & Eckert (1997) conducted a meta-analysis of the research literature on school interventions for ADHD. Seventy separate

experiments were utilized. The researchers found an overall effect size for contingency management procedures of .60 for between-subject designs, 1.00 for within-subject designs and about 1.40 for single-case designs. They also found that interventions aimed at improving academic performance by manipulating the curriculum for children with ADHD produced equal or greater effect sizes.

Social skills training is also an intervention that has been utilized in treating children diagnosed with ADHD. Peer relationships tend to be an area in which children with ADHD struggle and are therefore an important target for treatment (Melnick & Hinshaw, 1995). This type of treatment requires that children be taught social skills appropriate to their behavioral level. The treatment includes the reinforcement of skills such as communication, cooperation, participation and validation (Kavale, Forness, & Walker, 1999).

The summer treatment program is an intensive 8-week outpatient program for children diagnosed with ADHD. The treatment includes weekly, group-based parent training, a point system for children, positive reinforcement, effective commands, time out, a daily report card, social skills training, sports skills training and problem solving techniques (Chronis et al., 2004). The treatments are utilized across academic as well as recreational settings throughout the course of each day. The goal of the treatment is to improve children's peer relationships, interactions with adults, academic performance, and self-efficacy (Chronis et al., 2004). The summer treatment program has been found to be an effective intervention program when compared to a camp setting without any behavior modification strategies employed (Chronis, et al., 2004).

There has been evidence suggesting that a multimodal approach to the treatment of ADHD may be more effective than utilizing one type of treatment in isolation. In considering this, So, Leung and Hung (2008) considered 90 Chinese children diagnosed with ADHD. There were two treatment conditions: methylphenidate-only and methylphenidate with Behavior Therapy. The researchers found that a low dose of methylphenidate in combination with

Behavior Therapy were significantly more effective than just methylphenidate. At 6 and 12-month follow ups, the improvement in behavior remained stable.

The MTA study found that a multimodal approach to treatment was more effective in treating ADHD with comorbid anxiety disorders, children of low socioeconomic status and ethnically-diverse children (MTA Cooperative Group, 1999). However, combined treatment was more effective than medication alone with many of the social targets of treatment such as improved social skill and parent-child relationships (Hinshaw et al., 2000). Furthermore, a secondary analysis revealed that combined treatment was more effective in normalizing behavior and allowed for a lower dose of medication to be utilized (MTA Cooperative Group, 1999). Swanson and colleagues (2001) created a categorical measure of treatment outcome based on scores from teachers and parents that completed the Swanson, Nolan, and Pelham Questionnaire – IV. They found that treatment success rates were as follows: 68% for combined treatment, 56% for Medication alone and 34% for behavioral treatment alone.

CHAPTER 2: OBJECTIVE AND HYPOTHESES

2.1 Objective

The current study was an exploratory analysis using an archival data set to consider whether subtype, age and gender contribute to a lack of treatment as well as treatment utilization in children between the ages of 5 and 13 years.

2.2 Hypotheses

2.2.1 Primary Hypothesis

Children diagnosed with ADHD combined type will receive more treatment with medication than psychosocial treatment and treatment will decrease with age in accordance with the waning of hyperactive symptoms. Children diagnosed with ADHD inattentive type will receive more psychosocial treatment than treatment with medication, as their symptoms are not as

externalizing and disruptive. However, it is hypothesized that the use of treatment (medication and psychosocial treatment) will increase with age as the symptoms of Inattention become more apparent.

2.2.2 Secondary Hypothesis

Males will receive more treatment overall with medication verse females diagnosed with Attention Deficit Hyperactivity Disorder. Males with combined subtype will receive treatment the most frequently.

CHAPTER 3: METHOD

3.1 Participants

The data set originally collected at the Children's Hospital of Philadelphia includes 1,005 children. Participants were included in the previously collected data set if they were not intellectually disabled or had a Developmental Disorder and were deemed to possibly have a diagnosis of ADHD upon preliminary intake. The initial screening process included an intake conducted by phone. The family was contacted, informed about the services provided and asked questions about their child's behavior. If the clinician determined the child may be eligible (behavior suggested a diagnosis of ADHD without a comorbid Developmental Disorder), measures were sent to the parent and teacher to complete concerning the child. The measures sent to and completed by the parent included: The Pediatric Developmental Questionnaire, The Behavior Assessment System for Children parent version, the Homework Problem Checklist and the ADHD Rating Scale-IV parent version. The Behavior Assessment for Children teacher version, ADHD Rating Scale-IV and Academic Performance Questionnaire were mailed to the teacher for completion concerning the child. The measures were then reviewed by the clinician.

The current analysis included 433 participants. Participants from the original data set were not utilized if they were not between the ages of 5 and 13 years old and if they did not meet the criteria for ADHD Inattentive type, ADHD combined type or no diagnosis of ADHD. The criteria for diagnosing ADHD inattentive subtype were the parent report on the DICA-R-P met criteria for ADHD inattentive type and ratings on the ADHD Rating Scale-IV Teacher Version were at or above the 85th percentile on the Inattentive factors. The criteria for diagnosing ADHD combined subtype were a parent report on the DICA-R-P met criteria for ADHD hyperactivity/impulsivity as well as inattention and ratings on the ADHD Rating Scale-IV Teacher Version were at or above the 85th percentile on both the hyperactivity/impulsivity factors and the inattentive factors.

The participants were determined to not have a diagnosis of ADHD if they did not meet DICA-R-P criteria for any ADHD subtype, and were not at or above the 85th percentile on the ADHD Rating Scales.

3.1.1 Inclusion Criteria

A preliminary screening was conducted on potential participants. Participants were included if the initial judgment of the clinician was that the child may have a diagnosis of ADHD. For the purposes of the current analysis, participants were included if their chronological age is between 5 and 13 years.

3.2 Diagnostic Measures

In the original study, each participant was required to have a parent and teacher fill out a number of measures. The measures utilized in the current study are as follows.

3.2.1 Diagnostic Interview for Children and Adolescents- Revised- Parent Version

The DICA-R (Reich, Leacock & Shankefeld, 1995), is a semi-structured diagnostic interview. It is designed using the symptoms from the DSM-IV and is utilized to evaluate childhood psychopathology. Estimates of inter-rater reliability of the DICA-R-P have continually

been above the acceptable reliability range (Eiraldi, Power, Karustis, & Goldstein, 2000). Also, Reich (2000) studied a sample of 40 children aged six to twelve and thirty-five adolescents and found both groups displayed acceptable Kappa levels in reliability.

In the data set, doctoral level psychologists and advanced doctoral students in psychology administered the DICA-R-P. All psychologists and students were required to undergo training in the administration of the DICA-R-P. The interviews were video taped and a number were randomly chosen to be rated by another trained clinician to determine inter-rater reliability. Inter-rater reliability scores were obtained for 20% of the cases in the sample. The DICA-R contains scales that assess for the presence of a number of mental disorders. For the purposes of the current analysis, the section of the DICA-R pertaining to ADHD was considered as it distinguished hyperactive and inattentive symptoms and was a key part of the diagnostic criteria utilized in determining a participant's diagnosis.

3.2.2 ADHD Rating Scale-IV-Teacher Version

The ADHD Rating Scale-IV (Dupaul, Power, Anastopoulos, & Reid, 1998) is adapted from the DSM-IV symptom list of ADHD. It contains eighteen items: Nine inattentive items and nine hyperactive items. The measure lists classroom behaviors typical of children with ADHD and asks the teacher to rate on a Likert Scale (0-4) the frequency of each behavior. Estimates of test-retest reliability, internal consistency and concurrent validity support the integrity of the measure (DuPaul, Power, Anastopoulos, & Reid, 1998). In the data set, the 85th percentile cutoff was used to assist in the diagnosis of the subtype of ADHD due to its efficacy in identifying subtypes when used in conjunction with a parent measure (Power et al. 1998).

3.2.3 ADHD Rating Scale-IV-Parent Version

The ADHD Rating Scale-IV- Parent Version (Dupaul, Power, Anastopoulos, & Reid, 1998) is adapted from the DSM-IV symptom list of ADHD. It consists of eighteen items, nine of which are inattentive symptoms and nine hyperactive symptoms. The measure lists behavior at

home that is typical of children with ADHD and asks a parent to rate (from 0 – 4) how frequently the behavior is exhibited.

3.2.4 Behavior Assessment System for Children and Adolescents – Parent Rating Scale

The Behavior Assessment System for Children – Parent Rating Scale (Reynolds & Kamphaus, 1992) was designed to assist in evaluating children’s emotional and behavioral functioning at home. The BASC-PRS has three different versions that take into account the different developmental issues between age groups. There is a preschool version (2-5 years old), child version (6-11 years old) and an adolescent version (12-18 years old).

3.2.5 Behavior Assessment System for Children and Adolescents –Teacher Rating Scale

The Behavior Assessment System for Children – Teacher Rating Scale (Reynolds & Kamphaus, 1992) was designed to assist in evaluating children’s emotional and behavioral functioning at school. It asks questions about common behaviors seen in the classroom. As in the parent version, the BASC-TRS has three different versions that take into account the different developmental issues between age groups. There is a preschool version (2-5 years old), child version (6-11 years old) and an adolescent version (12-18 years old).

3.2.6 Pediatric Medical History Questionnaire

This measure contains a number of items concerning the child and mother’s medical history. It inquires about the mother’s pregnancy and any history of mental disorders in the family. The questionnaire also asks about the child’s medical history and any medication or behavioral treatment utilized. In the current study, this measure will be used in determining any treatment received by the children. The parent is asked to respond to a question asking about what type of treatment the child has received in the past for ADHD. The options for this item are no treatment, psychosocial treatment, treatment with medication or combined treatment.

3.3 Procedure

In the previously collected data set, participants were diagnosed with ADHD by the primary clinician collecting the research. The results of the measures as well as the clinician's judgment were utilized in making this diagnosis. In the current analysis, the DICA-R-P and the ADHD Rating Scale-IV Teacher version were used in making a diagnosis.

The criteria for diagnosing ADHD inattentive subtype were the parent report on the DICA-R-P met criteria for ADHD inattentive type and ratings on the ADHD Rating Scale-IV Teacher Version were at or above the 85th percentile on the Inattentive factors. The criteria for diagnosing ADHD combined subtype were a parent report on the DICA-R-P met criteria for ADHD hyperactivity/impulsivity as well as inattention and ratings on the ADHD Rating Scale-IV Teacher Version were at or above the 85th percentile on both the hyperactivity/impulsivity factors and the inattentive factors.

The participants were determined to not have a diagnosis of ADHD if they did not meet DICA-R-P criteria for any ADHD subtype, and were not at or above the 85th percentile on the ADHD Rating Scales.

The type of treatment utilized is an item on the pediatric and medical history questionnaire completed by the parents concerning the medical history of the children. This questionnaire also contains questions concerning the general medical history of the participant and any family history of mental disorders.

Participants were broken up into three age groups in considering the relationship between age, subtype and treatment. The age groups were: 5-7 years, 8-10 years and 11-13 year olds. Participants were broken up in this manner in accordance with their status in school. Five to 7 year olds are just starting school (kindergarten to first or second grade), 8 to 10 year olds are at the mid to late elementary level (third to fifth grades) and 11 to 13 year olds are in late elementary to middle school. These groups represent different levels of schooling that represent different concerns for children with ADHD.

The current study considered the relationship between ADHD combined type, ADHD

and ADHD inattentive type in terms of treatment. It is hypothesized that children diagnosed with ADHD combined type and hyperactive/impulsive type will receive more treatment with medication than psychosocial treatment and treatment will decrease with age in accordance with the waning of hyperactive symptoms. The use of psychosocial treatment will also decrease in following the symptoms of hyperactivity.

3.4 Statistical Analysis

3.4.1 Descriptive Statistics

Preliminary statistical analyses included descriptive statistics. Descriptives will be utilized to give general information concerning the gender, and subtype break up of the participants in the data set. Descriptives will also be used to determine the most commonly utilized treatment overall by participants in the data set.

3.4.2 Multinomial Logistic Regression

A Multinomial Logistic Regression was analyzed to consider the treatment choices in terms of subtype, age and gender. The outcome variable is the type of treatment utilized (medication, psychosocial, both psychosocial and medication or no treatment) and the independent variables are gender (male or female), subtype (Hyperactive, inattentive or combined) and age (5-7, 8-10, 11-13).

3.4.3 Crosstabulation

A crosstabulation was analyzed to consider the relationship between age, subtype and treatment utilization. This allowed for a further understanding of the precise break up of participants between subtype age and treatment utilization as the number of participants within each group and interaction group was easily seen by looking at the size of each cell. Crosstabulations were used instead of a chi-square as the cell sized in the sample were not large enough to allow for a chi-square.

4. Results

The current sample consisted of 336 males and 97 females. Statistics revealed that of the four treatment categories (No treatment, treatment with stimulants, psychosocial treatment and treatment with medication and psychosocial), 70.7 percent of participants received no treatment, 11.5 percent received treatment with stimulants, 9.5 percent received psychosocial treatment and 8.3 percent received medication and psychosocial treatment. Thirty-seven point 2 percent of participants fell between the ages of 5 and 7 years, 44.3 percent were between the ages of 8 and 10 years and 18.5 percent were between 11 and 13 years old. The majority of participants (47.8%) were diagnosed with ADHD Combined subtype using the DICA and ADHD Rating scale. Twenty-three point eight percent had no diagnosis using these criteria and 28.4 percent were diagnosed with ADHD predominantly inattentive subtype. The break up can be seen in table 1.

Table 1

Descriptive Statistics

Variable	Subjects	Percentages
No Treatment	306	70.7%
Treatment with Stimulants	50	11.5%
Psychosocial Treatment	41	9.5%
Treatment with medication and psychosocial	36	8.3%
5 to 7 years old	161	37.2%
8 to 10 years old	192	44.3%
11 to 13 years old	80	18.5%
No Diagnosis	103	23.8%
Diagnosis of Combined Type	207	47.8%
Diagnosis of Inattentive Type	123	28.4%
Male	336	77.6%
Female	97	22.4%

A multinomial logistic regression was utilized in analyzing the data. The “No Treatment” group was used as a reference as it allowed each independent variable to be considered in terms of the likelihood that they will receive no treatment verse treatment with

stimulants, psychosocial treatment and multimodal treatment. The Psuedo R-squared value, Nagelkerke is .138, indicating that 13.8% of the variance in treatment utilization can be accounted for by these predictors. The likelihood ratio tests indicate that Diagnosis is a significant predictor of treatment utilization ($p = .000$). Age is also a significant predictor of treatment utilization ($p = .001$).

A significant relationship was found between age and treatment utilization. Parameter estimates indicate that participants between the ages of 5 and 7 years were more likely to have received no treatment than to have received multimodal treatment ($p = .000$). Subjects between the ages of 8 and 10 years were also significantly more likely to receive no treatment than to have received treatment with stimulants ($p = .011$). Subjects diagnosed with ADHD combined type were more likely to have received no treatment than to have received treatment with stimulants ($p = .033$). Participants diagnosed with ADHD Combined subtype were also significantly more likely to have received no treatment than to have received multimodal treatment.

In order to examine the interaction between age, diagnosis and treatment utilization, cross tabulations were conducted to more specifically look at the break up of the sample. A crosstabulations was considered instead of a chi-square because the cell sizes were too small to allow for a chi-square analysis. The numbers reported from the crosstabulation and therefore the graphs, are the number of participants within each group and not the percentage of participants. Of the participants that had not received any treatment, the majority were between the ages of 5 and 7 years and were diagnosed with ADHD combined subtype. In total, 126 children between the ages of 5 and 7 years had not received any treatment. This total number decreased with age as 49 subjects between the ages of 11 and 13 had not received any type of treatment. However, within the inattentive subtype, the number of subjects that had received no treatment increased from 18 (14.3%) in 5 to 7 year olds to 45 (34.4%) in 8 to 10 year olds then decreased to 25 in the 11 to 13 year old age group.

Of subjects being treated with stimulant medication the group with the largest total number of participants was children between the ages of 8 and 10 years. Also, subjects diagnosed with ADHD combined type make up the majority of participants that receive treatment with stimulant medication. Within the 5 to 7 year old age group, and the 8 to 10 year old age group, subjects with combined subtype make up the highest number of those receiving treatment with stimulant medication. Participants between the ages of 11 and 13 years have very small cell sizes across diagnoses. However, inattentive type represents the majority of those within this age group that receive treatment with stimulants. The results are similar for subjects receiving only psychosocial treatment. Subjects between the ages of 8 and 10 years old diagnosed with ADHD combined type make up the majority of participants receiving psychosocial treatment. Five to 7 year olds diagnosed with ADHD Combined type makes up the second largest group of participants receiving psychosocial treatment only. Of those participants between the ages of 11 and 13 years old, the majority of subjects receiving only psychosocial treatment were diagnosed with ADHD predominantly inattentive subtype. However, the number of participants diagnosed with ADHD predominantly inattentive type receiving psychosocial treatment increased between the 5 to 7 year age group and the 8 to 10 year age group and then decreased between 8 to 10 years and 11 to 13 years. The break up of participants can be seen below (in count).

Figure 1

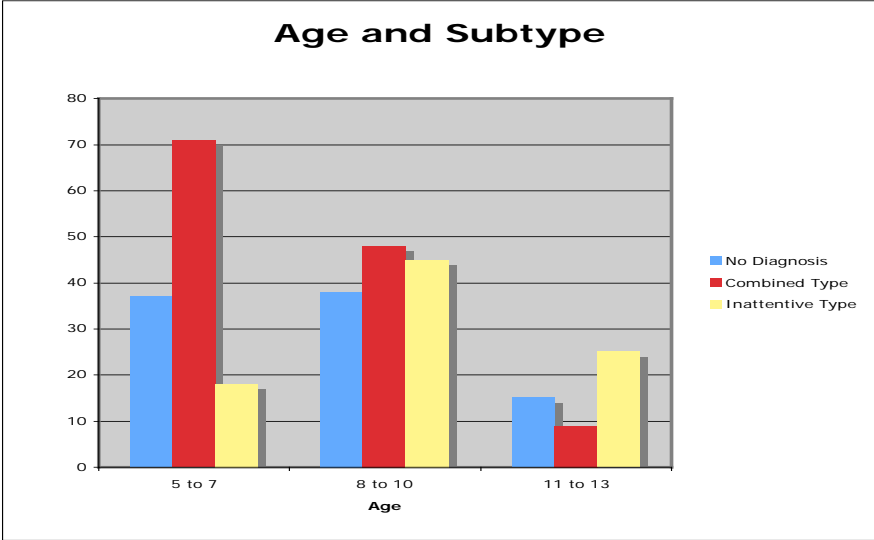


Figure 2

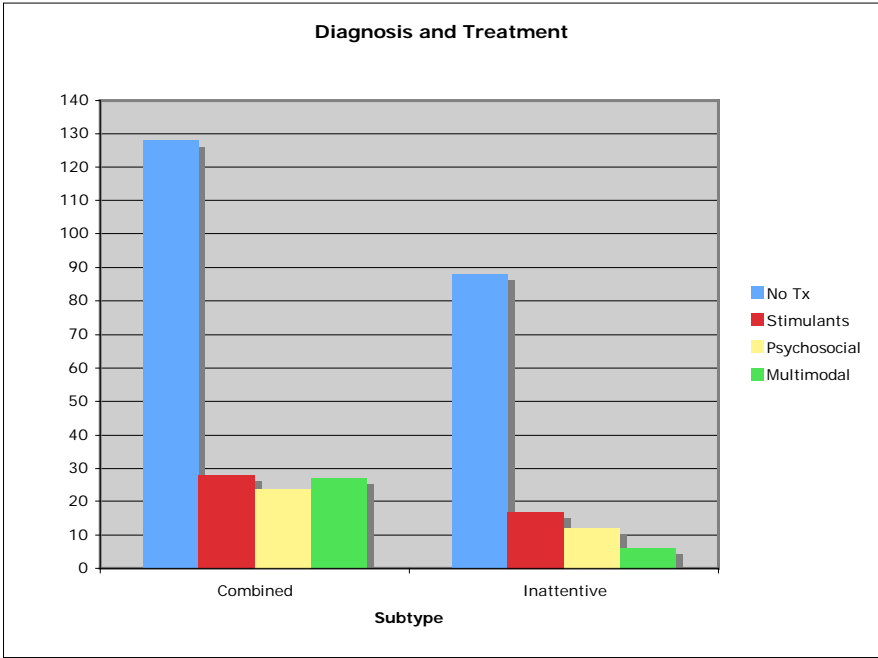
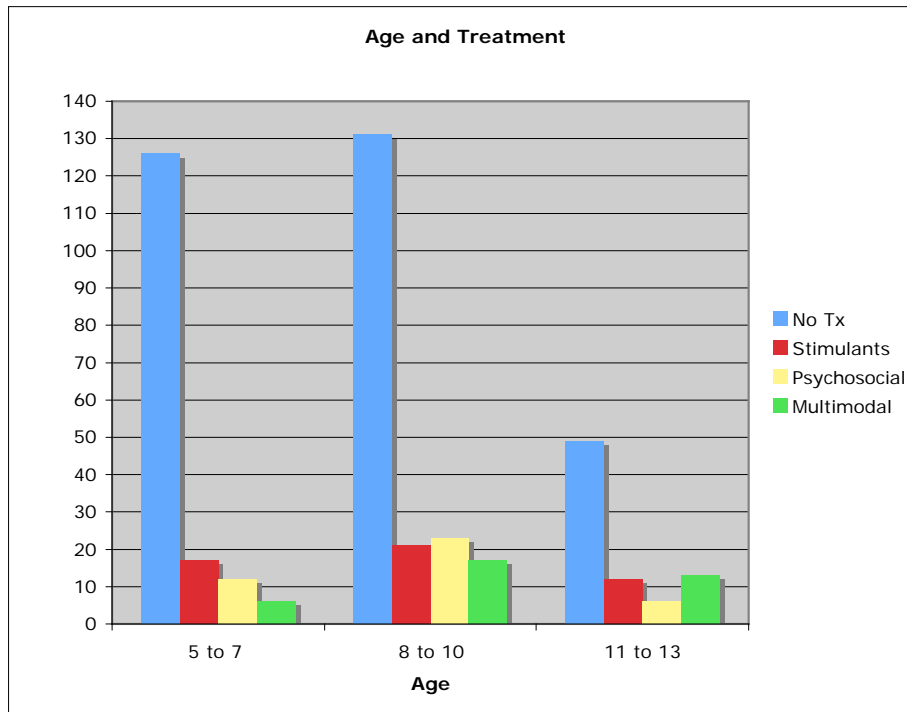


Figure 3



5. Discussion

In the current analysis, it was hypothesized that participants diagnosed with ADHD combined type would receive more treatment with medication than psychosocial treatment and that treatment use would decrease with age in accordance with the waning of hyperactive/impulsive symptoms. The results of the analysis did not support this hypothesis as the only significant relationship found was between no treatment, age and combined subtype. These results may be due to the overwhelmingly large number of participants receiving no treatment within the sample.

It was also hypothesized that participants diagnosed with ADHD Inattentive type would receive more psychosocial treatment and that treatment utilization would increase with age. These results were also not supported by the current analysis. The objective of the current

analysis was to consider whether age, subtype and gender were significant predictors of treatment utilization in children diagnosed with ADHD. However, the analysis only found a significant relationship between age and no treatment and diagnosis and no treatment. Limitations and possible explanations for these results are discussed below.

Limitations:

One limitation of the current analysis is that the data set utilized was a sample of convenience. The participants were coming to the Children's Hospital of Philadelphia for a psychological evaluation and therefore may have been seeking treatment. Therefore, the data set was not conducive to the question being asked in the analysis as it only considered the type of treatment utilized prior to the evaluation. Treatment after the evaluation was not considered when the participants may have very well received some type of treatment as a result of the evaluation.

Another limitation of the current analysis is the uneven distribution of treatment utilization by the subjects in the data set. The majority of participants have not utilized treatment in controlling the symptoms of ADHD. It also is important to note that this is cross sectional data and is not longitudinal. This may have some effect on the results of the analysis.

The measure used in determining treatment utilization was a pediatric medical questionnaire developed by the researchers. The measure did not have any psychometric properties and was reliant on the parent accurately answering all of the questions. Clinicians did not have access to medical records to ensure the accuracy of the responses given by the child's parent.

There was no significant relationship found between ADHD inattentive type and treatment utilization. There was also not a significant relationship between gender and treatment utilization as hypothesized. It has been established that males and females with ADHD tend to present symptoms differently. Therefore it was thought that they may receive different treatment.

The data set was overwhelmingly male (77.6%). The findings may have been different if the subjects were more evenly split between males and females.

One of the preliminary findings of this study is that the majority of the subjects considered received no treatment, regardless of age, subtype or gender. This is particularly noteworthy in the 11 to 13 year old age groups as these children are further along in their schooling and may be struggling more with their symptoms. However, it should be considered that participants may be seeking treatment at the time of the intake and therefore may have shortly after begun receiving treatment. Within subjects diagnosed with ADHD Combined type, 8 to 10 year olds make up the largest number of participants receiving multimodal treatment. In support of the hypothesis, this number decreases in the 11 to 13 year old age group. These findings are important in considering the trends in treatment utilization and support the hypothesis that treatment for children with hyperactive symptoms will decrease with age. However, these results should be considered with caution, as the number of participants in each cell of the crosstabulation was relatively small due to the break up of the subjects.

6. Future Directions

Future studies should consider methods of identification and treatment of ADHD at an earlier age, as the majority of participants in the current analysis received no treatment. This is particularly important in considering subjects in the 11 to 13 year old age group as not receiving treatment by this point (middle school and upper elementary school) may have detrimental effects on academic and social abilities. It may be beneficial to consider ways of detecting and treating ADHD at an earlier age, with the hope of earlier intervention and more positive outcome.

The fact that the majority of children in this sample diagnosed with ADHD combined type have not received any treatment is particularly concerning. These children tend to be more externalizing and disruptive, leading one to believe that they would be identified and treated somewhat readily. This may be due to a lack of awareness of the signs of ADHD or a lack of

awareness in how to proceed with a child that may display behavior problems. It may be beneficial to consider why it is that these children have not received treatment and possibly attempt to increase awareness of treatment options as well as identification of ADHD.

Future research should also consider why there are not differences in treatment utilization in terms of gender. If males and females tend to present symptoms differently, differences in treatment would make sense. It would also be beneficial to consider the interaction between gender, age and diagnosis in predicting treatment utilization. Lastly, other variables such as socioeconomic status and self-identified race may be useful to consider as predictors in and of themselves as well as how they interact with age, gender and diagnosis in predicting treatment utilization.

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