Patterns and Correlates of Cavaas Performance by Students with Spina Bifida and Attention Problems

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LOYOLA UNIVERSITY CHICAGO

PATTERNS AND CORRELATES OF CAVAAS PERFORMANCE BY STUDENTS WITH SPINA BIFIDA AND ATTENTION PROBLEMS

A DISSERTATION SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

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BY
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To my parents for their continued support, assistance and love. Thank you for instilling in me the importance of education.

To my children, Casie and Lynden, always believe in yourself and never stop short of your goals.

To my husband, Mitchell, thank you for continuing to believe in me.

To my sister, Sheri, your love of life, thirst for knowledge and endless giving to others will always inspire me.

To my nephew, Eric, you are my inspiration. I can only hope that research will continue and that our knowledge about spina bifida will grow.

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The number of children surviving with spina bifida (SB), a congenital malformation of the central nervous system, has greatly increased over the past twenty years. Since more children are surviving with SB, more of these children are being educated. Due to the increased numbers of children with SB who are being educated, many questions about the best way to educate them are being asked. These questions are directed at issues related to adaptive behavior, handwriting/fine motor skills, learning needs (math, reading, etc.), memory, attention, social skills, mobility, and on-going health needs. The area of attention is especially important, since one needs to attend to learn and to perform.

Attention deficits have been studied by many researchers. However, few have explored the relationship between inattention and SB. Could it be that persons with SB display a higher incidence of inattention than the general population? Could inattention help explain why persons with SB have greater difficulty successfully completing tasks such as handwriting, driving, catheterization, social conversation, and academic work (Agness, 1993)? Phyllis Agness (1993, 1994) has written about the apparent relationship between SB and inattention. It is her belief, based on her interpretation of the research literature as well as almost sixty evaluations of persons with SB, that persons with SB may display higher levels of inattention, distractibility, and impulsivity than persons in the general population. This could be due to a
number of reasons, including hydrocephalus, shunting, brain infections, Arnold-Chiari malformation, or other differences in brain development (Hurley et al., 1983).

The study to be described in what follows was designed to explore some possible factors contributing to inattention among children with SB who were referred for evaluation of apparent attention problems. It is expected that the findings of this study will shed some light on associations between specific demographic, psychiatric, and medical variables, and computer-based measures of attention to clarify what may be sources (or consequences) of attention problems among children with SB who display such problems. Because this study was based on archival data, and included no comparison groups, it was not possible to address questions about the prevalence of inattention among children with SB as a population.

Scores on the Comprehensive Auditory Visual Attention Assessment System (CAVAAS), a computerized attention task, and on the Diagnostic Interview Schedule for Children (DISC), a structured interview, were used to determine which students demonstrated elevated levels of inattention. Factors associated with elevated levels of inattention were then explored. Factors that may be associated with elevated levels of inattention on the CAVAAS included depression, dysthymia, anxiety or an attention deficit disorder, assessed by the DISC. Medical Factors that may be associated with a decrease of attention include hydrocephalus, presence of a shunt, history of shunt infection (ventriculitis), Arnold-Chiari malformation, seizure history, and intellectual level.

In what follows, the effects of these and related attention factors were systematically reviewed with reference to the relevant literature. First, the general characteristics of spina bifida were explored. This provides
background for the reader, since it is important to understand what SB is and how diversely one can be affected by it. Next, medical considerations that may have an impact on the level of attention in children with SB were discussed. Areas discussed included: folic acid; hydrocephalus and shunting; seizures; allergies and asthma; and oculomotor function. Although research is not conclusive with respect to how these variables impact attention, there was a corpus of research findings available suspecting the notion that inattention is correlated with all or some of these variables to allow us to infer that these variables affected performance on the CAVAAS to some degree. Various aspects of cognitive functioning that contributed to CAVAAS performance were then considered with an emphasis on attention, vigilance, and perceptual-motor skills. Finally, depression, attention deficit disorder, and anxiety were reviewed. It was assumed that these diagnoses may impair CAVAAS performance levels.
Spina Bifida: General Characteristics

Spina Bifida (SB) is a neural tube defect affecting one to two infants out of every one thousand live births (SBAA, 1995). Girls outnumber boys born with SB 1.3 to 1 (Anderson and Plewis, 1977). Approximately 11,000 babies with SB are born each year in the United States alone (Henderson and Synhorst, 1975). SB is considered to be the number one disabling birth defect in the United States (SBAA, 1995).

At about 24-26 days after conception, the embryo is at a critical stage, as far as neural tube defects developing (Wolraich and Henderson, 1979). It is at this stage that the neural plate begins to change into a tube. The once flat strip of cells begins to fold in the center, creating a tube. This process begins in the middle of the embryo's back, and continues to "zip" until it reaches each end of the embryo. The upper end continues to fold, eventually developing into the brain, while the bottom end will form the spinal cord. The neural tube is covered by skin (meninges), followed by bone and muscle (Striar, 1986). In SB, the neural tube fails to close, causing abnormalities of the spinal cord and brain.

It has been found that motor and sensory levels (the extent of areas of the legs and trunk in which sensation and voluntary movement are impaired) are associated with the degree of functional disability and mortality. Babies born with sensory loss extending above the area of the spinal vertebra thoracic
eleven (about shoulder level) had the lowest survival rate, while babies born with sensory loss below the area of the spinal vertebra lumbar three (mid-back) had the highest survival rate (Hunt and Poulton, 1995). Hunt and Poulton (1995) also found that there was a correlation between sensory level and walking ability. The lower the level of sensory loss, the greater chance of being a "community walker". The higher the sensory loss, the greater the chance of using a wheelchair. Hunt (1995) reported that intellectual functioning is correlated with sensory level. Normal intelligence is often found in persons with lower sensory levels.

Common secondary conditions in persons with SB include medical issues such as: Arnold-Chiari malformation and hydrocephalus; secondary infections; seizures; bowel and bladder incontinence; and ocular-motor difficulties. Physical malformations and illnesses include: fine and gross motor difficulties; kyphosis; club feet and other orthopedic problems; paralysis; skin sensation loss; hypersensitivity to noise; eating difficulties; heat and noise sensitivities; and latex allergies. Cognitive dysfunctioning includes: executive functioning difficulties (including attention, organization, planning, insight, etc.) (Agness, 1994; Shaer, 1995); learning difficulties; speech and language difficulties; and mental retardation.

Although most children with SB have learning problems, most also have intelligence within the low average to average range. Prompt treatment of hydrocephalus (the accumulation of excess fluid which puts abnormal pressure on brain tissues) does not guarantee normal intelligence. Hydrocephalus is treated by a shunt, a tube that drains excess fluid from the brain to the abdomen. According to McLone and colleagues (1982), intracranial infection of the shunt is the main reason for lowered intelligence in hydrocephalic children. The number of shunt revisions
(surgeries to repair a blocked or broken shunt) has not been found to be a significant variable in intellectual ability (McLone et al., 1982). Also noted by McLone et al. (1982) is that lesion level does seem to correlate with intellectual capabilities. This finding differs from an earlier reference of Hunt and Poulton (1995) who did not control for infection rates. Badell-Ribera (1966), Hurley and colleagues (1983), Shaffer and colleagues (1986), and Wills (1993), have also found that lower IQ scores have been associated with higher lesion levels.

Academically, math, writing and reading comprehension seem to be the most difficult areas for children with SB. These areas are impacted by poor attention, problem solving skills, and memory skills. According to Wills (1989), children with SB demonstrate lower academic achievement than is expected at a given grade level. It is also documented that a greater proportion of children with SB are diagnosed with learning disabilities as compared to the general population (Agness, 1994).

Next, selected medical factors that are associated with spina bifida will be discussed and related to how they contributed to the overall cognitive functioning as well as how they impacted the level of attention in children with spina bifida. Then, typical cognitive difficulties of children with SB will be summarized. These difficulties included: attention; vigilance problems; and perceptual-motor functioning. Finally, social/emotional issues that might impact CAVAAS performance will be discussed. Included issues were: depression; and anxiety.

Medical Factors Related To Attention and CAVAAS Performance

Folic Acid

Although the cause of SB is unknown, recent research has shown that folic
acid, a B vitamin, will prevent more than half of SB births (SBAA, 1995). Women of childbearing years are encouraged to take 0.4 mg of folic acid per day before becoming pregnant, and then continuing the dosage through pregnancy (SBAA, 1995). Researchers are suggesting that foods be fortified with folic acid to decrease the number of children born with SB.

Folate deficiency inhibits DNA synthesis, thus slowing the maturation of red blood cells and causing macrocytic anemia (Greenblatt et al., 1994). A relationship has been found between folate deficiency among adults (current, not prenatal) and many neuropsychiatric symptoms, including dementia, psychosis, delirium, forgetfulness, apathy, irritability, sleep disturbance, depression and affective disorders (Greenblatt et al., 1994). How folic acid abnormalities and behavior are linked is still unknown. Very interesting associations among prenatal and postnatal folic acid abnormalities, autistic behavior, and attention problems related to fragile X syndrome are also being investigated (Greenblatt et al., 1994). We know that folates play an important role in early brain development. It would be interesting to note if folate deficiency in a mother during pregnancy continues to impact a child behaviorally throughout life. Could it be that this prenatal folate deficiency in children with SB also contributes to their well documented attention difficulties?

According to Gross and colleagues (1974), women who were severely folate-deficient during pregnancy have children with abnormal or delayed intellectual development. Shapiro and colleagues (1983) documented a child who suffered with severe learning and behavioral difficulties which were secondary to folate deficiency during infancy. The disabilities continued even after the child was treated for folate deficiency. This research suggests that even after treatment, deficiency during an early, critical developmental
period of CNS (central nervous system) growth may result in permanent cognitive and behavioral difficulties (Greenblatt et al., 1994).

Young and Ghadirian (1989) have proposed that in adult psychiatric patients, "depression associated with folate deficiency is related to decreased CNS serotonin levels." Carney (1967) found that 23% of a psychiatric admission population had low serum folate levels. Low serum folate is most commonly associated with depression and dementia. Both dopamine and serotonin are considered to be important modulators of attention, affect, and higher order cognitive functioning. In fact, dopamine has been implicated in the pathophysiology of attention deficit disorder (Zametkin and Borcherding, 1989). Many studies have also been conducted with males with fragile X syndrome. Most of these studies have found that folic acid treatment of this group of males resulted in a decrease of hyperactivity and attention difficulties (Greenblatt et al., 1994). The use of folic acid supplements with children to decrease neuropsychiatric symptoms needs further research. It would be interesting, however, if children with SB were discovered to be folate deficient, and if folate treatment increased attention span and other executive functioning.

It should be noted that in the present study, there is no way to measure folate levels or to know whether folic acid deficiency contributed to the occurrence of SB for any specific individual. However, the fact that folic acid deficiencies are associated with both SB and inattention suggests that inattention among children with SB is not merely a coincidence but, rather, a co-occurring symptom of the underlying physiological disorder which caused the spinal malformation. Therefore, inattention would be expected to appear pervasively within this population. However, some children were more inattentive than others due to differences in the presence of other
complications discussed in the following sections, including hydrocephalus, seizures, allergies and oculomotor problems.

**Hydrocephalus**

Prior to the 1960's most babies born with SB died. Once the cerebrospinal fluid shunt was invented, however, non-selective treatment began, which saved many babies born with SB. As a result, however, many of the surviving children were severely disabled (Hunt and Poulton, 1995). The 1980's brought improved surgical techniques in neurology, orthopedics, and urology which assisted in lessening the severity of the disability.

About 70% to 86% of children with SB also have hydrocephalus (Knowlton, 1985). Approximately 75% to 80% of the SB population are shunted for hydrocephalus, most often within the first few weeks or months after birth (Anderson and Plewis, 1977; Raimondi and Soare, 1974). Raimondi and Soare (1974), found that shunting prior to 6 months of age correlated with higher intelligence. They also found that repeated shunt revisions (repairing or replacing a dysfunctional shunt) did not correlate with lower intelligence. Goldberger and Baron (1993) found that shunting by the 7th to 11th day was needed to avoid mental impairment. The development of ventriculitis (brain infection) is always a risk at each surgery to repair or replace these shunts. It should be noted that the risk is low, however. Absence of ventriculitis is also associated with higher cognitive functioning. Normal intelligence has been associated with no need of shunting for hydrocephalus or very early shunting for hydrocephalus. Many studies that have looked at hydrocephalus and cognitive functioning are difficult to compare to each other and to interpret, as they may not have excluded children with infection, bleeding, brain anomalies and other complications (Shaffer et al., 1986). When these
variables are controlled, however, intelligence of children with SB and non-complicated hydrocephalus falls within the low average to average range.

Hydrocephalus may impact gross motor skills by deforming the cerebellum, fine motor control by disturbing the basis for hand control, bimanual motor control by stretching the corpus callosum, and intellectual and perceptual skills due to ventricular enlargement (Watson, 1991). Hydrocephalus may also be responsible for distractibility, information processing deficits, visual-spatial problems, interhemispheric communication deficits, and uneven cognitive growth (Watson, 1991). Wills and colleagues (1987), also noted difficulties with fine motor speed and coordination and memorization which improves following effective shunting. Interestingly, bilateral brain damage caused by hydrocephalus may also play a role in handedness, with many children with SB developing a fixed handedness as late as age five or six (Goldberger and Baron, 1993; Wassing et al., 1993).

Based on these previous findings, it was expected that in the present study: that children with hydrocephalus would be more inattentive than those without hydrocephalus; that shunted children would be less attentive than unshunted children; and that those with a history of shunt infection would be the least attentive.

Seizures

Although seizures are not as common in children with spina bifida as hydrocephalus, seizures may impact overall cognitive functioning, thus impacting attention. Most often hydrocephalus plays a part in the presence of seizures. According to Lorber et al. (1978) approximately 30% of children with SB and hydrocephalus also have a seizure disorder. Most children with SB, who also have a seizure disorder, experience their first seizure between the ages of
two to five (Noetzel and Blake, 1991). Shunt infections and revisions seem to occur with greater frequency among children who experience seizures (Noetzel and Blake, 1991). Noetzel and Blake have also noted that time of shunt insertion, location of shunt catheter, family history, and level of spinal-cord lesion do not correlate with the occurrence of seizures. He also noted that lower cognitive ability does statistically correlate with seizures in children with SB. The presence or absence of hydrocephalus did not alter these results.

McLone and colleagues (1982) feel that due to ventricular infection that extends into the deeper layers of the cortex, a destruction of myelin (a sheath that surrounds some nerve fibers) and fragmentation (the breakdown into pieces) of cellular processes occurs. This may indicate the point at which a child develops seizures. The onset of seizures does correlate with a long-term outcome of lowered intelligence in this population, according to McLone and colleagues (1982). It is likely that seizures do not cause the drop in IQ scores but instead that both the seizures and the lowered IQ's are effects of a common underlying problem (e.g. ventriculitis or cyst formation). In the general population, seizure disorders do not necessarily lower intelligence, but seizure disorders and anti-convulsants are associated with inattention (Bender, Lerner and Poland, 1991). Therefore, in the present study it was expected that children with seizures would be more inattentive than children without seizures.

Allergies and Asthma

Children with allergies and asthma may be prone to various academic, emotional, and/or attention problems (Annett and Bender, 1994; Biederman et al., 1994). It is also known that children with SB are at risk for developing latex allergy. Sensitivity to latex has a wide range with as many as 68% and as
few as 18% of the SB population experiencing sensitivity (Kelly, 1995).
Detecting the allergy is extremely important, since this group of children
experience frequent surgeries, where latex is prevalent in adhesives, gloves,
etc. It may, in fact, be that multiple early surgeries sensitize persons with SB
to latex (Kelly, 1995). Other effects of latex allergies have not been
investigated but it seems possible that latex allergy may impact attention in
some students with SB. This may be the case with other environmental
allergens, such as food additives, and refined sugars (Feingold, 1975; Taylor,
1980), although the theoretical and empirical justification for this association
is quite controversial.

Some investigators have suggested that asthma occurs more frequently in
people with verbal deficits or dyslexia (Annett and Bender, 1994). However,
other investigators have found that asthma is unrelated to academic
performance (Lindgren et al., 1992). Still others have found that school
performance is impacted only when oral bronchiodilators are used
(Rachelefsky et al., 1986). Beta-agonists are not found to influence
neuropsychological functions (Joad et al., 1986), but corticosteroids have
been found to decrease verbal memory and mood (Bender et al., 1991).
Theophylline usage, in a group of 42 children being treated and studied while
taking theophylline, yielded increased anxiety, improved attention, increased
tremor and diminished verbal comprehension (Annett and Bender, 1994).
These effects are similar to those produced by caffeine (Annett and Bender,
1994). Biederman and colleagues (1994) have provided data that shows mixed
support for the notion that asthma may be associated with anxiety disorders.
The same study also found that children with ADHD were not at greater risk for
asthma, and that ADHD and asthma are independent of each other. A study
conducted by McGee and colleagues (1993) provided additional support.
Questions have been addressed in other studies related to the link between ADHD and asthma.

All things considered, although asthma is not linked to ADHD, it may be linked to anxiety, which may be associated with elevated inattention on certain tests. Therefore, in the present study, it was expected that children with asthma and/or allergies would be less attentive than children without asthma and/or allergies. Children with asthma and/or allergies were also expected to be more anxious, as indicated on the DISC than children without asthma and/or allergies.

It should be pointed out that in the present study, some students were treated for asthma. Ideally one needs to consider whether their level of inattention and/or anxiety was partly due to asthma medications or other variables related to their asthma, however, the present study cannot address that issue at such a detailed level, due to the limited resources and sample size.

**Oculomotor Function**

Forty-two percent to 59% of Turner's (1985) subjects with SB had strabismus (crossed eyes). Early detection of strabismus is considered to be important, as binocular vision is established during infancy. Binocular vision helps in making judgments of size, direction and distance (Watson, 1991). Tracking skills and scanning skills are dependent on good ocular motor control. It is believed that strabismus and other ocular defects may be caused by Arnold Chiari Type II malformations, in which part of the brainstem and the cerebellum are herniated into the cervical vertebral canal (Lennerstrand et al., 1990). Included in these ocular defects are squinting and nearsightedness.

Slower response time on vigilance tasks has also been associated with
strabismus. Response time has been demonstrated to be significantly longer when stimuli were presented in the visual field contralateral to the responding hand (Lennerstrand et al., 1990). This finding has ramifications for timed testing and needs to be considered when assessing subjects with strabismus with instruments such as the CAVAAS. It was also found that people with strabismus often demonstrate losses in the deviated eye (Sireteanu et al., 1993). These losses include a reduction of visual acuity (Amblyopia), contour interaction and crowding, disappearance of the fixed patterns (fading), missing parts of the visual fields (scotomata) and temporal instability of the visual scene (Sireteanu et al., 1993). Another difficulty associated with strabismus is pointing errors (Fronius, 1994). The majority of these errors were presented in the central visual field. Therefore, oculomotor difficulties may cause many children with SB to fare poorly on visual motor tasks, visual perception tasks and any visually based timed task.

The most common correction of strabismus in children with spina bifida is corrective glasses. According to the American Optometric Association (1984) 1.9% of persons age 3-5, 18.5% of persons age 6-16 and 37% of persons age 17-24 wear corrective glasses or lenses. These percentages are calculated on multiple diagnoses and not just strabismus.

In the present study, children's performance on two attention measures, auditory and visual, were compared. Children with glasses should perform relatively worse on visual than auditory measures, since the former involved both attention, and visual perception whereas the latter involved attention and a presumably unimpaired auditory system.

Next, cognitive variables assumed to be affected by medical issues were discussed. Attention, vigilance and perceptual-motor functioning were assumed to be contributing factors to performance on the CAVAAS.
Attention Deficit Hyperactivity Disorder

ADHD is a neurobiological disability that affects 3% and 5% of school aged children (American Psychiatric Association, 1994). Males are diagnosed with ADHD more frequently than are females (Ruel and Hickey, 1992). A study in 1990 by the National Institute of Mental Health (N.I.M.H.) documented that adults with ADHD utilize brain glucose at a lesser rate than do adults without ADHD. This reduced brain metabolism rate was most evident in the area of the brain that is important for attention, handwriting, motor control and inhibition of responses (N.I.M.H., 1990). Attention Deficit Hyperactivity Disorder (ADHD) is characterized by attention skills that are developmentally inappropriate, impulsivity and sometimes, hyperactivity. A person with ADHD is unable to sustain attention on a task and to delay impulsive behavior.

Symptoms arise in early childhood, with an onset before the age of seven and behaviors that are chronic, lasting at least six months. Symptoms can persist into adulthood. Symptoms for children with SB include: Fidgeting with hands, feet or moving wheelchair, difficulty following through with directions, shifting from one uncompleted task to another, difficulty playing quietly, interrupting conversations and switching topics, not listening to what is being said, doing things that are dangerous without thinking about the consequences, incomplete or missing homework, poor handwriting, forgetfulness, failing to give close attention to details, difficulty delaying rewards, and requiring supervision to complete given tasks (Agness, 1995). Consequences of ADHD include: school failure and drop out, depression, conduct disorders, failed relationships, and substance abuse (Barkley, 1991). Stimulants are the most widely used medication for ADHD, and 73-77% of
children with ADHD respond positively to stimulants (Barkley et al., 1993). Dr. Lowell Becker has found that children with SB also respond well to stimulants, however, time released administration is not as effective as regular dosages (Agness and Becker, 1994). Close supervision and the monitoring of medication is essential for the best treatment of ADHD.

In the present study, ADHD was assessed using the CAVAAS and DISC in order to discover if there was a higher incidence of ADHD among the SB population referred for testing of attention problems than in the general population, whether specific medical complications were associated with CAVAAS scores and/or ADHD diagnosis, and whether CAVAAS performance was associated with ADHD diagnosis based on the DISC.

**Attention In People With Spina Bifida**

Inattention is noted frequently in children with SB even those who may not meet the criteria for the diagnosis of ADHD. Since good attention skills are essential to succeed in school and life, discovering how to compensate for poor attention skills is essential. Children with SB often have difficulty with mental tracking, focusing attention on relevant information, sustaining attention to a given task and ignoring distractions, and shifting from one response to another (Wills, 1993). Many researchers, including Culatta (1980), Horn and colleagues (1985), Spain (1974), Stephens (1982), and Tew and Laurence (1975) have found that poor attention, distractibility and poor organization skills are characteristic of children with SB. Willoughby and Hoffmann (1977) indicate that children with SB demonstrate impaired skills on measures of selective visual attention, however skills on auditory attention tasks were adequate. These findings correlated with cognitive findings of higher verbal skills and weaker performance skills. Willoughby and Hoffman concluded that even on
perceptual tasks where motor demands are absent, children with SB still have difficulty. Thus, this might indicate the difficulty is actually with figure-ground tasks or selective visual attention tasks.

Difficulty also lies with independently structuring and organizing a task (Wills, 1993). Also noted by Snow (1994) are poor mental flexibility and cognitive planning skills. These weaknesses are consistent with frontal lobe dysfunction. The frontal lobes are also partly responsible for overall attention. It is thought that since the prefrontal lobes are a late maturing region of the brain, that disorders that have an early onset might be predicted to have an impact on the functional systems of the frontal area (Snow, 1994). This is due to the developmental process that is hindered. Lollar (1995) found that the children in his sample demonstrated significantly poorer scores than the normative population on the GDS (Gordon Diagnostic System), indicating greater impulsivity and inattention. Poorer problem solving skills on the Booklet Category Test, a measure of concept formation, were also noted by Lollar. These problems were seen across all intellectual levels. Fletcher and colleagues (1996) noted that children with hydrocephalus demonstrate inattentive behavior, as well as weak problem solving skills. They thought that this was due to brain defects that influence speed of the transfer of information across the corpus callosum. Already noted is the fact that SB is associated with brain malformations, including Arnold-Chiari, which may produce inattention.

Interestingly, it has been found that children with physical disabilities often do well on standardized tests because of the one-to-one administration that is given. When seat work is given, however, independence is required and the structure of the one-to-one setting is gone. These children frequently are unable to remain on task and are distractible, requiring adult
intervention. Thus, the attention difficulties impair these children at both the input stage of processing, as well as the output stage of work production.

Fletcher and his colleagues (1996) conducted a study of 116 children (46 with SB) which was designed to investigate executive functioning and attention skills in children with shunted hydrocephalus. Findings indicated that children with shunted hydrocephalus experienced difficulties with tasks that measured executive functioning, which included tasks of focused attention and selective attention. It was also found that children with early hydrocephalus had difficulties on novel problem solving tasks, with more trials needed to complete a problem solving task. Difficulty sustaining attention seemed to lead to the lack of success on these problem solving tasks. Goal directed behavior was also found to be reduced in children in this study with SB. This finding could help explain why work completion is often difficult for children with SB. It might also indicate that although inattention is an issue for this population, what is perceived as inattention might sometimes be the inability to properly direct ones behavior to achieve a given goal. The researchers also suggested the need for computer based assessment of attention skills due to the fine motor component of paper-and-pencil tasks.

Next we turn to the area of vigilance. Vigilance is a component of attention, which was addressed separately since the CAVAAS addresses vigilance performance with regards to auditory and visual tasks.

**Vigilance Performance**

Attention is a complex, multidimensional capacity which includes the ability to focus awareness, sustain concentration, ignore distractions, inhibit irrelevant responses and shift to a new response as required (Lezak, 1983).
Vigilance (the ability to sustain concentration) is one of these components. Vigilance performance is defined by Koelega (1992) "as the ability to sustain a high level of attention during lengthy task sessions." Weinberg and Harper (1993) add that "vigilance is a steady-state alertness, wakefulness and tonic arousal--the state of being alert, awake and watchful." When vigilance is decaying, the individual has a difficult time maintaining attention in tasks that require constant mental performance. Vigilance tasks also require participants to respond to changes in the task (Ballard, 1996a). These changes are often referred to as "signals" or "target stimuli". A signal may be a specific number or a series of numbers, for example. Vigilance has been considered to be a specialized function of the right hemisphere, probably of the parietal lobe. Vigilance can be impaired by various causes, including depression, epilepsy, medication, brain lesions of midbrain and right cerebral hemispheres, and learning disabilities (Weinberg and Harper, 1993).

Successful performance on auditory vigilance tasks has been correlated with high academic achievement (Hatta, 1993). Vigilance not only involves directed attention, but also involves affect, memory, motivation, and perception (Weinberg and Harper, 1993). A diagnosis of primary disorder of vigilance has been suggested and has very similar criteria as those for depression, anxiety disorder, and ADHD. Mild clumsiness, tremor, and spooning of the left hand are noted as co-occurring characteristics of a vigilance disorder, which make it easier to distinguish from depression, anxiety disorder, or ADHD (Weinberg and Harper, 1993). Treatment for a vigilance disorder includes stimulant medications. However, if a comorbid diagnosis of depression exists, then anti-depressants are used.

Assessment of vigilance is often accomplished through continuous performance tasks (CPT). CPT's utilize letters, numbers or other symbols
displayed on a computer monitor or similar device. Participants are instructed to watch for specific symbols or symbol combinations and then respond by pressing a button or similar response device. One such CPT is the Gordon Diagnostic System (GDS). The GDS is an electronic device designed to assess deficits in impulse control and attention (Gordon, 1987). The GDS is the visual component of the CAVAAS, which was one of the instruments used in the present study.

CPT’s in general have been scrutinized in many studies. However, task demands, environmental factors, and subject characteristics have often been inferred, and according to Ballard (1996b), "No studies have adequately examined examples of all such effects simultaneously". Ballard also states that inconsistencies between studies may stem from interaction effects among variables. She reinforces the notion of using more than one measure to diagnose ADHD.

When utilizing CPT’s such as the Gordon (GDS), knowledge of task parameters, environmental factors, and subject characteristics need to be strongly considered. Based on these factors, interpretation of CPT scores need to be interpreted accordingly. Table 1 outlines task parameters, environmental factors, and subject characteristics (Ballard, 1996b). When considering these factors in relation to the testing on the CAVAAS, critical areas include the medical background of the participants, environmental factors (stressors), and subject characteristics.
Table 1

**Factors impacting performance on vigilance tasks (Ballard, 1996b)**

<table>
<thead>
<tr>
<th>Task Parameters</th>
<th>Environmental Factors</th>
<th>Subject Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information to subjects</td>
<td>Environmental Stressors</td>
<td>Demographics</td>
</tr>
<tr>
<td>Instructions</td>
<td>Thermal Stress</td>
<td>Age</td>
</tr>
<tr>
<td>Subjects' Expectations</td>
<td>Vibration</td>
<td>SES</td>
</tr>
<tr>
<td>Practice</td>
<td>Noise</td>
<td>IQ Below Normal</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>Situational Factors</td>
<td>Personality Factors</td>
</tr>
<tr>
<td>Feedback</td>
<td>Crowding</td>
<td>Intro/Extroversion</td>
</tr>
<tr>
<td>Type of Task</td>
<td>Presence of Observers</td>
<td>Field Dependence</td>
</tr>
<tr>
<td>Sensory Modality</td>
<td>Time of Day</td>
<td>Temperament</td>
</tr>
<tr>
<td>Sensory or Symbolic</td>
<td>Performance of the Task</td>
<td>Clinical Symptoms</td>
</tr>
<tr>
<td>Task Duration</td>
<td>Performance Stress</td>
<td>ADHD, LD, MR, BD</td>
</tr>
<tr>
<td>Background Events</td>
<td></td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>Static or Changing</td>
<td></td>
<td>Brain Injury</td>
</tr>
<tr>
<td>Rate of Presentation</td>
<td></td>
<td>Seizure Disorder</td>
</tr>
<tr>
<td>Interstimulus Interval</td>
<td></td>
<td>Dementia</td>
</tr>
<tr>
<td>Event Duration</td>
<td></td>
<td>Physiological States</td>
</tr>
<tr>
<td>Critical Signals</td>
<td></td>
<td>General Arousal-Level</td>
</tr>
<tr>
<td>Amplitude/Size</td>
<td></td>
<td>Electrodermal-Lability</td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td>Cortical Arousal</td>
</tr>
<tr>
<td>Duration</td>
<td></td>
<td>Fatigue</td>
</tr>
<tr>
<td>Detectability</td>
<td></td>
<td>Sleep Deprivation</td>
</tr>
<tr>
<td>Signal to Noise Ratio</td>
<td></td>
<td>Drugs/Alcohol</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Medication</td>
</tr>
</tbody>
</table>

Melnyk and Das (1992) studied the performance of individuals with mental retardation as compared to non-retarded individuals. The two groups could not be distinguished on sustained attention tasks, but on selective
attention tasks (which involve more cognitive demand), differences were found. In order to be successful with selective attention tasks, one needs to be able to make a selection, resist distraction (impulsivity), and shift strategies when needed.

Gender may also play a role in performance on vigilance tasks. A 1966 study by Neal and Pearson found that women perform better than men on visual vigilance tasks. Hatta (1993) claimed that this is due to the commissural fibers, which may be more dense in females. Despite their better performance, women were found to be less motivated than men on vigilance tasks (Neal and Pearson, 1966).

A study by Hall and Kataria (1992) utilized the Gordon Diagnostic System with a group of ADHD children. The children were assessed on and off medication. When the children were assessed off of the medication, a twenty-four hour interim period took place before testing. Results indicated that when children were on medication (Ritalin) and were trained with cognitive interventions, they performed better on tasks that involved impulse control. Their performance on tasks that involved sustained attention, however, did not improve while on the medication. It could be that the sustained attention task was not long enough for vigilance decrement to set in. Another possibility is that the dosage of Ritalin taken by each subject was not enough or perhaps too much. This could not be determined, since the dosage level was not described in the study.

Ballard recommends based on her 1996b study involving the effects of task demand, noise and anxiety on CPT, that investigators need to "rule out anxiety and other contributors to poor vigilance performance." This recommendation is of particular interest since anxiety is one of the scales on the diagnostic interview that was used with the participants that were also
tested using the CPT, the CAVAAS.

Thus, vigilance tasks are tasks that require a participant to sustain concentration during a lengthy, boring task, while also responding to changes in the task (signals). Sustained attention is the act of maintaining alertness to a given task. Selective attention is the process of attending to a particular stimulus and not other stimuli (distractions). When a participant was able to maintain good selective attention, he/she was able to ignore distractions and was able to refrain from impulsive responses (those that occurred before a given signal or in the absence of a signal).

Taken together, these studies show that Ritalin and other stimulant medications enhance performance on laboratory tests of selective attention and impulsivity, and can enhance performance on longer or more complex vigilance tasks, but show little or no effect on brief, simple vigilance tasks. They also indicate that successful vigilance performance is reliant on good selective attention skills, sustained attention skills and being aware of and sensitive to task parameters, environmental factors and subject characteristics.

Based on the research noted above, it was expected that both impulsivity and vigilance on the sustained attention tasks of the CAVAAS should be sensitive measures of attention problems as assessed by The Diagnostic Interview Schedule for Children (DISC).

Perceptual-Motor Functioning

Because this malformation can impair the functions of sensory and oculomotor nerves, as many as 95% of the SB population may demonstrate weak perceptual-motor coordination (Shaffer et al., 1986). In order to be successful on motor tasks, one needs accurate sensory information. Visual,
auditory, and proprioceptive senses are used in responding to different motor tasks. Due to sensory and motor limitations, persons with SB may respond differently to their environment (Evaggelinou and Drowatzky, 1991). Hamilton (1991) found that children with SB had difficulty with position sense, which greatly impacts handwriting, cutting and manipulating utensils. The speed and coordination of these acts are also affected. It has been suggested that poor perceptual-motor functioning by children with SB may be due to disorganization from neurological damage or to limited opportunities to explore the environment (Shaffer et al., 1986; Williamson, 1987). Early exploration helps children develop body perception, which is important in developing appropriate feedback skills to correctly guide muscles. Poor perceptual-motor skills are related to the amount of time spent in the hospital during the first five years of life (Raimondi and Soare, 1977). Most children with SB spend weeks if not months in the hospital during the first five years of life, thus impacting perceptual-motor skill development. Higher lesions were found to correlate with poorer perceptual-motor difficulties as well (Raimondi and Soare, 1977). Arnold-Chiari malformation may also impact perceptual-motor functioning such as figure-ground and tactile perception (Wills, 1989).

According to a study by Evaggelinou and Drowatzky (1991), speed of processing on perceptual-motor tasks is related to ambulatory skills. Children with SB who were ambulatory responded more quickly and accurately on timed tasks than did children who were not ambulatory (Evaggelinou and Drowatzky, 1991). Thus, when children with SB are tested on the Performance Subtests of the WISC-3 (Weschler Intelligence Scale for Children-3rd edition), their score is impacted by their perceptual motor skills, which are impacted by their level of ambulation and their early
developmental/health history. Caution when interpreting IQ scores needs to be taken when assessing persons with perceptual-motor difficulties. Gordon (1987) indicates that "a host" of perceptual and cognitive skills are utilized in the performance of the GDS Delay Task. Testing on the CAVAAS also involved speed, accuracy, and visual-perception skills. Therefore, it is expected that ambulators will fare better than non-ambulators on the CAVAAS. Children with SB as a group are expected to score below norms for able bodied children on the visual parts of the CAVAAS because of slow response time due to perceptual-motor deficits. It should be noted that the auditory parts of the CAVAAS do not have standardized norms.

**Social/Emotional Issues and CAVAAS Performance**

As a consequence of their cognitive and medical impairments, social and emotional functioning of children with SB may also be disturbed. Thus, both medical and cognitive variables may predict depression, dysthymia (a chronically depressed mood, lasting most of the day for 1 to 2 years), anxiety, and attention deficit disorder, as indicated by performance on the CAVAAS and DISC, in this sample of students with SB and attention issues. An overview of depression and anxiety was presented in the next section to provide a context within which to examine these social/emotional areas.

**Depression**

The prevalence of major depression is estimated between 2% and 3% of the male general population and 5% and 9% of the female population, while dysthymia occurs in approximately 3% of the population (American Psychiatric Association, 1994). Ten percent to 20% of all clinical referrals exhibit some level of depression (de Mesquita and Gilliam, 1994).
Approximately one-half of all depression diagnoses also meet the criteria for at least one other disorder (de Mesquita and Gilliam, 1994). When one or more disorders exist together, this is called comorbidity. It is thought that depression is often overlooked as a diagnosis in children, with other, similar diagnoses occurring more often. These include anxiety disorder, conduct disorder, and attention deficit disorder, with more depressed children than non-depressed children being diagnosed with ADHD (de Mesquita and Gilliam, 1994).

Sprinkle (1992) found that 27% of an ADHD group had anxiety traits and 37% had depressive traits. Sprinkle stated that frequent misdiagnoses of ADHD occurs, with practitioners failing to recognize other disorders or the interaction of two or more disorders. Lahey and colleagues (1987) found a higher prevalence of anxiety and depressive disorders in non-hyperactive, inattentive children. The difficulty in determining comorbidity lies in the instruments used to make diagnoses. The most common tools used for the diagnosis of ADHD, anxiety and depression are observation, self-report, behavioral checklists and projective techniques. Even after completing these, the symptoms for the three disorders are so similar that an accurate diagnosis is difficult to make, especially in young children. It is not clear whether computerized tests such as the CAVAAS could distinguish better among these diagnoses.

Some children are at greater risk than others. Females pose a higher risk for depression once puberty occurs. Children who exhibit poor school performance or learning disabilities also pose a higher risk for depression. Also noted in the literature is a higher incidence of "low self-esteem" among students with spina bifida (Blum et al., 1991; MacBriar, 1983). These studies include depression and anxiety as contributing factors for low self-esteem.
Dorner (1976) and McAndrew (1979) report a very high rate of depression among adolescents with spina bifida. However, more recent studies have not confirmed this finding (Ammerman, et al., 1989; Holmbeck et al., 1995; Wolman et al., 1994). Females and youth attending residential or special schools appear to demonstrate the most difficulty with adjustment. Other studies reported conflict one another. Some studies indicate a higher incidence of depression among youth with spina bifida (Anderson et al., 1982; Dorner, 1976; Schmalz, 1985; St. Germaine, 1988; Wallander et al., 1988) while others report no increased rate (Spaulding et al., 1986; Van Hasselt et al., 1991). The spina bifida population is very diverse, with a lot of variation in groups studied. Based upon this it is difficult to interpret if an increased rate of depression in youth with spina bifida does exist. Varni and Wallander (1988) indicate in The Handbook of Pediatric Psychology that families of children with spina bifida and children with spina bifida are at an "increased risk" for experiencing some type of psychological dysfunction. Due to contradictory studies, however, the difficulties are not definitively stated.

Chronic medical problems place children at risk for depressive symptoms. However, most children with chronic medical problems are not diagnosed as being clinically depressed (Bennett, 1994). There are mixed findings concerning depression and the onset of the medical problem. Although some studies indicate that the longer the medical condition has existed, the greater the risk for depression, others indicate that the longer the medical problem has existed, the better one may be able to cope with it. Due to on-going medical needs, children often have difficulty externalizing their problems, instead of internalizing them (Bennett, 1994). Although most studies have found severity of the medical disorder to be unrelated to depression, Youssef (1988) who examined children with congenital heart
disease found a positive correlation. In another study in which children who had cancer were studied, a relationship was found between the severity of the cancer and depression (Gizynski and Shapiro, 1990). Children with spina bifida also display chronic medical problems, with the most common difficulties being related to shunt malfunction or infection and bladder infection.

Several studies indicate a higher rate of self-reported depression among the mothers of children with spina bifida (Kronenberger et al., 1992; Wallander, 1988). While this is often attributed to the stress of coping with a child's chronic disability, the vulnerability of depression can be heritable. A mother's level of satisfaction with her marriage, as well as support system are contributing factors to her psychological well being (Wallander et al. 1988). It is not noted in the present study what percentage of participant's parents are divorced, unhappy with their marriage or have adequate or inadequate support systems.

A review of the neuropsychological literature indicates that right hemisphere dysfunction may be associated with depression, ADHD, and some learning difficulties. It might be plausible that hydrocephalus and/or shunting in children with SB could play a role in right hemisphere dysfunction. It also appears that body image perception is a significant variable when analyzing depressive symptoms in children with medical needs (Jessop and Stein, 1985). Based upon this, it would seem that a goal with the SB population would be to foster self-esteem and provide qualified personnel for children to talk to about their diverse needs and concerns.

In the present study, depression and dysthymia were assessed in order to discover if there was a higher incidence of depression or dysthymia compared to the population base rates among the SB population referred for
testing of attention problems. Whether or not depression or dysthymia were associated with the severity of inattention as measured on the CAVAAS was also systematically assessed among the participants.

Anxiety

Three percent of the general population are diagnosed with generalized anxiety disorder, according to the American Psychiatric Association (1994). Anxiety is related to fear, in that both produce the same physiological response (Highland, 1981). It seems that anxiety is learned, and that it results from a threat to one's self system (Highland, 1981). When a person is anxious, his or her area of awareness is decreased (Highland, 1981). People can learn to overcome their anxiety, however. Psychotherapy, learning new behaviors, and learning new cognitions about anxiety provoking situations are just a few ways to overcome anxiety (Highland, 1981). Some researchers believe that moderate levels of anxiety will enhance performance, while others do not believe this. A study by McCaan and Meen (1984) "found little support for the hypothesis that high anxiety is associated with greater achievement for more intelligent students but is associated with lower achievement for less intelligent students."

According to Gordon and McClure (1983), the GDS is able to distinguish children with ADD from those who are reading disabled, overanxious and normal. Gordon (1987) indicates that "fearful children" tend to sit extremely still and produce very few responses on the GDS. This information is of significant relevance since the participants in the present study were assessed using the CAVAAS, which utilizes the GDS.

Anxiety is often diagnosed as existing comorbid with another disorder, frequently depression or attention deficit disorder. Lonigan and colleagues
(1994) reported that anxious children with a comorbid diagnosis of depression tend to be older. There is much debate over whether anxiety should be a separate diagnosis or whether it is a part of other diagnoses. It was found by Lonigan and colleagues (1994) that children who are depressed present more problems related to a loss of interest and low motivation, and they also demonstrate lower self-esteem. Children who are anxious tend to worry about the future, their well being and the reactions of others. Also noted by Lonigan and colleagues (1994) is that the absence of positive affect in depression is a distinguishable characteristic between anxious children and depressed children. Brady and Kendall (1992) note that in anxiety the predominant emotion is fear, while in depression it is sadness. Anxious children are found to be hospitalized more frequently according to Brady and Kendall (1992). This is an interesting finding, since all of the children in the present study have had multiple hospitalizations. Determining whether a child has experienced anxiety previous to hospitalizations or whether the anxiety was subsequent to hospitalizations is important in determining the contributing factors to the anxiety.

Johnson (1985) indicates that in a study of spina bifida students, behavior problems were noted by teachers and parents as anxious, inattentive and overly-inhibited nature. According to Blum et al. (1991) children with spina bifida who feel overprotected by their parents reported being less happy, less popular, having lower self-esteem and increased anxiety. Families with increased cohesion, reduced conflict, higher levels of maternal education and family income evidenced children who displayed better adjustment. Forty-four percent of hydrocephalic children in a study by Fletcher et al. (1995) displayed features of conduct disorder and anxiety disorder. Fletcher goes on to note that 16% of the spina bifida children in a study by Wallander et al.
(1989) were found to have "internalizing" behavior problems. Also noted is a study by MacBriar (1983) which indicates that persons with spina bifida have lower self esteem and higher anxiety than controls. However, a study by Landry et al. (1993) indicates that there are no significant differences between children with spina bifida and able-bodied peers in their self-concepts. Edwards-Beckett (1994) reports similar findings.

Studies comparing depressed and anxious children are difficult to interpret due to the many different classification systems that are used in diagnosing both disorders. Also, sample sizes tend to be small. Genetic influence and environmental factors and their role in anxiety are unclear (Brady and Kendall, 1992). More comprehensive studies need to be completed for a clearer understanding of the role of genetics and environment in anxiety disorders.

In summary, hospitalization is common among children with SB, and may be associated with increased anxiety. In this section, an effort was made to build a case for the notion that it was important to assess anxiety in the present study to determine if there was a higher incidence of overanxious disorder among the SB population referred for testing for attention problems, compared to the population base rates, and whether anxiety was associated with CAVAAS performance in this sample.
CHAPTER III

METHOD

Participants

Phyllis Agness and Lowell Becker have been systematically evaluating students with SB and attention difficulties in their Ft. Wayne, Indiana clinic since 1992. Participants were taken to the clinic by their parents because of parental concerns related to their children's inattention, distractibility, impulsivity, and poor academic performance. Between March of 1992 and March of 1995, the clinic collected data sets on 56 students with SB. These students were contacted by telephone in the fall of 1997, and invited to participate in the present study. Forty-three of these students consented to participate (see Table 2).

Table 2

Sample characteristics (N=43)

<table>
<thead>
<tr>
<th>Age at testing</th>
<th>%</th>
<th>Gender</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>7.0</td>
<td>Male</td>
<td>55.8</td>
</tr>
<tr>
<td>7</td>
<td>9.3</td>
<td>Female</td>
<td>44.2</td>
</tr>
<tr>
<td>8</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>11.6</td>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>7.0</td>
<td>Caucasian</td>
<td>97.7</td>
</tr>
<tr>
<td>13</td>
<td>4.7</td>
<td>Hispanic</td>
<td>2.3</td>
</tr>
<tr>
<td>14</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2.3</td>
<td>Income Level</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>2.3</td>
<td>20,000-29.9</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
(Table 2 Cont.)

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>7.0</td>
<td>30,000-39.9</td>
<td>16.3</td>
</tr>
<tr>
<td>20</td>
<td>4.7</td>
<td>40,000-49.9</td>
<td>4.7</td>
</tr>
<tr>
<td>21</td>
<td>7.0</td>
<td>50,000+</td>
<td>74.4</td>
</tr>
<tr>
<td>25</td>
<td>2.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Education**

Regular education w/ & w/out support 86.0

Special education 9.3

Home school 4.7

<table>
<thead>
<tr>
<th>IQ</th>
<th>%</th>
<th>Age At Shunt Placement</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>120+</td>
<td>2.3</td>
<td>Birth-1 month</td>
<td>83.7</td>
</tr>
<tr>
<td>110-119</td>
<td>7.0</td>
<td>1mo-6mo</td>
<td>9.3</td>
</tr>
<tr>
<td>90-109</td>
<td>65.1</td>
<td>6mo-older</td>
<td>2.3</td>
</tr>
<tr>
<td>70-89</td>
<td>20.9</td>
<td>No shunt</td>
<td>4.7</td>
</tr>
<tr>
<td>Below 70</td>
<td>4.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Lesion Level**

Sacral 4.7

Lumbar 69.8

Thoracic 25.6

<table>
<thead>
<tr>
<th>%</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk unassisted</td>
<td>4.7</td>
</tr>
<tr>
<td>Walk w/assistance</td>
<td>51.2</td>
</tr>
<tr>
<td>Wheelchair</td>
<td>44.2</td>
</tr>
</tbody>
</table>

**Number of Shunt Revisions**

Zero 11.6

1-3 55.8

4-6 14.0

7 or more 18.6

**Medication**

(*not taking at time of CAVAAS testing*)

Antibiotic 25.6

Anticholinergic 18.6

Antidepressant 16.3

Antiinfective 18.6

Antispasmodic 46.5

Anticonvulsant 7.0
The total data set consisted of 43 participants who ranged in age from 6 to 25 years at the time of testing, with the mean age being 12 and the median age being 11. The age range at the time of follow-up interviews was from 7 to 28, with the mean age being 14 and the median age being 14. The participants were from various states, with the majority being from Indiana, Illinois, and Michigan. There were 19 females and 24 males. Their characteristics are characterized in Table 2. Most of the participants were taking medication
while being tested on the CAVAAS. The most common types of medication included Ditropan, Macrodantin, and Bactrim. It should be noted that these medications are designed to control the bladder, and have no known effects on cognition and/or attention. However, 7 were taking an antidepressant and 8 were taking anticholinergics which may have side effects, such as drowsiness, that can impact test performance (Ladig, 1996). The general intellectual level according to parent's report about any standardized testing was 69 and above, with one student who was 6 years of age and bilingual being assessed on the English version of the WISC-R with an IQ of 54. The psychological Corporation (1967) maintains that IQ scores fall within a normal bell shape curve. According to this psychometric view, the present sample closely matches the standardization sample for the superior range (2.14%) and average range (68.26%). The above average range of this sample (7.0%) is approximately half of the standard (13.59%), while scores in the below average (20.9%) and mentally deficient (4.7%) ranges occur more frequently than the standards of 13.59% and 2.14% respectfully. The mean annual family income level was $50,000 or more. This relatively high income level may reflect the fact that these families were private paying clients who traveled a considerable distance to the clinic to receive treatment in Indiana.

Procedure

Prior to beginning the study, verbal consent was given to the investigator by Dr. Phyllis Agness and Dr. Lowell Becker to utilize their archival data set. All data related to the testing on the CAVAAS (Comprehensive Auditory Visual Attention Assessment System) and background information related to the participants was systematically obtained and photocopied from Dr. Agness' and Dr. Becker's files. A discussion with Dr. Agness and Dr. Becker related to the
procedures they employed in their testing took place. Next, written consent from all participants was obtained (see Appendices A and B). Parents consented for their minor child, and participants presently over 18 years of age consented for themselves or their parents to complete the interview. It should be noted that participants consented to allow the use of their CAVAAS data set, and agreed to be interviewed regarding demographic and medical background information, DISC items covering the history of anxiety, depression, dysthymia, and ADHD.

The procedure for collecting the CAVAAS data set was reported by Dr. Becker and Dr. Agness to be as follows: The test administration time was one-and-one-half hours. Testing took place in Ft. Wayne, Indiana in a quiet office suite. The CAVAAS was located on a table, with the participant seated in a chair in front of it. The examiner was seated to the right and slightly behind the participant. The Vigilance Tasks were administered first, followed by the presentation of the Distractibility tasks (described below). The visual tasks (GDS) always preceded the auditory tasks. The standard instructions, located in the Gordon manual, were orally read to each participant.

**Measures**

**Comprehensive Auditory Visual Attention Assessment System (CAVAAS)**

The CAVAAS is a computerized assessment tool that utilizes both the visually based Gordon Diagnostic System (GDS) and an auditory component that was developed by Dr. Lowell Becker, to evaluate how a student processes visual and auditory information. The system discussed within the context of this project includes a Visual Vigilance Task, a Visual Distractibility Task, an Auditory Vigilance Task, and an Auditory Distractibility Task. Respondents have nine minutes in which to complete each task.
**Vigilance tasks**

The Vigilance Tasks are designed to assess how well a child can sustain his or her attention for a period of time. The respondent is presented a series of single digit numbers (on a computer screen for the visual task, and through ear phones for the auditory task) and is instructed to respond by pushing a blue response button, only when a 9 is preceded by a 1. Digits are presented at a rate of one per second for 9 minutes (Wherry et al., 1993).

**Distractibility tasks**

The Distractibility Tasks are designed to assess how well a child can pay attention to the target stimuli, despite the presence of distracters. The visual distractibility task is identical to the visual vigilance task except that numbers are presented in three columns on the GDS computer screen. The participant is asked to respond when a 9 is preceded by a 1 in the middle column. The auditory distractibility task is identical to the auditory vigilance task except that some distracting background noise is presented to the participant as the series of numbers are being said into the headphones.

**Scoring**

On the CAVAAS Auditory and Visual Vigilance and Distractibility tasks, a respondent obtains 4 scores: (mean response time, response time error, delay response, and sustained attention). The total number of participants for each CAVAAS task (some were unable to complete all tasks) and the CAVAAS scores are presented in Table 4.

The errors recorded for the CAVAAS are different than for the GDS. Dr. Lowell Becker in consultation with Dr. Gordon developed the auditory
component and had someone write the computer program to accompany the CAVAAS. Becker utilizes the Visual Distractibility Threshold Tables for both the visual and auditory components. These are broken down into three categories: abnormal (5th% or less); borderline (6th%-25%); and normal (26th% and higher). These categories are located in the GDS manual and organized within the context of age groupings. Becker also developed his own "norms", not located in the GDS manual, based on the average scores of several thousand clients, who were referred for an evaluation of attention problems. The scores are categorized and recorded as follows:

1. Mean reaction time (Response Time)
2. Response/reaction time (Response Time Error)
3. Ability to delay impulses (Delay Response)
4. Ability to sustain attention over time (Sustained Attention)

**Mean response time**

The average response latencies, the delay between the appearance of the target stimulus and the subjects correct response are recorded. According to Dr. Becker's "norms", .5 seconds or less on the visual tasks, and .6 seconds or less on the auditory tasks are the average response latencies. Auditory tasks are known to take longer to process than visual tasks. This finding is used as the rationale to support the use of a .1 second difference criterion.

**Response time error**

The Response Time Error is recorded for each extraneous response that occurs. These responses might be responses to digits other than 1 or responses that are too slow. The correct response would follow a "1/9" sequence. The goal is to respond correctly each time, thus yielding a score of 0.
Delay response

The Delay Response score is increased each time that a student hits the blue response button after a 1, but before a 9 has occurred. The goal is to respond correctly each time to the stimulus, thus yielding a score of 0 for this category.

Sustained attention score

The Sustained Attention score is the total number of correct responses to the 1/9 stimulus. The goal is to receive a score of 45, which indicates that no errors (impulse or response/reaction) occurred.

Reliability/Validity

As noted many times above, the participants had been administered the CAVAAS. Intelligence for most children with SB is in the normal range. Although children with SB have an increased risk of having a learning disability, they are generally able to comprehend verbally given directions. It was assumed that the verbally given directions of the CAVAAS were comprehended.

Most research on the Gordon Diagnostic System (GDS), the visual part of the CAVAAS, indicates that it is a good assessment tool for vigilance and distractibility (Burg et al., 1995; Rasile et al., 1995). Depending on the assessment procedure used, the GDS may miss up to 30% of hyperactive children (Gordon, 1987). Therefore, it should be used in combination with other measures of attention. At the time of the CAVAAS assessment the only additional procedural measure used was a clinical psychiatric interview. Unfortunately, no other data were collected. Gordon (1987) reported that the GDS was designed to assess impulsivity and sustained attention. Barkley (1991)
found the GDS Delay Task to discriminate ADHD from normal children. The GDS was normed on over 1300 nonhyperactive, normal children between the ages of four and sixteen. In the normative sample, the Delay Task's primary scores were positively correlated with the child's age but not with the gender or SES of the child (Gordon, 1987). The Vigilance Task's total correct scores were positively correlated with mother's SES for the older children (6 and older) (Gordon, 1987). The relationship between a child's age and performance on the Vigilance and Distractibility Tasks indicated a need for age groupings. Thus, a breakdown of ages, which make up the threshold tables, (tables with values that can be used as comparison guides for scores on the GDS) were written (Gordon, 1987). Gordon's scores tend not to correlate with IQ scores. However, they may correlate with the Freedom from Distractibility score on the WISC-R (Douglas, 1983).

According to Gordon (1987), high correlations (mostly negative) occur among scores (such as the number of errors and the number correct) within a particular set of tasks (Delay, Vigilance, Distractibility). However "variables tend not to be related, supporting the notion that each task assesses a different aspect of functioning." Finally, is should be noted that test-retest reliability demonstrates that primary GDS scores are stable over time.

**Background Questionnaire**

Within the context of the study, a questionnaire and the Diagnostic Interview Schedule For Children (DISC) were completed by a parent during a telephone interview the same author. The questionnaire consists of sixteen health related questions (see Appendix C). They include: lesion level; seizure history; number of shunt revisions; age at initial shunt placement; number of shunt infections; asthma; latex allergy; vision status (strabismus/glasses);
history of depression/ADHD/anxiety disorder and type(s) of medication(s), if any; ADHD history in family; educational placement (regular, special or home) intellectual level; mobility status; race/ethnicity; and income level.

**Diagnostic Interview Schedule for Children (DISC)**

Detailed information about each participant's history of depressive symptoms, anxiety level in various situations and ability to attend within the 6 months prior to testing on the CAVAAS was addressed using the DISC during the telephone interview. The Diagnostic Interview Schedule for Children-2nd Edition (2.3, Parent Informant), is a structured interview used to elicit DSM III-R criteria for common pathologies found in children and adolescents ages 9-17 (N.I.M.H., 1992). Special field trials with children between the ages of 6 and 11 were completed. Prudence Fisher, one of the developers of the DISC, indicated that the DISC could be used for children as young as age 6 (personal communication). The DISC was designed to gain information about present symptomatology. The DISC-2.3 was developed under the guidance of The National Institute of Mental Health in 1992, with field site testing taking place in four different locations. "The general structure of the DISC-2.3 for each diagnosis is to obtain information about the symptoms or criteria which are present. If a certain (subdiagnosis) threshold is met, then age of first onset, impairment, contextual, and treatment questions are asked" (Shaffer et al., 1992).

According to a study conducted by Cohen and colleagues (1993), interrater reliability is excellent. For the purpose of this study, three areas from the Parent Version of the DISC-2.3 were chosen to be administered. They were Module A: Overanxious Disorder/Generalized Anxiety Disorder; Module C: Major Depression/Dysthymia; and Module E: Attention Deficit Hyperactivity
Disorder (see Appendix D). The administration time for the questions was about 45 minutes. Responses that are most frequently used are scored with a 0-no, 1-sometimes, 2-yes, 9-don't know. The questions were hand scored with a diagnosis of positive, negative, or undetermined for each module.

Many participants fell outside of the age range for which the DISC was designed. When searching for an instrument to use with this population, none were found that would encompass all ages and all diagnoses. It was felt that utilizing one instrument as opposed to aggregating over two or three different instruments would make interpretations more feasible. Also, the DISC included the four areas of interest, ADHD, anxiety, depression, and dysthymia. Other diagnostic interviews did not include all four areas. Interpretations were made with caution. Since 9 participants fell outside of the DISC standardization age range at the time when they were tested on the CAVAAS. These 9 participants were older than the specified age of 17 (ages 19, 20, 21, and 25).

The DISC utilizes the DSM III-R criteria for diagnosing depression, dysthymia, ADHD, and an anxiety disorder. This was felt to be appropriate, since no adequate measure which encompasses the given age parameters was found utilizing DSM-IV criteria, and for the purposes of this study only a broad estimate of these psychological diagnoses was needed.

The DISC questions were read to the parent of each child who was tested using the CAVAAS. If a person tested was an adult at the time when tested on the CAVAAS, then the questions were put directly to him or her. This was determined to be appropriate since participants who were not adults when assessed on the CAVAAS reported that their parents would be more accurate reporters. The reference point for responding to the questions is the time period before testing on the CAVAAS. By using this reference point, it was hoped that the results of the diagnostic interview estimated the participant's
functioning at the time of the testing on the CAVAAS. The CAVAAS was administered to the participants between the years of 1992 and 1995. The administration of the DISC was in 1997. Although there was a 2 to 5 year time lag between the CAVAAS testing and the DISC interview, it was felt that the parents of the children would be reasonably accurate reporters, based on their level of involvement in their children's educational career as well as their investment in the CAVAAS testing process. In addition, the persistence of ADHD symptoms among most persons with this diagnosis implies that those who had diagnosable ADHD 2 to 5 years ago would be likely to have symptoms of this disorder presently, which probably would increase the reliability of reported symptoms. (The same cannot be presumed of anxiety or depressive symptoms, which typically are more transient, and it is possible that current symptoms of anxiety or depression might tend to exaggerate estimates of such symptoms with reference to the time of testing).

Hypotheses

The following null and alternative hypotheses were tested:

1. There is no relationship between the level of lesion and inattention in this sample of students with SB. Alternatively, the higher the lesion level the greater the inattention.

2. There is no relationship between hydrocephalus and inattention in this sample of students with SB. Alternatively, hydrocephalics will be more inattentive.

3. Among children with hydrocephalus, there is no relationship between presence of a shunt and inattention. Alternatively, shunted hydrocephalics
will be more inattentive.

4. There is no relationship between age at the time of the initial shunt placement and inattention in this sample of students with SB and shunted hydrocephalus. Alternatively, the earlier the shunt was put in, the less inattention indicated.

5. Among shunted children, there is no relationship between the history of one or more shunt infections and inattention. Alternatively, students with a history of shunt infections will be more inattentive.

6. There is no relationship between the number of shunt revisions and inattention in this sample of students with SB and shunted hydrocephalus. Alternatively, the greater number of shunt revisions, the greater the inattention.

7. There is no relationship between seizure history and inattention in this sample of students with SB. Alternatively, students with a history of seizures will be more inattentive.

8. There is no relationship between latex allergies and inattention in this sample of students with SB. Alternatively, students with latex allergies will be more inattentive.

9. There is no relationship between latex allergies and anxiety in this sample of students with SB. Alternatively, students with latex allergies will be more anxious.

10. There is no relationship between the history of asthma and anxiety in this sample of students with SB. Alternatively, students with asthma will be more
anxious.

11. On the visual component of the CAVAAS, there is no difference between children who wear glasses, and children who don't wear glasses. Alternatively, students who wear glasses will score more poorly on the visual component of the CAVAAS.

12. Among children who wear glasses, the visual scores on the CAVAAS will be less than the auditory scores on the CAVAAS. Alternatively, students who wear glasses will score higher on the auditory components of the CAVAAS.

13. There are no differences in inattention across races/ethnicity, genders, and income levels in this sample of students with SB. Alternatively, females will score higher on the vigilance aspects of the CAVAAS, as indicated by Neal and Pearson, 1966.

14. There is no difference in the percentage of the sample diagnosed with ADHD on the DISC, compared to the rate of ADHD in the able bodied standardization sample. Alternatively, more students from this sample will be diagnosed with ADHD.

15. There is no difference in the level of inattention as indicated on the CAVAAS by vigilance or distractibility scores between children diagnosed or not diagnosed as having ADHD on the DISC. Alternatively, ADHD students will score lower on the CAVAAS.

16. There is no difference in the level of inattention on the visual components of the CAVAAS than the GDS norms. Also, there is no difference in the level of inattention on the auditory components of the CAVAAS than the experimental sample of non-disabled students obtained by Becker (unpublished finding).
Alternatively, the SB students will score lower on the visual components of the CAVAAS. Also, SB students will score lower on auditory parts on the CAVAAS.

17. There is no relationship between ambulation and CAVAAS scores (Evaggelinou, 1991). Alternatively, ambulators will score higher than non-ambulators.

18. There is no difference in the percentage of the sample diagnosed with depression on the DISC, compared to the rate of depression in the able bodied standardization sample for this measure. Alternatively, more students from this sample will be diagnosed as depressed.

19. There is no difference in the level of inattention as indicated on the CAVAAS by vigilance or distractibility scores between children diagnosed as depressed or not depressed on the DISC. Alternatively, depressed students will be more inattentive on the CAVAAS.

20. There will be a higher percentage of SB students with an attention referral who also have an anxiety disorder as compared to the DISC standardization sample. Alternatively, more students from this sample will be anxious.

21. There is no difference in the level of inattention as indicated on the CAVAAS by vigilance or distractibility scores between children diagnosed as anxious or not anxious on the DISC. Alternatively, anxious students from this sample will be more inattentive on the CAVAAS.

Exploratory Hypotheses

1. There is no relationship between DISC dysthymia diagnosis and the level of
attention as indicated on the CAVAAS by vigilance or distractibility scores. Alternatively, dysthyemic children will be more inattentive on the CAVAAS.

2. There is no relationship between the level of attention as indicated on the CAVAAS by vigilance or distractibility scores and IQ scores. Alternatively, children with higher IQ's will attend better.

3. There is no relationship between the diagnosis of ADHD on the CAVAAS and a family history of ADHD. Alternatively, the DISC will be more accurate in identifying children who have ADHD and a history of ADHD within the family.

4. There is no difference between CAVAAS ADHD diagnosis and DISC ADHD diagnosis. Alternatively, the DISC will more accurately identify children with ADHD.

Plan of Analysis

A list of the predictor variables and their values are presented in Table 3.

Table 3

Predictor variables

| Lesion level: sacral and lumbar, thoracic |
| Seizure history: yes, no |
| Shunted hydrocephalus: yes, no |
| Age at initial shunt placement: (continuous) |
| Number of shunt revisions: (continuous) |
| Shunt Infection: yes, no |
| Asthma: yes, no |
| Latex allergy: yes, no |
| Strabismus/Glasses: yes, no |
(Table 3 Cont.)

ADHD family link: yes, no  
History of depression: yes, no  
History of ADHD: yes, no  
Educational placement: regular, special, home  
Intelligence level: (continuous)  
Ambulation: walking with no assistance and walking with assistance, wheelchair  
Race/Ethnicity: Caucasian, other  
Gender: male, female  
Income level: <10,000, 10,000-19,999, 20,000-29,999, 30,000-39,999, 40,000-49,999, 50,000 or more

When analyzing the data, frequencies were tested first. These frequency tests were previously reported in the text, and are presently depicted in Table 2.

Not all variables were evenly distributed. Therefore, it became necessary to group the variables according to their distribution. Predictor variables with equal numbers of subjects at each level included: infection status; latex allergy; mobility; DISC ADHD diagnosis; and gender. Outcome variables that were distributed normally included: Visual Vigilance Response Time; Visual Distractibility Response Time; Auditory Vigilance Response Time; Auditory Distractibility Response Time; and all Sustaining Attention variables. When applicable, Student's t-tests were utilized to test these variables. Predictor variables that had unequal numbers per cell included: antidepressants; lesion level; shunt revisions; glasses; depression history; IQ; CAVAAS ADHD diagnosis; and DISC anxiety, depression and dysthymia diagnoses. Outcome variables that were not normally distributed included all delay tasks and reaction time error tasks. When applicable, the Mann-Whitney U test, a non-parametric test, was utilized to test these variables. The Mann-Whitney U test can be used with
skewed data, and unequal cell sizes.

The relationship between hydrocephalus and inattention (hypothesis 2), the presence of a shunt and inattention (hypothesis 3), seizure history and inattention (hypothesis 7), and the history of asthma and inattention (hypothesis 10) were tested using a series of point biserial coefficients. This technique is considered an appropriate statistical procedure for testing these hypotheses since the independent variables are dichotomous and the dependent variables are continuous and normally distributed.

The relationship between the level of lesion and inattention (hypothesis 1), the relationships between shunt infections and inattention (hypothesis 5), latex allergies and inattention (hypothesis 8), the difference between the CAVAAS scores of children wearing glasses and those not wearing glasses (hypothesis 11), the differences in inattention across races, genders, and income levels (hypothesis 13), differences in the level of inattention as shown on the CAVAAS (hypothesis 15), ambulation and CAVAAS scores (hypothesis 17), differences in CAVAAS scores and children diagnosed with depression (hypothesis 19), and differences in CAVAAS scores and anxious children (hypothesis 21) were tested using Student's t-tests on the variables that are normally distributed and Mann-Whitney U tests on the data that are skewed. These tests are appropriate statistical measures for comparing the distributions of two independent samples. An ANOVA for race/ethnicity, and income (hypothesis 13) was also used to compare the distributions of normally distributed scores across several, independent groups.

The association between the age at the time of the initial shunt placement and inattention (hypothesis 4) was tested using a series of Pearson product-moment correlation coefficients. This technique is considered an appropriate statistical method for testing these hypotheses since the independent variable
is at least ordinal and the dependent variable is continuous.

The association between the number of shunt revisions and inattention (hypothesis 6) was measured using Kruskal-Wallis test, a non-parametric test, which is appropriate when comparing the distribution of a skewed variable across several independent groups (Cohen & Cohen, 1975).

The difference between visual and auditory scores of those wearing glasses (hypothesis 12) was tested using the Wilcoxon for matched pairs.

The relationship between latex allergy and anxiety (hypothesis 9) was tested using a chi-square distribution.

Hypothesis 16, contrasting the scores of the present sample with CAVAAS norms, was tested using student's t-test for paired samples.

Hypothesis 14, the difference in the percentage of ADHD diagnoses on the DISC when compared to the population base rate; hypothesis 18, the difference in the percentage of depression diagnoses on the DISC when compared to the population base rate; and hypothesis 20, the difference in the percentage of anxiety diagnoses on the DISC when compared to the population base rate, were tested using student's t-test to test for the differences between the sample means and the population means. This is an appropriate statistic for two independent samples that are normally distributed.

Exploratory questions were tested using student's t-tests, Mann-Whitney U tests, chi square tests and Hit Rate Analyses.

The SPSS (Statistical Package for the Social Sciences) version 4.1 for IBM OS/MVS, was used to analyze the data sets.
CHAPTER IV

RESULTS

Overall scores of this sample on the CAVAAS measures are reported in Table 4.

Table 4

Range, mean, median, and standard deviation of CAVAAS scores

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Perfect Score</th>
<th>Range</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
</tr>
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<tbody>
<tr>
<td><strong>Visual Vigilance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(impulse control)</td>
<td>41</td>
<td>0</td>
<td>0-22</td>
<td>3.93</td>
<td>2</td>
<td>5.14</td>
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<tr>
<td>(sustained attention)</td>
<td>45</td>
<td>7-45</td>
<td>37.81</td>
<td>41</td>
<td>8.88</td>
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<tr>
<td>(response time error)</td>
<td>0</td>
<td>0-14</td>
<td>1.39</td>
<td>0</td>
<td>2.59</td>
<td></td>
</tr>
<tr>
<td>(average time per item)</td>
<td>---</td>
<td>.34-.92</td>
<td>.5</td>
<td>.5</td>
<td>.12</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Distractibility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(impulse control)</td>
<td>36</td>
<td>0</td>
<td>0-35</td>
<td>3.67</td>
<td>1</td>
<td>7.6</td>
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<td>(sustained attention)</td>
<td>45</td>
<td>10-45</td>
<td>34.06</td>
<td>37</td>
<td>9.66</td>
<td></td>
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<tr>
<td>(response time error)</td>
<td>0</td>
<td>0-8</td>
<td>.833</td>
<td>0</td>
<td>1.67</td>
<td></td>
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<tr>
<td>(average time per item)</td>
<td>---</td>
<td>.35-.78</td>
<td>.51</td>
<td>.5</td>
<td>.11</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Vigilance</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(impulse control)</td>
<td>42</td>
<td>0</td>
<td>0-7</td>
<td>1.12</td>
<td>0</td>
<td>1.74</td>
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<tr>
<td>(sustained attention)</td>
<td>45</td>
<td>5-45</td>
<td>31.95</td>
<td>35</td>
<td>10.57</td>
<td></td>
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<tr>
<td>(response time error)</td>
<td>0</td>
<td>0-18</td>
<td>4</td>
<td>3</td>
<td>4.13</td>
<td></td>
</tr>
<tr>
<td>(average time per item)</td>
<td>---</td>
<td>.45-1</td>
<td>.67</td>
<td>.68</td>
<td>.11</td>
<td></td>
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<tr>
<td><strong>Auditory Distractibility</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(impulse control)</td>
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<td>0</td>
<td>0-7</td>
<td>1.05</td>
<td>0</td>
<td>1.55</td>
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<tr>
<td>(sustained attention)</td>
<td>45</td>
<td>12-45</td>
<td>32.42</td>
<td>36</td>
<td>10.57</td>
<td></td>
</tr>
</tbody>
</table>

51
(Table 4 Cont.)

(response time error) 0 0-14 3.63 2 3.97
(average time per item) --- .52-1 .67 .64 .1

Note: N indicates the total number of participants for each task. The average time per item is reported in seconds. Impulse control indicates the number of impulsive responses, sustained attention indicates the total number of responses, response/reaction time errors indicates the number of responses after the given stimuli, and average time per item indicates how much time on average each response took.

Hypothesis 1

The first hypothesis stated that the higher the lesion level the greater the inattention. The results of the Mann Whitney tests indicated that children with higher lesion levels make fewer correct responses on Visual Distractibility Sustained Attention, but also make fewer impulsive responses on Visual Vigilance Delay Impulse, and Auditory Vigilance Delay Impulse (see Table 5).

Table 5

Association of lesion level and inattention/impulsivity

<table>
<thead>
<tr>
<th></th>
<th>M/SD (sacral/lumbar)</th>
<th>M/SD (thoracic)</th>
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<tr>
<td>Visual Vigilance</td>
<td>.5/.02</td>
<td>.48/.03</td>
<td>.68</td>
</tr>
<tr>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Distractibility</td>
<td>.51/.02</td>
<td>.54/.03</td>
<td>-1.1</td>
</tr>
<tr>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Vigilance</td>
<td>.67/.02</td>
<td>.68/.03</td>
<td>-.2</td>
</tr>
<tr>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Distractibility</td>
<td>.67/.02</td>
<td>.67/.03</td>
<td>-.02</td>
</tr>
<tr>
<td>Response Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Vigilance</td>
<td>37.2/1.7</td>
<td>39.8/2</td>
<td>-1</td>
</tr>
<tr>
<td>Sustained Attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Vigilance</td>
<td>31.2/1.9</td>
<td>34.4/3.3</td>
<td>-.85</td>
</tr>
<tr>
<td>Sustained Attention</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Distract.</td>
<td>31.6/1.9</td>
<td>35.1/3.6</td>
<td>-.87</td>
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<tr>
<td>Sustained Attention</td>
<td></td>
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(Table 5 Cont.)

<table>
<thead>
<tr>
<th></th>
<th>Mdn</th>
<th>Mdn</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>36.5</td>
<td>26.5</td>
<td>82*</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2.5</td>
<td>1</td>
<td>93*</td>
</tr>
<tr>
<td>Visual Distract. Delay Response</td>
<td>1</td>
<td>1</td>
<td>153.5</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>1</td>
<td>0</td>
<td>132</td>
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<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>117</td>
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<tr>
<td>Auditory Distract. Delay Response</td>
<td>.5</td>
<td>0</td>
<td>105</td>
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<tr>
<td>Auditory Vigilance Delay Response</td>
<td>.5</td>
<td>0</td>
<td>83*</td>
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<td>4</td>
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<tr>
<td>Auditory Distract. Reaction Time Error</td>
<td>5</td>
<td>1</td>
<td>108.5</td>
</tr>
</tbody>
</table>

*significant p<.05

**Hypothesis 2**

The second hypothesis stated that hydrocephalics would be more inattentive than participants who are not hydrocephalic. This could not be tested because there were only 2 participants who were not hydrocephalic.

**Hypothesis 3**

The third hypothesis stated that shunted hydrocephalics would be more inattentive than non-shunted participants. This could not be tested because there were only 2 participants who do not have shunts.

**Hypothesis 4**

The fourth hypothesis stated that the earlier the shunt was put in, the less inattention there would be. This could not be tested because all of the shunted participants were shunted within the first 6 months of life.

**Hypothesis 5**

Hypothesis five stated that among shunted children, there would be no relationship between shunt infections and inattention. The results indicated
that children who have had one or more shunt infection had faster Visual Vigilance Response Times, more items correct on the Visual Vigilance Sustained Attention, and Visual Distractibility Sustained Attention Tasks, but also had more errors on the Auditory Vigilance Delay Impulse Task (see Table 6).

Table 6

Association of shunt infection and inattention/impulsivity

<table>
<thead>
<tr>
<th></th>
<th>M/SD (infected)</th>
<th>M/SD (not infected)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.46/.1</td>
<td>.52/.13</td>
<td>-.2*</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.49/.11</td>
<td>.53/.11</td>
<td>-.94</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.64/.1</td>
<td>.69/.12</td>
<td>-.32</td>
</tr>
<tr>
<td>Auditory Distractibility Response Time</td>
<td>.64/.09</td>
<td>.69/.11</td>
<td>-1.6</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>40.2/4.7</td>
<td>35.7/10.9</td>
<td>1.8*</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>37/8</td>
<td>31.6/10.6</td>
<td>1.7*</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>34.3/8.2</td>
<td>31/2.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>34.5/8.9</td>
<td>31.6/11.8</td>
<td>.88</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2.5</td>
<td>1.5</td>
<td>176.5</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>1</td>
<td>1</td>
<td>190.5</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>1</td>
<td>1</td>
<td>185</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>.5</td>
<td>0</td>
<td>128</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>1</td>
<td>0</td>
<td>137</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>1</td>
<td>0</td>
<td>107*</td>
</tr>
<tr>
<td>Auditory Vig. Reaction Time Error</td>
<td>5</td>
<td>1.5</td>
<td>141.5</td>
</tr>
<tr>
<td>Auditory Distract. Reaction Time Error</td>
<td>4.5</td>
<td>3</td>
<td>195</td>
</tr>
</tbody>
</table>

*significant p<.05
Hypothesis 6

Hypothesis six stated that there would be no relationship between shunt revisions and inattention among shunted children. A Kruskal-Wallis test was used to test the hypothesis and no effect of shunt revisions was found (see Table 7).

Table 7

Association of shunt revisions and inattention/impulsivity

<table>
<thead>
<tr>
<th></th>
<th>Mdn (no revision)</th>
<th>Mdn (1-3)</th>
<th>Mdn (4-6)</th>
<th>Mdn (7+)</th>
<th>X²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.5</td>
<td>.5</td>
<td>.43</td>
<td>.48</td>
<td>.68</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.56</td>
<td>.46</td>
<td>.5</td>
<td>.56</td>
<td>1.2</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.69</td>
<td>.63</td>
<td>.72</td>
<td>.68</td>
<td>2.6</td>
</tr>
<tr>
<td>Auditory Distractibility Response Time</td>
<td>.71</td>
<td>.61</td>
<td>.65</td>
<td>.7</td>
<td>2.6</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>41</td>
<td>40</td>
<td>39</td>
<td>40</td>
<td>1.4</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>32.5</td>
<td>36.5</td>
<td>39</td>
<td>34</td>
<td>3.3</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>25.5</td>
<td>35</td>
<td>35</td>
<td>36</td>
<td>1.2</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>27</td>
<td>32</td>
<td>34.5</td>
<td>28</td>
<td>.02</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2</td>
<td>2</td>
<td>1.5</td>
<td>2</td>
<td>3.0</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>.5</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>1.5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>1.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>.5</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Auditory Vig. Reaction Time Error</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>.11</td>
</tr>
<tr>
<td>Auditory Distract. Reaction Time Error</td>
<td>7</td>
<td>3</td>
<td>2.5</td>
<td>3.5</td>
<td>.37</td>
</tr>
</tbody>
</table>

*significant p<.05

Hypothesis 7

The seventh hypothesis stated that participants with a seizure history would
be more inattentive. This could not be tested because only 2 participants experience seizures.

Hypothesis 8

The eighth hypothesis stated that there would be no relationship between inattention and latex allergies. The results of both the Student's t-tests and the Mann-Whitney tests indicated no significant association between the variables (see Table 8).

Table 8

<table>
<thead>
<tr>
<th></th>
<th>M/SD (latex)</th>
<th>M/SD (no latex)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.50/.1</td>
<td>.49/.14</td>
<td>.4</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.52/.1</td>
<td>.5/.12</td>
<td>.6</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.68/.1</td>
<td>.7/.13</td>
<td>.6</td>
</tr>
<tr>
<td>Auditory Distractibility Response Time</td>
<td>.68/.1</td>
<td>.67/.12</td>
<td>.4</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>38.3/8.2</td>
<td>36.8/10.1</td>
<td>.5</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>31.6/11.5</td>
<td>36.3/7.2</td>
<td>-1.5</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>31.1/10.3</td>
<td>33.5/11.3</td>
<td>-.7</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>30.7/10.9</td>
<td>35/10.3</td>
<td>-1.3</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>1</td>
<td>2.5</td>
<td>180.5</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>1</td>
<td>1</td>
<td>173</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>1</td>
<td>1</td>
<td>193</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>146.5</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>1</td>
<td>0</td>
<td>139</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>0</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>Auditory Vig. Reaction Time Error</td>
<td>3</td>
<td>3.5</td>
<td>156.5</td>
</tr>
</tbody>
</table>
Hypothesis 9

The ninth hypothesis stated that there would be no relationship between latex allergies and the diagnosis of anxiety on the DISC. Due to very uneven cell sizes, a hit rate analysis was done, which showed that anxiety was not related to having a latex allergy (see Table 9).

Table 9

| Latex allergy status as a predictor of DISC anxiety diagnosis |
|-----------------|------------------|
|                  | DISC Anxiety     |
|                  | Anxious         | Not Anxious |
| Latex           | 1               | 20          |
| No Latex        | 6               | 16          |

Sensitivity 14%
Specificity 44%
False negative 27%
False positive 95%

Hypothesis 10

The tenth hypothesis stated that students with asthma would be more anxious. This hypothesis could not be tested because only 2 participants had asthma.
Hypothesis 11

The eleventh hypothesis stated that there would be no difference between the children with glasses and those without glasses on the visual components of the CAVAAS. No differences between children with or without glasses were found (see Table 10).

Table 10

**Association of children with/without glasses and their performance on the visual components of the CAVAAS**

<table>
<thead>
<tr>
<th></th>
<th>M/SD (glasses)</th>
<th>M/SD (no glasses)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.5/.12</td>
<td>.5/.12</td>
<td>-.13</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.52/.12</td>
<td>.5/.1</td>
<td>.4</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>38.2/8.8</td>
<td>36.8/9.3</td>
<td>.5</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>35/8</td>
<td>32/13</td>
<td>.73</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2</td>
<td>2</td>
<td>180.5</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>1</td>
<td>1</td>
<td>143</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>1</td>
<td>1</td>
<td>169.5</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>128</td>
</tr>
</tbody>
</table>

*significant p<.05

Hypothesis 12

Hypothesis twelve stated that among children who wear glasses, visual scores on the CAVAAS would be less than auditory scores on the CAVAAS. A Mann-Whitney test was used, subtracting auditory scores from visual scores of the participants who wore glasses. No significant effect related to wearing glasses was found between the visual and auditory scores (Vigilance U, 99.5;
Hypothesis 13

The thirteenth hypothesis stated that there would be no differences in inattention across races/ethnicity's, genders and income levels. Race and income levels could not be tested since the sample is predominately white (only one Hispanic child), and upper/middle-class ($29,000 and higher). Gender differences were tested. Females were found to make fewer correct responses than males on Visual Distractibility Sustained Attention tasks (see Table 11).

Table 11

<table>
<thead>
<tr>
<th></th>
<th>M/SD (male)</th>
<th>M/SD (female)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.49/.14</td>
<td>.51/.1</td>
<td>-.61</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.5/.11</td>
<td>.53/.11</td>
<td>-.91</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.66/.11</td>
<td>.68/.11</td>
<td>-.67</td>
</tr>
<tr>
<td>Auditory Distractibility Response Time</td>
<td>.66/.10</td>
<td>.68/.11</td>
<td>-.55</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>38.5/8</td>
<td>37.1/9.9</td>
<td>5</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>36.7/9</td>
<td>31.4/10.2</td>
<td>1.7*</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>32.8/10</td>
<td>30.9/10</td>
<td>5</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>33.5/9.6</td>
<td>31.2/11.7</td>
<td>.7</td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2</td>
<td>2</td>
<td>216.5</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>0</td>
<td>1</td>
<td>156</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>5</td>
<td>1</td>
<td>205</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>158.5</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>0</td>
<td>1</td>
<td>135</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>0</td>
<td>.5</td>
<td>127.5</td>
</tr>
</tbody>
</table>
Hypothesis 14

Hypothesis fourteen stated that there would be no difference in the percentage of students diagnosed with ADHD on the DISC and the base rates of ADHD in the general population. A significantly higher number of students in this sample were diagnosed with ADHD (35%) compared to the base rates (3%) (Z=10.3, p<.05; a significant Z score is ±1.96).

Hypothesis 15

Hypothesis fifteen stated that there would be no difference in the CAVAAS scores between children diagnosed with ADHD on the DISC and those not diagnosed. Students with DISC based ADHD diagnoses gave fewer correct responses than those who did not meet the DISC criteria for ADHD on Visual Vigilance Sustained Attention, Visual Distractibility Sustained Attention, Auditory Vigilance Sustained Attention, and Auditory Distractibility Sustained Attention, but also made fewer impulsive errors on Visual Distractibility Delay Response (see Table 12).

Table 12

Association of CAVAAS scores and DISC ADHD diagnosis

<table>
<thead>
<tr>
<th></th>
<th>M/SD (ADHD)</th>
<th>M/SD (no ADHD)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.51/.11</td>
<td>.49/.12</td>
<td>.44</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.52/.12</td>
<td>.51/.11</td>
<td>.3</td>
</tr>
</tbody>
</table>
Hypothesis 16

Hypothesis sixteen stated that there would be no difference in the level of attention of participants on the visual components (Visual Vigilance Sustained Attention and Visual Distractibility Sustained Attention) of the CAVAAS when compared to the GDS norms for non-disabled children of the same age. A t-test comparing the subtest scores of the SB group to the norm group was run on participants under 17. It was not possible to include participants 17 and older, because the GDS norms for this group were completed on a 6 minute version of the GDS, not the 9 minute version. As a group, children with SB had fewer items correct than the GDS norm group on the Visual Vigilance Sustained Attention task, but did not differ from the norm group on the Visual Distractibility Sustained Attention task (see Table 13).
It should be noted that on the Visual Distractibility Sustained Attention task, 5 children (ages 6-8) were unable to complete the subtest. These 5 children also had the lowest scores on the Visual Vigilance Sustained Attention task. Thus, it could be hypothesized that these children lowered the mean on the Visual Vigilance Sustained Attention task making the result significant when comparing it to the GDS norms, and increased the mean (by not participating) on the Visual Distractibility Sustained Attention task making the overall result for the remaining children in the SB sample not significantly inferior to the GDS norms.

A series of t-tests were then run comparing the subtest scores of the GDS norm group to the SB group for each age grouping (6-7, 8-9, 10-11, 12-16) defined by the GDS norms. There were no significant differences found between the GDS norms and children with SB for 8 and 9 year olds or 12-16 year olds. As expected, 6-7 year olds with SB obtained lower scores than the norm group on the Visual Vigilance Sustained Attention task, but their performance was not found to be significantly different on the Visual Distractibility Sustained Attention task. Children 10-11 also obtained lower scores than the norm group on the Visual Vigilance Sustained Attention task, but their performance was not different from the norm group on the Visual Distractibility Sustained Attention task (see Table 14).

Table 13

<table>
<thead>
<tr>
<th>Association of CAVAAS scores and GDS norms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>M/SD (sample)</td>
</tr>
<tr>
<td>M/SD (norm group)</td>
</tr>
<tr>
<td>t</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
</tr>
<tr>
<td>32/15</td>
</tr>
<tr>
<td>41/2.8</td>
</tr>
<tr>
<td>-3.65*</td>
</tr>
</tbody>
</table>
(Table 13 Cont.)

Visual Distract. Sustained Attention
(n=26)

30/12.8 34/3.4 .04

*significant p<.05

Table 14

Association of CAVAAS scores and GDS age grouping norms

<table>
<thead>
<tr>
<th>Age 6-7</th>
<th>M/SD (sample)</th>
<th>M/SD (norm group)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>19/17</td>
<td>36/6.9</td>
<td>-2.45*</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>21/4.2</td>
<td>28/8.9</td>
<td>-2.17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 8-9</th>
<th>M/SD (sample)</th>
<th>M/SD (norm group)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>36/5.7</td>
<td>40/4.6</td>
<td>-1.85</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>27/5.7</td>
<td>31/9.27</td>
<td>-1.18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 10-11</th>
<th>M/SD (sample)</th>
<th>M/SD (norm group)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>27/18</td>
<td>43/2.1</td>
<td>-2.33*</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>27/19</td>
<td>35/8.1</td>
<td>-1.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age 12-16</th>
<th>M/SD (sample)</th>
<th>M/SD (norm group)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>39/12.1</td>
<td>43/2</td>
<td>-1.2</td>
</tr>
</tbody>
</table>
Hypothesis 17

Hypothesis seventeen stated that there would be no relationship between ambulation status and the CAVAAS scores. Participants requiring assistance to walk or using a wheelchair were found to be slower than independent ambulators on the Visual Distractibility Response Time task and Auditory Distractibility Response Time task (see Table 15).

Table 15

Association of ambulation and inattention/impulsivity

<table>
<thead>
<tr>
<th>Measure</th>
<th>M/SD (ambulates)</th>
<th>M/SD (no ambulation)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.49/.13</td>
<td>.50/.09</td>
<td>-.35</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.48/.11</td>
<td>.56/.10</td>
<td>2.1*</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.65/.13</td>
<td>.68/.1</td>
<td>-.47</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>37.3/9.3</td>
<td>38.5/8.5</td>
<td>-.41</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>36.3/8.1</td>
<td>31.3/10.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>33.1/9.7</td>
<td>30.3/11.7</td>
<td>.83</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>32.4/10.6</td>
<td>32.5/10.9</td>
<td>-.03</td>
</tr>
</tbody>
</table>

Mdn

<table>
<thead>
<tr>
<th>Measure</th>
<th>Mdn (ambulates)</th>
<th>Mdn (no ambulation)</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>3</td>
<td>1</td>
<td>155</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>1</td>
<td>1</td>
<td>165.5</td>
</tr>
<tr>
<td>Visual Vig. Reaction Time Error</td>
<td>1</td>
<td>0</td>
<td>190.5</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>138</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>0</td>
<td>.5</td>
<td>155</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>0</td>
<td>0</td>
<td>145</td>
</tr>
<tr>
<td>Auditory Vig. Reaction Time Error</td>
<td>3.5</td>
<td>3</td>
<td>148</td>
</tr>
<tr>
<td>Auditory Distract. Reaction Time Error</td>
<td>4</td>
<td>3</td>
<td>192.5</td>
</tr>
</tbody>
</table>
Hypothesis 18

Hypothesis eighteen stated that there would no difference in the number of children diagnosed with depression on the DISC compared to population base rates. The DISC reports no base rate, so the prevalence figure of 2% from the DSM-III-R was used as an estimate of the population base rate of depression. There were more children diagnosed with depression from this sample (12%) compared to base rates samples (Z=22.5, p<.05, a significant Z score is ±1.96).

Hypothesis 19

Hypothesis nineteen stated that there would be no difference in the level of inattention on the CAVAAS between children diagnosed as depressed or not depressed on the DISC. Visual Distractibility Response Time was faster and the Visual Vigilance Sustained Attention scores were slightly less accurate among children diagnosed with depression than among non-depressed children (see Table 16).

Table 16

<table>
<thead>
<tr>
<th></th>
<th>M/SD (depressed)</th>
<th>M/SD (not depressed)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Time</td>
<td>.45/.08</td>
<td>.5/.12</td>
<td>-1.2</td>
</tr>
<tr>
<td>Auditory Vigilance</td>
<td>.66/.07</td>
<td>.67/.11</td>
<td>-.28</td>
</tr>
<tr>
<td>Auditory Distractibility</td>
<td>.64/.08</td>
<td>.68/.11</td>
<td>-.76</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>42.6/3.8</td>
<td>37.1/9.2</td>
<td>2.39</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>37.8/8.2</td>
<td>33.5/9.9</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>Mdn</td>
<td>Mdn</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Distract. Sustained Attention</strong></td>
<td>34.4/6.3</td>
<td>32.1/11</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Distract. Response Time</strong></td>
<td>.41</td>
<td>.5</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Vig. Sustained Attention</strong></td>
<td>39</td>
<td>39.5</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Vigilance Delay Response</strong></td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Distractibility Delay Response</strong></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Vigilance Reaction Time Error</strong></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Distract. Reaction Time Error</strong></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Distract. Delay Response</strong></td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Vigilance Delay Response</strong></td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Vig. Reaction Time Error</strong></td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Auditory Distract. Reaction Time Error</strong></td>
<td>2</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

*significant p<.05

**Hypothesis 20**

Hypothesis twenty stated that there would be no difference in the percentage of students diagnosed with anxiety on the DISC, and the population base rates of anxiety. A significantly higher number of students were diagnosed with anxiety (16%) compared to the population base rates (3%) \((Z=32.5, p<.05, \text{ a significant Z score is } \pm 1.96)\).

**Hypothesis 21**

Hypothesis twenty-one stated that there would be no difference in levels of attention between children diagnosed or not diagnosed with anxiety on the DISC. No such differences were found (see Table 17).
Table 17

Association of DISC anxiety diagnosis and inattention/impulsivity

<table>
<thead>
<tr>
<th></th>
<th>M/SD (anxious)</th>
<th>M/SD (not anxious)</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Vigilance Response Time</td>
<td>.46/.06</td>
<td>.50/.13</td>
<td>-1.6</td>
</tr>
<tr>
<td>Visual Distractibility Response Time</td>
<td>.49/.01</td>
<td>.52/.12</td>
<td>-.74</td>
</tr>
<tr>
<td>Auditory Vigilance Response Time</td>
<td>.65/.07</td>
<td>.68/.11</td>
<td>-.82</td>
</tr>
<tr>
<td>Auditory Distract. Response Time</td>
<td>.66/.07</td>
<td>.67/.11</td>
<td>-.27</td>
</tr>
<tr>
<td>Visual Vigilance Sustained Attention</td>
<td>41.9/3.3</td>
<td>36.9/9.5</td>
<td>2.4</td>
</tr>
<tr>
<td>Visual Distract. Sustained Attention</td>
<td>35.7/7.3</td>
<td>33.7/10.2</td>
<td>.62</td>
</tr>
<tr>
<td>Auditory Vig. Sustained Attention</td>
<td>34.4/8.9</td>
<td>31.5/10.0</td>
<td>.78</td>
</tr>
<tr>
<td>Auditory Distract. Sustained Attention</td>
<td>34.6/7.3</td>
<td>31.9/11.2</td>
<td>.77</td>
</tr>
<tr>
<td>Mdn</td>
<td></td>
<td>Mdn</td>
<td></td>
</tr>
<tr>
<td>Visual Vigilance Delay Response</td>
<td>2</td>
<td>2</td>
<td>103.5</td>
</tr>
<tr>
<td>Visual Distractibility Delay Response</td>
<td>1</td>
<td>1</td>
<td>115</td>
</tr>
<tr>
<td>Visual Vigilance Reaction Time Error</td>
<td>0</td>
<td>1</td>
<td>77</td>
</tr>
<tr>
<td>Visual Distract. Reaction Time Error</td>
<td>0</td>
<td>0</td>
<td>88</td>
</tr>
<tr>
<td>Auditory Distract. Delay Response</td>
<td>0</td>
<td>1</td>
<td>72</td>
</tr>
<tr>
<td>Auditory Vigilance Delay Response</td>
<td>0</td>
<td>0</td>
<td>68.5</td>
</tr>
<tr>
<td>Auditory Vig. Reaction Time Error</td>
<td>1</td>
<td>3</td>
<td>83.5</td>
</tr>
<tr>
<td>Auditory Distract. Reaction Time Error</td>
<td>5</td>
<td>3</td>
<td>114</td>
</tr>
</tbody>
</table>

*significant p<.05

Results Related to Testing the Exploratory Hypotheses

Hypothesis 1

The first exploratory hypothesis stated that there would be no relationship between the DISC dysthymic diagnosis and inattention/impulsivity as indicated on the CAVAAS. Only Auditory Vigilance Response Time differed in relation to dysthymia diagnosis with dysthymic children responding faster (Dysthymic
Hypothesis 2

The second exploratory hypothesis stated that there would be no relationship between IQ scores and CAVAAS scores. Only Visual Distractibility Sustained Attention differed in relation to IQ with brighter children being significantly more accurate (IQ of 90-120+ Mdn=37, IQ of 70-89 Mdn=27, U=58, p<.05).

Hypothesis 3

The third exploratory hypothesis stated there would be no relationship between the diagnosis of ADHD on the CAVAAS and family history of ADHD. Due to very uneven cell size, a hit rate analysis was done (see Table 18). This showed that a positive family history of ADHD predicted inattention on the CAVAAS, but many children with a negative family history of ADHD were also diagnosed as having ADHD on the CAVAAS.

Table 18

<table>
<thead>
<tr>
<th>CAVAAS</th>
<th>ADHD</th>
<th>No ADHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family ADHD</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>No ADHD</td>
<td>29</td>
<td>6</td>
</tr>
</tbody>
</table>

Sensitivity 19%
Specificity 100%
False negative 83%
False positive 0%
Hypothesis 4

The fourth exploratory hypothesis stated that there would be no relationship between DISC ADHD diagnosis and family history of ADHD. A hit rate analysis was done (see Table 19). This showed that family history of ADHD is absent among children diagnosed as not having ADHD, having a family history of ADHD does not mean that a child will be diagnosed as having ADHD.

Table 19

<table>
<thead>
<tr>
<th>Family history of ADHD as a predictor of DISC ADHD diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISC</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>Family ADHD</td>
</tr>
<tr>
<td>No ADHD</td>
</tr>
</tbody>
</table>

Sensitivity 33%
Specificity 93%
False negative 29%
False positive 29%

Hypothesis 5

The fifth exploratory hypothesis stated that there would be no difference between CAVAAS ADHD diagnosis and DISC ADHD diagnosis. A hit rate analysis was done (see Table 19). This showed that the two instruments had agreement when a student clearly did not meet the ADHD criteria. However, the CAVAAS also over-diagnosed many students as meeting the ADHD criteria, while the same students did not meet the criteria on the DISC.
According to the CAVAAS, 37 (86%) of the participants should be diagnosed as having ADHD, whereas on the DISC only 15 (35%) met criteria for ADHD. Even the latter may seem to be a very high hit rate, but it is important to remember that all participants were suspected of having attention problems.

Table 20

<table>
<thead>
<tr>
<th>CAVAAS ADHD</th>
<th>DISC ADHD</th>
<th>DISC No ADHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADHD</td>
<td>15</td>
<td>22</td>
</tr>
<tr>
<td>No ADHD</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Sensitivity 71%
Specificity 0%
False negative 100%
False positive 59%

Summary of Results

Attention problems on the CAVAAS were associated with higher lesion level, assisted ambulation, lower IQ, females, and DISC diagnosis of depression, dysthymia, and especially ADHD. The CAVAAS scores of this sample indicated more inattention than CAVAAS norm groups. The frequencies of DISC diagnoses of ADHD, depression, anxiety, and dysthymia exceeded population base rates. Infection status yielded findings opposite of what was expected, in that the sustained attention scores on visual tasks were poorer and the Visual Vigilance Response Times slower in youth who had not experienced shunt
infections than in those who had a history of shunt infections. Assisted ambulators had slower response speed on the Visual Distractibility Tasks, but no differences in accuracy, compared to independent ambulators. Unexpectedly, response speed was faster on Visual Distractibility in depressed compared to nondepressed children and in dysthymic compared to nondysthymic on Auditory Vigilance. The total sample of children with SB, as well as the age groupings 6-7 and 10-11, obtained less correct than GDS norm groups of non-disabled children the same age on Visual Vigilance Sustained Attention.

It had been expected that the measure of impulsive responding (delay response) should be higher when correct responding (sustained attention) was lower. Instead, the results show that fewer correct responses often co-occurred with fewer impulsive responses. The "delay response" measure has a severely skewed distribution, and very narrow range (typically ranging from 0 to 3) and therefore is very difficult to interpret. It seems likely that this measure simply reflects the child's total rate of responding, and is therefore associated with total correct responses. A lower rate of impulsive errors occurred together with a lower rate of correct responses among children with thoracic level lesions, compared to sacral/lumbar lesions, on the Visual and Auditory Vigilance Tasks; uninfected children, compared to those with a history of infection, on the Auditory Vigilance Task; and DISC diagnosed ADHD children, compared to those not diagnosed with ADHD, on the Visual Distractibility Task.

No associations were found between CAVAAS measures and frequency of shunt revisions, presence of latex allergy, need for eyeglasses, or DISC diagnosis of anxiety.
Table 21

**Summary of significant comparisons**

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Visual Distractibility</th>
<th>Visual Vigilance</th>
<th>Auditory Vigilance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic &lt; Sacral/Lumbar</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Delay Response: fewer impulsive errors</td>
<td></td>
</tr>
<tr>
<td>Not Infected &lt; Infected Shunts</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Response Time: slower responses</td>
</tr>
<tr>
<td>Females &lt; Males</td>
<td>Sustained Attention: fewer correct responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DISC ADHD &lt; Not ADHD</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Delay Response: fewer impulsive errors</td>
</tr>
<tr>
<td>Sample &lt; GDS Norms</td>
<td>Sustained Attention: fewer correct responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assisted &lt; Unassisted Ambulators</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Sustained Attention: fewer correct responses</td>
<td></td>
</tr>
<tr>
<td>DISC Depression &lt; Not Depressed</td>
<td>Sustained Attention: fewer correct responses</td>
<td>Response Time: faster responses</td>
<td></td>
</tr>
</tbody>
</table>

(total sample and age groups 6-7 and 10-11)
DISC Dysthymic < Not Dysthymic
Auditory Vigilance Response Time: faster responses

89 and Less IQ < 90+ IQ
Visual Distractibility Sustained Attention: fewer correct responses

NOTE: The symbol "<" implies poorer performance on attention measures. The brief description pertains to the first-listed group, e.g., for "A<B", "A" obtained fewer correct responses than "B".

Finally, it should be noted that some hypotheses could not be tested due to small cell sizes, namely, association of inattention with the presence of hydrocephalus, presence of a shunt, age at the time of the first shunt placement, asthma history, seizure disorder, race, educational placement or income level of parents.
CHAPTER V

DISCUSSION

Overview

Scores on the CAVAAS confirm that 86% of these children, suspected of having attention problems, were inattentive. However, only 35% met DISC diagnostic criteria for ADHD diagnosis. Inattention was found to be more frequent than in the general population. It was also found that this inattention was reflected in diagnoses on the DISC depression, dysthymia, overanxious disorder or comorbid diagnoses.

It should be noted that the sample was too homogeneous to allow for statistical analyses of effects of SES, race, educational placement, and CAVAAS scores. One difference favoring males on a Visual Distractibility Task was noted, but all other results were found to be equivalent between males and females.

Strengths of the study included the selection of the medical variables, which were selected based upon the literature reviewed. Another strength is that the variables of the CAVAAS can now be narrowed down for future study. As noted, the Visual Sustaining Attention variables seem to be the most sensitive variables.

Medical variables

Faster reaction time in independent ambulators and higher accuracy in lower lesion participants is consistent with research on associated brain
differences in children with SB (Evaggelinou and Drowatzky, 1991; Raimondi and Soare, 1977). That is, the children with higher lesions are more likely to have assisted ambulation, and also more likely to have more severe and/or more complicated brain anomalies. Arnold-Chiari malformation, enlarged ventricles, stretching of the corpus callosum, and other brain anomalies are all contributing factors not measured within the context of this study that may also provided some support for the notion that there are brain differences among participants.

Children of higher intelligence performed better than children of lower intelligence, which is reflective of overall brain integrity. This is consistent with Rasile and his colleagues (1995) who found that the better subjects did on given intelligence subtests, the better they did on the GDS.

The effects of shunt infection were surprising. Although shunt infection is associated with lower IQ and poorer achievement (McLone and colleagues, 1982), in this sample the infected group responded faster on the Visual Vigilance Response Time task and had fewer errors on the Auditory Vigilance Delay Response task, the Visual Vigilance Sustained Attention task, and the Visual Distractibility Sustained Attention task. Six percent of the infected children had thoracic level lesions, as compared to 37% of the uninfected children (Fisher's exact test = .03, p < .05). A possible confounding effect related to the CAVAAS variables and lesion level with the effects of infection is suspected. A two way ANOVA procedure testing for the effect of lesion level and Visual Distractibility Sustained Attention controlling for IQ was also completed (ANOVA = .6, p > .05). None of the infected group had lower IQ's (below 70), compared to 7% of the uninfected group. However, there was not a significant difference found (Fisher's exact test = .17, p > .05).

The effects of hydrocephalus, shunt presence, or seizures could not be
tested due to small numbers. As noted above, no effect of shunt revisions was found, which is consistent with the previous research findings reported by others (Goldberger and Baron, 1993; McLone et al., 1982; Raimondi and Soare, 1974). However, no effects of latex allergies or corrective glasses were found, which is contrary to prior studies. This suggests that these factors may be associated with inattention or anxiety (Annett and Bender, 1994; Biederman et al., 1994; Lennerstrand et al., 1990).

**Comorbid diagnoses**

Children with SB, who were referred for attention problems, did show a high frequency of ADHD diagnoses on the CAVAAS (86%) and DISC (35%). They also showed increased frequency of DISC depression (12%), dysthymia (12%), and anxiety (16%) diagnoses as well. CAVAAS variables were unrelated to DISC anxiety, but were related to DISC depression (lower accuracy, but faster reaction time on one test) and dysthymia (faster reaction time on one test). Thus, affective problems may be a cause or a complication of attention problems among SB children who seem inattentive at school or home. Previous literature on non-disabled samples has shown inattention among depressed children, but this has not been previously reported among children with SB (de Mesquita and Gilliam, 1994; Sprinkle, 1992).

**Utility of CAVAAS as a diagnostic measure**

Since a large number of comparisons were made, it is possible that some of these significant results are due to random chance. However, Visual Distractibility Sustained Attention emerges consistently as a sensitive measure differentiating groups in a direction consistent with previous research (Douglas, 1983) and clinical experience. Most of the comparisons reveal
differences that are consistent across several CAVAAS measures, lending more confidence to the findings. However gender and IQ may show weaker effects yielding only one significant comparison each.

The CAVAAS grossly overdiagnosed children who demonstrate attention problems as having ADHD, compared with the DISC which previous researchers have shown to be a more reliable measure of diagnosing ADHD and differentiating ADHD from anxiety, dysthymia, and depression.

Taken together, the present data set suggest that auditory tasks added little to the visual tasks in discriminating between more and less attentive children. It should be noted that this finding may reflect the lack of adequate standardization of the auditory measures (in contrast to the well standardized GDS). Also, there was no clear advantage of using both the distractibility and the vigilance tasks. The fact that the distractibility task is essentially a more complex visual array, with the same response requirements as the vigilance task, may account for the relatively good sensitivity of this measure.

Anecdotal Reports: adjustment of children with spina bifida and attention problems

Through the telephone interviews, information was gathered that was anecdotal in nature and could not be quantified. It is recommended that future researchers might utilize this information to gain more knowledge about spina bifida. Over 75% of the parents interviewed expressed concern about their child's social interactions. Specifically, most of the parents shared that their child had few, if any, friendships and that very few social invitations were extended to their child. Many parents stated that they thought that this was due to their child's physical limitations. The parents were frequently the "substitute" friend, taking the place of the typical "best" friend that most
children/adolescents have.

It was also reported by many parents that they did not believe that the school system in which they lived was doing a good job with meeting their child's diverse and special needs. It was frequently stated that few adaptations were made, including adaptations for handwriting, processing time, etc. Two participants were home schooled due to frustration with the public school system.

Young adults who were interviewed reported that they seemed to have an extended adolescence. Although physically they matured early, emotionally they matured late. All of the young adults stated that they started feeling better about themselves around the age of twenty-one. Many of these young adults said that they frequently felt sad, experienced isolation from peers, and had experienced suicidal ideation, although none expressed suicidal ideation at the time of the interviews.

The majority of parents expressed that although medication improved their child's ability to attend, their child continued to be inattentive, sad, and worried. It was found that many of these participants had comorbid diagnoses and that they may not have received medical treatment for them. Practitioners should consider the possibility of a comorbid diagnosis and investigate more thoroughly the diagnoses of anxiety, depression, and dysthymia instead of solely considering ADHD.

It was also found that most of the participants did not meet the criteria for hyperactivity as part of the ADHD diagnosis. The most frequent behaviors given were in the inattentive and impulsive realm. This could be due to the physical limitations of most participants, which did not allow them to run around, etc. This is consistent with the findings reported by Agness (1993, 1994) who outlined common behaviors among children with spina bifida who
present ADHD qualities.

Also interesting was that many students met the overall criteria of ADHD on the DISC, however, they did not meet the onset of age criteria (kindergarten or first grade). This excluded them from the DISC ADHD diagnosis. It seems that within the sample being studied, many students become inattentive and distractible at a later age, perhaps giving more merit to other diagnoses or comorbid diagnoses.

**Limitations of the Study**

The first limitation of the study is the fact that a non-random selection procedure was utilized in selecting participants. The participants were all tested at one Indiana clinic. This introduces the possibility that biasing factors could have affected the selection of the participants, thus influencing the results. Clearly these findings can be generalized only to higher SES, white, children suspected of having attention problems. Spina bifida affects people of all races (although far more prevalent among Caucasians), income levels, and is found in all parts of the United States and other countries.

A second limitation of the study is the sample size. Only forty-three participants took part in this study. Because of the relatively small sample size, the chances of error are greater.

A third limitation of the study is the fact that neither the GDS or the DISC are normed on people with the same medical conditions as the participants in the study. It is recognized that the test scores and diagnoses should be interpreted with considerable caution.

A forth limitation of the study is the fact that the DISC is normed on students from 7-17 years of age. It was used with students from 6-25 years of age, which calls into question the DISC's validity and reliability with the
students outside of the age parameters. In addition, the DISC diagnoses were based on retrospective report of 2 to 5 years ago.

A fifth limitation of the study is the fact that neither the CAVAAS (auditory components) or the medical questions are standardized. This raises some uncertainty related to the validity and reliability of these measures.

A sixth limitation centers around the alpha level. Due to the large number of statistical tests run on each hypothesis, the alpha level may be elevated, which makes it more likely that random, chance findings were found to be statistically significant and interpreted as meaningful.

A seventh limitation is the fact that 15 of the 43 participants were taking an antidepressant or anticholinergic while being tested on the CAVAAS. These medications have known side effects, such as drowsiness, that can impact test performance, hence impacting the overall results of the present study. T-tests and Mann-Whitney tests comparing children on antidepressants and/or anticholinergics to those not on either of these medications indicated results contrary to the many medication side effects. Participants on these medications responded more quickly than those not on these medications on the Visual Vigilance Response Time task ($t=-2.19$, $p<.05$) and the Visual Distractibility Response Time task ($t=-1.93$, $p<.05$), and got more items correct on the Visual Vigilance Delay Response task ($U=133$, $p<.05$).

Implications for Future Research

Future research on the utility of CAVAAS performance and DISC diagnosis among students with spina bifida who have attention problems would be improved if initial testing on the CAVAAS were accompanied by other traditional methods of diagnosing ADHD. These methods might include a behavior checklist for the parent/teacher to complete, usage of the DSM-IV
criteria, and a student interview. Some practitioners might also choose to complete a full test battery including cognitive, academic, and social/emotional assessment.

Practitioners are urged to consider the diagnosis of ADHD, as well as other diagnoses that might impact attention such as depression, dysthymia, and anxiety disorder. Comorbidity of more than one diagnosis should also be considered.

The usage of a larger, more diverse population is also recommended. Exploring attention in youth with spina bifida of all races, income levels, and geographic areas is needed.

Determining if different types of schooling impacts attention in youth with spina bifida is another interesting issue that could be addressed. Regular classrooms with no academic support, regular classrooms with academic support, self-contained classrooms, and home schooling represent an array of educational settings that could be further explored.

Family ADHD, depression, and anxiety history of persons with spina bifida and attention problems is another area to that is recommended for further study. Comparing the base rate familial pattern of the occurrence of these diagnoses to the actual occurrence in this population would be interesting.

Folic acid deficiency is an area that has been linked to causing spina bifida, but has not been heavily investigated with respect to the possible impact of folate deficiency on attention and executive functioning in children with spina bifida. A thorough medical investigation of this topic would be of some interest to researchers in the area.

A final area recommended for further investigation, is the area of learning disabilities and the possible relationships among spina bifida, inattention, and learning disabilities. Are children who have learning disabilities and spina
bifida more inattentive than peers who have learning disabilities? Academic programming would benefit from knowledge learned about spina bifida, inattention, and the impact on learning.

**Special Implications for the Field of School Psychology**

School psychologists assess a wide array of individuals. Included in the array are students with spina bifida. Information that was found to be significant through statistical analysis can be useful when making decisions about a student's educational programming. It is significant to note how many students with spina bifida have attention difficulties, what their strengths and weaknesses within the attention area are, their increased risk for ADHD and emotional disorders such as depression, dysthymia, and anxiety, and how the many health complications of spina bifida can impact on a student's level of attention.

Previous findings reported by Culatta (1980), Horn, and colleagues (1985), Spain (1974), Stephens (1982), Tew and Laurence (1975), and Wills (1993) indicate that children with spina bifida do have more difficulty with tasks involving attention, concentration, and organization when compared to other children. In the present study, tasks involving sustaining attention were found to be the most difficult for spina bifida students with attention problems. School psychologists should be aware of this information when planning testing sessions, and when designing educational programs for children with spina bifida in the classroom. Shorter sessions/lessons may be warranted, especially when information is visually based. Frequent breaks may also be needed. This information should also be applied during group testing sessions or long "work completion" times.

When assessing the emotional status of a child with spina bifida, it is
important to consider the possibility of a comorbid diagnosis. According to the results of the present study, the population used met the criteria of ADHD, depression, and anxiety more frequently than base rate comparisons. Referrals to outside agencies may be needed. The importance of a private provider who closely monitors medications and is well aware of the complications related to spina bifida is clearly needed.

As always, it is advocated that a multi-faceted approach of diagnosing emotional disorders is used. This would include, but not be limited to, an interview with the child/parent/teacher, observations, behavioral checklists, and the usage of the DSM-IV criteria for diagnosis. When assessing the symptoms of ADHD, it is apparent that a child with spina bifida may exhibit the hyperactive criteria differently than an able bodied child, or may be simply impulsive and inattentive.

It is apparent that children with spina bifida have many medical needs. A school psychologist should be aware of the side effects of the various medications that students take, the signs of shunt malfunction, and the possible impact of hydrocephalus, Arnold Chiari malformation, and strabismus. A school psychologist should be able to present his or her findings within the context related to medical variables, stating the limited validity and reliability due to the multiple interacting factors.

When assessing children with SB, school psychologists should consider utilizing the Verbal IQ, as opposed to the Full Scale IQ since the Performance score relies heavily on visual perception skills and visual attention.

Individual Educational Plans should take into consideration the "invisible" disabilities of children with SB (overall brain functioning due to brain differences, inattention, etc.) and not just the obvious physical differences. Appropriate modifications should occur based on these "invisible" disabilities.
Since school is more than academics, psychosocial support should be considered for children with SB. This support can assist with peer relations, self-advocacy, building self-esteem, and educational modifications.

The review and research findings reported in the dissertation research project highlight the need to expect some attentional difficulties among children with SB, but at the same time, to anticipate individual differences among the respondents. Such differences are related to both medical and psychosocial factors which influence the development of children with SB.
APPENDIX A

CONSENT FORM (MINOR)
Dear

My name is Susan Boyle-Fields and I am a practicing School Psychologist with physically handicapped children. I am completing my dissertation for my Ph.D. on the topic "Patterns and Correlates of CAVAAS Performance By Students With Spina Bifida and Attention Problems". I have been in close contact with Dr. Phyllis Agness and Dr. Lowell Becker and have received permission from them to use their test results of people with Spina Bifida whom they have tested using the CAVAAS, a computerized attention test. Enclosed is a consent form to be signed by you that gives me permission to use the data on your child.

Your child's name will not appear anywhere in the discussion of this study. Each subject has been assigned a number to assure confidentiality. The results will be reported as group results and not individual results. If for any reason, however, it is decided that you do not want the data on your child to be used for this study, you may withdraw at any time.

There is some additional information that is needed to analyze those test results. This information might help explain why many people with spina bifida have attention problems. In order to obtain this information, I need your verbal and written consent to speak with you over the telephone. I will ask you questions about your child's health and development. The telephone interview will take about thirty minutes. I will also ask you to sign and return the enclosed consent form in the return envelope provided.

Thank-you for your cooperation. Once this study is completed, the results (with no personally identifying information) will be shared with Spina Bifida Association of America for their newsletter, or you are welcome to contact me for a summary.

If you have any questions, please feel free to call me at (847) 821-8732.

Sincerely,

Susan Boyle-Fields, M.Ed.
Yes, I give consent for the use of the CAVAAS data on my child

__________________________ and I also consent to complete the DISC
(child's name)

(Diagnostic Interview Schedule for Children) and informal health
questionnaire over the telephone with Susan Boyle-Fields.

__________________________  ____________
(signed) (parent or guardian) (date)
APPENDIX B

CONSENT FORM-ADULT
Dear

My name is Susan Boyle-Fields and I am a practicing School Psychologist with physically handicapped children. I am completing my dissertation for my Ph.D. on the topic "Patterns and Correlates of CAVAAS Performance By Students With Spina Bifida and Attention Problems". I have been in close contact with Dr. Phyllis Agness and Dr. Lowell Becker and have received permission from them to use their archival data on the test results of people with Spina Bifida that they have tested using the CAVAAS. Enclosed is a consent form to be signed by you that gives me permission to use the data from your testing on the CAVAAS.

Your name will not appear anywhere in the discussion of this study. Each subject has been assigned a number to assure confidentiality. The results will be reported as group results and not individual results. If for any reason, however, you decide that you do not want the data from your testing used, you may withdraw at any time.

There is some additional information that is needed to analyze those test results. This information might help explain why many people with spina bifida have attention problems. In order to obtain this information, I need your verbal and written consent to speak with you over the telephone. I will ask you questions about your health and development. The telephone interview will take about thirty minutes. I will also ask you to sign and return the enclosed consent form in the return envelope provided.

Thank-you for your cooperation. Once this study is completed, the results (with no personally identifying information) will be shared with Spina Bifida Association of America for their newsletter, or you are welcome to contact me for a summary.

If you have any questions, please feel free to call me at (847) 821-8732.

Sincerely,

Susan Boyle-Fields, M.Ed.
Yes, I give consent for the use of the CAVAAS data on me

_________________________ and I also consent to complete the DISC (participant's name)

(Diagnostic Interview Schedule for Children) and informal health questionnaire over the telephone with Susan Boyle-Fields.

_________________________ ________________
(signed) (date)
APPENDIX C

BACKGROUND QUESTIONNAIRE
1. What is your child's lesion level (the place where the hole is at)?
   Sacral____ Lumbar____ Thoracic_____

2. Has your child ever experienced seizures? Yes No (circle)
   Has your child ever taken anticonvulsant (the medications to control seizures) medication? Yes No (circle)

3. If your child has a shunt, what was your child's age at the time of his/her INITIAL shunt placement?__________.

4. Has your child had a shunt revision? Yes No (circle)
   If yes, estimated number__________.

5. Has your child had a shunt infection? Yes No (circle)

6. Does your child have asthma? Yes No (circle)
   If yes, what medication does your child take to control asthma?__________

7. Does your child have latex allergy? Yes No (circle)

8. Does your child wear corrective glasses? Yes No (circle)
   Does your child have strabismus (crossed eyes) or any other eye problem? Please describe__________________________.

9. Has your child ever been diagnosed with depression? Yes No (circle)
   If yes, when and how was it treated? Please list any medications.

10. Has your child ever been diagnosed with anxiety disorder? Yes No (circle)
    If yes, when and how was it treated? Please list any medications.

11. Was your child ever diagnosed with ADD? Yes No (circle)
    If yes, did your child ever take medication for ADD? Yes No (circle)
    If yes, what was the name of the medication prescribed? Ritalin Cylert Tofranil Imipramine Other (circle all that apply)

12. Is there any history of ADD in your family? Yes No (circle)__________ (relationship to participant)

13. Is your child in: Regular Education, Special Education (circle)

14. Which intellectual quotient (IQ) range best describes your child's measured intelligence on standardized tests (WISC-R, WISC-III, Stanford-Binet, etc.)? (circle)
   120 and up (gifted), 110-119 (high average), 90-109 (average), 70-89 (slow learner), 69 and below (retarded)

15. What is your child's main means of mobility? walking with no assistance, walking with assistance (braces, crutches, walker), wheelchair (circle)

16. What is your child's race or ethnicity? White Black Hispanic/American Asian/American Other (circle)

17. Which earning category best describes your annual family
income? (circle)

- <10,000
- 10,000-19,999
- 20,000-29,999
- 30,000-39,999
- 40,000-49,999
- 50,000 or more
APPENDIX D

DISC QUESTIONS

(The DISC is public domain and not subject to copyright limitations)
DISC ADHD, DEPRESSION/DYSTHYMIA, AND OVERANXIOUS DISORDER QUESTIONS

O=No  1=Sometimes  2=Yes  8=Not applicable  9=Don't know

ADHD

For the next questions, we'll talk about the six months prior to CAVAAS testing. I would like to ask some questions about problems with over-activity and not paying attention. A lot of youth are sometimes overactive or don't concentrate, but we are interested in problems that were there most of the time.

1. At the time specified, did anyone say that______ moves his/her hands and feet a lot or squirms around in his/her seat/wheelchair during class or at his/her job?  

   0 1* 2* 8 9

2. Have you noticed that he/she has more trouble sitting still than others his/her age?  

   0 1* 2* 9

3. At the time specified, have you or other people noticed that he/she is too fidgety or restless? That is, fiddling with his/her hands or jiggling his/her feet or wrigglng or twisting around in his/her seat?  

   0 1* 2* 9

4. If he/she is someplace where he/she has to be still or stay put, like church or riding in a car, does he/she get very restless and feel he/she has to move around?  

   0 1* 2* 9

If yes, A. is that so even if he/she is only there for 15 minutes?  

   0 1 2 9

For children age 12 or over, ask Q5.

5. If he/she has to stay in a place more than 10 minutes, does he/she nearly always seem restless, as if he/she wanted to kick his/her feet or move about?  

   0 1* 2* 9
If "*" response to Q1, 2, 3, 4, or 5, ask:

6. Has this trouble with sitting still or fidgeting been a problem for at least 6 months? 0 (2) 9

7. Has anyone said that he/she gets up from his/her seat a lot at school/job? 0 1* 2* 8 9

8. Have you noticed that he/she doesn't stay in his/her seat at home? For example, when he/she is eating at the table or watching TV or doing his/her homework/work? 0 1* 2* 9

If "*" response to Q7 or 8 ask:

9. Has not being able to stay in his/her seat been a problem for at least 6 months? 0 (2) 9

10. In the time specified, has anyone said that he/she has a hard time keeping his/her mind on his/her schoolwork/work when there were other things going on (in the classroom/at work place)? 0 1* 2* 8 9

11. At home, does he/she have a problem playing games or working on projects or doing his/her homework/work, because little things keep taking his/her mind off what he/she is doing? 0 1* 2* 9

If "*" response to Q10 or 11, ask:

12. Has difficulty with keeping his/her mind on what he/she is doing been a problem for at least 6 months? 0 (2) 9

13. At the time specified, when he/she was playing games, has he/she often had trouble waiting for his/her turn? 0 1* 2* 9

14. Does he/she often push or try to cut ahead when he/she has to wait in line? 0 1* 2* 9

If yes, A. Have people gotten mad at him/her for doing that? 0 1 2 9

If "*" response to Q13 or 14, ask:
15. Has trouble waiting for his/her turn or cutting ahead in line been a problem for at least 6 months? 0 (2) 9

16. Has anyone said that he/she often calls out the answers at school or work even before teacher/co-worker has finished the question? 0 1* 2* 8 9

17. Does he/she often blurt out an answer before you finish asking a question? 0 1* 2* 9

If yes, A. Have you gotten annoyed at him/her for that? 0 1 2 9

If "*" response for Q16 or 17, ask:

18. Has blurting out answers like this been a problem for at least 6 months? 0 (2) 9

19. Since (when) has ________had to remind him/her what he/she is supposed to be doing again and again and again? 0 1* 2* 8 9

20. When you ask him/her to do something, do you have to keep reminding him/her to go back to it because he/she can't remember what he/she is supposed to do? 0 1* 2* 9

If "*" response to Q19 or 20, ask:

21. Has needing to be reminded to follow through on things been a problem for at least 6 months? 0 (2) 9

22. At the time specified, has anyone said that________often has trouble paying attention to his/her schoolwork/work? 0 1* 2* 8 9

23. Suppose________is playing a game or doing a project he/she enjoys at home. Does he/she have trouble paying attention even if there is nothing else happening to take his/her mind off it? 0 1* 2* 9

24. At home, is it hard for him/her to spend more than a few minutes doing anything? 0 1* 2* 9

If "*" response to Q22, 23, or 24, ask:
25. Has this trouble paying attention been a problem for at least 6 months?  
0 (2) 9

26. Have you been told that he/she has a problem at school/work because he/she keeps stopping and starting the work he/she is doing?  
0 1* 2* 8 9

27. When he/she is at home, does he/she have a problem doing his/her homework or chores because he/she keeps stopping and starting what he/she is doing?  
0 1* 2* 9

If "*" response to Q.26 or 27, ask:

28. Has stopping and starting what he/she is doing been a problem for at least 6 months?  
0 (2) 9

29. At the time specified, has anyone said that he/she often stops in the middle of doing something at school/work before he/she has finished?  
0 1 2 8 9

If yes, A. Was this because he/she would start doing something else instead?  
0 1* 2* 9

B. Does he/she even stop in the middle of doing fun things like games?  
0 1 2 9

30. How about at home? Is it a problem that he/she often stops in the middle of things without finishing?  
0 1 2 9

If yes, A. Is that because he/she starts doing something else instead?  
0 1* 2* 9

B. Does he/she even stop in the middle of a game or when he/she is playing?  
0 1 2 9

If "*" response to Q29A or 30A, ask:

31. Has shifting from one thing to another been a problem for at least 6 months?  
0 (2) 9
32. In the last 6 months, has he/she been much more noisy than other kids when he/she is doing fun things?  0  1  2  9
If yes, A. Is it hard for him/her to do fun things quietly?  0  1*  2*  9
33. Have his/her teacher/boss or other people complained because he/she is too noisy when he/she does fun things?  0  1*  2*  9
If "*" response to Q32A or 33, ask:
34. Has being so noisy when he/she is doing fun things been a problem for at least 6 months?  0  (2)  9
35. Has anyone said that he/she runs around a lot more than other children his/her age at school/work, for example, during gym or free time?  0  1*  2*  8  9
If "*" response to Q35 or 36, ask:
36. How about when he/she is at home? Is he/she always running around a lot like running or jumping or climbing on things?  0  1*  2*  9
If "*" response to Q35 or 36, ask:
37. Has running or jumping or climbing on things been a problem for at least 6 months?  0  (2)  9
38. Has anyone said that he/she talks too much at school/work?  0  1*  2*  8  9
If yes, A. Have you or anyone else complained about this?  0  1  2  9
40. Do you or other adults think he/she is a motormouth, always talking too much?  0  1*  2*  9
If "*" response to Q38, 39, or 40, ask:
41. At the time specified, has___ often started to talk when somebody else is still talking?  0  1*  2*  9
If yes, A. Have people gotten annoyed because___ interrupts too much?  0  1  2  9
43. Does he/she often butt in on what others are doing? 0 1* 2* 9
If yes, A. Did they ever get mad at him/her for that? 0 1 2 9
If "*" response to Q42 or 43, ask:

44. Has interrupting or butting in on others been a problem for at least 6 months? 0 (2) 9

45. Since the named event have/has__________'s teacher/boss said that he/she often seems not to listen to what they are saying?
0 1* 2* 8 9
If yes, A. Is that because he/she has a problem with hearing? 0 1 2 9
If yes, B. What kind of hearing problem does he/she have?__________
C. Have his/her teacher/boss complained about his/her not listening?
0 1 2 9
D. Did he/she not listen because he/she was daydreaming? 0 1 2 9

46. Does he/she often seem not to be listening to what you or others are saying? 0 1* 2* 9
If yes, A. Is that because he/she is daydreaming? 0 1 2 9
If "*" response to Q45 or 46, ask:

47. Has not listening been a problem for at least 6 months? 0 (2) 9

48. Has anyone said that________often loses papers, books, pens, etc. that he/she needs for his/her job or school? 0 1* 2* 8 9

49. At home, does________lose things more than others his/her age?
0 1* 2* 9
If "*" response to Q48 or 49, ask:

50. Has losing things been a problem for at least 6 months? 0 (2) 9

51. Has anyone at his/her school/work said that he/she makes a lot of careless mistakes when doing his/her school work/work? 0 1* 2* 9

52. At home, does he/she make more careless mistakes than other children
his/her age? 0 1* 2* 9

If "*" response to Q51 or 52, ask:

53. Has making careless mistakes been a problem for at least 6 months?
0 (2) 9

54. At the time specified, had he/she often gotten into a dangerous situation where he/she could have been injured because he/she wasn't thinking? 0 1 2 9

If yes, A. describe______________________________

B. Was this something he/she did suddenly without thinking about it first? 0 1 2 9

C. Has doing dangerous things like this been a problem for at least 6 months? 0 (2) 9

55. Has anyone said that he/she often forgets or seems to lose track (drifts off) of what he/she is doing at school/work? 0 1* 2* 8 9

56. Does he/she often lose track (drift off) of what he/she is doing at home? 0 1* 2* 9

If "*" response to Q55 or 56, ask Q57.

57. Sometimes people seem to lose track of what they are doing when they are using drugs or alcohol, or are very tired or haven't slept well, or sick, or worried or anxious. Does_______lose track of what he/she is doing when he/she is in one of these situations? 0* 1 2 9

If yes, A. Does he/she often lose track when he/she is not in one of these situations? 0 2* 9

If "*" response to Q57 or 57A, ask:

58. Has losing track or drifting off been a problem for at least 6 months? 0 (2) 9

59. At the time specified, had anyone told you that he/she often seemed drowsy
or sluggish at school/work, like he/she had no energy?

0 1* 2* 8 9

60. How about at home? Does he/she seem drowsy or sluggish there?

0 1* 2* 9

If "**" response to Q59 or 60, ask Q61.

61. Sometimes people seem drowsy or sluggish when they are using drugs or alcohol, or are very tired or haven't slept well, or sick, or worried or anxious. Does ______ seem drowsy or sluggish when he/she is in one of these situations? 0* 1 2 9

If yes, A. Does he/she often seem drowsy or sluggish when he/she is not in one of these situations? 0 2* 9

If "**" response to Q61 or 61A, ask:

62. Has being drowsy or sluggish been a problem for at least 6 months?

0 (2) 9

63. Has anyone said that there are a lot of things he/she wants to do and knows how to do at school/work, but never gets around to doing?

0 1* 2* 8 9

64. At home, are there a lot of things that he/she can do and wants to do but never gets around to doing? 0 1* 2* 9

If "**" response to Q63 or 64, ask Q65 to 67.

65. Is that because he/she doesn't seem to have any energy? 0 1 2 9

66. Is that because he/she is very disorganized? 0 1 2 9

67. Sometimes people don't get around to doing things when they are using drugs or alcohol or trying to make someone mad. Does ______ have trouble getting around to things when he/she is in one of these situations? 0* 1 2 9

If yes, A. Does he/she often have trouble getting around to things when
he/she is not using drugs or trying to make someone else mad? 0 2* 9
If "*" response to Q67 or 67A, ask:
68. Has not getting around to things been a problem for at least 6 months? 0 (2) 9
Are 4 or more criteria met () responses to Q1-68? 0 2
If yes: continue. If no, go to Q77.
69. I've asked you a lot of questions about problems__may have had with paying attention or being too active. For example, you said___.
Did any of these things cause problems for him/her when he/she was in kindergarten or 1st grade? 0 1 2 8 9
70. How old was he/she when he/she first starting having problems because of these things?________
71. Thinking about the time we specified, have these things caused a problem with how he/she gets along with people at home? 0 1 2 9
72. Have these things caused a problem with how he/she gets along with people his/her age? 0 1 2 9
73. Have these things caused problems for him/her at school/work? 0 1 2 8 9
74. Did these problems with paying attention or being too active begin soon after some bad thing or big change happened to him/her? 0 2 9
If yes, A. What was it?__________________________________________
Is this clearly a one time event? 0 2
If yes: Go to C, If no, go to B.
B. Is this event still going on? 0 2 9
C. When did this event begin/happen?______________________________
D. Did he/she have these problems paying attention or being too active before the stressful event? 0 2 9
If yes, E. Did these problems get worse after the event? 0 2 9

If yes, F. How soon after the event did this behavior become more of a problem? <1 month 1, 1-3 months 2, >3 months 3, DK 9

G. Was this behavior more of a problem for longer than 6 months? 0 2 9

If no, H. How soon after the event did he/she begin having problems paying attention or being too active? <1 month 1, 1-3 months 2, >3 months 3, DK 9

Has_______ever seen a professional because of problems with paying attention or being too active? 0 2 9

If no, go to E. If yes, A. Who?________________________________________

B. What did the person say was wrong?________________________________

C. How old was he/she the first time he/she saw someone for problems of not paying attention or being too active?_______________

D. Did this occur during the time we specified? 0 2 9

If no, E. Did you ever think that he/she should see a professional for these problems? 0 2 9

F. Did the school/work ever suggest that_______see someone for these problems? 0 2 9

G. Did_______ever ask to see someone for these problems? 0 2 9

76. Has_______ever taken medication for hyperactivity? 0 2 9

If yes, A. Has he/she taken it in the last 6 months? 0 2 9

B. What is the name of medication?________________________________________

MAJOR DEPRESSIVE DISORDER/DYSTHYMIA

1. At the time specified, were there times when_______seemed to be very sad? 0 1 2 9

If yes, A. When he/she feels sad this way, does it last most of the day?
B. Would you say ______ has been very sad a lot of the time for as long as a year? 0 2 9
If yes, C. Would you say most of the time? 0 (2*) 9
If yes, D. was he/she very sad most of the time for as long as 2 years? 0 2 9
E. Now thinking about the time we specified, was there a time when he/she was sad almost every day? 0 2 9
If yes, F. Did this go on for 2 weeks or more? 0 2* 9

2. At the time specified, were there times when he/she was grouchy or irritable often in a bad mood, so that even little things would make him/her mad? 0 1 2 9
If yes, A. When he/she is grouchy this way, does it last most of the day? 0 1 2 9
B. Would you say ______ has been grouchy a lot of the time for as long as a year? 0 2 9
If yes, C. Would you say most of the time? 0 (2*) 9
If yes, D. was he/she is grouchy most of the time for as long as 2 years? 0 2 9
E. Now thinking about the time we specified, was there a time when he/she was grouchy almost every day? 0 2 9
If yes, F. Did this go on for 2 weeks or more? 0 2* 9

3. Has there been a time in the time specified when nothing was fun for ______ even things he/she used to like? 0 1 2 9
If yes, A. Was that a change from how he/she usually was? 0 1 2 9
B. When he/she seemed like nothing was fun for him/her did this last most of the day? 0 1 2 9
C. Was there a time when nothing was fun for him/her almost every day? 0 2 9

If yes, D. Did this last for two weeks or more? 0 2* 9

4. In the time specified, has there been a time when ______ just wasn't interested in anything and seemed bored or just sat around most of the time? 0 1 2 9

If yes, A. Was that a change from how he/she usually was? 0 1 2 9

B. When he/she seemed not to be interested like this did this last most of the day? 0 1 2 9

C. Was there a time when he/she seemed not to be interested almost every day? 0 2 9

If yes, D. Did this last for two weeks or more? 0 2* 9

NOTE 1: Were any "*" or "(*)" responses coded for Q1-Q4? 0 2

If yes, ask *A questions in Q5 to 30 in this section

If no, omit *A questions.

If 2 or more "*" moods coded above in Q1 to Q4, select first "*" mood for you example in reading *A questions.

Now I'm going to ask you about some things he/she may have felt or done during the time he/she was (sad, grouchy, not interested in things).

5. During the time specified, has there been a time when he/she often did not feel very much like eating? 0 1 2 9

If yes, *A. Was this during the time he/she was (sad, grouchy, not interested in things). 0 (1) (2) 9

B. Did he/she feel like eating less most days for two weeks or more? 0 2 9

6. At the time specified, has ______ lost a lot of weight? 0 1 2 9

If yes, *A. Did ______ lose this weight during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Was he/she on a diet or trying to lose weight? 0 2 9
C. Did he/she lose so much weight that other people noticed? 0 2 9
7. At the time specified, has there been a time when he/she often wanted to eat more than usual? 0 1 2 9
If yes, *A. Did ______ eat more than usual during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Did he/she want to eat more than usual most days for two weeks or longer? 0 2 9
8> At the time specified, has ______ gained a lot of weight? 0 1 2 9
If yes, *A. Did ______ gain this weight during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Was he/she trying to gain weight? 0 2 9
C. Did he/she gain so much weight that other people said it was a problem? 0 2 9
9. At the time specified, has he/she had more trouble sleeping than usual, that is, more trouble falling asleep or staying awake or waking up early? 0 1 2 9
If yes, *A. Did ______ have trouble sleeping during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Did he/she have trouble sleeping most nights for two weeks or more? 0 2 9
10. At the time specified, has he/she had a time when he/she slept a lot more than usual? 0 1 2 9
If yes, *A. Did ______ sleep more than usual during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Did he/she sleep more than usual for two weeks or more? 0 2 9
11. Has there been a time when he/she definitely talked or moved around a lot less than usual? 0 (1) (2) 9
If yes, * A. Was ________ slowed down this way during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

B. Did he/she talk or move like this most days for two weeks or more? 0 2 9

12. At the time specified, has there been a time when he/she was very restless, when he/she just had to keep walking around? 0 1 2 9

If yes, * A. Was ________ restless like this during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

B. Was this different from how he/she usually is? 0 1 2 9

C. Was he/she like this most days for two weeks or more? 0 2 9

13. Has ________ been so down that it was hard for him/her to do his/her school work/work? 0 1 2 9

If yes, * A. Did ________ feel like this during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

14. Has he/she had trouble looking after him/her or his/her things, like keeping him/herself clean or picking up after him/herself? 0 1 2 9

If yes, * A. Did ________ have trouble looking after things during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

15. Has there been a time when ________ seemed more tired than usual, so that he/she sat around and didn't do much of anything? 0 1 2 9

If yes, * A. Was ________ tired this way during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

B. Was he/she tired like this most days for two weeks or more? 0 2 9

16. At the time specified, has ________ had a time when he/she seemed like he/she had much less energy than usual, so that it was a big effort to do anything? 0 1 2 9

If yes, * A. Was ________ lacking energy this way during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Was he/she lacking energy like this most days for two weeks or more?
0 2 9

17. Was there a time when he/she seemed to feel less good about him/herself than usual and when he/she blamed him/herself a lot for things that happened in the past? 0 1 2 9

If yes, *A. Did ______ blame him/herself this way during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

B. Did he/she blame him/herself even for things that weren't his/her fault? 0 1 2 9

C. Was he/she blame him/herself like this most days for two weeks or more? 0 2 9

18. Has_______been more down on him/herself than usual, when he/she said that he/she couldn't do anything right? 0 1 2 9

If yes, *A. Did ______ feel bad about him/herself during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

B. Was he/she down on him/herself most days for two weeks or more? 0 2 9

19. Has_______often said bad things about the way he/she looks? 0 1 2 9

If yes, *A. Did ______ say bad things about him/her appearance during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

20. At the time specified, were there times_______often seemed like he/she was about to cry or was in tears? 0 1 2 9

If yes, *A. Did ______ seem tearful during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9

21. Was there a time when he/she had more trouble than usual paying attention to his/her schoolwork/work, or keeping his/her mind on other things he/she was doing? 0 1 2 9

If yes, *A. Did ______ have trouble keeping his/her mind on things during
the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Was this different from how______usually is? 0 1 2 9
C. Did he/she have trouble paying attention or keeping his/her mind on things most days for two weeks or more? 0 2 9
22. Has there been a time when he/she didn’t seem able to concentrate or to think as clearly or as quickly as usual? 0 1 2 9
If yes, *A. Did ______seem to be thinking slowly during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Did he/she have trouble concentrating or thinking clearly most days for two weeks or more? 0 2 9
23. Has_______often said that things never seem to work out all right for him/her? 0 1 2 9
If yes, *A. Did ______say this during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
24. At the time specified, has there been a time when it was harder than usual for him/her to make up his/her mind about things or to make decisions? 0 1 2 9
If yes, *A. Did ______have trouble during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
B. Did he/she have trouble making up his/her mind most days for two weeks or more? 0 2 9
25. Has_______had times when he/she said that life was hopeless and that there was nothing good for him/her in the future? 0 1 2 9
If yes, *A. Did ______seem hopelesss during the time he/she was sad/grouchy/not interested in things? 0 (1) (2) 9
26. At the time specified, did he/she talk more than usual about death or dying? 0 1 2 9
If yes, *A. Was that when _______ was feeling very sad/grouchy/not interested in things? 0  (1)  (2)  9
B. Did he/she talk a lot about death for two weeks or more? 0  2  9
27. At the time specified, did _________ say he/she was thinking about suicide or killing him/herself? 0  1  2  9
If yes, *A. Was that when _______ was feeling very sad/grouchy/not interested in things? 0  (1)  (2)  9
B. Did he/she speak about killing him/herself for two weeks or more? 0  2  9
C. Did he/she tell you of a specific plan for how he/she would kill him/herself? 0  2  9
If yes, D. Please tell me about this.
28. Has he/she ever in his/her whole life tried to kill him/herself? Actually doing something to try to commit suicide? 0  2  9
If no, go to note 2.
If yes, A. How many times did he/she attempt suicide? How many times?______
B. How old was he/she when he/she attempted suicide the first time?______
29. Has he/she tried to kill him/herself at the time specified? 0  2  9
If yes, *A. Was that when _______ was feeling very sad/grouchy/not interested in things? 0  (1)  (2)  9
B. How many times did he/she attempt suicide in the past six months? 0  (1)  (2)  9  How many times?__________
30. How did he/she try to kill him/herself? drug overdose 1,
other ingestion 2, hanging 3, jumping 4, firearms 5, cutting 6,
other ________ 7.
If drug overdose to Q30 and more than one lifetime attempt, ask A. Otherwise, go to note 2.
A. Has he/she ever used any other method to attempt suicide? 0  2  9
If yes, B. What was it? _______

Note 2: Were 2 or more () symptom responses coded in Q5 to 30. 0 2
If yes: Go to note 3.
If no: Go to Q42, p.17.

Note 3: Were () responses coded for Q1C or 2C? 0 2
If yes: Go to Q31.
If no: Go to Q32.

31. You told me that ______ was very sad/grouchy/not interested in things a lot of time for a year. When he/she started feeling this way, was it a big change from the way he/she used to be? 0 1 2 9

32. You also said that he/she had a time when he/she (list all *()* items in Q9- Q30). Was there a time in the past 6 months when several of these problems occurred together, within the same month? 0 2 9

33. How old was he/she when he/she first seemed to be very sad/grouchy/not interested in things for two weeks or longer? ______

34. At the time specified, has feeling sad/grouchy/not interested in things caused problems with how he/she gets along with people at home? 0 1 2 9

35. Have these feelings caused problems in getting along with friends or other people his/her age? 0 1 2 9

36. Have these feelings caused problems for him/her at school/work? 0 1 2 8 9

37. At the time he/she seemed sad/grouchy/not interested in things, did that feeling come on after someone he/she was close to died? 0 2 9
If no, go to Q38
If yes, A. Who died? __________
B. When did he/she die ________
C. Was _____ sad/grouchy/not interested in things before this person dies?
0 2 9
If no, go to G
If yes, D. Did feeling sad/grouchy/not interested in things definitely get worse after this death? 0 2 9
If yes, E. How soon after this person died did _____ start feeling sad/grouchy/not interested in things become more of a problem for _____? <1 month 1, 1-3 months 2, >3 months 3, DK 9
F. Did he/she seem sad/grouchy/not interested in things for longer than 6 months? 0 2 9
If no, go to C. G. How soon after this death did he/she begin to seem sad/grouchy/not interested in things? < 1 month 1, 1-3 months 2, >3 months 3, DK 9
H. Did he/she seem sad/grouchy/not interested in things for longer than 6 months? 0 2 9
38. When he/she was sad/grouchy/not interested in things, did that feeling begin soon after some bad thing or some big change happened to him/her? 0 2 9
If no, go to Q39.
If yes, A. What was it? __________
Note 4: Is this clearly a one time event? 0 2 9
If yes, go to C. If no, go to B.
B. Is this event still going on? 0 2 9
C. When did this happen? __________
D. Did he/she seem sad/grouchy/not interested in things before _________? 0 2 9
If yes, D. Did seeming sad/grouchy/not interested in things definitely get worse after this began? 0 2 9
If yes, E. How soon after this event did ______ start feeling sad/grouchy/not interested in things become more of a problem for ______?  
<1 month 1, 1-3 months 2, >3 months 3, DK 9

F. Did he/she seem sad/grouchy/not interested in things for longer than 6 months? 0 2 9

Go to Q39.

If no, H. How soon after this event did he/she begin to seem sad/grouchy/not interested in things? < 1 month 1, 1-3 months 2, 
>3 months 3, DK 9

I. Did he/she seem sad/grouchy/not interested in things for longer than 6 months? 0 2 9

39. Would you say that he/she is more likely to feel sad/grouchy/not interested in things when the days are shorter, like in the fall or winter? 0 2* 9

If no, A. How about the opposite, in the spring or summer? 0 2* 9

If "*" response, to Q39 or 39A: B. For how many years have you noticed this? last 3 3, last 2 2, this year only 1, DK 9

40. Has ______ ever seen a professional because he/she has problems with feeling sad/grouchy/not interested in things? 0 2 9

If yes, A. Who did he/she see? __________

B. What did the person say was wrong? __________

C. How old was he/she the first time he/she saw someone because he/she had problems with feeling sad/grouchy/not interested in things? __________

D. Did he/she see anyone for the 6 months prior to the time we specified? 0 2 9

Go to Q41.

If no, E. Did you ever think that he/she should see someone because of feeling
that way? 0 2 9

F. Did his/her school/job or anyone ever suggest he/she should see someone because of this? 0 2 9

G. Did he/she ever ask to see someone for this? 0 2 9

41. Has_______ever taken medicine for depression? 0 2 9

If yes, A. Has he/she ever taken it during the six months prior to the time specified? 0 2 9

If yes, B. What is the medicine?__________

OVERANXIOUS DISORDER

103. At the time specified, has_______had a lot of headaches? 0 1 2 9

If yes, A. How often has he/she had headaches? Would you say every day, or at least once a week...or at least once a month? every day 4,

1-6 days a week 3, 1-3 days a month 2, less than once a month 1, DK 9.

B. Was that when he/she was sick, say with a cold or flu or because of another medical problem (0) 1 2 9

If yes, C. Has he/she had a lot of headaches when he/she wasn't sick or didn't have a medical problem 0 (1) (2) 9

D. Has he/she told a Dr. about these headaches? 0 2 9

If yes, E. Did the Dr. say the headaches were because he/she is nervous or worried? 0 2 9

104. At the time specified, has_______had a lot stomach aches? 0 1 2 9

If yes, A. How often has he/she had stomach aches? Would you say every day, or at least once a week...or at least once a month? every day 4,

1-6 days a week 3, 1-3 days a month 2, less than once a month 1, DK 9

B. Was that when he/she was sick, say with a cold or flu or because of another medical problem (0) 1 2 9
If yes, C. Has he/she had a lot of stomach aches when he/she wasn't sick or didn't have a medical problem 0 (1) (2) 9
D. Has he/she told a Dr. about these stomach aches? 0 2 9
If yes, E. Did the Dr. say the stomach aches were because he/she is nervous or worried? 0 2 9

105. At the time specified, has he/she had a lot of other aches and pains? 0 1 2 9
If yes, A. How often has he/she had stomach aches? Would you say every day, or at least once a week...or at least once a month? every day 4, 1-6 days a week 3, 1-3 days a month 2, less than once a month 1, DK 9
B. Was that when he/she was sick, say with a cold or flu or because of another medical problem (0) 1 2 9
If yes, C. Has he/she had a lot of aches and pains when he/she wasn't sick or didn't have a medical problem 0 (1) (2) 9
D. Has he/she told a Dr. about these aches? 0 2 9
If yes, E. Did the Dr. say these aches were because he/she is nervous or worried? 0 2 9

106. Is he/she the kind of child who often gets worried or nervous? 0 1 2 9
If no, go to Q108
If yes, A. Has he/she been worried or nervous a lot of times during the six months prior to the time specified? 0 1 2 9
If no, go to Q108
If yes, B. When________is worried do any of these things happen to him/her?
Does it seem like he/she can't catch his/her breath? 0 1 2 9
C. Does he/she tremble or twitch or say that he/she feels shaky? 0 1 2 9
D. Does he/she say his/her heart is pounding or beating too fast? 0 1 2 9
E. Does he/she get a pain in his/her chest or does it feel tight? 0 1 2 9
F. Does he/she sweat more than usual or do his/her hands get cold and wet?
   0 1 2 9

G. When he/she gets nervous or worried, does his/her mouth get dry?
   0 1 2 9

H. Does he/she say he/she feels dizzy or like he/she is going to faint?
   0 1 2 9

I. Does he/she say he/she feels like he/she isn’t real or that he/she is outside
   of the real world? 0 1 2 9

J. Does he/she say he/she feels sick to his/her stomach or has diarrhea?
   0 1 2 9

K. When he/she feels nervous or worried does he/she get very hot or very
   cold? 0 1 2 9

L. Does he/she have to urinate more often than usual? 0 1 2 9

M. Does he/she have trouble swallowing or get a lump in his/her throat?
   0 1 2 9

N. When he/she gets nervous or worried does he/she seem very keyed or
   edgy? 0 1 2 9

O. Does he/she jump when people speak to him/her? 0 1 2 9

P. Does he/she have problems keeping his/her mind on what he/she is doing
   because he/she is so nervous? 0 1 2 9

Q. When he/she feels nervous does his/her mind sometimes start to go blank?
   0 1 2 9

R. When he/she is worried is he/she afraid that he/she is going crazy or
   losing control? 0 1 2 9

S. Does he/she have trouble falling asleep or staying asleep? 0 1 2 9

T. Is he/she grouchy or irritable bothered by even little things? 0 1 2 9

U. When he/she feels nervous or worried do his/her muscles get tight or
achey? 0 1 2 9
V. Does he/she get very fidgety or need to move around a lot? 0 1 2 9
W. Does he/she get tired more easily? 0 1 2 9
Note 13: Were 5 or more items coded "sometimes" (1) or "yes" (2) in Q106B-106W?
If yes, ask Q107. If no, go to Q108
107. When he/she said he/she felt (repeat all symptoms) was he/she sick or did he/she have some physical problem that may have made him/her feel that way? 0 1 2 9
If yes, A. What was that?______________________
B. Did he/she ever seem that way when he/she wasn't sick? 0 2 9
108. Now I'm going to ask you about certain things that might worry him/her. For all of these please think back to the six months before the time of testing.
Does______get worried about things that are coming up, like a test or a game or a party? 0 1 2 9
If yes, A. When something special like that is coming up, does he/she almost always say or do things that make you think he/she is worrying a lot about it? 0 1 2 9
If yes, B. What about things coming up that he/she usually does okay at? Does he/she worry a lot about them? 0 (1) (2) 9
C. When______is worried like that, does he/she keep asking you or other people if things will turn out okay? 0 1 2 9
D. Has he/she worried a lot about things coming up for as long as 6 months? 0 2 9
109. At the time specified, has_______been very worried about how well he/she does his/her schoolwork/job? 0 1 2 8 9
If yes, A. Does he/she say or do things at least once a week that make you
If yes, B. Do most people say he/she is doing okay in his/her schoolwork/job? 0 1 2 9
C. Does he/she keep asking you or other people if he/she is doing okay in his/her schoolwork/job? 0 1 2 9
D. Has he/she worried a lot about his/her schoolwork/job for as long as 6 months? 0 2 9

110. Has he/she been very worried about how good he/she is at sports or games or in gym? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. What about games that he/she usually does okay at? Does he/she worry a lot about them? 0 (1) (2) 9
C. Does he/she keep asking you or other people if he/she is doing okay in sports or games? 0 1 2 9
D. Has he/she worried a lot about how good he/she is at sports or games for as long as 6 months? 0 2 9

111. At the time specified, has he/she been very worried about being on time, has he/she often been afraid that he/she would be late? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. Does he/she worry about being late even when he/she has plenty of time? 0 (1) (2) 9
C. Does he/she keep asking you or other people if he/she will be on time? 0 1 2 9
D. Has he/she worried a lot about being late for as long as 6 months? 0 2 9

112. At the time specified, has he/she often been worried that he/she has
made a mistake or done something the wrong way? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. Does he/she worry about things that aren't that important? 0 (1) (2) 9
C. When _____ is worried like that, does he/she keep asking you or other people if things will turn out okay? 0 1 2 9
D. Has he/she worried a lot about doing wrong for as long as 6 months? 0 2 9

113. Has he/she been very worried about whether the family has enough money? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. Does he/she worry about money even when there is no need to worry? 0 (1) (2) 9
C. Does _____ keep asking you or other people if the family has enough money? 0 1 2 9
D. Has he/she worried a lot about money for as long as 6 months? 0 2 9

114. At the time specified, has he/she often worried that he/she has made a fool of him/herself in front of other people? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. How about when he/she is around kids who think he/she is okay? Does he/she worry a lot about this then? 0 (1) (2) 9
C. When _____ is worried like this, does he/she keep asking you or other people if he/she acted okay? 0 1 2 9
D. Has he/she worried a lot about how he/she seems to other people for as long as 6 months? 0 2 9
115. At the time specified, has he/she often worried about how he/she looks? 0 1 2 9
If yes, A. Does he/she worry about his/her looks or appearance more than other kids his/her age? 0 1 2 9
If yes, B. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, C. When______ is worried like this, does he/she keep asking you or other people if he/she looks okay? 0 (1) (2) 9
D. Has he/she worried a lot about how he/she looks for as long as 6 months? 0 2 9

116. At the time specified, has he/she been very worried about whether other people like him/her? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. How about when he/she is with people who do like him/her? Does he/she worry then? 0 (1) (2) 9
C. Does______ keep asking you or other people if people like him/her? 0 1 2 9
D. Has he/she worried a lot about whether others like him/her for as long as 6 months? 0 2 9

117. Has he/she been very worried about his/her health or about getting sick? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is worried about this? 0 1 2 9
If yes, B. Is he/she generally healthy? 0 (2) 9
C. Does he/she keep asking you or others if his/her health is okay? 0 1 2 9
D. Has he/she worried a lot about his/her health for as long as 6 months?
118. Is he/she the kind of person who doesn't like to be noticed or is easily embarrassed or is very self-conscious? 0 1 2 9
If yes, A. Does he/she say or do things at least once a week that make you think he/she is self-conscious? 0 (1) (2) 9
If yes, B. Does being self-conscious keep him/her from going places or meeting people? 0 1 2 9
C. When he/she is self-conscious does he/she often get up and leave or have a bad reaction like crying? 0 1 2 9
D. Has he/she been self-conscious for as long as 6 months? 0 2 9
119. Is______the kind of person who is almost always worried about something? 0 1 2 9
If yes, A. Does he/she always worry a lot more than he/she needs to? 0 (1) (2) 9
B. Has he/she been worried like this for as long as six months? 0 2 9
120. Is______the kind of person who is often very tense, or who finds it very hard to relax? 0 1 2 9
If yes. A. Is he/she like this even when there's no reason to be tense? 0 (1) (2) 9
B. Has he/she been tense like this a lot of the time for as long as 6 months? 0 2 9
Note 14: Were 3 or more "()" responses coded in Q103 to 120? 0 2
If yes: Continue If no: Go to note 16.
121. You told me that_________(state responses Q103-120). How old was he/she when he/she started to feel this way?___________
122. Has worrying about things or feeling nervous made it hard for him/her to do things with friends or with other people in the six months prior to the
123. Does worrying about things keep him/her from doing things that he/she might really want to do? 0 1 2 9

124. Does worrying so much cause problems for him/her at work/school? 0 1 2 8 9

125. Does worrying about things cause problems for him/her at home? 0 1 2 9

126. Did his/her feelings of being nervous or worried begin soon after something bad or some big change happened? 0 2 9
If no, go to note 16. If yes, what was it?______________________________

Note 15. Is this clearly a one time event? 0 2
If yes: go to C. If no, go to B

B. Is this event still going on? 0 2 9

C. When did this happen?___________

D. Did he/she worry about things before the event? 0 2 9
If no, go to H. If yes, E. Did worrying or being nervous get worse after this event? 0 2 9
If yes, F. How soon after the event did being worried or nervous become more of a problem? <1 month 1, 1-3 months 2, >3 months 3, DK 9

G. Did he/she seem more worried and nervous for longer than 6 months? 0 2 9
If no to D, H. How soon after the event did being worried or nervous become more of a problem? <1 month 1, 1-3 months 2, >3 months 3, DK 9

G. Did he/she seem more worried and nervous for longer than 6 months?

Note 16: Were any () responses coded in Q12 to 120? 0 2
If yes: continue. If no: stop.

127. I've asked you a lot of questions about________'s being nervous or worried.
You told me that he/she (name all responses).

Has________ever seen a professional because of feeling nervous or worried?

If yes, A. Who?________________________

B. What did that person say was wrong?________________

C. How old was he/she the first time he/she saw someone because of feeling this way?________________

D. Did he/she see anyone in the 6 months prior to the time specified?   0    2    9

If no, E. Have you ever thought he/she needed to see someone because of this?  0    2    9

F. Has his/her school/work ever suggested he/she see someone because of this?  0    2    9

G. Has he/she ever wanted to see someone because of this?  0    2    9
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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Date

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