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FASD, Verbal Comprehension And Maladaptive Behavior

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FASD, VERBAL COMPREHENSION AND MALADAPTIVE BEHAVIOR

by

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This dissertation, submitted by Anthony B. Athmann in partial fulfillment of the requirements for the Degree of Doctor of Philosophy from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done, and is hereby approved.

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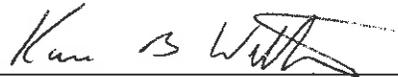
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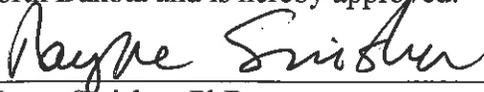
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Anthony B. Athmann
April 24, 2016

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ACKNOWLEDGMENTS

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ABSTRACT

A Fetal Alcohol Spectrum Diagnosis is comprised of various levels of physical

dysmorphia and behavioral and cognitive dysfunctions. Early identification and diagnosis

is difficult, requires specially trained practitioners and often results in the delay of

receiving necessary services. This is particularly true for those individuals living in

underserved rural areas. However, screening children with commonly used assessment

tools may help to more quickly identify children who have been prenatally exposed to

alcohol. The purpose of the present study was to contribute to the development of a

neurobehavioral profile of alcohol-exposed children through examining if relationship

exists between verbal comprehension deficits and maladaptive behaviors across the

different FASD diagnostic categories. This study conducted a review of records of 178

individuals referred for an FASD evaluation who were suspected of being prenatally

exposed. This study supports previous findings indicating that lower cognitive

functioning and higher maladaptive behaviors co-occur in children suspected of prenatal

alcohol exposure. However, a more specific link between factices of verbal

comprehension and maladaptive behavior was not supported in this study. Post hoc

analysis of additional characteristics found in this group and implication for future

research are also discussed.

CHAPTER I

INTRODUCTION

Children prenatally exposed to alcohol are at a high risk for problem behaviors which can interfere with their home, school and social environments and last into adulthood (Burd, 2007). Early intervention is the only mitigating factor that has resulted in greater long term success for these individuals (Streissguth et al., 2004). Though exposure to alcohol prenatally can often result in physical and neurological consequences, the effects often vary considerably, making screening difficult for the all but the most seriously affected. A review of the literature suggests that a neurobehavioral profile of FASD may link aspects of cognitive functioning with behavioral outcomes.

Fetal Alcohol Spectrum Disorder (FASD) is an umbrella term used to describe a group of physical, cognitive, and behavioral conditions that can occur in an individual whose mother consumed alcohol during pregnancy. The consequences of prenatal alcohol use include general growth retardation, central nervous systems dysfunction, and differential evidence of facial dysmorphia or other physiological symptoms (Hoyme et al., 2005; Burd, 2007). Medical professionals often attempt to identify FASD characteristics through screening and make diagnosis through recognizing the range of outcomes and disabilities that may be produced when a fetus is prenatally exposed to

alcohol. When the physical and neurological consequences are detected the results may include one of several medical diagnoses: fetal alcohol syndrome (FAS); partial Fetal Alcohol Syndrome (pFAS); Alcohol-Related Brain Damage (ARBD); and Alcohol Related Neurodevelopmental Disorder (ARND).

Prenatal alcohol use stands alone as the largest cause of physical and cognitive disabilities in North America (Burd, 2007; Popova et al., 2011; National Institute of Health, NIH, 2010). Nationally, FASD affects 10 in 1,000 live births a year (Minnesota Organization of Fetal Alcohol Syndrome, MOFAS, 2011). Individuals diagnosed with FASD pose a significant cost with an estimated national expenditure of $5.4 billion in direct and indirect services (Popova et al., 2011; NOFAS, 2010). Individuals with FASD often present with a profile of reduced IQ and are one of the leading causes of mental retardation (Abel & Sokol, 1987). In addition, it is a large cause of mental health disabilities. Studies that cover the lifespan of individuals with FASD indicate a significantly increased risk of mental health issues (e.g., ADHD, bi-polar disorder and substance abuse) (Greenbaum et al., 2006). In addition, they present with increased substance abuse and criminal history rates that result in these individual being over represented in the criminal justice system (Abel & Sokol, 1986; Fast et al., 1999; Burd et al., 2011). Prenatal exposure to alcohol clearly has the potential for negative impact on cognitive and behavioral functioning, with important ramifications for the individual and the systems by which they are served.

Of the wide range of adverse physical and neurological effects of prenatal exposure to alcohol, cognitive impairments appear to be the most pervasive. Deficits in cognitive ability make up a central impairment of FASD (Kodituwaku, 2007) and are

suggested to be the most devastating consequence of prenatal alcohol exposure (Riley, Mattson, & Thomas, 2009). Approximately 25% of individuals with FASD have an intellectual disability (e.g., mental retardation) (Streissguth et al., 2004). In a similar but slightly contradictory finding , Mattson and Riley (1998) found that children and adolescents with FASD possessed below average IQ ranging from mildly retarded to borderline range (Kodituwakku, 2007). It seems that that the cognitive profile for FASD individual may have considerable variation. Therefore, not all individuals who fall into the FASD categorization have a diagnosis of mental retardation but fall into a wide range of intellectual functioning.

This wide range of intellectual functioning affects a variety of functions that are necessary in academic performance. For example, individuals with FASD often have difficulties in planning, organization, abstract reasoning and verbal learning (Mattson et al., 1996). Special education services is designed to aid in these areas but may not be available for individuals with FASD, as cognitive deficits alone may not qualify them for services through the traditional assessment routes. In sum, although cognitive dysfunction among individuals with FASD is prevalent, it is also highly variable. As a result, it is difficult to identify a cognitive profile that is specific to individuals with FASD that would aid in screening. However, there is research that may suggest some link between some of the cognitive deficiencies and behavioral difficulties individuals with FASD often present.

Aside from the significant impairments in cognitive functioning, children with FASD generally possess pervasive behavioral issues (Mattson & Riley, 2000; Jirikowic, Gelo, & Astley, 2010). They are often impulsive as they do not consider the

consequences of their actions. Children with FASD can demonstrate extreme mood changes that can result in aggressive behavior, or temper tantrums (Staroseleky et al., 2009; O'Connor et al., 2002). There is also a significant rate of comorbidity with symptoms and diagnosis of ADHD as children with FASD often demonstrate inattention, hyperactivity and impulsiveness, which may also be symptoms of attention deficit hyperactivity disorder (ADHD). These difficulties present as significant behavioral problems that impede their ability to function successfully in an academic setting. As a result, a significant number of individuals with FASD are diagnosed with attention deficit hyperactivity disorder, depression, oppositional defiant disorder, and conduct disorder (O'Connor et al., 2002). Previous research which examined children with FASD revealed that behavior issues may not present as significant early in education (Green, 2007). This may be due to early difficulties with social functioning which may be more acceptable at a young age and less likely to present as needing targeted intervention (Green, 2007; Olswand et al., 2010). Other studies have proposed that individuals exposed to alcohol prenatally may possess the neurobehavioral deficits without presenting the facial phenotype of FASD, making identification additionally difficult. Therefore, in an academic setting, as a child progresses in age and grade and the demands for appropriate functioning become more complex, their behaviors may become increasingly inappropriate and significantly different from peers (Streissguth et al., 1991; Olswand et al., 2010) even in the absence of a diagnosis or identification.

It has been hypothesized that deficits in verbal intelligence also affect adaptive and social functioning (Crocker, Riley & Mattson, 2011; Riley et al., 1997; Martens et al., 2010; Davis et al., 2011). McGee et al. (2008) found that children with heavy prenatal

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alcohol exposure had difficulty with verbal and non-verbal concept formation. This suggests that they have considerable difficulty integrating information to form concepts, which impairs their ability to solve problems. Teachers and clinicians have described their difficulties as children who may have a lot to say, but are unable to retrieve the words they need. Some children may have no problem in simple expression, but have difficulties retrieving and organizing words and sentences when expressing more complicated thoughts and ideas. This may occur when they are trying to describe, define, or explain information or retell an event or activity. Despite the considerable effort that have been devoted to creating public awareness of the adverse effects of prenatal alcohol exposure , and professional training in screening, many children and adolescents with FASD may go undiagnosed (Streissguth, 1997). It is therefore particularly important to attend to the ways in which students with FASD access school and educational services. Adolescents with FASD have higher rates of utilizing special education services (Aragón et al., 2008). Specifically, they are more often provided special-education services under emotional behavioral disturbance (EBD) to address the behavioral issues that often accompany FASD (Burd et. al., 2004; Aragón et al., 2008). This is not an attractive situation for the school or student. Financially, it presents a significant cost to the school, as the cost per individual can be as much as $30,000 more per year. For the individual, the money and resources may actually result in a poor academic outlook, as research has repeatedly shown that students receiving EBD services have the highest dropout rate (greater than 40%) among all the categories of special education students (Aragón et al., 2008).

However, it is known that early intervention is likely to result in significantly fewer problems later in life. A longitudinal study on children with FASD found that individuals diagnosed with FAS who received services had far less adverse life outcomes than individuals who were diagnosed with other FASD designations (e.g., pFAS, ARND) and received no services (Streissguth, 2007). This was true even though symptoms for individuals diagnosed with FAS are likely to be more severe and significant than the symptoms of the other FASD categories. This difference in outcome may be related to the fact that children with FAS are likely to be identified at a very early age, due to the greater likelihood of having visible facial dysmorphia that accompanies FAS more consistently than other FASD diagnoses (pFAS, ARND). In other words, children with pFAS and ARND are less likely to receive early services than children with FAS, and so may have a greater incidence of adverse outcomes.

The academic setting is the most likely place for early intervention to occur, as the behavioral and cognitive dysfunctions often draw the attention of professional educators. However, identifying and providing appropriate support is complicated by the insidious nature of FASD. As previously mentioned, cognitive deficits may not identify them leaving the behavioral components as the primary marker (Paley, 2009). Though diagnostic criteria for FASD have been well established, children with FASD do not typically do not meet the requirements to qualify for services in an academic setting. To receive services, individuals must often qualify within criteria and diagnosis other than FASD. Under the existing *Individuals with Disabilities Education Improvement Act* (2004), FASD as a diagnosis, does not by itself qualify the individual for special education services. Currently, Fetal Alcohol Syndrome (FASD) is not identified as a

specific category of disability; instead, it is a medical diagnosis. As mentioned previously, most children with FASD are not diagnosed as mentally retarded and often score in the low-average to average range in intellectual functioning. Consequently, many individuals with FASD not diagnosed with FAS often do not receive intervention services until other comorbid conditions (e.g., ADHD) present as significant impairments (Paley, 2009).

The cognitive and behavioral challenges often severely limit the individual's ability to learn and function in a school setting. Once identified, the behavioral and cognitive dysfunction caused by prenatal alcohol exposure results in children with FASD needing a wide range of support, which often include special education services and medication (Streissguth et al., 1991). However, both anecdotal evidence and research suggests that many children with FASD are not provided the necessary support until behavioral, academic, or social problems become significant. It is important to identify possible challenges and provide interventions as early as possible to create the most opportunity for children prenatally exposed to alcohol to have success. Nash et al. (2013) suggest that an effort to efficiently "differentiate diagnosed from undiagnosed" using various cognitive domains that include verbal reasoning.

Summary

Children prenatally exposed to alcohol are at a high risk for problem behaviors that can interfere with their home, school and social environments and last into adulthood. Early intervention is the only mitigating factor that has resulted in greater long term success for these individuals. Though exposure to alcohol prenatally can often result in physical and neurological consequences, the affects can vary considerably making

screening difficult for the all but the most seriously affected (Paley, 2009). There is a dearth of research specifically examining those individuals who fall outside of the full FAS diagnosis. Although there is literature documenting extensive deficits in children prenatal alcohol exposure, questions remain as to whether children with prenatal alcohol exposure display a distinct neurobehavioral profile. Research suggests there may be a link between children and adolescents cognitive profile (Mattson, 2009) and prenatal exposure to alcohol. Creating more insight into the neurobehavioral profile by comparing children exposed prenatally to alcohol cognitive performance and maladaptive behaviors may provide insight into a unique behavioral phenotype of children exposed prenatally to alcohol. Identifying a neurobehavioral profile for children exposed prenatally to alcohol was proposed by Arago'n et al., (2008).

The purpose of the current study was to assess if there exists a correlation with verbal comprehension deficits and maladaptive behaviors across the different FASD diagnostic categories. Efforts focused on looking into this question may reveal whether different FASD diagnostic groups are more vulnerable to such deficits and be used to identify children and adolescents who may present with behavioral difficulties later in academic settings. First, this is a relevant question because of the inconsistent findings of previous studies regarding the symptoms and severity among children exposed to alcohol prenatally. Second, research suggests that individuals who do not have a diagnosis of FAS may not qualify and receive services. Finally, when services are provided to individuals with FASD, they are more likely to be served special education services under an emotional or behavioral disorder.

CHAPTER II

LITERATURE REVIEW

This chapter will begin with an overview of FASD and the important terminology that will be used in this paper. Next, a description of essential features, diagnostic criteria, and subtypes of FASD will be discussed. In addition, previous research on adaptive functioning, behavioral characteristics, and maladaptive behavior will be reviewed. Then, the relationship between intelligence and fetal alcohol exposure will be explored. Finally, research that describes a link between verbal intellectual functioning and maladaptive behavior will be discussed.

Terminology Relevant to Fetal Alcohol Syndrome Research

Understanding the effects of alcohol on the fetus includes distinguishing a variety of overlapping terms that illustrate a wide range of the potential negative effects. In general, these terms use semi-descriptive language in an attempt to capture the wide array of alcohol's potential effects on developing fetus. Though science had observed the effects of prenatal exposure to alcohol since the 1800's, the language to describe the effects did not originate until the late 20th century. Some of the first diagnostic language originated in 1973, as the term "Fetal Alcohol Syndrome" was coined by dysmorphologist David Smith, and his associate, Kenneth Lyons Jones. Their study of

infants born from mothers who were diagnosed with alcohol disorder during pregnancy set a foundation for the diagnostic criteria that included the neurological and physical indicators of alcohol related anomalies in children. The 11 initial cases included growth deficiencies, delays in cognitive development, and distinct facial and cranial anomalies which remain a part of the current diagnostic criteria (Riley & Warren, 2011).

Although the original term "Fetal Alcohol Syndrome" has gone through changes that reflect the advancements in research and diagnosis, the diagnostic criteria have continued to center on four areas of clinical features: facial malformations, retardation of overall growth, Central Nervous System malformations (CNS), and maternal alcohol use during pregnancy. Continued advances in research have resulted in expanded terminology that is more inclusive and refined; however, researchers and clinicians have developed an understanding that a wide variety of potential outcomes can result from prenatal alcohol exposure. As a result, several classifications have been developed to aid in diagnosis and classification. Within the FASD spectrum, the term fetal alcohol spectrum disorders (FASD) has been used to underline the long-term consequences of prenatal alcohol exposure. With FASD being used to describe the continuum of minimal to severe effects, Fetal Alcohol Syndrome or FAS, describes the more severe and of the spectrum is used throughout this paper to refer to individuals who meet the diagnostic criteria for FAS (Manning & Hoyme, 2007; Hoyme et al., 2005; Bertrand et al., 2004).

As research into the prenatal effects of alcohol exposure increased, Clarren and Smith (1978) introduced the term suspected fetal alcohol effects or Fetal Alcohol Effect (FAE) in an effort to denote the partial expression of the syndrome. This term was later suggested to be abandoned by Aase et al. (1995), as it was misused by healthcare

professionals as an umbrella term to label any child with behavior problems coming from families with suspected alcohol abuse. In 1996, the Institute of Medicine (IOM) acknowledged the broad and imprecise classification system and recommended new terminology to refine the diagnostic categorization of fetal alcohol spectrum disorders (Jones & Streissguth, 2010; Manning & Hoyme, 2007). This included: 1) Fetal Alcohol Syndrome (FAS) with confirmed maternal alcohol use will reconfirmed maternal alcohol exposure evidence of a characteristic pattern of facial abnormalities and narrow developmental disabilities; 2) Fetal Alcohol Syndrome (FAS) with unconfirmed maternal alcohol use is alcohol exposure evidence of a characteristic pattern of facial abnormalities and narrow developmental disabilities; 3) Partial Fetal Alcohol Exposure (pFAS) will possess some components of characteristic facial abnormalities, evidence of growth retardation, central nervous system neurodevelopmental abnormalities and a pattern of behavior or cognitive abnormalities as inconsistent with developmental level and cannot be explained by familial background or environment; 4) Alcohol Related Birth-Defect (ARBD) describes the presence of congenital abnormalities, malformations, or dysplasia as a result of prenatal alcohol exposure (Manning & Hoyme, 2007; Lockhart, 2001); and Alcohol Related Neurodevelopmental Disorder (ARND) evidence of a CNS neurodevelopmental abnormality such as decreased cranial size, structural brain abnormalities, or a pattern of behavioral or cognitive abnormalities inconsistent with developmental level, which cannot be explained by familial background or environment (Lockhart, 2001).

The most recent guidelines were established as the result of a federally mandated U.S. Department of Health and Human Services (DHHS) 2002 Appropriations Bill,

which directed the Centers for Disease Control and Prevention (CDC) to update and refine diagnostic and referral criteria to reflect the scientific and clinical advances in the understanding of this disorder over the past 30 years (Bertrand et al., 2004). In addition, the CDC is in the process of refining the diagnostic criteria for other FASD such as alcohol related neurodevelopmental disorder and alcohol related birth defects (Bertrand et al., 2004; Riley, Alejandra-Infant, & Warren, 2011).

In summary, FASD is used as a non-diagnostic umbrella term to describe a wide range of effects resulting from prenatal alcohol exposure. As a result, FAS, pFAS, ARBD and ARND would all fall under the term FASD (Riley, Alejandra-Infant, & Warren, 2011). For the purpose of this review, unless otherwise specified, the above-mentioned terms will be used interchangeably under the criteria of FASD to describe the effects of alcohol on the cognitive, physical, and functional regarding maternal alcohol use during pregnancy.

Classic Presentation of FASD

Although the original term "Fetal Alcohol Syndrome" has gone through changes that reflect the advancements in research and diagnosis, the basic phenotype of FASD changed little since Jones and Smith (1973), and continues to be the basis for which the evaluation of the clinical features. Jones et al. (1973) were the first in describing the now-characteristic dysmorphic facial features related to FASD. They were one of the first researchers to note that alcohol consumed during pregnancy often creates human congenital malformations. Briefly, these malformations occur when normal development in the cell is interrupted and set on a course outside or range of normal development which often results in abnormal physical and structural characteristics. The diagnostic

criteria for FASD falls into three major categories that include facial dysmorphia, growth

deficiency and central nervous system abnormalities; this may include small head

circumference, neurological problems, cognitive and developmental deficits, and

behavioral and emotional problems (Bertrand et al., 2004).

Facial Dysmorphia

FASD is characterized by dysmorphia which include the physical facial

characteristics that are commonly referred to as the facial phenotype of FAS. Facial

dysmorphia is a pattern of facial abnormalities that include a smooth philtrum (i.e., lack

of the vertical groove in the upper lip) or flattened philtrum (Manning & Hoyme, 2007), a

thin vermillion border (i.e., thin upper lip), and small paperbal fissures (i.e., the opening

of the eyes between the eyelids) (Hoyme et al., 2005; Chudley et al., 2005; Bertrand et al.,

2004).

In an effort to better identify and define the facial features of FASD, Hoyme et al.,

(2005) studied facial features of 1500 children and adolescents. They identified three

categories of facial dysmorphia that included abnormalities in upper lip thickness, upper

lip vertical groove depth, and openings in the eyes. To measure upper lip and vertical

groove thickness clinicians use The Lip-Philtrum Guides (Hoyme, 2004). These guides

are 5-point pictorial rulers that are used by clinicians to accurately measure philtrum

smoothness and upper lip thinness (Hoyme, 2004). The scale reflects the full range of lip

thickness and philtrum depth one would see in the population. A ranking of 5 represents

the typical expression of the smooth philtrum and thin upper lip seen in individuals with

FAS (Hoyme, 2004). The ranking of 1 would demonstrate and individual with a very

deep philtrum and full upper lip. As you advance up the Guide from picture #1 to #5, the

upper lip becomes thinner and the philtrum becomes smoother.

Growth Deficiency

Growth deficiencies have routinely observed in individuals with FASD (Riley,

Mattson & Thomas, 2009). These include observations related to head circumference,

height and weight of the body, and growth timing that are continually found to be below

the 10th percentile (Hoyme et al., 2004; Bertrand et al., 2004).

Central Nervous System and Structural Brain Abnormalities

CNS abnormalities represent the most devastating consequences of FASD, as they

generally last the lifetime of the individual. To meet the diagnostic criteria for central

nervous system (CNS) abnormalities, structural (e.g., head circumference below the 10th

percentile or disproportional to the size of the body), neurological (e.g., seizures, visual,

and motor control issues), or functional deficits (e.g., cognitive, attention, and social

skills deficits) or a combination of these need to be observed (May et al., 2004). Prior to

the development of these systems, physicians subjectively interpreted the criteria

independently with very little guidance from research and no formal diagnostic

methodology.

Structural brain abnormalities resulting in damage and under development often

result in mild to severe cognitive deficits can be gauged in several ways: 1)

Abnormalities in brain structure (i.e., reduced size or shape of cerebellum) may be

determined through brain imaging. 2) The size and shape of the head (i.e., head

circumference) falls below the 10th percentile (Hoyme et al., 2005; Astley, 2006). The

neurological components include abnormalities indicative of neurological problems such

as seizures not related to other identifiable medical conditions. This would include other neurological signs such as issues with reflex, coordination, and motor control. 3) Function difficulties includes a low full scale or deficits in three or more specific functional domains such as cognition, executive and motor functioning, attention and hyperactivity, memory and social skills. Functional issues are often assessed through the use of standardized measures such as the Wechsler Intelligence Scale for Children, fourth edition, and are determined based on norms (Wechsler, 1997). FAS without confirmed maternal alcohol exposure includes all of the previous criteria but without confirmed maternal alcohol exposure. Furthermore, it is important to remember that these abnormalities can be present despite the absence of facial abnormalities and growth deficiencies (Rasmussen & Bisanz, 2009).

Diagnostic Systems

There are four commonly used diagnostic schemas that have gone through development and revision that are used worldwide; 1) Institute of Medicine, 1996 (Revised IOM) (Hoyme et al., 2005); 2) Astley and Clarren 1996 (4-digit code); 3) Canadian Diagnostic Guidelines (Chudley et al. 2005); National Task Force/CDC (Bertrand et al. 2004). The following paragraphs will briefly describe these systems.

The diagnostic system by Astley and Clarren, which came to be known as the "University of Washington 4-Digit diagnostic code" was created in effort to increase the reliability of diagnosis in response to the original IOM classifications. This system used a four digit code in an attempt to quantify and objectively measure specific features (Manning & Hoyme, 2007). This later included Astley and Clarren (2000) developing and refining measures to assess in FASD facial characteristics that include the philtrum

and vermillion border (Calhoun & Warren, 2007) the now well-known and utilized lip-philtrum guide that is now standard in the diagnosis of FASD.

Following the Astley and Clarren, the Centers for Disease Control (CDC) produced its own system of evaluating children and adults (Manning & Hoyme, 2007). The CDC guidelines reinforced the original criteria for with full-blown FAS as described by IOM (1996) but did not expand on the definition of FASD with was still a subject of debate in the medical field (Manning & Hoyme, 2007).

The Canadian Diagnostic Guidelines are another classification system developed in an effort to reconcile the original Institute of Medicine's criteria and Astley and Clarren's "4-digit code" (Manning & Hoyme, 2007). The significance of the CDG is that it combines the IOM and 4-Digit Diagnostic Code with an emphasis on a multi-step team approach to diagnosis. The multi-step team approach to diagnosis is now a standard procedure used world-wide.

The final common system is the Revised Institute of Medicine (Revised IOM, 2005) clarification system. The original IOM diagnostic clarification system (Stratten et al., 1996) was a response to the poorly defined and inconsistent diagnosis that plagued the medical field in the identification and diagnosis of FASD. It attempted to outline a more objective method of the morphological assessment and stressed differential diagnosis prior to assigning a diagnosis in the FASD continuum (Calhoun & Warren, 2007). However, some in the field felt the categories were still too ambiguous and lacked clinical refinement and a broader, more culturally inclusive multinational sampling (Hoyme et al., 2005). As a result, the revised IOM (2005) diagnostic criteria (Hoyme et al., 2005) have been field tested with a large, culturally inclusive, international cohort of

children prenatally exposed to alcohol and contain sufficient symptoms qualify in the FASD spectrum. The evolution of the diagnosis classification system of FAS has been expanded and refined but still includes many of the original anomalies found. However, there are two points that set this system apart from the previous systems. First, the revised system has been tested on a large multiracial international sample of children. In addition, not only does it use a multi-step team approach, it also incorporates possible genetic and teratogenic causes of developmental disabilities (Manning & Hoyme, 2007).

Despite some of the diagnostic differences, these systems all tend to agree on the three distinct areas; facial anomalies, growth deficiency, and central nervous system dysfunction. In sum, the guidelines for FASD diagnostic criteria have undergone significant revisions and advancements and though research has expanded to include new symptoms, the basic tenants of FASD remain in the diagnostic criteria. However, these systems have been critiqued in not attending to the secondary symptoms that often accompany the less severe forms of FASD (i.e., ARND).

Subtypes of FASD and Diagnostic Criteria

Understanding the differential diagnosis and the relationship between physical manifestations and functional impairment of the different subtypes of FASD has been difficult to distinguish in the past, as the language and categorization has been subject to various changes as the medical and research community struggled describe the various affects (Hoyme et al., 2005). In an effort to clarify the diagnostic methods and language, the Centers for Disease Control and Prevention introduced a diagnostic system that included four categories: fetal alcohol syndrome (FAS), partial fetal alcohol syndrome (pFAS), alcohol related birth defect (ARBD), and alcohol related neurocognitive disorder

(ARND) (Hoyme et al., 2005). The term "fetal alcohol effect" (FAE) was commonly

misused for both diagnosis terminology and as an umbrella phrase to describe all

individuals not diagnosed but exposed to alcohol. FAE was recommended not to be used

(Calhoun & Warren, 2007).

Fetal Alcohol Syndrome (FAS)

Diagnosis of FAS using the revised IOM (2005) criteria includes a combination of

the four necessary features: facial phenotype, growth deficiency, CNS abnormalities, and

confirmed or likely exposure to alcohol prenatally (Hoyme et al., 2005; Astley, 2006).

Facial features must include evidence of a characteristic pattern of unique facial

anomalies (i.e. dysmorphia) that include a minimum of two or more of features of a short

palpebral fissures (i.e. the opening for the eyes between the eyelids), thin vermillion

border (i.e. thin upper lip), and smooth philtrum (i.e. vertical groove in the upper lip)

(Hoyme et al., 2005; Astley, 2006). This includes documentation of pre- and/or post-natal

growth deficiency of height and weight that is stunted, as to fall at or below the 10% for

norms. Finally, central nervous system abnormalities documented through evidence of

deficient brain growth or significant structural deviations (Hoyme et al., 2005) is also

necessary for diagnosis.

Partial Fetal Alcohol Syndrome (pFAS)

Partial Fetal Alcohol Syndrome (pFAS) is a term used to describe a similar cluster

of problems that have some signs of the above listed criteria of FAS but not all. Similarly,

these can include some of the characteristic facial abnormalities associated, growth

deficiency, neurodevelopmental abnormalities, and behavioral or cognitive abnormalities

(Astley, 2006). Facial features must include evidence of a characteristic pattern of unique

facial anomalies (i.e. dysmorphia) that include a minimum of two or more of features of a short palpebral fissures (i.e. the opening for the eyes between the eyelids), thin vermillion border (i.e. thin upper lip), and smooth philtrum (i.e. vertical groove in the upper lip) (Hoyme et al., 2005; Astley, 2006). However, the diagnosis of pFAS is separated from FAS as it requires only one of the additional criteria of either growth deficiency, CNS abnormalities, or behavioral and cognitive abnormalities (Hoyme et al., 2005).

Alcohol Related Birth Defect (ARBD)

The classification for ARBD includes at least two facial abnormalities, and also includes one or more congenital defects that have been proven by human or animal studies to be related to prenatal exposure to alcohol, including malformations and dysplasia of the heart, bone, kidney, vision, or hearing systems, and confirmed prenatal alcohol exposure (Hoyme et al., 2005). It is important to note that this diagnosis differs from the alcohol related neurodevelopmental disorder in that the clinical focus relates to the congenital malformations often observed from exposure to alcohol.

Alcohol Related Neurodevelopmental Disorder (ARND)

The classification of Alcohol Related Neurodevelopmental Disorder does not require the facial or growth dysmorphias, but focuses on the functional or mental impairments that include two or more of the CNS linked functional domain deficits (Hoyme et al., 2005). This includes behavioral or cognitive abnormalities including performance in complex tasks, higher-level language deficits, learning difficulties, poor school performance, poor impulse control, and problems with mathematical skills, memory, attention, and/or judgment. These abnormalities must be consistent with prenatal exposure to alcohol and not explained by genetic predisposition or environment.

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In sum, these individuals display normal growth and structural development, but demonstrate a pattern of abnormal behavior and cognitive deficits (Hoyme et al., 2005).

Relationship between Cognitive Functioning and Behavior

An important area for consideration when studying behavior is its relationship to cognitive functioning (i.e., intelligence). Cognitive functioning refers to processes that involve memory, attention, learning, speech and language. It also includes an individual's ability to reason, comprehend complex ideas, and solve problems. It is a state of functioning that includes both concepts of both intelligence and adaptive behaviors. For example, the diagnosis of mental retardation as stated in the DSM-IV-TR (APA, 2000) is an intelligence test score below 70 and significant deficits in adaptive skills. The inclusion of both of these variables in the definition of mental retardation indicates the presence of a relationship between the two constructs.

Cognitive Functioning

Children who have been exposed to alcohol prenatally often have diminished cognitive abilities (Mattson et al., 1997). In an early academic setting, children with FASD may demonstrate learning disabilities related to functioning that include information processing, planning, and organizing. Deficits in the areas of executive functioning including planning, flexibility, fluency, inhibition, concept formation, and reasoning have been reported in children with heavy prenatal alcohol exposure (Kodituwakku et al., 1995; Mattson et al., 1999).

Research indicates that most individuals with the most severe diagnosis of FAS are not mentally retarded, with only approximately 25% having IQ scores <70 (Streissguth et al., 1990). IQ scores also vary widely, for example, from a low of 20

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(Streissguth, Randels , & Smith, 1991) to a high of at least 120. In addition, the mean IQ

is estimated to be between 65 and 72, and children with more dysmorphic features tend to

have lower IQ scores than those with fewer features (Mattson et al., 1997). These

findings suggest that individuals located on the most severe range of FASD are likely not

to fall into the mentally retarded range of intellectual functioning. In addition, individuals

who were exposed to alcohol but do not meet the FAS criteria are less identifiable

through intellectual functioning alone (Streissguth, 1991; May et al., 2004). In sum, the

detrimental effect of alcohol on intelligence is supported by widely researched findings

(Davis, Desrocher, & Moore, 2011; Crocker, Riley & Mattson, 2011). Children who have

been prenatally exposed to alcohol have been found to score lower on overall intellectual

functioning (Rasmussen & Wyper, 2007; Mattson et al. 1997). While some may have a

diagnosis of mental retardation, most will possess low average to average IQ scores

(Streissguth et al., 1991).

Behavioral Functioning

In addition to the cognitive and adaptive deficits, prenatal alcohol exposure is

associated with serious mental health problems including debilitating emotional and

behavioral disorders. Clinical observations of children with FASD have indicated that

they often display impulsive, aggressive, assertive, and unpredictable behaviors

(Streissguth, 1997; Tanner-Halverson, 1997). Streissguth et al. (1996) reported that

mental health problems were present in 94% of their sample of children and adults with

prenatal alcohol exposure. Children with prenatal alcohol exposure often present with an

extensive variety of psychological symptoms including hyperactivity, emotional

disorders, sleep disorders, behavior problems (e.g., aggression, inappropriate sexual

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behavior, delinquency, and self-injury), social skill deficits, and abnormal habits and stereotypes (Kodituwakku, 2007; Jirikowic, Kartin, & Olson, 2008; Steinhausen, 1996; Thiel et al., 2011).

Hyperactivity and attention problems are some of the most frequently reported symptoms associated. A comorbidity of diagnoses that include attention deficit hyperactivity disorder (ADHD), depression, oppositional defiant disorder, conduct disorder (Thiel et al., 2011), and anxiety disorders are often found to be present with individuals with FASD (Steinhausen, 1997). In addition, there is often the presence of significant deficits in social behavior that include aggression and other externalized behaviors (Kelly, Day, & Streissguth, 2000). Children affected by prenatal alcohol exposure also suffer from internalizing symptoms such as low self-esteem, social isolation, and mood disorders. In sum, children with FASD are significantly more likely to present with emotional and behavioral problems severe enough for placement into some sort of restrictive special education setting.

Children who are attending school in a mainstream classroom setting and special education setting have been frequently described has displaying difficulty managing behaviors. Brown et al. (1991) used The Child Behavior Checklist (CBCL; Achenbach, 1991) to examine the social skills and behavior problems of three groups of children. The study measured the behavior problems and compared the children of three groups of women. These groups consisted of; 1) women who reported not drinking during pregnancy (n = 21), 2) women who reported drinking throughout pregnancy (n = 25), 3) women who reported drinking until their second trimester and then stopped after an intervention (n = 22). The children who were exposed to alcohol throughout the entire

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pregnancy exhibited significant attention and behavior problems when compared to those whose mothers did not drink. However, children whose mothers were exposed for the first trimester and then stopped drinking demonstrated far less attention issues but demonstrated significant externalizing maladaptive behaviors (e.g., attention, aggression, and delinquency). This research noted that individuals with prenatal alcohol exposure tend to demonstrate significant externalizing behaviors. However, this study did not delineate the age and severity of the maladaptive behaviors.

It appears that research suggests there is a moderate correlation between cognitive functioning and adaptive behavior. The construct that appears to have the greatest likelihood of underlying both cognitive functioning and adaptive behavior is verbal or communication skills (Bolte & Poustka, 2002; Lambert, 1981). Specifically, Lambert (1981) hypothesized that verbal comprehension is the component of intelligence that underlies an individual's ability to understand and express social and adaptive behavior. In keeping with this theory, exploring the relation of verbal intelligence and maladaptive behavior may be beneficial.

Relationship between Verbal Intelligence and Behavior

For individuals with FASD, not only do deficits appear in general intelligence constructs, but deficits in the verbal intelligence have also been described to affect adaptive and social functioning (Crocker, Riley & Mattson, 2011; Riley et al., 1997). The construct of verbal IQ is defined as a measure of verbal concept formation, which assesses children's ability to listen to a question, draw upon learned information from both formal and informal education, reason through an answer, and express their thoughts aloud (Wechsler, 1997).

McGee et al., (2008) found that children with heavy prenatal alcohol exposure had difficulty with verbal and non-verbal concept formation. This suggests that they have considerable difficulty integrating information to form concepts, which impairs their ability to solve problems. In a study that compared children diagnosed with an FASD and those who were not, found that those who were diagnosed showed a greater weakness in overall cognitive functioning with greater deficits in verbal reasoning (Nash et al, 2006).

These difficulties often present themselves in academic setting through classroom behaviors. Teachers and clinicians have described their difficulties as children who may have a lot to say, but are unable to retrieve the words they need. Some children may have no problem in simple expression, but have difficulties retrieving and organizing words and sentences when expressing more complicated thoughts and ideas. This may occur when they are trying to describe, define, or explain information or retell an event or activity.

Social functioning may also suffer as verbal comprehension index assesses the child's verbal abilities as well as that child's ability to apply verbal comprehension skills to produce solutions to novel situations (Wechsler, 1997). This ability has been linked to negotiating social situations with peers as individuals with FASD may have difficulty with conversation. For example, they may be talkative, but what they say can sometimes seem inappropriate or out of place. Children with FASD have been described as "talking too much and too fast, but having little to say" (Streissguth, LaDue, & Randels, 1988, p. 31). These studies suggest there may be an unexplored link between verbal learning and behavioral outcomes for children with FASD. In addition, previous research has revealed

another important and common deficit with children prenatally exposed to alcohol that involves verbal learning processes.

This is supported by research that suggests a strong correlation with social abilities (Stattler, 1992), and children with FASD tend to have low verbal IQ. In a review of the literature conducted by Mattson and Riley (1998), they propose that FASD children display significant delays in speech and language comprehension. More specifically, other studies suggest that there are larger deficits in language-based IQ measures of intelligence (e.g., Verbal IQ) (Wyper & Rasmussen, 2011; Pei, Kully-Martens, & Rasmussen, 2011). Thomas and colleagues (1998) studied 15 normal children aged 5 to 12 years of age comparing verbal IQ and social functioning. This study proposed a negative correlation with Verbal IQ and social skills functioning, suggesting as age and social demands increase, social skills deficits may become more significant. For children with FASD, having a deficit in verbal learning may impact their ability to adapt to the growing demands of a school environment as they age. This suggests a large component of how children learn and adapt in their environment is based on how they comprehend and process language.

Other studies have shown that students diagnosed with an emotional or behavioral disorder (common for FASD children) presented with IQ scores in the low average range with lower verbal IQ scores (Rutherford, Quinn, & Mathur, 2004, p. XXX; Streissguth et al., 1996). As a consequence, individuals with FASD may struggle with reasoning related to expressive and receptive language. For example, the child may have difficulties with understanding the directions expressed by teachers. Instructions from teachers to take out a particular book or perform a specific action may be difficult to comprehend.

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Greenbaum (2006) found although all intelligence test scales were significantly

lower in all individuals with FASD, Verbal IQ scores for FASD were significantly lower

than the ADHD and normal controls. However, Greenbaum used Processing IQ rather

than FSIQ as an estimate of general intelligence due to PIQ not being as easily

confounded by language abilities as suggested by other studies (e.g., Greenbaum, 2004)

(Greenbaum et al., 2009). Although children with FASD often possess functioning

difficulties which likely interfere with daily functioning skills, research has also noted

these individuals also have difficulty with behavioral functioning. Previous research on

children with an FASD examined their classroom functioning with the WISC-IV found

that children with lower verbal intelligence scores performed more poorly on a wide

range of classroom tasks as well as presenting with more behavioral problems

(Kodituwakku, 2007).

In short, research suggests there may be a relation between the Verbal IQ and

behavioral functioning. Low scores with verbal learning have been linked to higher rates

of mental health issues and behavior problems (Shaywitz, Caparulo & Hodgson, 1981).

For example, Streissguth et al. (1996) reported that mental health problems were present

in 94% of their sample of children and adults with prenatal alcohol exposure. That is,

children with FASD who may have average FSIQ levels that include lower verbal

comprehension index scores may be prone to later emotional and behavioral functioning

problems as they progress in age and grade level in school (Kodituwakku, 2007).

Children with FASD are overrepresented in special education settings

(Kodituwakku, 2007). Focusing on children with FASD verbal intelligence may provide

future insight by linking verbal intelligence and maladaptive behavior. This may provide

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psychologists and educators another tool for preventive interventions that reduce the number of children with FASD being placed in emotional behavioral disorder special education settings. Other studies have demonstrated that a set of neuropsychological measures can discriminate between exposed children and unexposed controls; however, the battery of tests used in many of those studies often requires referral to specialists. The testing is extensive, quite time-consuming, and expensive and often they are not readily available to those working in schools and communities (Mattson et al., 2010).

Previous research that examined children with FASD revealed that behavior issues may not present as significant early on in education (Green, 2007). This may be due to early difficulties with social functioning being more acceptable at a young age and less likely to present as needing targeted intervention (Green, 2007; Olswang et al., 2010). However, as a child progresses in age and grade, the demands for appropriate social functioning become more complex. As a result, behaviors may become increasingly inappropriate and significantly different from peers (Streissguth et al., 1991; Olswang et al., 2010).

Screening

Of particular importance is identifying cognitive and behavioral profiles of the children and adolescents who fall into the diagnosis outside the FASD spectrum (e.g., Alcohol Related Neurodevelopmental Disorder, ARND, etc.). Previous research which examined children with FASD revealed they exhibited more behavioral problems than their non-prenatally exposed peers (May et al., 2009; Kully-Martins et al. 2011; Green, 2007). In research conducted by Mattson et al., (1997) many ARND individuals fall through the cracks in the systems of care. As a result, children and adolescents who fall

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into a diagnosis such as Alcohol Related Neurodevelopmental Disorder often do not receive services until other possible cognitive or behavioral issues become significant. Frequently, the child's behavior becomes the target for intervention. As a result, a number of children and adolescents outside the full FASD spectrum receive services through a designation of emotional behavioral disorder. What this means is individuals who do not present with more pronounced physical dysmorphias are often more difficult to identify. Tragically, the secondary problems often displayed through maladaptive behaviors are what trigger services. This is undesirable for both the children and academic system.

Olswang, Svensson, and Astkey (2010) found that FASD children exhibited significantly more irregular and disengaged behaviors. However, this study also found that FASD children performed more occurrences of pro-social behavior than their matched partners. For two weeks, twelve pairs of children were observed in a school setting. The pairs consisted of one child who had a diagnosis on the FASD spectrum and another child who was not. In addition, Thomas et al. (1998) found that children diagnosed with FAS exhibited significant deficits across the domains of communication, socialization, and daily living. These researchers noted that the social problems associated with prenatal alcohol exposure did not appear to be solely linked to cognitive functioning.

Greenbaum et al. (2009) studied 33 children with FASD, 30 with ADHD, and 34 normal controls who were assessed and compared regarding social cognition and emotion processing to determine behavior problems. The results showed that children with FASD show a distinct behavioral profile from children with ADHD. The CBCL demonstrated

that individuals with FASD had more externalizing problems (e.g., rule breaking, aggression) than individuals with ADHD. These are the types of behaviors that result in individual being placed in SED special education programs.

Summary and Study Rationale

Children with FASD often possess a varying degree of cognitive and behavioral features which often result many forms of maladaptive behavioral functioning. Uncovering a neurobehavioral profile would be beneficial in identifying and implementing early services to help mitigate future issues. Previous research has attempted to focus on different cognitive aspects (i.e., executive functioning) with variable success in identifying a neurobehavioral phenotype. There is research that suggests that there may be a link between verbal intelligence and maladaptive behavior. As such, uncovering a pattern of verbal comprehension index scores from the WISC-IV and maladaptive behavior patterns from the CBCL could be useful in helping to identify a neurobehavioral phenotype for FASD. This in turn could be useful in making predictive decisions regarding early referral for school based interventions. The early implementation of services could prevent an increase the potential for maladaptive behaviors and forgo placement into restrictive special education services (i.e., emotional behavioral disorder services) that tend to be costly for school and have poor educational outcomes for the student.

To the best of this researcher's knowledge, no research has specifically examined if there is a correlation with verbal comprehension deficits and maladaptive behaviors across the different FASD diagnostic categories. Efforts focused on looking into this question may reveal whether different FASD diagnostic groups are more vulnerable to

such deficits. Thus, the primary purpose of the current study was to address the question of whether a correlation exists between verbal comprehension abilities and maladaptive behavioral functioning between children diagnosed with FAS, pFAS, ARND, and children who were prenatally exposed to alcohol, but otherwise did not meet criteria for a FASD diagnosis. Research on the adverse effects of prenatal alcohol exposure in children will provide teachers with information about the types of difficulties these students may experience. Studies suggest teachers could expect a student diagnosed under the FASD spectrum to have difficulties with information processing speed, coping with stress, executive function, learning and memory. Understanding how these challenges relate to problem behaviors would be essential to providing appropriate interventions and accommodations. First, this is a relevant question because of the inconsistent findings of previous studies regarding the secondary symptoms and severity among children exposed to alcohol prenatally. Second, in general there remains a scarcity of research on this topic.

Hypotheses and Research Questions

Hypotheses

  Hypothesis 1: There will be a negative relationship between Verbal Comprehension (as measured by VCI scores) and maladaptive behavior (as measured by BASC-2 BSI scores). Lower VCI will be associated with higher BASC-2 BSI scores (i.e., maladaptive behavior).

  Hypothesis 2: There will be differences between FAS and other FASD categories on both VCI and BASC-2 scores.

  The pre-existing data used to conduct this study did not include sufficient numbers of participants in different FAS and FASD categories to conduct the tests of this

hypothesis. Therefore, it will not be reported in the results. Additional information

gathered from the data does support the following research questions, which were

addressed in place of the proposed Hypothesis 2.

Research Questions

1. Are there patterns of mental health diagnoses relevant to children with FAS

   and/or FASD?

2. Does the presence of other mental health diagnoses influence cognitive or

   behavioral profiles of children with FAS and/or FASD?

CHAPTER III

RESEARCH METHODS

Participants

The research protocol was approved by the Institutional Review Boards at

CentraCare Hospital St. Cloud and the University of North Dakota. Inclusion criteria

required those individuals who were referred for prenatal alcohol screening and who met

the requirement of further FASD evaluation. Of the 657 children in the target population,

178 children met the study's inclusion criteria as having both a BASC-2 TRS and WISC-

IV. Disorders and conditions known to be correlated with adaptive functioning and

academic achievement such as pervasive developmental disorders (e.g., autism), genetic

diseases, seizure disorder, or IQs less than 79 (i.e., cognitive disabilities) were excluded

from the sample as they are more likely to be identified and receiving special education

services under those criteria.

Tables 1 and 2 provide a descriptive statistics including gender and age for the

participants in this study. The sample was made up of 123 males and 76 females. Ages at

the time of testing ranged from 6 years to 16.8 years with the mean age of participants at

the time of testing in the present study being 10.66 (SD =3.04 years). The mean grade at

the time of testing was 4.4 (SD = 2.92).

Table 1. Gender Summary.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	112	62.9	62.9	62.9
	Female	66	37.1	37.1	100.0

Table 2. Age and Grade Summaries.

	N	Minimum	Maximum	Mean	Std. Deviation
Age at test time	178	6.00	16.83	10.67	3.0
Grade at test time	127	1.00	11.00	4.43	2.8

It is known through previous research that children prenatally exposed to alcohol are at increased risk for meeting the criteria for a mental health diagnosis. Table 3 describes the diagnostic categories of the study sample. Like many other studies, there is a high incidence of a diagnosis of ADHD with 108 participants (60.7%) having a diagnosis. Depression was the next most frequent diagnosis (41.6%) with Anxiety (28.7%) and Disruptive Disorders (24.7%) composing the next to highest. Posttraumatic Stress Disorder was diagnosed in 16 subjects, corresponding to 9.0% of patients in this study sample.

Table 3. Diagnostic Categories.

	#	%
Learning Disorder	21	11.8
Depression	74	41.6
Anxiety	51	28.7
Disruptive	44	24.7

Table 3. cont.

	#	%
ADHD	108	60.7
FASD	10	5.6
PTSD	16	9.0

Instrumentation

Although the children in this sample typically were evaluated through a general but comprehensive neuropsychological evaluation, only the measures relevant to the present study were included. The assessments include (1) The Behavior Assessment System for Children-Second Edition (BASC-2) Teacher Form (Reynolds & Kamphaus, 2004) and the Wechsler Intelligence Scale for Children IV.

Behavior Assessment System for Children-Second Edition

The Behavior Assessment System for Children, Second Edition (BASD-2; Reynolds & Kamphaus, 2004) is a multiple informant based questionnaire designed to assess a broad range of emotional and behavioral symptoms seen in children. The BASC-2 gathers information from a broad spectrum of environments (e.g., school and home) with multiple standpoints as it allows for analysis of children's behaviors from the teacher, parent and child perspectives. It is commonly used by professionals across a variety of settings (i.e., inpatient, outpatient, school etc.) to assess behavior. In this study, it is used by MOFAS in the screening, assessment and diagnosis of children suspected of prenatal alcohol exposure at CentraCare Hospital St. Cloud, MN which granted permission to use its records to provide data for this study. Of the several versions of the BASC-2 which can be used, the Teacher Rating Scale (TRS) was selected for this study.

For the purpose of the present study, the child's behavioral symptoms index score was used as a unitary measure of maladaptive behavior.

The BASC-2 TRS focuses on positive and negative attributes of student conduct and provides a assessment of observed behavior (Reynolds & Kamphaus, 2004). The BASC-2 TRS is a standardized tool found to be a reliable and valid measure of behavior for students without FASD and an effective tool for progress monitoring (Reynolds & Kamphaus, 2004). The BASC and BASC-2 have been used in over 100 studies including evaluations of the Head Start Project in the USA (Reynolds & Kamphaus, 2004). BASC-2 has a large nationwide normative sample on which norm referenced scores are based, allowing for one to confidently make many normative referenced interpretation of scores.

The BASC-2 TRS is made up of 100-139 items describe specific behaviors that are rated on a four-point scale of frequency, ranging from "Never" to "Almost Always." Scored responses are grouped into scales that detect the presence of behavior problems and whether or not these problems are acted out or kept internal within the child. Constructs are measured in eight clinical scales, three composite scales, and two adaptive scales. The clinical scales include; Hyperactivity, Aggression, Anxiety, Depression, Somatization, Atypicality, Withdrawal, Attention Problems, and Learning Problems (teacher form). The composite scales include; Externalizing, Internalizing, Behavior Symptoms Index, School Problems (teacher form). Adaptive scales include: Adaptability and Social Skills.

The BASC-2 PRS is made up of 134-160 items and uses a four-choice response format describe specific behaviors that are rated on a four-point scale of frequency, ranging from "Never" to "Almost Always." The clinical scales measure levels of

negative or undesirable behaviors as compared to same-aged peers. T-Scores between 41 and 59 fall in the average range. T-Scores between 60 and 69 fall in the "at risk" range. T-Scores above 70 indicate clinically significant levels of maladaptive behavior.

The Adaptive scales measure levels of positive behaviors compared to same aged peers. However, on the Adaptive scales, higher scores indicate more positive behaviors. T-Scores between 41 and 59 fall in the average range. T-Scores between 31 and 41 fall in the "at risk" range. T-Scores below 30 indicate clinically significant levels of maladaptive behavior.

Reliability of the BASC-2 TRS in samples without diagnosed FASD was high (Reynolds & Kamphaus, 2004). Correlation coefficients for internal consistency ranged from .88-.97 for the composite scales used in this study (Reynolds & Kamphaus, 2004). Test-retest correlation coefficients were .84-.94 for intervals of 8-65 days on the composite scales (Reynolds & Kamphaus, 2004).

Validity of the BASC-2 TRS has been examined using factor analysis (construct validity), correlations with other instruments (criterion-related validity), and the score profiles of selected clinical groups (differential validity). Factor loading correlations for the Externalizing Problems and School Problems composites scales has been high (.74-.91) while the correlations range from .41 to .85 for the Internalizing Problems composite and .93-.90 for the Adaptive Skills composite indicating construct validity of the composite scales is variable (Reynolds & Kamphaus, 2004). Information in support of validity is also presented in the test manual. The BASC-2 was compared to a variety of child behavior rating scales to determine concurrent validity. When compared to the Child Behavior Checklist (CBCL) another rating scale which is commonly used for the

assessment of behavior in many studies with FASD individuals for evaluating behavioral problems (Greenbaum et al., 2009) it yielded correlations ranging from .74 to .83 for Externalizing Problems (used in this study) and .65 to .75 for Internalizing Problems scores.

Criterion-related validity has been high as the correlations between the composites scales from the Achenbach System of Empirically-Based Assessment Teacher Report Form and the BASC-2 TRS for internalizing behavior, externalizing behavior, and total problem behavior ranged from .74-.80 (Tan, 2007). Achenbach's (2001) CBCL has been used in several studies of children with FASD (Coles, Kable, & Taddeo, 2009; Dixon, Kurtz, & Chin, 2008; Franklin, Jirikowitz, & Astley, 2008). The BASC-2 TRS can differentiate between the following clinical groups; attention-deficit/ hyperactivity disorder, bipolar disorder, depression disorders, emotional/behavioral disturbance, hearing impairment, learning disability, mental retardation or developmental delay, motor impairment, pervasive developmental disorders, and speech or language disorder (Tan, 2007). These findings indicate the BASC-2 TRS can provide a reliable measure of classroom behavior. For each scale, age-normed t-scores (mean = 50, standard deviation = 10) were calculated (Reynolds and Kamphaus, 2004). A score of 60 or over indicates that an individual may be experiencing clinically relevant symptomatology (Reynolds and Kamphaus, 2004).

Wechsler Intelligence Scale for Children—Fourth Edition (WISC-IV)

Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) is a standardized, norm-referenced assessments of intelligence for use on children aged 6 years 0 months to 16 years, 11 months old (respectively). The WISC-IV provides a global

composite measure of cognitive functioning (FSIQ) and four main indices that supply

standardized scores of intelligence: Verbal Comprehension, Perceptual Reasoning,

Working Memory, and Processing Speed. Verbal Comprehension measures the ability to

draw upon learned information and reason through an answer, Perceptual Reasoning

measures nonverbal and fluid reasoning, Working Memory assesses a child's ability to

memorize novel information, hold it in short-term memory, concentrate, and manipulate

that information, and Processing Speed measures the ability to scan, distinguish between

and order visual information in a timely manner (Wechsler, 2003). In addition to the

composite measures, the WISC-IV contains 10 core subtests and five supplemental

subtests. All 10 core subtests need to be administered to obtain the FSIQ and four index

scales. The FSIQ and four index scales are reported as a standard score, with a mean of

100 and a standard deviation of 15. The subtests are reported as scaled scores, with a

mean of 10 and a standard deviation of 3. The WISC-IV is a measure with good

reliability, as evidenced by internal consistency reliability ranging from .81 to .97 for the

composite indices on the WISC-IV (Sattler & Dumont, 2004). The WISC-IV appears to

have good criterion validity as evidenced by high correlations between the WISC-IV and

other measures of cognitive functioning, academic achievement, and adaptive behavior

(Wechsler, 2003b). Additionally, the WISC-IV has been shown to have good construct

validity as factor analytic studies have provided evidence that it is a good measure of

general intelligence and confirmed the utility of the four indices on the WISC-IV (Sattler

& Dumont, 2004; Wechsler, 2003b). For the purpose of this study, the verbal

comprehension index was used as a unitary score.

Verbal Comprehension Index

The Verbal Comprehension Index (VCI) is a measure of a child's ability to reason, form concepts, and demonstrate acquired knowledge though verbal modalities (Wechsler, 2003b). The core subtests that comprise the VCI include Similarities, Vocabulary, and Comprehension. The Information and Word Reasoning subtests are supplemental and may be administered to acquire more information about the child or to substitute for the core subtests in the event of an invalid administration. The VCI has an overall average internal consistency reliability of .94 and a .93 stability coefficient (Wechsler, 2003b).

Perceptual Reasoning Index

The Perceptual Reasoning Index (PRI) is a measure of a child's fluid reasoning, visual-spatial processing, and visual-spatial concept formation (Wechsler, 2003b). The core subtests that comprise the PRI include Block Design, Picture Concepts, and Matrix Reasoning. The Picture Completion subtest is supplemental and may be administered to acquire more information about the child or to substitute for the core subtests in the event of an invalid administration. The PRI has been shown to have an overall average internal consistency reliability of .92 and a .89 stability coefficient (Wechsler, 2003b).

Working Memory Index

The Working Memory Index (WMI) is a measure of a child's auditory attention and working memory abilities (Wechsler, 2003b). The core subtests that comprise the WMI include the Digit Span and Letter-Number Sequencing subtests. The Arithmetic subtest is supplemental and may be administered to acquire more information about the child or to substitute for the core subtests in the event of an invalid administration. The

WMI has an overall average internal consistency reliability of .92 and a .89 stability

coefficient (Wechsler, 2003b).

Processing Speed Index

The Processing Speed Index (PSI) is a measure of a child's ability to visually

examine, order, and discriminate simple visual information (Wechsler, 2003b). The core

subtests that comprise the PSI include the Coding and Symbol Search subtests. The

Cancellation subtest is supplemental and may be administered to acquire more

information about the child or to substitute for the core subtests in the event of an invalid

administration. The PSI has been shown to have an overall average internal consistency

reliability of .88 a .86 stability coefficient (Wechsler, 2003b).

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Procedures and Data Screening

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This study was conducted through a review of existing medical records of 657

children with suspected prenatal alcohol exposure who had been evaluated as part of a

FASD diagnostic evaluation at the clinic under the supervision of Dr. Scott A. Palmer,

PhD, LP CentraCare Hospital, St. Cloud, MN. The sample for the present study included

individuals who were referred, screened and completed a full diagnostic evaluation for

possible prenatal alcohol exposure. The study was conducted using archival data from a

clinical database containing approximately 657 individuals referred to a FASD diagnostic

clinic in large West Central Minnesota FASD diagnostic clinic. The participants in the

current study were drawn from an archival database derived from CentraCare Hospital, St.

Cloud, MN. The original data for this study was collected between August, 2009 and

September, 2012. All patients had been referred to the clinic form various internal and

external agencies in the region.

The target population for this study was individuals with a medical diagnosis of an FASD disorder. The database contained all the individuals who completed a FASD diagnostic evaluation at the clinic. Though the clinic screened all individuals who were referred, the requirements to qualify for a FASD diagnostic evaluation were that the individual met one or more of the following criteria; 1) individual be under the age of 18, 2) evidence of prenatal exposure to alcohol, 3) difficulties with mood, behavior or developmental delays.

All of the children in the database had received an interdisciplinary FASD diagnostic evaluation using a modified version of the FASD 4-Digit Diagnostic Code developed by Astley and Clarren (1997, 2000) identified as the "Minnesota Version" by the MOFAS organization. As previously described in the review of the literature, the four digits of the code identify the severity of the four key diagnostic feature of FASD in the following order: 1) growth deficiency, 2) FAS facial features, 3) central nervous system impairment, and 4) prenatal alcohol exposure. The four features are ranked on a 4-point Likert scale. The purpose if this study was to evaluate the relationship between verbal comprehension abilities and maladaptive behavioral functioning between children diagnosed with FAS, pFAS, ARND, and children who were prenatally exposed to alcohol, but otherwise did not meet criteria for a FASD diagnosis. All diagnoses were made in accordance with DSM-IV-TR diagnostic criteria and guidelines. Limitations of the data set resulted in an insufficient number of subjects in those four categories to conduct the anticipated between-group analyses. As a result, the group as a whole was measured to assess if there is a relation between verbal comprehension abilities and maladaptive behavioral functioning.

Information that included the child's demographics, diagnostic information and psychological test data to be used for future archival research was stored in an SPSS data base created to track information related to screening for prenatal alcohol exposure as part of a state wide effort conducted by the Minnesota Organization of Fetal Alcohol Spectrum (MOFAS) under the supervision of Dr. Scott A. Palmer, PhD, LP CentraCare Hospital, St. Cloud, MN. The original data for this study was collected between August, 2009 and September, 2012. The data was entered by CentraCare support staff as well as several undergraduate psychology practicum interns.

For the purposes of this study, the data extracted from medical records were cleared of all identifying information and patient privacy was protected using a coded number to represent the participant. Any datum that could be reasonably used to identify the patients was removed. Due to the retrospective nature of this study and the deidentified data, this study was found to be "exempt" by the University of North Dakota Institutional Review Board. Additionally, this study was reviewed and approved by the medical committee of CentraCare Hospital where data were collected. The research protocol was approved by the Institutional Review Boards at CentraCare Hospital St. Cloud and the University of North Dakota.

Prior to conducting the main statistical analysis, the data was screened to help ensure accuracy. All the variables of interest were examined for accuracy of data entry, missing values, the normality of distributions and multivariate outliers. SPSS 21 software was used to produce frequency tables with histogram and box plots across the variable to help identify incorrectly entered scores. To account for accuracy, frequency tables were used to find improbable scores across the variables. No improbable or unlikely scores

were identified. Missing data was identified and deleted. There were no outliers identified by using a visual scatterplot. Any data that was in question was deleted, leaving 178 cases for the main analyses.

Analyses

Preliminary analysis included conducting Chi-square and between-group *t*-tests to identify differences related to gender, age, and grade level in both BASC-2 and WISC-IV subscale scores.

In order to investigate the strength and nature of the relationship between the Verbal Comprehension Index and the BASC-2 TRS variables, a Pearson correlation matrix was constructed and analysis was run. Specifically, for the correlation matrix, the Pearson's correlation coefficient was reported between the WISC-IV Verbal Comprehension Index (VCI) Score and the BASC-2 Teacher Rating Scale clinical and composite scales. The WISC-IV VCI Index Score were placed in one set of variables and the BASC-2 TRS clinical and composite scales were placed in the second set of variables.

Additional analyses were conducted to assess for the presence of variables that could impact cognitive or behavioral functioning. The variables included in these analyses were gender, age and mental health diagnosis.

CHAPTER IV

RESULTS

Following a presentation of the descriptive data for the study participants, the results are discussed in terms of the hypothesis and research questions subsequent to the results of various statistical analyses. It is divided into several sections: (1) description of the sample; (2) results of the Correlations analyses; and (3) conclusions.

Preliminary Analyses

In order to identify associations between demographic variables and the main variables of interest, a series of preliminary analyses were conducted. Preliminary analysis was conducted on the 178 participants in this study in order to identify any association between demographic variables (e.g., age and sex) and the variables of focus.

The first step was to conduct a chi-square analysis. Diagnoses were re-coded into dichotomous variables (e.g., depression, no depression). Chi-square analysis revealed no significant differences between gender and the presence of diagnoses (e.g., Depression, Anxiety, Learning Disorder, Disruptive Behaviors, ADHD, FASD and PTSD) of interest in this study. No relationship was found between gender and depression, χ^2 (1, $N =178$) = .02, $p = .89$. No relationship was found between gender and anxiety, χ^2 (1, $N =178$) = .10, $p = .76$. No relationship was found between gender and learning disorder, χ^2 (1, $N =178$) = 1.80, $p = .18$. No relationship was found between gender and disruptive behavior diagnosis, χ^2 (1, $N =178$) = .22, $p = .64$. No relationship was found between gender and

ADHD diagnosis, χ^2 (1, N =178) = .00, p = .99. No relationship was found between

gender and FASD diagnosis, χ^2 (1, N =178) = 1.33, p = .25. No relationship was found

between gender and PTSD diagnosis, χ^2 (1, N =178) = .34, p = .56. It appears that neither

males nor females were overrepresented in any of the diagnostic categories. NOTE: All

learning disorders, Disruptive Behavior Disorders, FASD and ADHD categories were

group into a unitary variable.

Results indicated some statistically significant differences related to demographic

group variables and the main variables of interest. There were a total of 178 participants

in this study. Of those, 112 were male representing 62.9 percent and 66 were female

representing 37.1 percent of the sample. When considering gender, there was some

difference in cognitive functioning as males (M = 103.71, SD = 11.86) had higher

Perceptual Reasoning Index (PRI: ability to process and understand visual information)

scores than females (M = 99.98, SD = 11.61), t(177) = 4.15, p < .05, d = 0.32. No

statistical difference was found between gender and BASC-2 scales that measure

maladaptive behavior. There were no significant differences between age and grade with

any of the BASC-2 maladaptive scales.

Hypothesis Testing

Hypothesis 1: There will be a negative relationship between Verbal

Comprehension (as measured by VCI scores) and maladaptive behavior (as measured by

BASC-2 BSI scores). Lower VCI will be associated with higher BASC-2 BSI scores (i.e.,

maladaptive behavior).

There was no significant correlation between the scores on the BASC-2

Behavioral Symptoms Index (BSI) composite scale and the WISC-IV Verbal Composite

Index scores r(178) = -.046, p > .05). Correlations with the VCI and the BASC-2

Behavioral Symptom Index composite scale were in the anticipated direction (negative

correlation), but did not reach the level of statistical significance. Further investigation of

this general measure of maladaptive behavior was conducted through examination of the

clinical scales relation to the verbal comprehension index. Verbal comprehension was

negatively correlated to the Somatization $r(178) = -.158$, p < .05) and Learning Problems

scales $r(178) = -.220$, p < .05).

Post-hoc Research Questions

Cognitive Profile

Index Scores on the WISC-IV and BASC-2 were collected for the sample. Table 4

provides participant scores on cognitive functioning.

Table 4. Frequency of Diagnosis Present in Participants.

Diagnosis	Frequency
Depression	21
Learning Disorder	21
Anxiety	51
Disruptive Disorder	44
ADHD	108
FASD	10
PTSD	16

Descriptive statistics for the Wechsler Intelligence Scale are reported in Table 5.

The Wechsler Intelligence Index Scale scores are reported as Standard Scores ($M = 100$,

$SD = 15$). To investigate possible differences in this sample and the general population of

children and adolescents, one-sample t-tests were computed against a mean of 100.

Results indicated that the sample population has significantly lower scores across four of

the five index scales when compared to published norms. Participants scored significantly

lower on all of the Index scales with the exception of the Perceptual Reasoning Index

scale.

Behavioral Profile

On the BASC-2, composite and clinical subscales scales of the sample population

were compared to the norm mean of 50 and standard deviation of 10 using one-sample t-

tests. Higher scores on the clinical and composite scales indicated higher levels of

maladaptive behaviors. On all of the composite and clinical scales, Teachers endorsed

scores that indicate significantly higher problem behaviors than the mean. On the

composites scales, teachers rated this sample as demonstrating significantly higher levels

of maladaptive behavior than the norm on the Behavior Symptoms Index ($M = 61.67$, SD

$= 11.96$), $t(178) = 13.01$, $p < .001$, Externalizing Problems ($M = 58.37$, $SD = 11.95$),

$t(178) = 9.34$, $p < .001$, and Internalizing Problems ($M = 58.36$, $SD = 13.59$), $t(178) =$

8.21, $p < .001$. On all the clinical subscales, teachers rated this sample as significantly

higher in maladaptive behaviors. See Table 5.

Table 5. WISC-IV Summaries.

	N	Minimum	Maximum	Mean	Std. Deviation
Full Scale IQ	178	79.00	129.00	97.99	10.81
Verbal Comprehension Index	178	71.00	140.00	98.79	12.43
Perceptual Reasoning Index	178	75.00	139.00	102.33	11.88
Working Memory Index	178	62.00	129.00	94.78	11.08
Processing Speed Index	178	47.00	144.00	95.13	14.01

Pearson correlations were conducted to examine the associations between age and

gender and the BASC-2 clinical collapsed across all diagnostic groups. There were no

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significant correlations between age and five BASC-2 maladaptive scales. Sex

differences were not significant for most BASC-2 clinical scales; however, females

obtained higher T-scores on the Somatization scale than males (r = .186, p = .020).

Table 6. BASC-2 Summaries.

	N	Minimum	Maximum	Mean	Std. Deviation
Behavioral Symptoms Index	178	39.00	99.00	61.67	11.96
Externalizing Problems Composite	178	40.00	94.00	58.37	11.95
Internalizing Problems Composite	178	39.00	105.00	58.36	13.57
School Problems Composite	178	38.00	83.00	59.16	9.57
Learning Problems Composite	178	39.00	85.00	56.17	10.58
Conduct Problems	178	40.00	91.00	56.37	13.56
Hyperactivity	178	39.00	102.00	59.77	12.70
Aggression	178	41.00	99.00	57.42	13.56
Anxiety	178	38.00	106.00	55.29	12.56
Depression	178	41.00	108.00	60.55	14.83
Somatization	178	41.00	107.00	54.78	13.03
Attention Problems	178	38.00	82.00	60.69	9.09
Atypicality	178	42.00	102.00	59.19	13.53
Withdrawal	178	39.00	100.00	58.70	11.56

Mental Health Diagnoses

Mental health diagnosis was not significantly related to cognitive functioning with

the exception of individuals diagnosed with a Disruptive Behavior Diagnosis (i.e.,

Oppositional Defiant Disorder and Conduct Disorder). Participants with this Disruptive

Behavior Diagnosis produced significantly higher scores on the Verbal Comprehension

Scale (F (1,177) = 5.67, $p < 05$, Working Memory Index (F (1,177) = 4.16, $p < 05$, and

Full Scale Intelligence Quotient (F (1,177) = 4.63, $p < 05$. An inspection of the mean

scores indicated that individuals with a diagnosis ($M = 102.61$, $SD = 10.98$) had higher

VCI scores than those who did not ($M = 97.54$, $SD = 12.66$); had higher ($M = 97.70$, $SD = 11.68$) WMI scores than those who did not ($M = 93.81$, $SD = 10.75$); and had higher

FSIQ scores ($M = 101.00$, $SD = 11.17$) than those who did not ($M = 97.00$, $SD = 10.54$).

CHAPTER V

DISCUSSION

The umbrella term of FASD includes a wide range of physical and

neuropsychological disabilities. As most children do not present with the typical physical

features, especially those individuals who have moderate and lesser levels of exposure,

identification and diagnosis is especially challenging. These children are typically

overlooked and services and interventions not provided (Green, 2007). This risk of being

overlooked was also observed in this study, in two important ways. Diagnostic

information was limited to the assessments provided by the medical records and the

children's records did not record adequate demographic and family information, nor any

indication of interviews with the caregivers. As a result, identifying additional factors,

such as maternal consumption of alcohol during pregnancy, was frequently absent,

making accurate diagnosis very difficult.

The purpose of this study was to better understand the relationship between verbal

cognitive functioning and maladaptive behavior through analysis of the scores on WISC-

IV Verbal Comprehension Index and the BASC-2 Behavioral Symptoms Index. The

literature has shown that the prenatally exposed children often demonstrate impairments

in overall cognitive functioning with specific difficulties in verbal reasoning (Nash et al.,

2013). Additionally, children and adolescents diagnosed with an FASD as well as those who lack diagnosis, but are known to have confirmed prenatal alcohol exposure, demonstrate higher levels of maladaptive behaviors (Kodituwakku et al., 1995; Mattson et al., 1999).

This study supports previous findings indicating that lower cognitive functioning and higher maladaptive behaviors co-occur in children suspected of prenatal alcohol exposure as indicated by teacher report. However, a more specific link between facets of cognition and maladaptive behavior (Hypothesis 1) in this study was not supported. The results of the correlational analyses did not indicate a statistically significant relationship between the Verbal Comprehension Index (VCI) and Behavioral Symptoms Index (BSI) in the sample. The hypothesis that lower VCI scores would result in higher levels of maladaptive behavior was not supported by this study. Previous studies of alcohol exposed children have found deficits in verbal comprehension to be linked with behavioral difficulties, although not always consistently. Studies that include research on alcohol exposed children have suggested that verbal deficits are strong predictor of problem behavior; the lack of similar results was a surprising finding in this study (Moffitt, 1990; Moffitt, 1993a). Conversely, these results are consistent with previous research documenting that cognitive verbal functioning is not related to elevations of maladaptive behaviors (Fried, O'Connell & Watkinson, 1992). However, these studies have mostly included children with confirmed exposure to extensive amounts of alcohol in addition to environmental traumas. The current study had a mix of supported and suspected but unknown individuals. Most surprisingly, the results indicate that the verbal comprehension scale was the only cognitive scale that did not have a significant

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relationship with any of the BASC-2 maladaptive scales. Comparison with other studies such as Rasmussen & Bisanz (2010) and Becker, Warr-Leeper & Leeper, (1990) suggest the results of this study have mixed support from the body of research implicating verbal cognitive ability as a possible identifier related to prenatal exposure to alcohol. Finally, it is possible that the verbal deficits may be more apparent in "real world" setting rather than in a clinical testing setting. It will be import for future studies to compare children with an FASD to children with those solely suspected of exposure in order to attempt to finer specificity to an FASD neurobehavioral profile. Additionally, research exploring the links for cognitive and behavioral functioning with alcohol-exposed children has largely focused on children with confirmed moderate to heavy levels of alcohol exposure. The sample of that composed in this study had very few subjects with confirmed alcohol exposure with an unclear number of suspected individuals. As such, the findings from the current study result from a more applied example of community mental health practices that highlight the diagnostic challenges with this population.

The present study, however, can be viewed as providing valuable information for individuals referred to community based and primary care settings for evaluation. As a result, this study included a wide variety of subjects with a broad variety of functioning; reflective of real-world community based mental health settings. Although other studies have found more significant neurobehavioral links, these have often included more structured designs in clinical settings. Findings of the current study corroborate and add to the information needed in the assessment of children in a practical application setting.

Consistent with prior research examining neurocognitive functioning in children with FASD (Mattson & Riley, 1998; Streissguth, Barr, & Sampson, 1990), full scale IQ

(FSIQ) on the WISC-IV was lower when compared to the existing standardization sample. There was also a significant small negative correlation with the Full Scale Intelligence Quotient and the Behavioral Symptoms Index.

Prior research has found equivocal results regarding performance on verbal tasks. The findings of the current study suggest that verbal comprehension may less affected by alcohol exposure. This is particularly import for clinician's who are at the front lines of assessing individuals suspected of prenatal alcohol exposure as these individuals typically do not present with the facial features often thought of in this diagnosis. These results suggest that, for groups of individuals referred for FASD evaluations, the scores on the Verbal Comprehension Index provide independent information to the clinical evaluation. This is concurrent with studies that suggest there is considerable variability within this population (Mattson et al., 1998; Mattson et al., 2013; Aragon et al, 2008, Ware et al. 2013).

Using the Verbal Comprehension Index and the Behavioral Symptoms Index to measure general measures of cognitive and behavioral functioning may miss some of the finer details of these aspects of functioning. Although the two variables were unrelated in a more general manner, there were significant practical relationships between subtest scores. A high percentage of children in this study demonstrated both lower cognitive functioning and higher maladaptive behaviors as indicated by teacher report. Further, exploratory analysis revealed lower VCI scores to be related to the Somatization and Learning Problems scales. This is very relevant to the assessment of children as these measures are commonly used in evaluation.

According to Wechsler (2003), working memory is less likely than full-scale IQ to be affected by socioeconomic or cultural conditions and thus provide a useful, more targeted measure of possible effects of alcohol exposure on brain function. In this sample, there was a significant but small negative correlation between the Working Memory Index and the Behavioral Symptoms Index. This is similar to other studies that have examined WMI and maladaptive behavior (Connor et al., 2000); the result from this study supports the idea that working memory is linked with behavioral deficits. Executive functioning has been attributed to difficulties in behavioral regulation (Brown, 2008). Riley, Mattson, & Thomas (2009) found that executive functioning contributed to adverse behavioral outcomes. It is not surprising that executive functioning was negatively correlated with maladaptive behavioral functioning in that study as 60.7% of the participants had been diagnosed with ADHD. This identifies another potential diagnostic challenge as an FASD diagnosis may be misidentified as ADHD. Additionally, there is the added misdiagnosis of ADHD vs. PTSD diagnosis.

In some studies, nearly 9 out of 10 children with FASD exhibit a psychiatric illness (O'Connor et al., 2002). Neuroimaging studies reflect a remarkable similarity between the CNS imagery of children know to have been traumatized (DeBellis & Van Dillen, 2005) and those with a diagnosed classification of FASD (Riley et al., 2004). Research exploring the behavioral profile related to these two groups has supported this link (Henry, Sloane & Black-Pond, 2007). When considering this evidence, it is questionable that the diagnosis of PTSD is not seen in this study in greater rates; such as found in Streissguth et al. (2004). Given the high correlation between foster care placement, trauma and a FASD diagnosis, it could lend to higher rates of a trauma related

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diagnosis being present. This leads to another possibility that trauma is being misdiagnosed as ADHD or other mental health disorders.

Exploratory analysis found higher Working Memory, Verbal Comprehension and Full Scale Index scores were related to a Disruptive Behavior Diagnosis. It is possible that these children's scores may be preventing them from receiving interventions that adequately address their level of impairment (Streissgusth, 1997b). It is also possible that other variables interplay in an indirect but linked manner with cognitive ability and maladaptive behavior went unmeasured in this study. Results from this study suggest trauma exposure as one strong possibility. Other candidates would include variables such as socioeconomic status, genetics and parenting quality.

These results imply that more than one behavioral phenotype may exist in children suspected of being prenatally exposed to alcohol. Given the results of this study, it may make sense for practitioners such as psychologists to begin screening with a broad-based set of rating scales rather than one specific to FASDs. Further, the different cognitive, behavioral and psychiatric outcomes found in this study demonstrate that the risk of secondary deficits may be such that these children may require more specialized and tailored interventions and treatments.

Summary

There are several interesting findings in this study. First, the lack of data indicates that children who are suspected of prenatal alcohol exposure and who have been exposed to alcohol prenatally present with a wide variation of deficits. Identifying them remains a considerable challenge for front line educational and mental health professionals. Identifying individuals who should be referred for a more extensive evaluation is made

difficult by the fact that many of the mothers are unavailable or unwilling to interview. Further, children are often in the care of foster homes and not family members who may be familiar with their developmental history. In this clinician's experience, this is more often the rule than the exception. When information is available, the children who have been exposed often have unclear and multifaceted developmental histories that often include adverse conditions and exposure to trauma. As a result, this lends to considerable variability in the factors typically assessed in the effort to find a unique neurobehavioral profile with prenatal alcohol exposure. Additionally, there is the diagnostic challenge that includes the inability of the client to follow through with all the steps required in the diagnostic evaluation. Depending on the performance of individuals on these assessments, mental health providers might consider follow-up for more specific diagnostic testing thereby avoiding misdiagnosis or under diagnosis. The expectation is that all practitioners seeking to properly diagnose and treat FASD, and understand differences between FASD and other possible disorders, will benefit from this study.

Limitations

The following potential limitations of this study should be considered. First, the study sample was drawn from a population of children referred for an FASD diagnostic evaluation with a blend confirmed and suspected, but not confirmed prenatal exposure to alcohol. As noted in previous studies, gaining confirmation of prenatal alcohol use is a significant difficulty in the research of this population. It is also a significant hurdle in the diagnosis. Alcohol exposure to the fetus is known to have differing negative effects on development depending on when and how much exposure occurs. For the limited number of confirmed cases in this study, the amount, duration and trimester of the alcohol

exposure was not available for analysis. In this study, the sample sized was too small for the FASD categories of groups to be compared. However, this is a common impairment related to studies on children with an FASD, obtaining meaningful sample sizes with the disorder is difficult (Davis, Desrocher & Moore, 2001). An additional issue that surround this sample pertains to the sample selection itself as the children referred to this clinic were suspected of a prenatal alcohol exposure and or emotional or behavioral concerns.

Second, since this was a retrospective records examination, several important pieces of demographic data such as ethnicity, academic records, prior out of home placements, socioeconomic and other demographic data, which are known covariates, were not available for inclusion in the study. Third, the BASC-2 TRS is a standardized assessment tool based on subjective individual teacher's report. This may affect the consistency of the data depending on subjective report. Individuals who are referred to the FASD clinic for evaluation are more likely to be experiencing developmental issues than those with no developmental concerns.

The current study analyzed data gathered from one FASD evaluation center in rural central Minnesota. One important point to make is that the data in this study is useful in adding to the research in an applied manner. That is, this study was conducted in a real-world setting among a clinically referred sample, which is a group most likely to be assessed with instruments such as the WISC-IV and the BASC-2. Nonetheless, the lack of a non-clinical comparison group prevents cross-validation of the findings. The correlational nature of the current study prohibits exploration of causal pathways between the domains of functioning assessed. Understanding where the referrals for evaluation originated from would also help to identify areas of training, outreach and education. For

example, how many of these referrals came from a school, parent, guardian or mental health professional?

Implications for Further Research

This study examined the usefulness of the WISC-IV and the BASC-2 in exploring a neurobehavioral link between verbal comprehension and maladaptive behaviors. The findings of this study suggest the need to interpret individual's performance on the VCI in regards to behavior with caution. Testing results and information should be treated as an independent relative to the functioning of the individual. However, rating scales provide a time and cost efficient means of gathering information and assessment. While the results were not support of the hypothesis, the findings from this study fall in line with similar research exploring a neurobehavioral profile of FASD.

With the variability in the cognitive and behavioral presentation of an FASD, it may be worth exploring some of the facial presentation of an FASD. One study directed focus on using the facial phenotype of an FASD to identify children. The most efficient component in the screening process leading to a diagnosis of FAS was finding the specific facial features of the disorder (Clarren, Randels, Sanderson & Fineman, 2001). It was found that it was feasible to screen pre-school children for an FASD using the specific facial features of the disorder. With the availably of a more inclusive demographics of the database used in identifying the facial phenotype may be possible. This has become more efficient as Astely (2015) has updated the database to include a more expansive and demographically inclusive data set.

Future research might improve on the current study by utilizing a control group, randomly selected sample, or longitudinal study design. Additionally, future research

could investigate whether there are differences between populations served at other FASD diagnostic centers around the country or even rural vs. urban areas. Follow-up studies using the current data set could also be conducted. A more extensive and detailed examination of the demographic variables would add considerable value to this research. Obtaining demographic variables would add insight into what role, if any, foster care, prenatal care, socioeconomic and ethnicity may contribute. This was considered in this study but would add undue expense and time considering some of this information may be impossible to obtain.

<center>Implications for Practice and Training</center>

Screening for FASD should occur earlier and more intensively. As previous researchers have shown, early diagnosis and intervention is the most effective means for mitigating the effects of prenatal alcohol exposure. There is considerable effort being placed into identifying a neurobehavioral profile for FASD (Nash et al., 2013; Mattson, Crocker & Nguyen, 2011; Rasmussen, Horne & Wital, 2006). Concerns related to the negative cognitive and behavioral consequences typically begin to present in educational and outpatient mental health settings. Obtaining a diagnosis is often very difficult for both mental health providers as well as those families being served. The diagnostic process is lengthy, expensive and time consuming and these mental health settings may not be equipped with the time, financial resources, or clinicians with the specialized training for comprehensive FASD evaluations. With these concerns in mind, researchers have forwarded efforts to better identify a more practical and efficient method to identifying a neurobehavioral profile of FASD. To address the practical limitations of early identification of a neurobehavioral profile in the educational and outpatient mental

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health settings, it would be ideal for practitioners such as school and outpatient mental health psychologists to be able to utilize existing sets of assessment tools to identify parentally exposed children.

The use of behavioral rating scales such as the BASC-2 and CBCL can provide symptom information. As previously described in this study's literature review, Nash et al. (2006) found maladaptive behaviors that included higher levels of externalizing with children who were exposed that specifically included deficits in guilt and remorse that was able to differentiate children with FAS from controls. The use of behavioral measures that have been supported by research to help screen for the behavioral evidence of an FASD related disorder may help to trigger further evaluation. Behavioral measures such as the BASC-2 and CBCL are commonly used among mental health providers; they are not invasive, nor cost prohibitive. If a matching pattern of behavioral deficits are produced; referral to an FASD specialist would be recommended.

As with all psychological assessment, it will be important for clinicians who work with these children to be aware that even normal developing children can vary widely in their competencies and difficulties. Integrating this into the fact that prenatal exposure to alcohol can affect the brain in a way that influences a wide variety of cognitive and behavioral outcomes. A holistic view of the individual across the developmental lifespan is needed. As such, it may be beneficial for these individuals to be screened and assessed by a specially trained multidisciplinary team.

It important to recognize that all mental health professionals are not specifically trained to recognize and understand the cognitive and behavioral deficits often demonstrated in children prenatally exposed to alcohol. Additionally, it is compounded

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by the fact that there is a high rate of secondary emotional disabilities that accompany it. As such, more training is needed for teacher and other paraprofessionals to help identify children to be screened. Further, educational institutions should be provided support through a multisystem approach.

As alcohol clearly interferes with the development of brain structure, further research should focus on neuroimaging to identify structures of the brain most effected by exposure. Further studies involving neuroimaging techniques aimed at the identification of specific brain regions associated with cognition, behavior and complex higher-order processes, such as EF, could strengthen the evidence for a direct link between maladaptive functioning deficits and cognitive processes in children with histories of prenatal alcohol exposure. According to Astley, Alyward et al. (2009) who used fMRI to study children with an FASD found that children across the full spectrum of FASD exhibited significant working memory deficits and altered activation patterns in brain regions that are known to be involved in working memory. With this technology becoming more accessible and improved, it may be possible to utilize these advances to identify those suspected exposure. As this technology becomes more affordable and mobile; the possibility of mobile vans with the equipment to venture into more rural areas may become an option.

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