Comparison of the Pervasive Developmental Disorders Screening Test and Modified Checklist for Autism in Toddlers: Which is the Better Predictor of Autism in Toddlers?

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COMPARISON OF THE PERVERSIVE DEVELOPMENTAL DISORDERS SCREENING TEST AND MODIFIED CHECKLIST FOR AUTISM IN TODDLERS:

WHICH IS THE BETTER PREDICTOR OF AUTISM IN TODDLERS?

By

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A dissertation submitted in partial fulfillment of the requirements for the

Doctor of Philosophy in Special Education

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University of Nevada, Las Vegas
May 2013
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THE GRADUATE COLLEGE

We recommend the dissertation prepared under our supervision by
Vanessa Fessenden
entitled
Comparison of the Pervasive Developmental Disorders Screening Test and Modified Checklist for Autism in Toddlers: Which is the Better Predictor of Autism in Toddlers?
be accepted in partial fulfillment of the requirements for the degree of

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May 2013
ABSTRACT

Comparison of the Pervasive Developmental Disorders Screening Test and Modified Checklist for Autism in Toddlers: Which is the Better Predictor of Autism in Toddlers?
by Vanessa Fessenden

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Early intervention for children with autism spectrum disorders (ASD) has significant impact on children and families. Early intervention optimizes long-term diagnosis for children with ASD. Unfortunately, many children with ASD are not diagnosed until after age three and often receive services from a local school district rather than through early intervention services. However, many of the symptoms of ASD can be hard to identify because symptoms during infancy may be more difficult to detect or may present differently than manifestations of the symptoms at older ages. Despite the difficulty in identifying symptoms of ASD in young children, there are certain indicators children under the age of three display that are consistent with ASD. Some symptoms may even be observable around 12 months of age.

In the last decade several promising screening instruments including the M-CHAT and PDDST-II have been developed and validated to aid in the diagnosis of ASD for children under two years of age. Nevertheless, a great deal of research still needs to be conducted on these tools. Most of the current research on these tools has focused on the original development of the tools. Longitudinal studies are needed to examine whether the original samples that were used to validate these tools would still meet the
diagnostic criteria for ASD. In addition, cross validation of these tools should be conducted using new samples of children. Finally, research is needed to compare the tools to determine which tool is a better predictor of ASD in young children.

This study compared the accuracy of the results of M-CHAT and PDDST-II Stage One and Stage two screeners with the results of the Autism Diagnostic Observation Scale (ADOS) for a group of children under the age of three (N=80). Eighty children were screened with two screeners (MCHAT and PDDST-II Stage One) during the eligibility appointment at local early intervention agencies or during the mandated 18 or 24 month screening for ASD. These 80 children were then re-screened using the PDDST-II Stage Two and evaluated using the ADOS at a follow-up appointment. The results of all three screeners were compared with the results of the ADOS to determine the level of sensitivity and specificity for all three screeners. The PDDST-II Stage One results were compared with the PDDST-II Stage Two results to determine whether using a Stage Two screener decreases the number of false positives, therefore, reducing the number of children that require further diagnostic testing. The results of this study indicate that the PDDST-II Stage Two was the best predictor of ASD in children who were enrolled in early intervention programs. The PDDST-II Stage Two resulted in highest levels of sensitivity and specificity. In addition, the PDDST-II Stage Two reduced the number of children requiring further assessment that were identified as being at risk for ASD by the MCHAT and the PDDST-II Stage One. Further research should be completed in order to replicate the results of this study in order to validate the use of the PDDST-II Stage Two as screener with the early intervention population.
I would like to take a moment to thank everyone who supported me throughout my doctoral program. I am grateful for the faculty and staff at UNLV who have provided me with the knowledge and support needed to earn my doctorate, particularly the members of my committee for their continued guidance throughout this process. Dr. Nancy Sileo and Dr. Catherine Lyons, thank you so much for all your brainstorming, editing, and other contributions to my dissertation. I could not have completed my study without you. Dr. Richard Tandy, thank you for helping me define my research questions and analyze and interpret my data. Your insight was invaluable. Dr. Kyle Higgins, your questions and feedback encouraged me to look more critically at my results and have given me great ideas for continued studies and future endeavors.

Next, I would like to give a special thanks to the staff at Southwest Autism & Behavioral Solutions who dedicated their time and resources to helping me complete my dissertation. Ashley Horton and Anna O’Malley, thank you for administering and scoring the numerous assessments needed for my research. I would not have been able to complete these evaluations without your help. Lena Sankovich, I appreciate your constant friendship and advice. You kept me focused and were always there when I needed support. Also, a sincere thank you to the staff and families at Integrated Support Solutions who played a key role in this research study.

Finally, I must thank my family for their continued support throughout all of my education. To my mother, Rose, my best friend, thank you for inspiring me to reach for my dreams and never allowing me to back down from anything I have ever aspired to achieve. And my husband, David, thank you for understanding how important this
journey has been to me, taking care of things at home while I have been researching, studying, and writing, for giving me feedback when I needed it, and your constant encouragement and love in all that I do.
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CHAPTER ONE

INTRODUCTION

The group of disorders known as “autism spectrum disorders (ASD)” is comprised of three separate disorders, which include autism, Asperger’s syndrome, and pervasive developmental disorder – Not otherwise specified (PDD-NOS; American Psychological Association [APA], 2000; Lord & Bailey, 2002). These disorders have common developmental characteristics that can lead to common behavioral deficits, but have different diagnostic criteria. According to the DSM-IV criteria (APA, 2000), in order to qualify for a diagnosis of autism an individual must display marked impairments in the following three areas of development: (a) reciprocal social interaction (b) speech and communication, and (c) stereotyped and repetitive behaviors with an onset of these developmental delays prior to three years of age. Asperger’s syndrome differs from autism in diagnostic criteria (APA, 2000). The three major criteria to be considered when assigning a diagnosis of Asperger’s syndrome are (a) impaired social interactions, (b) repetitive and stereotypical patterns of behavior, and (c) impaired social or occupational functional skills. However, children with Asperger’s syndrome do not exhibit significant delays in language, self-help skills and cognitive development. Further, in order to receive a diagnosis of Asperger’s Syndrome, children must not meet any other criteria for other pervasive developmental disorders (American Psychological Association [APA], 1994). Children that are diagnosed with PDD-NOS are those that exhibit symptoms of autism, meaning they may show delays in the same three areas, but they do not fully meet the diagnostic criteria for autism (Akshoomoff, Corsello, & Schmidt, 2006).
Over the past decade, the prevalence of children diagnosed with autism spectrum disorder (ASD) has increased substantially. According to the Center for Disease Control and Prevention (CDC, 2008), the prevalence of ASD is approximately at 1 in every 150 children. The current hypothesis regarding the increase in ASD includes several reasons for the increased prevalence including (a) the broadening of the diagnostic category, (b) better diagnosticians, (c) elimination of other diagnostic categories, (d) growth of available services, and (e) increased research and understanding of the disorder (National Institute of Mental Health [NIMH], 2007). Even though ASD still has a relatively low prevalence rate compared with other developmental disorders, it is quite significant in terms of impact on the child and family unit and resource needs (Akshoomoff et al., 2006).

**Impact of Autism Spectrum Disorders on Families**

Parents are likely to feel a wide range of emotions when they find out their child has been diagnosed with a disability. These feelings can include anger, anxiety, depression, confusion, denial, and self-pity (Randall & Parker, 1999). Families of children diagnosed with ASD can be significantly impacted by the diagnosis. Further, parents of children with disabilities are more likely to suffer from psychological distress than those parents of typically developing children (Higgins, Bailey, & Pearce, 2005).

Children with ASD are generally not evaluated for ASD until two to three years of age when a noticeable delay in speech and language development becomes apparent. Perhaps more importantly, they are often not diagnosed until three to four years of age. According to Randall and Parker (1999), many parents notice differences in their child’s development as early as six months old, but are often told by medical professionals that
there is nothing wrong. The delay in the diagnosis can lead to the family’s feelings of
guilt and denial. By the time a diagnosis has been made, many children with ASD are
displaying significant externalizing behaviors in the home setting. The existence of these
behaviors has been correlated with increased family stress and decreased emotional well-
being of the family unit (Donenberg & Baker, 1993). Research has shown that having a
child diagnosed with ASD can have detrimental impacts on family relationships, a
sibling’s development, and a family’s financial situation.

**Impact on Family Relationships**

Parents with children diagnosed with ASD experience more stress and have more
negative psychological outcomes than families of children diagnosed with other
disabilities (Dumas, Wolf, Fisman, & Culligan, 1991). This stress primarily results from
a child’s extreme antisocial and disruptive behaviors such as tantrums, and self-injurious
and aggressive behaviors (Gray & Holden, 1992). Further, having a child diagnosed with
an ASD has been correlated to lessened levels of family cohesiveness and family
adaptability (Higgins et al., 2005).

Having a child with ASD can lead to less marital satisfaction (Rodrique, Morgan,
& Geffken, 1990). A significant portion of a family’s time and effort is focused on the
child with ASD, leaving little time for the parents to spend together. Having a child with
ASD also has a significant impact on the ability to engage in social activities outside the
home, which may negatively impact marital satisfaction.

Another source of marital tension stems from disagreements between parents
and/or family members on the best method to address behavior problems in the home
(Higgins et al., 2005). In addition, having a child diagnosed with ASD, often leads to
disruptions to the daily functioning of the family unit. According to Higgins and colleagues, the addition of a child with ASD to a family challenges existing roles, and may lead to a restructuring of the family member’s roles in order to cope with a child with special needs and financial difficulties that are encountered.

Families of children with ASD may feel a lack of support from friends and extended family members. According to Higgins et al. (2005), one reason for this is the embarrassment parents feel due to their child’s externalizing behaviors. Many parents feel that their friends and family will not understand the reason for the externalizing behaviors. The existence of these behaviors also impacts the leisure activities of the family because the family may feel a sense of shame related to their child’s disruptive behaviors in public settings (Bromley, Hare, Davison, & Emerson, 2004). The lack of family activities can have a significant impact on the family’s happiness, feelings of cohesiveness, and psychological development of siblings.

Impact on Siblings’ Development

Research on siblings of children with ASD has been inconsistent. Rodrigue and colleagues (1993) found that the siblings of children with ASD did not differ significantly with regard to perceived competence and social emotional adjustment. The same study showed that siblings may show higher levels of internalizing and externalizing behaviors, but the difference was not significant compared to siblings of children with other disabilities or siblings of a typically developing child. On the other hand, a study by Gold (1993) documented that siblings of children with ASD may display more adjustment problems than siblings of typically developing students. Some clinicians suggest that siblings may have concerns and feelings that can go undetected by standardized
instruments and open-ended questions should be used when assessing the siblings of children with ASD (Glasberg, 2000).

According to Glasberg (2000), siblings of children with ASD reported concerns about their sibling’s future due to having ASD, played less with their sibling, reported increased feelings of loneliness and had fewer friends than siblings of children with other disabilities. One means to buffer the negative feelings of a sibling of a child with ASD is to provide the sibling with access to developmentally appropriate information regarding the diagnosis of ASD and its impacts. Glasberg also found that siblings of children with ASD were more likely to have negative outcomes when they did not have an age-appropriate understanding of ASD. Based on these findings, Glasberg suggested that siblings of children with ASD receive ongoing education about autism that becomes more complex and comprehensive as the sibling gets older.

Financial Impact of Having a Child with Autism Spectrum Disorders

The estimated cost of bringing up a child with a severe disability can be as much as three times more than a child without a disability. Many of the out-of-pocket expenses are used to pay for therapies, interventions, and respite (Jarbrink, Fombonne, & Knapp, 2003). Jarbrink and colleagues, explored the economic impact of having a child with ASD and found that a family’s financial status was negatively affected due to loss of salary and income for taking time off, buying more expensive toys and computer games to be used in therapy, paying for assessments, and money spent on special therapies. Early diagnosis and early intervention of children with ASD can significantly cut the costs of treatment needed later in the child’s life. The goal of intensive early intervention behavior therapy is “best outcomes,” which means the child:
(a) is assessed as having an average IQ, (b) no longer requires further supports or services in regular mainstream education, and (c) no longer meets the diagnostic criteria for autism. Research shows that children who receive intensive early intervention behavior therapy are more likely to achieve these best outcomes requiring less service later in life (McEachin, Smith, & Lovaas, 1993).

However, a confounding factor noted in the research literature is the large gap between the age of the child at the parent’s first concern, the age of the first evaluation, and the age of a definitive diagnosis (Siegel, Pliner, Eschler & Elliott, 1988). This delay in diagnosis causes additional distress, including financial concerns to parents as well as wasting valuable intervention time (Robins, Fein, Barton, & Green, 2001). Children who do not receive early intensive interventions often require lifelong care and therapies. Current research indicates that targeted early intervention for children with ASD is essential for best outcomes for both the child and the family unit (NRC, 2001).

**Early Intervention**

Early intervention for a child with ASD has significant positive impact for a family and a child. Many children with ASD display high levels of externalizing behaviors at an early age that can contribute to a decreased ability to communicate their wants and needs effectively, and a lack of understanding of social rules. Numerous studies demonstrated that the presence of externalizing behaviors can cause undue stress on family members and the family unit as a whole (Lecavalier, Leone & Wiltz, 2005). Educating family members about effective intervention strategies and providing support in implementing the strategies is critical in the reduction of family stress (Lee, Poston, & Poston, 2007). Family education and training is one of the major focuses of early
intervention programs. The National Research Council (2001) recommends that families be provided information on ASD by early intervention programs as soon as the child is suspected as having autism. The information should include specific information of teaching methods, expectations about their child’s behavior, finances, special education rights, and information regarding how services may vary.

Lord (1995), found that early intervention optimizes long-term prognosis for children with ASD. According to Lord, early intervention for young children with or suspected of having ASD should focus on the development of language and communication skills, play skills, and behavioral control. Evidence indicates, that children who receive early intervention and develop language and symbolic play skills before the age of five, have a better prognosis (Lord, 1995). Specifically, these children are more likely to develop functional communication skills and develop fewer externalizing behaviors (Siegel et al., 1988).

As discussed, previous studies show early intervention is essential for children with ASD. Unfortunately, many children with ASD are not diagnosed until after age three and would often receive services from the school district rather than early intervention services. Children diagnosed with ASD after the age of three do not receive the benefit of early intervention, which has been cited as essential for best outcomes for children with ASD and their families. For this reason, it is essential that effective screening procedures are developed in order to promote earlier detection of ASD.

**Early Detection of Autism Spectrum Disorders**

There are no pathognomonic signs or laboratory tests for ASD, therefore, the detection of ASD can be challenging during primary care visits (Nadel & Poss, 2007).
Many of the symptoms of ASD can be hard to identify because symptoms during infancy may be more difficult to detect or may present differently than manifestations of the symptoms at older ages. Specifically, many of the reciprocal social interaction and repetitive and stereotyped behavior markers are not easily detectable until between the age of two and three (Nadel & Poss, 2007). Another difficulty in detecting ASD in young children is that the presentation of ASD often changes depending on the child’s age (Robins et al., 2001).

Children under the age of three years old rarely display perseveration, preoccupations, or resistance to change that are part of the DSM-IV diagnostic criteria (Rapin, 1996). Preschool age children and toddlers with ASD can often show unusual sensory responses that can include repeated motor actions or preoccupation with certain stimuli (Lord, 1995). The repetitive movements and repetitive stimulation tend to decrease in adolescence and are replaced by restricted interests in narrow topics (Lord, 1995). Charman et al. (1998) also noted that while children three to four years of age diagnosed with autism display reduced levels of pretend play, joint attention, and sharing in positive social experience, these signs may not be as apparent with a child with either PDD-NOS or Asperger’s syndrome. The shift in behavioral manifestations based on the child’s age and diagnosis can make identification of ASD in young children extremely difficult. This has led to the need for practitioners, especially pediatricians, to be trained in identifying early signs of ASD and more importantly the need for reliable and valid screening and assessment tools.
Screening Instruments for Autism Spectrum Disorders

Despite the difficulty in identifying symptoms of ASD in young children, there are certain indicators children under the age of three display that are consistent with ASD. Lord (1995) found that at the age of two, children who do not engage in showing behavior or respond to their name can be diagnosed with an eighty-three percent accuracy rate. Other symptoms observed in children prior to age of three include a delay or absence in pointing, looking at others, and poor visual attention (Lord, 1995). In addition, children may also exhibit sensory-motor difficulties such as mouthing objects excessively, aversions to social touch, stereotyped play with toys, and unusual posturing of body parts (Dumont-Mathieu & Fein, 2005). In the last decade several promising screening instruments to aid in the diagnosis of ASD have been developed and validated for children under two years of age that focus on these particular behavioral indicators. However, a great deal of research still needs to be conducted on these tools. Most of the current research on these tools has focused on the original development of the tools. Longitudinal studies are needed to examine whether the original samples that were used to validate these tools would still meet the diagnostic criteria for ASD. In addition, there needs to be cross validation of these tools using new samples of children (Dumont-Mathieu & Fein, 2005). Finally, research is needed to compare the tools to determine which is a better predictor of ASD in young children. Four of the screening instruments that should be examined further include the Checklist for Autism in Toddlers (CHAT), Modified Checklist for Autism in Toddlers (MCHAT), Pervasive Developmental Disorders Screening Test (PDDST-II) and the Screening Tool for Autism in Toddlers (STAT).
Checklist for Autism in Toddlers (CHAT)

The Checklist for Autism in Toddlers (CHAT) (Baron-Cohen, Allen, & Gillberg, 1992) was originally developed in Great Britain. It is a screening tool for children at 18 months old in the general pediatric population. Nine parent report items and five observation items are to be completed by a home observer are included in the CHAT. Original research on the CHAT indicated that it was successful at identifying five of the key indicators of autism and had overall good specificity. However, the overall level of sensitivity was low ranging from 20-38% (Dumont-Mathieu & Fein, 2005). This screener was not used in the present study because the focus of this study was on screeners that solely rely on parent report and the CHAT utilizes a combination of parent report and observation.

Screening Tool for Autism in Toddlers (STAT)

The Screening Tool for Autism in Toddlers (STAT) (Stone, Coonrod, & Ousley, 2000) was intended to be a second level screener, meaning it is meant to be used to discriminate between children that have ASD and those with other developmental delays. This screener is not a parent report screener. The screener items are administered in twenty-minute play based interactive sessions. The initial data from this instrument was promising and showed relatively high rates of sensitivity and specificity. However, the sample size was small with forty children in the sample. Future research needs to be completed on this instrument with a larger population and compared against standardized assessments such as the ADOS (Dumont-Mathieu & Fein, 2005). The STAT will not be used in the present study because it is not a parent report screener.
Modified Checklist for Autism in Toddlers (M-CHAT)

The Modified Checklist for Autism in Toddlers (M-CHAT) (Robins et al., 2001) is an extension of the CHAT. It includes the first nine items from the CHAT. Unlike the CHAT, the M-CHAT is solely a parent report screener. Pediatricians often use the instrument with the general pediatric population, and early intervention agencies use it to discriminate between children who have a developmental delay and those who show signs for ASD. To date, the M-CHAT is the most popular screener that is used to screen children under the age of three for ASD. The MCHAT was used in the present study.

Pervasive Developmental Disorders Screening Test (PDDST-II)

The Pervasive Developmental Disorders Screening Test (PDDST-II) (Siegel, 2004) contains three separate stages that are intended for use in three separate clinical settings and with different populations. The PDDST-II is the first ASD screener based on developmental milestones and behavioral markers at certain ages. It provides developmental ranges for each item. The PDDST-II is designed to provide essential information at each stage of the instrument. The first stage of the instrument is used with the general pediatric population to indicate children who may require additional assessment to determine whether or not they have ASD. The second stage of the instrument is used by early intervention personnel for those children exhibiting developmental delays. According to Siegel (2004), accurate use of the PDDST-II at this stage for children with ASD could reduce the number of children that require further costly testing by ruling out ASD in children that are not ruled out by the first stage of the screener. The final stage of the PDDST-II is used among children that are suspected of having ASD and is intended to discriminate between autism and other diagnoses on the
spectrum. To date the only research completed on this instrument was by the author of
the instrument. The utility of the first two stages of the PDDST-II is the focus of this
study.

**Purpose of the Study**

The purpose of this study was to examine the effectiveness of the PDDST-II in
identifying children with ASD and to provide an independent investigation of this tool.
The PDDST-II is the first parent report screener to include early indicators of ASD based
on developmental milestones and can potentially lead to earlier identification of children
with ASD. This study examined the first two stages of the PDDST-II. The purpose of
examining stage one of the PDDST-II was to determine its validity in being used as a
level one screener to identify children at risk for ASD who require further evaluation.
The purpose of examining stage two of the PDDST-II was to determine its validity as a
level two screener in differentiating between children with ASD and those with other
developmental delays. Siegel (2004) found the stage two screener could further reduce
the number of children who were identified by a level one screener. This could reduce
the number of children who require further diagnostic testing. The following research
questions were addressed in this study:

1. Is the Pervasive Developmental Disorders Screening Test Stage One (PDDST-II
   Stage One) a better predictor of children at-risk for ASD than the Modified
   Checklist for Autism in Toddlers (MCHAT)?

2. Does the Pervasive Developmental Disorders Screening Test Stage Two
   (PDDST-II Stage Two) accurately predict whether a child will meet the criteria
   for ASD?
3. Does the Pervasive Developmental Disorders Screening Test Stage Two (PDDST-II Stage Two) accurately decrease the number of children identified by a level one screener who require a full assessment?

**Significance of the Study**

There is a need for better diagnostic tools to identify children with ASD under the age of three. It is critical that these tools accurately identify children who may and may not have ASD in order for them to receive intensive early intervention. Current research in this field has focused on the development and validation of screening tools to be used in the general pediatric population and the population of children with developmental delays. However, to date, research has not compared these screening instruments to one another to determine which tool most accurately identifies children with ASD. This study compared two popular parent report screening instruments, the *Modified Checklist for Autism in Toddlers* and the *Pervasive Developmental Disorders Screening Test*. Additionally, this study examined claims that the use of second level screener, specifically the PDDST-II Stage Two could reduce the number of children that require further standardized testing by ruling out children that are identified by the first level screeners. Furthermore, the results of these screening instruments were compared to the results of the *Autism Diagnostic Observation Scale (ADOS)*. The ADOS is currently considered the gold standard diagnostic tool for diagnosing a child with ASD. Few studies have compared the results of the screening instruments with the results of the ADOS.
Definitions of Terms

**Autism spectrum disorders (ASD).** Autism spectrum disorders is a group of pervasive developmental disorders, which is comprised of three separate disorders, which includes; autism, Asperger’s syndrome, and pervasive developmental disorders, Not otherwise specified (PDD-NOS; Lord & Bailey, 2002).

**Autism.** Autism is a pervasive developmental disorder that impacts three areas of development that include; reciprocal social interaction, speech and communication, and stereotypical behaviors (APA, 2000).

**Asperger’s syndrome.** Children with Asperger’s syndrome show marked delays in social interaction and stereotypical behaviors, but do not have significant delays in language and communication skills, self-help skills, or cognitive development (APA, 2000).

**Pervasive developmental disorder-Not otherwise specified (PDD-NOS).** Children with this diagnosis share many of the same delays as children that are diagnosed with autism, but they do not fully meet the criteria for a diagnosis of autism or Asperger’s syndrome (Akshoomoff et al., 2006).

**False Positive.** A false positive occurs when a test reports a positive result for a person who does not have the condition. Statistically, this is a type I error (Hinkle, Wiersma, & Jurs, 2003).

**False Negative.** A false negative occurs when a test reports a negative result for a person who has the condition. Statistically, this is a type II error (Hinkle et al., 2003).

**Level one screener.** Level one screeners are intended for widespread uses among the general pediatric population. Level one screeners are usually brief and low cost since
many of the children screened are not considered at risk. Level one screeners do not typically require specialized training (Robins, 2008). Level one screeners are synonymous with stage one screeners.

**Level two screener.** Level two screeners are intended for use in a subsample of the population identified at-risk for ASD. Level two screeners can be more costly and require more expertise to administer since children who receive level two screeners have a greater likelihood of having ASD (Robins, 2008). Level two screeners are synonymous with stage two screeners.

**Sensitivity.** The sensitivity of an instrument indicates the probability that someone who has the condition will test positive for it; a true positive (Siegel, 2004).

**Specificity.** The specificity of an instrument indicates the probability that someone who does not have the condition will test negative; a true negative (Siegel, 2004).

**Weighted Kappas.** Weighted Kappas are a measure of interrater reliability. Kappas are used to evaluate the level of agreement between two classifications on ordinal or nominal scales (Cohen, 1960).

**Summary**

Currently, there is a need for more research on early identification of young children with ASD. Early intensive intervention is considered critical for children with ASD. Children with ASD that receive early intensive intervention before the age of three are more likely to achieve best outcomes. Historically, children with ASD have not been diagnosed until after the age of three since the presentation of ASD differs depending on age, previous standardized instruments were normed on children over the age of three,
and pediatricians have limited understanding of the early symptoms of ASD. Since pediatricians are likely to be the only practitioner to see the child before school age, it is critical that the screening instruments used by pediatricians accurately predict ASD.

The intent of this study was to contribute the current body of literature on screening instruments for ASD. Previous literature focused on the development and norming of these screening instruments. Little to no research was conducted to compare the current instruments and determine which instrument is a better predictor of ASD. The purpose of this study was to compare the screeners that are commonly used to screen for ASD.

Details related to this study are discussed in the subsequent chapters. A review of literature related to the MCHAT, PDDST-II, and ADOS is discussed in Chapter II. Methodology used for implementation of the study is discussed in Chapter III. The results and discussion of their implications are reported in Chapters IV and V.
CHAPTER TWO
REVIEW OF RELATED LITERATURE

This chapter serves three purposes. The first is to summarize and analyze existing literature related to the development and use of the Modified Checklist for Autism in Toddlers (M-CHAT). The second purpose is to summarize and analyze existing literature related to the Autism Diagnostic Observation Scale (ADOS). The third purpose is to summarize and analyze existing literature related to the development and use of the Pervasive Developmental Disorders Screening Test (PDDST-II). Knowledge of the literature base for these three assessments is crucial to this study. The PDDST-II is the focus of this study and understanding the purpose of the development, norming of the test, and its uses are a critical component of this study. It is also essential to have knowledge of the M-CHAT because it is the most prevalent screening instrument used today and will be used as a comparison measure in the study. Finally, knowledge of the ADOS is important because it is considered the “gold standard” diagnostic tool for ASD in the field today. In addition, the ADOS will be used as a comparison tool in the present study.

The chapter begins with a description of the literature review procedures that were used to locate the experimental studies on the M-CHAT, ADOS, and PDDST-II. Next experimental studies related to these three instruments are summarized and analyzed. Finally a summary and synthesis of the research related to the screening and assessment of children with ASD using these three instruments is provided.
Literature Review Procedures

A comprehensive search of several computerized databases that included Academic Search Premier, ERIC, Child Development, PsychInfo, and Education Full Text was completed. The following descriptors were used: (a) early detection and ASD, (b) assessments and ASD, (c) screening assessments and ASD, (d) diagnosing ASD, (e) Modified Checklist of Autism in Toddlers, (f) Pervasive Developmental Screening Test, and (g) Autism Diagnostic Observation Schedule. Next a manual search was completed through the journals dated 2007-2012 that were identified in the computerized databases. Finally, a search through the reference list of relevant journals was completed to identify other related articles.

Selection Criteria

Studies related to the identification of ASD in young children were included in the review if: (a) the study was related the development and use of the M-CHAT, (b) the study was related to the development and use of the PDDST-II, and (c) the study was related to the development and use of the current version of the ADOS. Studies were excluded from the review of the literature if they did not meet these criteria. Studies related the CHAT, STAT, ADOS-G, and ADOS Toddler module were excluded because they were not used for this study.

Modified Checklist for Autism in Toddlers

The Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 2001) is an extension of the Checklist for Autism in Toddlers (CHAT; Baron-Cohen et al., 1992). The CHAT was developed and researched in Great Britain in 1992. The format of the
CHAT included 9 questions that were asked of the parents and five items that were supposed to be observed in the home by a home visitor. The home portion of the assessment, would limit the number of children that could be screened using the CHAT. The M-CHAT was developed as a level one parent report screener that could be used in pediatrician’s offices with children who are at least twenty-four months of age. Robins et al. indicated the instrument could also be used by early intervention programs to screen children suspected of having a developmental delay. The first nine items of the M-CHAT were taken directly from the CHAT with the original author’s permission. The M-CHAT consists of a total of 23 questions that assess sensory abnormalities, motor abnormalities, social interaction, and early joint attention/theory of mind, and early language and communication (Robins et al., 2001).

Robins et al. (2001) developed and conducted the first research study on the M-CHAT. In the study, Robins et al. hypothesized that the M-CHAT would have better sensitivity than the CHAT for three reasons that included: (a) the age the screening is to be used is 24 months rather than 18 months thereby including the children that may regress between 18 and 24 months old, (b) the M-CHAT has a lower threshold than CHAT for follow-up, and (c) the use of a structured telephone interview as an intermediate screening step kept the specificity relatively high without compromising sensitivity.

Robins et al. (2001) identified four purposes for the initial research study on the M-CHAT. The first was to determine how predictive each item was for autism/PDD. The second purpose was to determine how many items children with autism/PDD fail in order to establish a cut-off score. The third purpose was to determine whether the total
checklist score or any subset of items are sufficient to predict autism/PDD with reasonable accuracy. The final purpose was to assess how the final score on the M-CHAT compared to the final score of the CHAT (Robins et al., 2001).

Participants consisted of children screened during well-baby checkups with their pediatrician or family doctor at 18 or 24 months (570 males, 531 females, 21 unknown gender) and children that were screened through early intervention providers between 18 and 30 months (123 male, 46 female, and 2 unknown gender). None of the children in the study were previously diagnosed with autism. Children were excluded from the study if they had a combination of total lack of expressive language or functional communication and severe motor deficits that could preclude obtaining meaningful responses (Robins et al., 2001).

In the initial phase of the study, the M-CHAT included 30 items. After this screener was administered to the first 600 participants, eight items were removed because they were not found to be as discriminating as the other items, or parents misunderstood them. Initially, participants received a follow-up telephone interview after failing five of the 30 items on the checklist. After the removal the eight items, the cut-off criteria were changed to either failing two out of six critical items or any three items. The purpose of the telephone interview was to confirm the failed items. If the results were confirmed, the families were offered a free developmental evaluation for their child(ren).

The reliability of the instrument was measured using Cronbach’s alpha of the entire 22 item checklist ($\alpha = .85$) as well as for the subset of the 6 items ($\alpha = .83$) found to be the best discriminators of children diagnosed with ASD. The level of reliability was considered adequate (Robins et al., 2001)
Children were also divided into four groups in order to measure difference in 
score on the assessment across groups. The four groups were (a) children who did not 
require any follow up (n=1161), (b) children who required a telephone interview, but did 
not require an evaluation (n=74), (c) children who were evaluated and were found to have 
language or global delays, but not autism (n=19), and (d) children who were evaluated 
and diagnosed with autism or PDD (n=39). A one-way analysis of variance (ANOVA) 
was used to measure the difference in three separate scores (total scores for the 23 items, 
score for nine original items from CHAT, and the score of the six critical items). The 
one-way ANOVA indicated there was a significant difference between groups for all 
three summary scores (Robins et al., 2001).

The calculation of absolute sensitivity and specificity could not be determined 
until follow-up of the entire initial sample; however, a discriminant functional analysis 
provided tentative sensitivity and specificity values. Based on this test, the M-CHAT had 
a sensitivity of .87 and a specificity of .98 (Robins et al., 2001). Specifically of the 1,233 
participants without autism, 27 were misclassified as having autism/PDD and four 
children were misclassified as not having autism/PDD when there was a clinical 
diagnosis.

The original study on the M-CHAT revealed promising data to indicate the M-CHAT could lead to earlier identification of children who were at-risk for ASD. One 
limitation of this study was that the largest portion of the sample (n=1161) was children 
that were given the screener and did not receive any follow-up. Because these children 
did not receive any follow-up, it was not possible to determine the actual sensitivity and 
specificity of the instrument. It was possible there were children in this group that would
qualify for a diagnosis of ASD but were missed. According to Dumont-Mathieu and Fein (2005), it was possible that the psychometric properties of the M-CHAT would be different if larger numbers from an unselected population were obtained. Also, the screener was used as both a level one and level two screener because the sample included both the general pediatric population and those referred for early intervention. Later studies should examine the screener with each population separately (Robins et al., 2001).

A follow-up study on the M-CHAT was completed in 2007 (Kleinman et al., 2008). This study was divided into two parts. The purpose of the first part of the study was to replicate the original M-CHAT research. The purpose of the second part of the study was to follow-up with the children when they are four years of age to determine the accuracy of the original M-CHAT classification and to estimate the number of children tested at two years of age, that were missed using the M-CHAT.

The participants for the first part of the study were selected from two sources (a low-risk sample and high-risk sample). The low-risk sample consisted of 3,309 children that were screened in their pediatrician’s office. The high-risk sample included 484 children that were screened during intake with an early intervention provider. The children in this sample were between 16 and 30 months of age (Kleinman et al., 2008)

Each child in the sample was given the M-CHAT. Each child who received a positive screen, which was defined as receiving a total score higher than three or failing two or more critical items out of the six critical items, received a follow-up telephone interview to review the results. If the child still had a positive result on the M-CHAT, then the family was offered a free developmental and diagnostic evaluation.
The results of the study were calculated by examining the positive predictive value (PPV) for the initial screening. The PPV was calculated as the proportion of the children who failed the M-CHAT who were later diagnosed with ASD. For the entire sample, 385 children failed the initial screening and 137 of these children ultimately received a diagnosis of ASD, which yielded a PPV of .36 (Kleinman et al., 2008). The internal consistency of the measure of the entire instrument and the six critical items subset was also measured using Cronbach’s Alpha. The internal consistency for the instrument was .85 and for the subtest was .84, which was considered adequate. In addition to the sample identified by a failed M-CHAT, 18 additional children were given a diagnostic evaluation due to concerns from the pediatrician to examine possible misses by the M-CHAT. These 18 children passed the M-CHAT. Of the 18 children, one child was missed and later diagnosed as having ASD (Kleinman et al., 2008).

The participants for the second part of the study included 1,416 children (1,160 were screened from low-risk sites and 256 from high-risk sites). These children were selected from part one of this study and the original M-CHAT study that was conducted in 2001 (Kleinman et al., 2008; Robins et al., 2001). The children in the second part of the study ranged from 42 to 54 months of age.

There were two different procedures for part two of the study depending on the individual child’s results from part one of the study. Children who did not receive a diagnostic evaluation in part one of the study due to passing the M-CHAT were mailed a second M-CHAT approximately two years after the initial screening. Any children who received a positive result at the time of the rescreening were given a phone interview. Children who received a positive result on the initial screening/phone interview, second
screening/phone interview, or referred by a physician were provided a full diagnostic evaluation. A total of 131 children were evaluated during part two of the study (Kleinman et al., 2008).

The results of the second part of study indicated a similar positive predictive value (PPV) that was found during the first part of the study. The PPV for the second part of the study was .38. The second part of the study also examined the amount of misses. A miss for this part of the study was defined as a child who passed the initial screener or initial telephone interview and was diagnosed with ASD during the second part of the study. There were seven children that were identified as misses during the second part of this study. Overall, this study has shown that the PPV and the internal validity of the M-CHAT are adequate. The M-CHAT accurately identifies children that may be at risk for ASD (Kleinman et al., 2008).

The research studies that have been conducted on the M-CHAT indicated this was a promising tool for identifying young children who are at-risk for ASD. This research indicated the M-CHAT has adequate sensitivity, specificity, and positive predictive values. The authors of the M-CHAT indicate this tool can be used as both a level one screening instrument and a level two screening instrument. However, many children that are identified by the M-CHAT as at risk for ASD are later not diagnosed for ASD. For example, in the study by Kleinmen et al. (2008), during part one of the study, 385 children failed the initial screening. Of these 385 children, only 137 were ultimately diagnosed with ASD. However, there were only a total of eight misses in this study. This indicated the M-CHAT may over identify children who are at-risk for ASD. These data support claims made by Siegel that there needs to be an additional level of screener
to reduce the number of children that require costly diagnostic evaluations (Siegel, 2004). At this point, the M-CHAT has been shown to be more effective as a level one screening instrument. Further research would need to be conducted to determine the efficacy of this instrument as a level two screening instrument.

**Autism Diagnostic Observation Schedule**

The current version of the *Autism Diagnostic Observation Scale* (ADOS) is a combination of two earlier instruments, the 1989 version of the ADOS (Lord et al., 1989), and the *Pre-Linguistic Autism Diagnostic Observation Scale* (PL-ADOS; DiLavore, Lord, & Rutter, 1995). The ADOS is a semi-structured standardized assessment of communication, social interaction, and play. It contains four modules with individual protocols for each module. Each module contains a schedule of activities designed for use with children, adolescents, and adults at a particular developmental level (Lord, Rutter, DiLavore, & Risi, 2001). Module one is based on the PL-ADOS and is intended for individuals who have limited language skills and do not use phrase speech. Module two is intended for individuals that have some phrase speech, but whose speech is limited and not fluent. Module three is based on the 1989 version of the ADOS and is for children who use phrase speech fluently and have speech at the developmental level of four years of age. Module four is intended for adolescents and adults. It includes some of the social emotional questions from module three but extends to tasks and interview questions related to daily living skills (Lord et al., 2001).

The purpose of the 1989 version of the ADOS was to provide a series of contexts for the observation of communicative and social behavior of persons with autism and related disorders (Lord et al., 1989). It provided an observation protocol that extended...
beyond other interview and rating scales for the diagnosis of autism. This observation protocol looked particularly at the social and communication deficits that are associated with autism.

The purposes of the first two studies on the ADOS were to assess interrater and test-retest reliability, and to validate that the instrument distinguished between individuals with autism, those with intellectual disabilities, and typically developing children (Lord et al., 1989). The subjects for the assessment of interrater and test-retest reliability were twenty children and adolescents who were diagnosed with autism and twenty children and adolescents who were diagnosed as having an intellectual disability. The participants were matched individually for chronological age, sex, and verbal IQ.

The ADOS assessments were conducted in a variety of settings including schools, homes, and clinics. All of the sessions were videotaped with the examiner alone in the room with the children except in cases of live interrater reliability where there were two people in the room with the individual. The examiners were blind to the diagnosis of each individual. The five persons who devised the scale and standardized its procedures served as the examiners and raters for the study (Lord et al., 1989).

A balanced incomplete block design and weighted kappas were used to assess interrater reliability. Weighted kappas, for the task items ranged from .61 to .92, general ratings ranged from .58 to .87 and were considered adequate. The test-retest reliabilities were adequate for all task items (ranged .57 to .84) and general ratings (range .58 to .92). Finally, there were no significant differences between diagnostic groups (Lord et al., 1989).
The second component of the study examined the concurrent criterion-related and discriminant validity across four groups of individuals. The samples for these groups were: (a) children with autism and a mild intellectual disability, (b) intellectual disability, (c) autism with no signs of an intellectual disability, and (d) typically developing. Each of the four groups included twenty subjects. Two of the groups (children with autism and a mild intellectual disability and children with an intellectual disability) were the same two groups used in the earlier study. The other two groups were added for this portion of the study (Lord et al., 1989).

Discriminant validity was tested by comparing the differences in distribution of rating scores across autism and non-autism samples. A Kruskal-Wallis ANOVA was used to assess the distribution of the ratings across the four groups. The four general ratings (unusual use of eye contact, nonverbal communication linked with language, amount of overtures, and unusual preoccupations) showed significant differences between the autism and non-autism samples, but not between the two autism groups. Two other ratings (level of non-echoed language and social distance), showed a significant difference between IQ levels for the groups. For the other ratings (overactivity, attention, negativism, overall distress, anxiety, and inappropriate cheerfulness), significant differences were not found between groups (Lord et al., 1989).

Concurrent criterion-related validity of the scale was tested by comparing the ICD-10 clinical guidelines of the draft version of the diagnosis of autism and the behaviors that were scored in specific items of the ADOS. An algorithm for these specific items was used to determine the agreement between the number of subjects that were previously diagnosed with autism and the subjects that were placed in the category
based on the ADOS. A Kruskal-Wallis ANOVA yielded significant differences for the social (x2 =57.40) and communication (x2 =53.13) items. These results show the ADOS were successful in differentiating between subjects who have autism and those who do not have autism. Overall, this study indicated that the first draft of the ADOS had adequate interrater and test-retest reliability and that it was valid for distinguishing between children who qualified for a diagnosis of autism and those who did not qualify for the diagnosis of autism (Lord et al., 1989).

There were several limitations to these studies. The first limitation was the small group size of participants that was used in the study. Another limitation was the authors of the scale were the only persons to administer the test and serve as interraters. The authors indicated the reason for this was because substantial training was required for the administration and scoring of the ADOS. A third limitation of this study and the scale was that it was created for those who have the mental and language skills of a three-year-old. The validity and reliability of this scale was not tested with younger children (Lord et al., 1989).

The Pre-Linguistic Autism Diagnostic Observation Schedule (PL-ADOS) is a semistructured observation scale that was designed as a diagnostic tool for children under the age of six who were not yet using phrase speech and were suspected as having autism. The PL-ADOS emphasized the observation of playful interactions with toys that are designed for young children. It consisted of 12 activities with 17 accompanying ratings that assess social, communication, and play skills. The examiner served as the child’s partner for social interaction and play. The PL-ADOS was an extension of the 1989 version of the ADOS that focused on activities and the use of materials that were
appropriate for older populations and those that have some phrase speech (DiLavore et al., 1995).

DiLavore et al. (1995) examined the usefulness of the PL-ADOS in diagnosing young children with autism by assessing interrater reliability and validity. The subjects for the interrater reliability portion of the study were 20 children (12 children with autism, 4 developmentally delayed, and 4 typically developing) who were previously assessed and identified in a larger study as meeting these categories. The 12 children with autism (9 male, 3 female) had a calculated age of 33 months (range 22-51 months) and a mean mental age of 17.62 months (range 12.0-25.5). The four children (3 male, 1 female) diagnosed as developmentally delayed had a mean calculated age of 34.5 months (range 16-56) with a mean mental age of 18.33 months (range 17.6-26.6 months). The four typically developing children (2 male, 2 female) had a mean calculated age of 18 months (range 12-26 months) and a mean mental age of 20.03 months (range 13.4-27.9).

The administration of the PL-ADOS was videotaped. Four graduate students who had not previously administered the PL-ADOS participated in a 15-hour training program and were trained to score the PL-ADOS. At the end of the training sessions the four individuals attained at least 80% agreement consensus scores for individual items on at least two tapes. Each of the four graduate students observed the twenty videos independent of one another. The raters were blind to the child’s previous diagnosis (DiLavore et al., 1995).

After the final revision and analyses of the twelve activities and summary scores, weighted kappas for the activities ranged from .63 to .95. Weighted kappas for the summary scoring of all the activities were .71-.83 for communication, .60-.94 for
reciprocal social interaction, .78-1.00 for play, .60-.92 for stereotyped behavior and restricted interests, .65-.92 for other abnormal behaviors, and .86 for the overall autism clinical rating. These kappas range from moderate to very good level of agreement for interrater reliability (DiLavore et al., 1995).

In addition to the interrater reliability portion of the study, DiLavore et al. (1995) conducted a validity study on the PL-ADOS. The subjects for this study included 21 children with autism with a calculated age of 38 to 61 months, 21 children aged three to four-years-old with a developmental delay other than autism, and 21 children aged one to two-years-old with developmental delay other than autism. The developmentally delayed three to four year old group was equivalent to the autism group in IQ, calculated age, and mental age, but was significantly higher in the areas of both receptive and expressive language. The goal of the PL-ADOS was to discriminate between groups of children on the basis of the presence or absence of autism rather than the presence or absence of a language delay, the two year old group was included in the comparison because they had similar language skills as the children with autism (DiLavore et al., 1995).

The PL-ADOS was administered to all of the children by one of the five experienced examiners who had already achieved interrater agreement with one another in the previous study. All of the sessions of the PL-ADOS were videotaped; however, ratings were coded during the administration because the goal of the assessment was for live ratings. After an initial analysis of the items, items that were highly correlated (r > .80) within the autism group were eliminated because they did not provide any additional independent information.
The results of the study were analyzed using a one-way fixed effect ANOVA and a Tukey Test. The results indicated that nine of the 17 individual activity codes discriminated the autism group from the other two developmentally disordered groups. Specifically, the statistical analysis revealed that the autism group was significantly different from both developmentally delayed groups on all summary ratings except overall level of language, tantrums and aggression, functional play, imagination/creativity, and showing (DiLavore et al., 1995). For all summary ratings, the autism group had higher mean scores than the developmentally disordered groups indicating a higher level of abnormality (DiLavore et al., 1995). Since the activity and summary ratings discriminated the children with autism from the children with a developmental delay, the items were used to create an algorithm using the criteria for autism from the DSM-IV and the ICD-10 (APA, 1994). Algorithm scores are computed by adding each of the summary scores within the two major diagnostic areas: social interaction/communication, and restricted repetitive behaviors. Cutoff scores that correctly classified children in the three groups were identified. It was found that this current algorithm was successful in classifying all children correctly except that it did not effectively discriminate between verbal children with autism from nonverbal children with developmental delays.

Overall the initial study on the PL-ADOS indicated that it had overall good reliability and validity statistics for the activity items and the summary ratings. Specifically, the PL-ADOS was shown to be a reliable assessment for observing the communication skills, social interaction, and other behaviors that appear to be impacted in children with autism (DiLavore et al., 1995). The algorithm that was developed for the
PL-ADOS was effective in discriminating between young non-verbal children with autism and those that did not have autism. The PL-ADOS and algorithm was not effective for discriminating between verbal children with autism and those that were not verbal. This was the basis for a later version of the ADOS that included four different modules that were based on a child’s current level of verbal communication. Another limitation of this study was that the algorithm developed was based on the sample in the study. This algorithm was not tested against other samples (DiLavore et al., 1995).

As previously stated, the current version of the ADOS (2001) was developed based on the original ADOS and the PL-ADOS. Several research studies have been completed on the current version of the ADOS. Lord and colleagues (2001) conducted the original reliability and validity studies on the four separate modules. Since the focus of this study was on early identification of children under the age of three, the validation of only module one of the ADOS is discussed. There were a total of 74 (57 male and 17 females) participants that were selected for the study. These children ranged in chronological age from 15 months to 11 years. The participants were selected for module one because they were not yet using meaningful three word phrases (Lord et al., 2001).

In order to obtain reliability scores for the individual items, individual raters that were blind to the child’s diagnosis scored the items. Individual items were scored on a three-point scale. Weighted kappas were used to determine the overall reliability of the item. Items that were scored under .40 were eliminated unless the item was considered important diagnostically. Items that were under .50 were rewritten for clarification. Rewritten items were then retested using a sample of twenty children. Overall, it was determined that interrater reliability was very high for module one items averaging .91.
All of the individual items had at least an interrater agreement of .80. All kappas for the items exceeded .60 except for those that were focused on repetitive behaviors. Interrater agreement was also determined for the overall domain scores and classification as autism vs. non-autism (1.0) and between autism, PDD-NOS, and non-autism (.91).

In addition, the authors analyzed the validity of the current instrument. Correlation matrices were developed for all of the items in module one for the three diagnostic categories (autism, PDD-NOS, and non-autism). Items that were correlated at a rate of more than .70 were targeted for possible elimination due to redundancy. Next an exploratory factor analysis was used to evaluate the items in module one. Two major factors emerged in the module were “social interaction” and “communication.” These were the two main areas that were scored and added for a combination score to determine the classification between the three diagnostic categories. Almost all of the items on the test loaded on to one of these two factors accounting for .72 of the variance (Lord et al., 2001).

A one-way fixed affect ANOVA was performed to compare the three diagnostic groups for module one. All items except non-specific behavioral items such as “anxiety” and “overactivity” demonstrated a specific pattern in which the autism group scored the highest, followed by the PDD-NOS, and the non-autism group scoring the lowest. In module one, .25 to .40 of the items differed significantly across all three groups. Items that yielded significant differences between the three diagnostic groups were operationalized based on the diagnostic criteria for autism in the DSM-IV and ICD-10 and served as the scoring algorithm for each module. For module 1, three separate scores (social interaction, communication, and social interaction + communication) were
identified to correctly discriminate between the three diagnostic categories. When all three of these scores are used, the ADOS module one demonstrated sensitivity equal to .97 and specificity equal to .94 for the discrimination between autism and PDD-NOS from the non-spectrum group. Results from this study indicated that the current version of module one of the ADOS was an effective assessment for discriminating between children with autism, autism spectrum disorder, and those who do not have autism spectrum disorder (Lord et al., 2001).

Gray, Tonge, & Sweeney (2008), completed a follow-up study comparing the validity of the ADOS and the *Autism Diagnostic Interview-Revised (ADI-R)* to evaluate young children. The purpose of this study was to evaluate the validity of two instruments, the ADOS and ADI-R in the diagnosis of young children. The study was an extension of the studies conducted by the developers of the ADOS. The goal of this study was to specifically look at the utility of the instruments for preschool children.

The participants in this study were 2098 children that were aged 20 to 55 months of age who were referred to an assessment clinic for children with developmental delays and/or those suspected of having autism. One hundred and twenty of the children were diagnosed with autism, 23 with a diagnosis of PDD-NOS, and the other children in the sample were diagnosed with a developmental delay and/or language impairment. One hundred and ninety-five of the children were evaluated using module one of the ADOS (Gray et al., 2008).

An ANOVA was used to evaluate mean domain scores for both the ADI-R and the ADOS across the three diagnostic groups (autism, PDD-NOS, and non-autism). Post Hoc tests indicated that there were statistically significant differences between all three
groups for the three domain scores. When the diagnostic algorithms were used to compare against clinical consensus of the diagnosis, it was found that the sensitivity of the instrument was .85, specificity was .89, and an overall correct classification rate was .89. There were 18 false negatives and 10 false positives in the sample. The false negatives were significantly older in chronological age than the remainder of the sample indicating that another module of the ADOS would have been more appropriate for assessing these children. Of the 10 false positives, six had a clinical diagnosis of PDD-NOS and all but one has a significant language delay. This indicated that children with severe language delays and/or PDD-NOS could be over classified in the autism category (Gray et al., 2008).

Overall the study found that children with autism scored higher on both the ADI-R and the ADOS than those without autism, indicating both instruments were able to discriminate between diagnostic groups. However, the researchers found that the ADOS performed better than the ADI-R when compared to a consensus of clinical opinion. This indicated that the ADOS may be better than the ADI-R at correctly diagnosing young children with autism Spectrum Disorder (Gray et al., 2008). The Gray et al. study was the first to examine the use of these instruments among young children. Additional studies need to be completed on children under the age of thirty-six months since the focus is on diagnosing children before the age of three. Also, the study included a small population of children that qualified as PDD-NOS. Further research needs to be completed on the utility of the ADOS discriminating between young children with autism, PDD-NOS, and severe language delays.
Since its development, the ADOS has become the golden standard in the diagnosis of young children. The ADOS has been recommended in several best practice guidelines as an appropriate standardized diagnostic observation tool (NRC, 2001). Research completed by Aksshoomoff and colleagues (2006) investigated the utility of the ADOS in the diagnosis of children with autism by interviewing school and clinical psychologists. The research participants included 44 clinical psychologists who reported that they use the ADOS and 88 school psychologists (44 who used the ADOS and 44 non-users of the ADOS).

The purpose of this study was to examine practitioner’s opinions of the ADOS in both community and school settings and to compare the practices in the diagnostic practices between school psychologists who used the ADOS and those who did not use the ADOS. A survey was developed to assess the opinions of both the user and non-users of the ADOS. The 88 users of the ADOS were asked questions about their opinions of the advantages and disadvantages of the ADOS. A Chi-square analysis was used to evaluate the responses between groups. The results indicated the two biggest advantages of using the ADOS included items/activities that capture behaviors that are consistent with ASD, and the administration was standardized and when properly implemented, the activities often elicit behaviors associated with ASD. Some of the disadvantages noted were that clinicians felt the ADOS tended to over classify other developmentally delayed groups as ASD and did not discriminate well between ASD subgroups.

Aksshoomoff et al. (2006) conducted the first study to evaluate practitioner’s perceptions of the use of the ADOS. The overall results indicated that many practitioners were using the ADOS as one of main diagnostic tools in completing evaluations and that
many relied heavily on the results of the ADOS in determining a diagnosis. One of the limitations in this study was that the group of psychologists that were interviewed was small. Also, the study only contained the opinion of licensed clinical and school psychologists. Users of the ADOS can include developmental specialists, early childhood teachers, and speech pathologists. Many early intervention providers use the ADOS as a tool to determine eligibility and level of services. Future studies on the perceptions of the ADOS should extend to these professional groups.

The ADOS is a standardized semi-structured assessment of communication, social reciprocity, and play skills. Assessments prior to the ADOS, utilized solely rating scales. The ADOS uses a variety of activities to elicit observable behaviors that are associated with ASD. As previously discussed, the current version of the ADOS was developed from previous versions. The current version of the ADOS assesses children based on their current language skills. The ADOS is currently the golden standard diagnostic assessment for ASD. However, Lord et al, (2001) cautions against utilizing the ADOS as the sole assessment for diagnosing a child with ASD. A diagnosis of ASD should be provided using the ADOS in conjunction with other formal and informal measures.

**Pervasive Developmental Screening Test-II**

The *Pervasive Developmental Disorders Screening Test (PDDST-II; Siegel,* 2004) is a clinical screening tool for autism and other pervasive developmental disorders intended for children aged 12 to 48 months (Siegel, 2004). The PDDST-II contains three stages of parent-report screeners that are specific to the clinical setting. Stage one is intended to be an initial screener used by a primary care provider. The purpose of stage one is to discriminate between children with a high likelihood of autism and those with
non-specific developmental delays. Stage two is intended to be used by an early intervention provider or those who work in a developmental clinic in which many children are referred for developmental delays. The purpose of the second stage is to discriminate between children with ASD and those that have related developmental disorders such as language disorders and some forms of intellectual disorders. Stage three is intended to be used by an autism clinic or autism professionals in order to differentiate between autism and other disorders on part of the autism spectrum such as PDD-NOS and Asperger’s Disorder (Siegel, 2004).

According to Siegel (2004), the PDDST-II was expected to be the first ASD screening instrument to contain items that were specific to development in the first 48 months of life. Further Siegel stated the PDDST-II was also the first screening tool to be standardized with large groups of children with other types of neurodevelopmental disorders so that ASDs can be differentiated from non-specific developmental delays, intellectual disabilities, language disorders, infant psychiatric disorders, and typical development.

The norming sample for the PDDST-II was 943 children that were 14 months of age to more than 48 months of age. The sample of children that were referred for ASD testing were all assessed and diagnosed between 1985 and 2002 at an autism clinic. Each child received an extensive clinical work-up which included a developmental history, genetic family history, pre- and perinatal risks, report of first concerns, social development, development of peer relationships, non-verbal communication development, language development, play, sensory motor abnormalities, history of routines and rituals and adaptive behavior. Each case was given a direct assessment
using a standardized autism-specific play observation and age appropriate cognitive
testing. The diagnosis was given based on a consensus among evaluators based on the
DSM-IV criteria (Siegel, 2004).

Based on the child’s diagnosis, each case was assigned to one of five groups. These groups included autism (n = 410), Other PDD (n=108), other neuropsychiatric disorder (n=36), language disorder (n=89), and intellectual disorders (n=44) without any of the other above diagnoses. Comparison groups for each stage of the instrument were selected and the sensitivity and specificity of each stage of the instrument was determined. (Siegel, 2004).

The cut-off scores for Stage One of the instrument were determined by comparing the specificity and sensitivity of the instrument between children at-risk for ASD (n=681) and those with mild to severe other developmental disorders (n=256). For a cut-off score of five, which means that a child with a score equal to five or higher would be classified as having a positive screener, the sensitivity was .92 and the specificity was .91. The cut-off for stage two of the instrument was determined by comparing the specificity and sensitivity between those with ASD and those referred for ASD concerns that were ruled out. For a cut-off score of five, the sensitivity was .73 and the specificity was .49. The specificity of stage two is much lower than that of stage one. The authors indicated that this could be because many developmental disorders share at least a few features with ASD and the comparison group were those that were referred for an ASD screening. The cut-off scores for stage three of the instrument were determined by comparing the specificity and sensitivity of the instrument between children with autism (n=355) and those with PDD-NOS/Asperger’s Disorder (n=99). With a cut-off score of eight, there
was a reasonable level of sensitivity (.58) and specificity (.60), which indicated that the screener could discriminate between autism and PDD-NOS in some children. It should be noted, that this instrument was found to be more effective with children who were closer to three years of age based on the developmental skills evaluated by this instrument (Siegel, 2004).

Overall, research indicated that the PDDST-II can be an effective tool for identifying very young children who show signs of ASD. Stage one of the screener had a very good level of specificity and sensitivity at discriminating between children who have autism and those who do not. The specificity and sensitivity of the other two stages were decreased, but the initial data indicated that these stages may still be effective in identifying children who need further testing. Specifically, the use of stage two could potentially reduce by half, the number of children who were referred for a costly and lengthy evaluation for autism (Siegel, 2004). While the research on the development of this instrument showed that this can be a promising instrument as both a level one and level two screen as described earlier, to date there have not been any peer reviewed studies published on the PDDST-II (Robins, 2008).

Summary

The ADOS has been established as the “golden” standard for assessing and diagnosing children with ASD. The ADOS is a standardized play based assessment that takes between 45 minutes and one hour to administer and requires examiners who have been trained in administering the assessment. Therefore, it is not feasible to administer this assessment to a large number of children. This has led to the need for accurate parent report screening instruments that are quick and reliable. Two screening instruments that
have been developed to meet this need are the Modified Checklist for Autism in Toddlers (M-CHAT) and the Pervasive Developmental Disorder Screening Test (PDDST-II). Both screening instruments have been developed and shown to be reliable for the use with young children under the age of four. However, there is a lack of research comparing these screening instruments with the same population (children under the age of 36 months) to determine which instrument is more reliable in identifying young children who exhibit early signs for ASD.
CHAPTER THREE

METHODOLOGY

Early intervention services are essential for children with autism spectrum disorders (ASD). Young children with ASD who receive early intervention services have a better prognosis than those who do not receive these services (Lord, 1995). The children are more likely to develop functional verbal communication and appropriate play and social skills and less likely to develop externalizing behaviors (Lord, 1995; Siegel et al., 1988). Unfortunately, many children with ASD do not receive intensive early intervention services because they are diagnosed after the age of three. This is primarily because many social interaction and stereotyped behavior markers are not easily detectable before the age of three (Nadel & Poss, 2007).

Despite the difficulty in identifying symptoms in young children with autism Spectrum Disorders, two parent report screeners have been developed based on behavioral markers that are present under the age of two. These screeners are the Modified Checklist for Autism in Toddlers (M-CHAT; Robins et al., 2001) and the Pervasive Development Disorders Screening Test (PDDST-II, Siegel, 2004). Both of these screeners have been validated to identify children under the age of three who exhibit signs of ASD. However, these two screeners have not been compared to determine which screener more accurately predicts ASD in young children.

This study was developed to compare the accuracy of the results of M-CHAT and PDDST-II Stage One and Stage Two screeners with the results of the Autism Diagnostic Observation Scale (ADOS) for a group of children under the age of three (N=80). Eighty children were screened with two screeners (MCHAT and PDDST-II Stage One) during
their eligibility appointment at local early intervention agencies or during their mandated 18 or 24 month screening for ASD. These 80 children were then screened using the PDDST-II Stage Two and evaluated using the ADOS at a follow-up appointment. The results of the screeners were blinded to the evaluators who were giving the ADOS. Evaluators did not see the screener results until after the results of the ADOS. The results of all three screeners were compared against the results of the ADOS to determine the level of sensitivity and specificity for all three screeners. The PDDST-II Stage One results were then compared with the PDDST-II Stage Two results to determine whether using a Stage-II screener decreases the number of false positives, therefore, reducing the number of children that require further diagnostic testing.

**Research Questions**

There were three research questions:

1. **Is the PDDST-II Stage One a better predictor of children at-risk for ASD than the MCHAT?**

   It was predicted that the PDDST-II Stage One would be a better predictor of ASD than the M-CHAT because it is a developmental screener that is based on behavioral markers at different developmental periods.

2. **Does the PDDST-II Stage Two accurately predict whether a child will meet the criteria for ASD?**

   It was predicted that children who meet the criteria for ASD on the ADOS, will receive a positive score on the PDDST-II Stage Two.

3. **Does the PDDST-II Stage Two accurately decrease the number of children, identified by a level one screener, who requires a full assessment?**
It was predicted that the number of children who receive a positive score on PDDST-II Stage Two would be less than the number of children who receive a positive score on the MCHAT and PDDST-II Stage One. It was also predicted that the children that were ruled-out by using the PDDST-II Stage Two would have negative scores on the ADOS, therefore reducing the number of false positives that were identified by the MCHAT and PDDST-II Stage One screener.

Participants

Parents of Children in Early Intervention Program

The parents of the children in the early intervention program participated in the study by completing the three parent report screeners. The first two screeners (M-CHAT and PDDST-II Stage One) were given to the parents to fill out at either the intake appointment or the appointment for the 18 or 24 month mandated screening after signing the informed consent form (see Appendix A). The parents completed the third screener (PDDST-II Stage Two) at the scheduled appointment for the ADOS. Parents participated in the ADOS assessment as directed by the administrator of the ADOS according to the ADOS protocol.

Children in Early Intervention Program

The children selected for this study were children who were referred for an early intervention evaluation at local early intervention agencies to determine their eligibility for early intervention services or those who entered an early intervention program before the age of twenty-four months. The children were referred for the evaluation by either their parents or a medical provider such as a pediatrician or nurse. The children in these programs range from birth to three years old. Upon turning three years of age, the
children are referred for school-based services. The children referred for an early intervention intake are suspected of having a developmental delay in at least one of the five areas of development. Part C services of Nevada require that children be screened for ASD upon entry to the program if they are older than eighteen months old. Existing children in the program receive screenings for ASD at eighteen and twenty-four months old.

All of the children selected for this study met the following criteria: (a) were at least 18 months old, (b) were under the age of 36 months, and (c) were new intakes between the ages of 18 and 36 months or entered the program under the age of 24 months and were due for a 18 month or 24 month screening as mandated by the state. Children excluded were those who were automatically eligible for the program due to medical diagnosis of Down syndrome, cerebral palsy, severe neurological disorders such as hydrocephaly or macrocephaly, or severe motor difficulties. Only children whose parents provided permission by signing a parent permission form (see Appendix B) participated in the research study. A total of 80 children were recruited as participants for this study. Demographic information was collected for all children participating in the study (see Table 1).

All participants were screened with all three screeners and evaluated using the ADOS. Additionally, all children were videotaped during the ADOS assessment for interobserver agreement.

**Administrators of the Autism Diagnostic Observation Scale (ADOS)**

The administrators of the ADOS were employed as behavior consultants or autism interventionists for Southwest Autism and Behavior Solutions. The behavior
consultants held a Master’s degree in an educational field such as special education or educational psychology and have a minimum of four years working with children with ASD. The autism interventionists all held a Bachelor’s degree and were enrolled in graduate programs. Two behavioral consultants and two autism interventionists participated in the administration of the ADOS. Demographic information for the administrators of the ADOS are provided (see Table 2).

The two behavioral consultants participated in a two day clinical training presented by the publishers of the ADOS assessment and achieved reliability in scoring (over 90% agreement) with one another during the practice scorings at the training. The autism interventionists attended a four-hour training provided by the behavior consultants that attended the two-day training and watched the training video provided by the publisher. The autism interventionists practiced scoring the instrument for four videotaped ADOS sessions. Autism interventionists did not administer or score the ADOS until they reached at least percentage of agreement of 80% with the two behavior consultants. Interobserver agreement was calculated by \[ \frac{\text{agreements}}{\text{agreements + disagreements}} \times 100 = \text{percent of agreement for the communication, social interaction, and communication + social interaction scores.} \] Additional training was provided to interventionists if the percentage of agreement fell below 80%. All ADOS administrators utilized the ADOS administration script (see appendix C) during the assessments.
Table 1

Demographics of Children Participants in Early Intervention Programs

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>56</td>
</tr>
<tr>
<td>Female</td>
<td>24</td>
</tr>
<tr>
<td><strong>Age (in months)</strong></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>26.8</td>
</tr>
<tr>
<td>Range</td>
<td>18-35</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>54</td>
</tr>
<tr>
<td>African American</td>
<td>3</td>
</tr>
<tr>
<td>Hispanic</td>
<td>17</td>
</tr>
<tr>
<td>Asian / Pacific Islander</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 2

Demographics of ADOS Administrators

<table>
<thead>
<tr>
<th>Administrators</th>
<th>Age</th>
<th>Gender</th>
<th>Ethnicity</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant A</td>
<td>33</td>
<td>Female</td>
<td>Caucasian</td>
<td>M. Ed</td>
</tr>
<tr>
<td>Consultant B</td>
<td>47</td>
<td>Female</td>
<td>Caucasian</td>
<td>M. Ed</td>
</tr>
<tr>
<td>Interventionist A</td>
<td>30</td>
<td>Female</td>
<td>Caucasian</td>
<td>B.A.</td>
</tr>
<tr>
<td>Interventionist B</td>
<td>27</td>
<td>Female</td>
<td>Caucasian</td>
<td>B.S.</td>
</tr>
</tbody>
</table>

Interrater Observers

Two behavior consultants employed by Southwest Autism and Behavioral Solutions were responsible for collecting interobserver data for the scores on the ADOS and administrator procedural fidelity. Each behavior consultant held a Masters’ degree in an education related field and had over four years experience working with children with ASD in a school and home setting. The interobservers did not participate in the administration of the ADOS assessments. The interobservers participated in the four hour training and practice scorings until they reached a percentage of agreement of at least 90% with the two behavior consultants that were serving as administrators of the ADOS. Interobserver agreement was calculated by \[
\text{percent of agreement} = \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100
\]

Reliability of ADOS Scores. Each interobserver watched 25% of the videotaped administrations of the ADOS assessments. The videotapes were randomly selected by
the interobservers. Each interobserver recorded observations and scored the ADOS on a protocol. The administrator’s scores for the communication, social interaction, and communication + social interaction were compared with the interobservers’ scores. Interobserver agreement was calculated by \[
\frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 = \text{percent of agreement.}
\]

**Administrator procedural reliability.** The interraters observed 25% of the videotaped administrations for each administrator each month using an administrator fidelity checklist (see Appendix D) that was developed by the author. The fidelity checklist was based on the ADOS instructions for each activity in the module. Adherence to the administration was based on the steps for each activity that is measured using the checklist. Additional training and feedback was provided to the administrators if their adherence to the protocol fell below 90% as measured by the checklist.

**Setting**

The first two screeners (M-CHAT and PDDST-II Stage One) were given at the intake appointment or at the 18 or 24 month mandated screening. The screeners were given to the parents by the intake coordinator or developmental specialist at either the office of Integrated Support Solutions or at the family’s home. The second screener and ADOS were administered at the office of Southwest Autism and Behavioral Solutions (see Appendix E).

**Instrumentation**

Two screeners, the M-CHAT (see Appendix F) and PDDST-II Stage One (see Appendix G) were given in the first phase of the study. The second phase of the study included a third screener, the PDDST-II Stage Two (see Appendix H) and a standardized
assessment, the ADOS. The results of the three screeners were compared to the results of the ADOS to determine the accuracy of the screeners in identifying children at-risk for ASD.

**Modified Checklist for Autism in Toddlers (M-CHAT)**

The M-CHAT is a twenty-three item parent report screening instrument used to identify children at risk for ASD. The intent of the M-CHAT is that it be used as a stage one screener with the general pediatric population. However, it has also been shown to be an accurate screener with the population of children with developmental delays to discriminate between children who have ASD and those that have other developmental delays (Robins et al., 2001). The items on the M-CHAT assess sensory abnormalities, motor abnormalities, social interaction, and early joint attention/theory of mind, and early language and communication. The authors of the M-CHAT found the instrument had a sensitivity of .87 and a specificity of .98 based on their original norming sample (Robins et al., 2001).

**Pervasive Developmental Disorder Screening Test II (PDDST-II)**

The PDDST-II (Siegel, 2004) is a parent screening instrument for autism for children aged 12 to 48 months. The assessment contains three stages of screeners. The purpose of the first stage is to discriminate between children with a high likelihood of autism and those with non-specific developmental delays. It is intended to be a general pediatric screener. The Stage one screener was used during the first phase of the study. The results were compared to M-CHAT and can be found in Chapter 4. The authors of the PDDST-II found that Stage One of the instrument had a sensitivity of .92 and the specificity of .91. Stage two is intended to be used by an early intervention provider or
those who work in a developmental clinic in which many children are referred for developmental delays. The purpose of the second stage is to discriminate between children with ASD and those that have related developmental disorders such as language disorders and some forms of intellectual disabilities. The authors of the PDDST-II found that Stage Two of the instrument had a sensitivity of .73 and the specificity of .49. It was hypothesized that the lower level of reliability was due to the developmentally delayed population sharing some behavioral markers with those that have ASD (Siegel, 2004).

### Autism Diagnostic Observation Scale (ADOS)

The ADOS is considered the gold standard assessment for identifying young children with ASD. The ADOS is a play based standardized assessment that contains four modules. The module to be used was selected based on the child’s level of communication. Module one of the ADOS was designed for children who have limited verbal communication up to one to two word phrases. Children who use a variety of flexible three word phrases are not given Module one of the ADOS. The children in this study were provided module one of the ADOS based on their age and language level. Thus, following ADOS protocols, children with flexible three word phrases were excluded from sample. Module one of the ADOS contains ten play-based activities that are administered by the examiner. Observational data is taken during administration and used to score the protocol in the areas of social interaction, communication, play, and stereotyped behaviors. The authors of the instrument found that module one of the ADOS has sensitivity equal to .97 and specificity equal to .94 (Lord et al., 2001).
Design and Procedures

The study was conducted over a five-month period and contained two phases. The two phases were conducted simultaneously. The first phase of the study included parent’s completion of the M-CHAT and PDDST-II Stage One at the intake appointment or during the 18 or 24 month mandated evaluation. The second phase of the study included the parent’s completion of the PDDST-II Stage Two screener and the administration of the ADOS module one.

Phase I

At intake appointments, the intake coordinator gained parental consent for participation in the study for children that were over the age of 18 months. Once consent was given, the parents were given the M-CHAT and the PDDST-II Stage One to complete. The intake coordinator collected the screeners from the parents. Copies of the screeners were kept in the child’s file and additional copies of the screeners were put in a sealed envelope and given to the examiner. Families who completed the screeners were contacted by the examiner to schedule an appointment for phase two of the study.

At 18 and 24 month mandated screenings, the developmental specialist gained parental consent for participation in the study. Once consent was given, the parent was given the M-CHAT and the PDDST-II Stage One to complete. The developmental specialist collected the screening forms from the parents. Copies of the screening instruments were kept in the child’s file and additional copies of the screening instruments were put in a sealed envelope and given to the examiner. Families who
completed the screening instruments were contacted by the examiner to schedule an appointment for phase two of the study.

Phase II

The consent forms were provided to the examiner during phase one of the study. Once the consent form was received, the examiner called and made an appointment with the family for the PDDST-II Stage Two and ADOS. When the parent arrived, the parent was given the PDDST-II Stage Two to complete before being called back for the assessment. The PDDST-II Stage Two was collected by the administrative staff and placed in a sealed envelope. When the PDDST-II Stage Two was complete, the ADOS module one was conducted by one of the qualified administrators. All administrations of the ADOS were videotaped. The parents were invited to observe and participate in the ADOS administration as specified in the ADOS administration manual. The results of the three screening instruments were blind to the administrator of the ADOS in order to remove observation bias.

Every month throughout phase two, 25% of the videotapes collected for each administrator were selected by an interobserver for procedural fidelity. Also, the interraters observed and scored, 25% of the ADOS assessments given during phase two. If the percentage of agreement fell below 80% for any of the administrators for procedural fidelity or test reliability, additional training was completed with that administrator. Phase two of the study was complete when all children who received phase one screeners were administered the ADOS.
Data Collection

The scores for the M-CHAT, PDDST-II Stage One and Two, and the ADOS scores were entered into Excel™ for data analysis. Scores were coded as 0 for pass and 1 for fail. Failed scores indicated that the screening instrument was positive for ASD. These data were entered into Excel™ throughout the study. The screening instruments given to individual families were scored and entered into Excel, once the ADOS assessment was completed for each individual child.

Interobserver agreement data were taken for 25% of the videotaped administrations of the ADOS throughout phase two of the study. Interobserver agreement was calculated by \[ \frac{\text{agreements}}{\text{agreements} + \text{disagreements}} \times 100 = \text{percent of agreement} \] for the communication, social interaction, and communication + social interaction scores.

Procedural fidelity of the administration of the ADOS was measured using a checklist (see Appendix D) of steps in the administration of the ADOS based on the administration manual. Raters watched 25% of the videotaped administrations for each of the administrators. Checklists were used to determine the number of steps completed correctly. The goal for procedural fidelity was 90% or above for administration of the ADOS.

Treatment of Data

Data were analyzed to answer each of the research questions:

Research Question 1: Is the PDDST-II Stage One a better predictor of children at-risk for ASD than the MCHAT?
Analysis: The specificity and sensitivity of the M-CHAT were calculated using the ADOS as the validation tool. The specificity and sensitivity of the PDDST-II were calculated using the ADOS as the validation tool. The specificity and sensitivity were compared between the M-CHAT and PDDST-II.

Research Question 2: Does the PDDST-II Stage Two accurately predict whether a child will meet the criteria for ASD?

Analysis: The specificity and sensitivity of the PDDST-II Stage Two were calculated using the ADOS for validation tool.

Research Question 3: Does the PDDST-II Stage Two accurately decrease the number of children identified by a level one screener who requires a full assessment?

Analysis: Determined the number of false positives identified on the level one screening instruments (MCHAT and PDDST-II Stage One). Compared to scores on level 2 screening instrument (PDDST-II Stage Two) to determine whether the PDDST-II Stage Two correctly classified the false positives identified by the MCHAT and PDDST-II Stage One.
CHAPTER FOUR

RESULTS

Early intervention has been found to optimize the prognosis of children with ASD. Children with ASD who receive intense intervention before the age of three in the area of social skills, functional communication, play skills, and behavioral control are more likely to have better outcomes than children with ASD who do not receive intervention before the age of three (Lord, 1995). In addition, early intervention has been found to reduce stress within the family unit and promotes positive child and family relationships (Lecavalier et al., 2005; Lee et al., 2007). Unfortunately, many families and children with ASD do not benefit from early intervention due to late diagnosis. Over the last decade several screening instruments have been developed to aid in early diagnosis of children with ASD (Dumont-Mathieu & Fein, 2005). However, minimal research has been conducted to validate these tools or compare the tools to determine which screening instrument is a better predictor of ASD in young children.

The purpose of this study was to provide an independent investigation of the validity of the Pervasive Developmental Disorders Screening Tool (PDDST-II) and to determine if it is a better predictor of ASD in young children than the Modified Checklist for Autism in Toddlers (MCHAT). Eighty children who were enrolled in early intervention programs were assessed using three early screening instruments that included (a) MCHAT, (b) PDDST-II Stage One, and (c) PDDST-II Stage Two. Each child was also assessed using the Autism Diagnostic Scale (ADOS) Module One. The ADOS was used as the comparison tool to determine whether each child would meet the
criteria for a diagnosis of ASD. The following research questions were addressed in this study:

1. Is the PDDST-II Stage One a better predictor of children at-risk for ASD than the MCHAT?

2. Does the PDDST-II Stage Two accurately predict whether a child will meet the criteria for ASD?

3. Does the PDDST-II Stage Two accurately decrease the number of children, identified by a level one screener, who requires a full assessment?

Data from each of the screening instruments were analyzed and compared using quantitative analyses.

**Procedural Fidelity**

In order to ensure children were accurately assessed using the ADOS, procedural fidelity checks were conducted throughout the study. Interobservers were two behavioral consultants who attended a four-hour training on scoring the ADOS and achieved at least 90% accuracy with the behavioral consultants providing the training. The interobservers observed 25% of the videotaped administrations for each administrator each month using an administrator fidelity checklist (see Appendix D) that was developed by the author. Both behavioral consultants A and B and Autism Interventionist B achieved procedural fidelity scores above 90% for the duration of the study. Autism Interventionist A obtained a procedural fidelity score of 82% during her initial administration of the ADOS during the first month of phase 2 of the study. Interventionist A received additional training on the administration protocol. During all subsequent administrations by
Interventionist A, procedural fidelity scores exceeded 90%. Procedural fidelity scores for each interventionist have been provided (see Table 3).

### Table 3

**Procedural Fidelity Scores for Administrators of the ADOS**

<table>
<thead>
<tr>
<th>Administrator</th>
<th>Overall Procedural Fidelity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior Consultant A</td>
<td>98.6%</td>
</tr>
<tr>
<td>Behavior Consultant B</td>
<td>98.1%</td>
</tr>
<tr>
<td>Autism Interventionist A</td>
<td>93.7%</td>
</tr>
<tr>
<td>Autism Interventionist B</td>
<td>97.1%</td>
</tr>
</tbody>
</table>

**Reliability of ADOS Scores**

To ensure accurate scoring and categorization during the ADOS administration, each interobserver watched 25% of the videotaped administration of the ADOS assessment. The videotapes were randomly selected by the interobservers. Cut-off scores determined by the publisher were used to categorize a child in one of three categories: (a) No ASD present, (b) ASD, or (c) autism. The administrator’s categorization for the communication score, social interaction score, and communication + social interaction score were compared with the interobservers’ categorizations. Interobserver agreement was calculated by \[\frac{\text{agreements}}{\text{agreements} + \text{disagreements}}\] X 100 = percent of agreement. Reliability of ADOS scores were calculated at 91.7%. There were disagreements in the scores for two children. For both of these children the
disagreements were discrepancies between the categorization of ASD or autism in the three scores. There were no discrepancies between the categorization of No ASD present and an ASD or No ASD present and autism.

**Summary Results for Screening Instruments**

Based on the results of each screener, the participant was placed in one of two categories: a positive test indicating the participant may have an ASD or a negative test indicating that ASD was not present. Further, based on the results of the ADOS, each child was also placed in one of two categories: ASD which included children who scored in the categories of ASD and Autism, and No ASD. The results of each screening instrument were compared to the results of the ADOS. A summary of the results for the MCHAT, PDDST-II Stage One, and the PDDST-II Stage Two is provided in Table 4, Table 5, and Table 6 respectively.

Table 4

*Summary Results of MCHAT Screening Instrument*

<table>
<thead>
<tr>
<th>ADOS Classification</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASD</td>
</tr>
<tr>
<td>MCHAT</td>
<td></td>
</tr>
<tr>
<td>Positive Test</td>
<td>34</td>
</tr>
<tr>
<td>Negative Test</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
</tr>
</tbody>
</table>
Table 5

*Summary Results of PDDST-II Stage One Screening Instrument*

<table>
<thead>
<tr>
<th>ADOS Classification</th>
<th>ASD</th>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PDDST-II Stage One</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Test</td>
<td>35</td>
<td>22</td>
<td>57</td>
</tr>
<tr>
<td>Negative Test</td>
<td>3</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>38</td>
<td>42</td>
<td>80</td>
</tr>
</tbody>
</table>

Table 6

*Summary Results of PDDST-II Stage Two Screening Instrument*

<table>
<thead>
<tr>
<th>ADOS Classification</th>
<th>ASD</th>
<th>No ASD</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PDDST-II Stage Two</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Test</td>
<td>35</td>
<td>9</td>
<td>44</td>
</tr>
<tr>
<td>Negative Test</td>
<td>3</td>
<td>33</td>
<td>36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>38</td>
<td>42</td>
<td>80</td>
</tr>
</tbody>
</table>

Sensitivity and Specificity of Screening Instruments
The sensitivity and specificity of the three screening instruments were analyzed in order to determine the accuracy of the instruments. The sensitivity of an instrument indicates the probability that a person who has a condition will test positive for the condition. It is a true positive. The specificity of an instrument indicates the probability that someone who does not have a condition will test negative for the condition. It is a true negative (Siegel, 2004). Data were analyzed to answer the following research questions:

1. Is the PDDST-II Stage One a better predictor of children at-risk for ASD than the Modified Checklist for Autism in Toddlers?
2. Does the PDDST-II Stage Two accurately predict whether a child will meet the criteria for ASD?

The sensitivity and specificity of all three instruments are shown in Table 7. The results of the data analysis indicate the MCHAT had a sensitivity of .89 and a specificity of .62, the PDDST-II Stage One had a sensitivity of .92 and a specificity of .48, and the PDDST-II Stage Two had a sensitivity of .92 and a specificity of .79.

Table 7
### Sensitivity and Specificity of Screening Instruments

<table>
<thead>
<tr>
<th>Screening Instrument</th>
<th>Sensitivity</th>
<th>Specificity</th>
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</thead>
<tbody>
<tr>
<td>MCHAT</td>
<td>.89</td>
<td>.62</td>
</tr>
<tr>
<td>PDDST-II Stage One</td>
<td>.92</td>
<td>.48</td>
</tr>
<tr>
<td>PDDST-II Stage Two</td>
<td>.92</td>
<td>.79</td>
</tr>
</tbody>
</table>

### False Positive Rates of Screening Instruments

The number of false positives identified during the administration of the MCHAT, PDDST-II Stage One, and the PDDST-II Stage Two were calculated in order to answer the following research question:

3. Does the PDDST-II Stage Two accurately decrease the number of children identified by a level one screener who requires a full assessment?

In addition, the false positive rates of the three instruments were calculated. There were 16 false positives identified by the MCHAT (false positive rate = .32), 22 false positives identified by the PDDST-II Stage One (false positive rate = .39) and 9 false positives identified by the PDDST-II Stage Two (false positive rate = .20). Results indicated the PDDST-II Stage Two had a lower false positive rate than both the MCHAT and the PDDST-II Stage One.

### Summary
The purpose of this study was to provide an independent evaluation of the PDDST-II and determine whether the PDDST-II or MCHAT is a better predictor of autism, based on an ADOS diagnosis, in young children. The analysis of the data indicated the PDDST-II had a slightly higher sensitivity than the MCHAT. Further, the PDDST-II Stage Two had significantly higher specificity than the PDDST-II Stage One. Concomitantly, the PDDST-II Stage One had the lowest specificity of the three screeners. Additionally, the PDDST-II Stage Two had a lower false positive rate than the PDDST-II Stage One. These results and implications for an autism or ASD diagnosis in young children are discussed in Chapter 5.
DISCUSSION

Autism spectrum disorders (ASD) is comprised of three separate disorders that include autism, Asperger’s syndrome, and pervasive developmental disorder – Not otherwise specified (PDD-NOS; APA, 2000; Lord & Bailey, 2002). Children with ASD demonstrate deficits in the areas of social skills, speech and communication, and stereotypical behaviors (APA, 2000). Children with ASD can develop behavioral patterns of aggression and self-injurious behaviors that can worsen as a child matures (Gray & Holden, 1992). Additionally, having a child with ASD can significantly impact the cohesiveness and relationships of the family unit (Higgins et al., 2005).

Early intervention is critical for children with ASD and their families. Research literature has shown that early intervention can mitigate the stress of having a child with ASD (Lecavalier et al., 2006; Lee et al., 2007). Additionally, the research has shown that children with ASD who receive early intervention in the areas of social skills, play skills, and communication before the age of five have a better prognosis (Lord, 1995). Unfortunately, many children with ASD are not provided early intervention services due to a delay in diagnosis. This delay in diagnosis can be contributed to the lack of certain behavioral markers before the age of three (Nadel & Poss, 2007). However, in the last decade, several screening instruments have been developed to screen children as young as twelve months. These screening instruments focus on symptoms that may be observable by twelve and eighteen months of age (Dumont-Mathieu & Fein, 2005).

This purpose of this study was to examine three screening instruments, MCHAT, PDDST-II Stage One and PDDST-II Stage Two, commonly used by pediatricians and early education professionals to determine if one instrument was a stronger predictor of
ASD in young children. Historically, minimal research was conducted to validate the predictability of these instruments. The majority of the research conducted on these instruments focused on the development and initial validation (Dumont-Mathieu & Fein, 2005). To date, research had not compared these instruments to determine which tool was a better predictor of ASD in young children. This study was a preliminary comparison of three screening instruments, the MCHAT, the PDDST-II Stage One, and the PDDST-II Stage Two. The research questions for this study were:

1. Is the PDDST-II Stage One a better predictor of children at-risk for ASD than the MCHAT?
2. Does the PDDST-II Stage Two accurately predict whether a child will meet the criteria for ASD?
3. Does the PDDST-II Stage Two accurately decrease the number of children identified by a level one screener who requires a full assessment?

**Comparison between MCHAT and PDDST-II Stage One**

To answer the first research question in this study, the MCHAT or the PDDST-II Stage One were compared to determine if one was a better predictor of ASD in young children under the age of three. Siegel (2004) indicated that the purpose of the PDDST-II was to serve as an initial screener to identify children that require further assessment. The PDDST-II Stage One is intended to be a level one screener (Siegel, 2004). The authors of the MCHAT indicate that MCHAT was an effective instrument as a level one or level two screener (Robins et al, 2001). This study compared these screeners with the same population of children to determine if one screener was a better predictor of ASD.
In order to compare the screening instruments, the sensitivity and specificity was calculated for both instruments. Based on the results of this study, the sensitivity and specificity of the MCHAT were calculated as .89 and .62 respectively. During the initial study completed by Robins et al. (2001), a calculation of absolute sensitivity and specificity could not be calculated until there was a follow-up on the initial sample. However, a discriminant functional analysis provided a tentative sensitivity of .87 and a specificity of .98 (Robins et al., 2001). The results of this study indicated a similar sensitivity calculation to that of the original study on the instrument indicating that the instrument was able to accurately identify children who have ASD with few misses; few children who have the diagnosis of ASD will test negative when screened using the MCHAT.

However, the specificity results of this study were inconsistent from those found in the original study. The specificity in this study was calculated at .62 compared to a specificity of .98 that was found by Robins et al. (2001). The lower specificity indicates the screening instrument did not always accurately identify children who do not have ASD; that is, children test positive on the screening instrument when in fact they do not have ASD. There are several probable reasons for the discrepancies between specificity calculations of the two studies. First, the original study sample was obtained from both the general pediatric population and those referred for early intervention, whereas the population for this study was selected from those referred for early intervention and children already receiving services from early intervention programs. The children in this study were suspected of having a developmental delay or assessed to have a developmentally delay. This may indicate that the MCHAT assesses symptoms that are
similar in children with ASD and other developmental disabilities such as children with a communication or social emotional delay. Further, during the original study, a follow-up with the largest portion of the sample was not completed. Only children who were found at risk for ASD on the screener received any follow-up. Since not all of the children in the sample received a follow-up assessment, this may be a plausible explanation for the difference in specificity. This was a noted limitation in the study (Robins et al., 2001).

Based on the results of the current study, the sensitivity and specificity of the PDDST-II Stage One were calculated as .92 and .48 respectively. During the initial study conducted by Siegel (2004) sensitivity was calculated as .92 and specificity was calculated .91. Similar to the MCHAT, the sensitivity of the PDDST-II in this study was calculated to be the same as found by Siegel. However, there was a similar discrepancy found in the specificity of the instrument. This study calculated significantly lower levels of specificity than were found in the original study, indicating that the PDDST-II Stage One can lead to a significant number of false positives. One reason for this discrepancy is that the author of the instrument indicated that this screener should be used as a level one screener with the general pediatric population. During this study, the PDDST-II Stage One was used with a level two population, those suspected as having a developmental delay that may share similar symptoms to a child that has an ASD. Therefore, it is likely that this tool may be better suited for discriminating between children with no delays and those who have ASD rather than discriminating between children with developmental delays and those with ASD.

It was hypothesized prior to this study that the PDDST-II Stage One would be a better predictor of ASD in young children than the MCHAT because the PDDST-II is a
developmental screener that is based on behavioral markers at different developmental periods. Based on the results of this study, both the MCHAT and the PDDST-II Stage One had adequate sensitivity and were able to accurately identify children that have ASD. At the same time, both screeners over identified children in this sample resulting in a significant number of false positives. The PDDST-II Stage One resulted in more false positives than the MCHAT. Due to the number of false positives identified by both screening instruments, it can be implied that these screening instruments would sufficiently serve the purpose of level one screening instruments and additional instruments would need to be used to reduce the number of false positives. Further research should compare the use of these screening instruments with the general pediatric population to confirm this theory and ascertain adequate levels of sensitivity and specificity with the general pediatric population.

**Pervasive Developmental Disorders Screening Test-II Stage Two**

The second research question focused on whether the PDDST-II Stage Two was an accurate predictor of whether a child would meet the diagnostic criteria for ASD. Siegel (2004) found that the sensitivity and specificity of the PDDST-II Stage Two were .73 and .49 respectively. Siegel further indicated that while sensitivity and specificity were lower for this stage of the instrument, that the instrument could be an effective level two screening instrument for identifying children with ASD. Siegel hypothesized that lower levels of sensitivity and specificity were obtained because several developmental disorders share common features with ASD.

In this study, the PDDST-II was given to a sample of children comprised of those who were suspected of having a developmental delay, or those who had already been
assessed as having a developmental delay (level two population). The sensitivity and specificity of the PDDST-II Stage Two were .92 and .79 respectively, based on the results of this study. The data indicated higher levels of sensitivity and specificity for this stage of the screener than were originally found by the author of the instrument. One possible reason for this discrepancy was that characteristics of the study populations varied. Siegel (2004) divided the original sample into comparison groups. The ASD group scores were then compared with those referred for an ASD screening. In this study all children suspected of or having a developmental delay were screened for ASD. It is possible that the original ASD group and group referred for ASD screening may have shared more common symptoms as compared to those in this study.

The PDDST-II Stage Two had the highest levels of sensitivity and specificity of the three instruments for this sample. Thus it can be concluded that the PDDST-II Stage Two is a more accurate predictor of ASD within the early intervention population than the PDDST-II Stage One and MCHAT. It is suggested that further research be conducted in order to replicate and confirm these results. If these results can be replicated, the PDDST-II Stage Two could then be used as the initial screener within the early intervention population rather than using the MCHAT or PDDST-II Stage One as the initial screener and using the PDDST-II as a follow-up screener as suggested by the Siegel (2004). Thus, cutting down on the assessment time and simplifying the process for the early intervention population and their families.
PDDST-II Stage Two as a Level 2 Screener

Siegel (2004) asserted that PDDST-II Stage Two could potentially reduce by half, the number of children who tested positive on the PDDST-II Stage One screener, reducing the number of false positives. The focus of the third research question in this study: Does the PDDST-II Stage Two accurately decrease the number of children, identified by a level one screener, who requires a full assessment?, evaluated the validity of this assertion. A secondary focus of this research question was to examine whether the PDDST-II could reduce the number of children who tested positive on the MCHAT. If this result was positive, a multi-level screening process could potentially reduce the number of children who required costly and lengthy testing without eliminating children that do have the condition (false negatives).

In this study, it was predicted that the PDDST-II Stage Two would decrease the number of false positives identified by the PDDST-II Stage One and the MCHAT. Results of the data analysis in this study collected confirm this hypothesis. There were 16 false positives identified with the MCHAT and 22 false positives identified using the PDDST-II Stage One, while there were only 9 false positives identified using the PDDST-II Stage Two. However, based on the data collected by Siegel, it was expected that PDDST-II Stage Two might have more false negatives compared to the PDDST-II Stage One. The data from this study did support those previous results. Both the PDDST-II Stage One and Stage Two identified the same number of false negatives (n=3) and the MCHAT identified four false negatives, only one more than the PDDST-II.

A possible explanation for this discrepancy is that the original study by Siegel used different sample populations when calculating the sensitivity and specificity of the
two stages. In this study, the same sample population was used for both PDDST-II stages and the MCHAT. While there may be benefits of using a multi-level screening process with the general pediatric population, these results were not replicated with the early intervention population. This study found the PDDST-II Stage Two screener could be used as the initial and only screener within this population with accurate testing results.

Limitations

There are several limitations to this study. The first limitation was sample size. The previous studies conducted on the MCHAT (Robins et al., 2001) and on the PDDST-II (Siegel, 2004), had sample sizes that exceeded six hundred children and included large groups of children from the general pediatric population. The sample population for this study was limited to 80. In addition, this sample population was focused on those who were referred for early intervention services or those who were already receiving early intervention services. It is possible, even probable that sensitivity and specificity calculations would be different if the sample included larger numbers or children from the general pediatric population. Additionally, all the participants in the sample were from the same large southwest city and participated in the same early intervention program. This sample may not be representative of the entire country. Despite the location specific sample size used in this study, these results still contribute to the body of literature. This study serves as a preliminary comparison of the accuracy of the three screening instruments, which has not been previously conducted.

A second limitation of this study is that the PDDST-II Stage One and the MCHAT were primarily intended to be level one screening instruments. The intent of these instruments was to screen the general pediatric community for ASD. Participants
were children who had been referred for an evaluation by an early intervention agency or
those receiving services from an early intervention agency. Due to this limitation,
conclusions about the validity of the MCHAT and the PDDST-II Stage One as a level
one screener cannot be made. However, the level of agreement between the MCHAT,
the PDDST-II Stage One, and the PDDST-II Stage Two within this population provides
invaluable information regarding effective screening instruments for children enrolled in
early intervention programs.

A third limitation of this study was the method in which the parents completed the
survey. Parents of the children who were being screened were handed the screeners and
allowed to complete the screeners independently. The purpose was to assess the validity
of the instruments based solely on parent as was directed by each screener’s protocol.
The parents’ understandability of the questions was not assessed during this study.
However, informally many parents indicated confusion regarding one or more of the
questions on both the MCHAT and PDDST-II screening instruments. Further research
should investigate the social validity of these instruments and whether instrument validity
is affected by the delivery of the questions.

**Recommendations for Further Study**

Effective screening instruments are critical for early identification and diagnosis
of ASD in young children. However, there has been limited research on the validity of
these instruments. The majority of the research completed on these instruments has been
by the author of the instrument during their development. In addition, research studies
have not examined whether one instrument is a better predictor of ASD in young
children. To date, there had not been any research comparing the ASD screeners with the same sample population.

The purpose of this study was to compare the validity of three common screening instruments that are utilized to screen children under the age of three for ASD. Based on the results of this study there are several recommendations for further research. First, it is recommended that the results of this study be replicated with a larger sample size. While this research study indicated significant results regarding the validity of the instruments measured, the sample size in this study was smaller than the sample typically used to measure the sensitivity and specificity of instruments.

Second it is recommended that this study be replicated with the general pediatric population to determine if the same level of specificity and sensitivity can be validated with this population. The result of this study indicated that the PDDST-II Stage Two was the best predictor of ASD in young children. However, this sample included children diagnosed with a developmental disability and this could impact the overall validity of the instrument. The original purpose of the MCHAT and the PDDST-II Stage One was for the screeners to be used with the general pediatric population. Further research should examine whether the MCHAT and PDDST-II Stage One are better predictors of ASD with the pediatric population or whether the PDDST-II Stage Two can be used as the initial screener with the same results that was concluded by this study.

A third topic of research that should be considered is the social validity of the screening instruments from parent’s perspective. Specifically, whether any screening instrument is “parent friendly” in terms of the readability and understandability of questions and language used throughout the screener. Additionally, the delivery method
of the screeners should be researched. Does the instrument have better validity if the parents complete the screener independently or if it is completed with a service provider? If a service provider completed the questions with the family, would the service provider’s explanation of the question bias the parent’s answer?

Another avenue of research that should be completed is related to the impact of the new diagnostic criteria for ASD that is going to be released in the fifth addition of the Diagnostic and Statistical Manual (DSM-V) in 2013. According to the APA (2012), the new diagnostic manual will eliminate the categories of PDD-NOS and Asperger’s syndrome. All pervasive developmental disorders will fall under an umbrella category of autism spectrum disorder with levels of severity assigned based on deficits in communication, social interaction, and repetitive and stereotyped behaviors. According to the Autism Research Institute (ARI, 2012), these changes to the diagnostic criteria could have a significant impact on the ASD diagnosis. Many children who previously received a diagnosis of PDD-NOS or Asperger’s may no longer qualify for a diagnosis of ASD under the new criteria. The new criteria are expected to be more strict and thorough when compared to the existing criteria (ARI, 2012). Specifically, children who previously received a diagnosis of PDD-NOS due to not meeting all the criteria for a diagnosis of autism may not meet the criteria for a diagnosis of ASD at all. The changes to the diagnostic criteria could significantly impact the validity of these screening instruments. Future research should compare the results of these screening instruments to the new DSM-V criteria for ASD to ensure that these tools can still be used to accurately predict which children will qualify for a diagnosis of ASD.
Summary

Several conclusions can be drawn from the data analyzed in this study. Overall, the PDDST-II Stage Two was the best predictor of ASD in young children who were enrolled in an early intervention program. The PDDST-II Stage Two had the highest levels of sensitivity (.92) and specificity (.79) when compared to the other instruments in this study. While the results are promising and this tool should be considered as an effective screening tool, these results should be viewed cautiously for several reasons. The first reason is that these results are significantly different than the sensitivity and specificity results found by Siegel (2004) during the development of the tool. The second reason is the size of the sample was significantly smaller than the sample used to standardize the screening instrument.

Another conclusion based on the results of this study is that the MCHAT and PDDST-II Stage One both had adequate sensitivity statistics meaning the instruments were able to appropriately predict children who have an ASD. However, both of these instruments also had lower specificity statistics compared to that of the PDDST-II Stage Two. Both of these instruments lead to many false positives within the sample. This was an expected result due to these instruments being considered level one screening instruments intended to screen the general pediatric population. Since the sample for this study was composed of children from early intervention programs, the adequacy of these screening instruments as level one screeners could not be assessed. The lower specificity of these instruments with the early intervention population may be considered a fair trade-off for having high sensitivity levels within the general pediatric population since
the high number of false positives would ensure that the screening instruments would miss few children who actually have ASD.

The third conclusion resulting from the data collected in this study was the validation that the PDDST-II Stage Two can be used as a second level screener as suggested by Siegel (2004). The PDDST-II Stage Two reduced the number of false positives identified by the PDDST-II Stage One and MCHAT by thirteen and seven respectively. This could have significant practical implications. If the PDDST-II Stage Two is used by developmental specialists and early childhood educators to further screen children who were identified as possibly having ASD by one of the level one screening instruments, this could reduce the number of children who require lengthy and expensive assessments such as the ADOS. Additionally, the results of this study supported the use of the PDDST-II Stage Two as an initial screener with the early intervention and developmentally delayed population. The PDDST-II Stage Two had higher levels of specificity and higher or equal to levels of sensitivity when compared to the PDDST-II Stage One and the MCHAT. Since the PDDST-II Stage Two screener did not lead to more false negatives than the other two instruments, it was more effective at screening this sample. The PDDST-II Stage Two could further reduce the number of screening instruments needed to screen this population. Further research should investigate the accuracy of the PDDST-II Stage Two as an initial screening instrument with both the general pediatric population and those who have been identified as having a developmental delay.

This research is significant to the current body of literature on early identification of ASD in young children because it provides the first comparison of screening
instruments with the same sample of children. It also provides an independent evaluation of the PDDST-II and explores whether a multi-level screening process is effective for screening young children for ASD. Further research should be conducted to replicate the results of this study.
APPENDIX A

INFORMED CONSENT
INFORMED CONSENT

Department of Educational and Clinical Studies

TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

INVESTIGATOR(S): Vanessa Fessenden and Nancy Silve

CONTACT PHONE NUMBER: 702-895-4851

Purpose of the Study
You are invited to participate in a research study. The purpose of this study is to evaluate the accuracy of a parent report screening instrument in identifying children at-risk for Autism Spectrum Disorders. A doctoral student and faculty member at the University of Nevada Las Vegas are conducting this study. Integrated Support Solutions (ISS) is not conducting this study. However, personnel from ISS, such as Intake Coordinators and Developmental Specialists are recruiting families and gathering consent forms for the study.

Participants
You are being asked to participate in the study because you are a parent of a child under the age of three who is participating in an early intervention program.

Procedures
If you volunteer to participate in this study, you will be asked to do the following: (a) complete two parent report screening instruments (M-CHAT & PDDST-II Stage 1) that are intended to assess whether a child is at-risk for Autism Spectrum Disorders, (b) bring your child to a follow-up appointment where a standardized assessment will be completed, (c) complete a third screening instrument (PDDST-II Stage 2) during a follow-up appointment, (d) participate in the administration of a play-based standardized assessment intended to assess whether a child meets the diagnostic criteria for Autism Spectrum Disorders, and (e) be videotaped during the standardized assessment.

Benefits of Participation
There may not be direct benefits to you as a participant in this study. However, you will complete assessments/evaluations that can lead to additional early intervention services. Early intervention services can lead to remediation of developmental delays and lessen the likelihood that a child will need additional special education services when he or she reaches school age.

Participant Initials ________

Approved by the UNLV IRB. Protocol #1110-3930
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012
TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

Risks of Participation

There are risks involved in all research studies. This study may include only minimal risks. This study may include only minimal risks including minimal discomfort and/or stress in response to the observation, being videotaped, and/or answering questions asked on the screening instruments.

Cost/Compensation

There will be no financial cost to you to participate in this study. The study will take between 1-3 hours of your time. You will not be compensated for your time.

Contact Information

If you have any questions or concerns about the study, you may contact Nancy Mileo or Vanessa Fessenden at 702-895-4851. For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the UNLV Office of Research Integrity – Human Subjects at 702-895-2794 or toll free at 877-895-2794 or via email at IRB@unlv.edu.

Voluntary Participation

Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

The assessments and evaluations your child receives from ISS, will not be negatively impacted if you choose not to participate, in this study as ISS is not conducting the study. Regardless of whether your child participates in this study or not, if your child is found to have Autism Spectrum Disorder any other developmental delay, you child will receive the appropriate services based on the diagnosis.

Confidentiality

All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for at least three years after completion of the study. After the storage time the information gathered will be destroyed and deleted.

Participant initials ___

Approved by the UNLV IRB. Protocol #1110-3530
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012

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TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

Parent / Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Participant ___________________________ Date ____________

Participant Name (Please Print) ___________________________

Participant Initials ______

Approved by the UNLV IRB. Protocol #1110-3930
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012
TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

INVESTIGATOR(S): Vanessa Fessenden and Nancy Sileo

CONTACT PHONE NUMBER: 702-895-4851

Purpose of the Study
You are invited to participate in a research study. The purpose of this study is to evaluate the accuracy of a parent report screening instrument in identifying children at-risk for Autism Spectrum Disorders. A doctoral student and faculty member at the University of Nevada Las Vegas are conducting this study. Integrated Support Solutions (ISS) is not conducting this study. However, personnel from ISS, such as Intake Coordinators and Developmental Specialists are recruiting families and gathering consent forms for the study.

Participants
Your child is being asked to participate in the study because he or is under the age of three and participating in an early intervention program.

Procedures
If you allow your child to volunteer to participate in this study, your child will be asked to do the following: be videotaped and observed during a play-based standardized assessment intended to assess whether a child meets the diagnostic criteria for Autism Spectrum Disorders. The purpose of the videotaping procedure is ensure the reliability and validity of the administration and scoring of the Autism Diagnostic Observation Scale (ADOS). These videotapes will be kept in a secure location at UNLV and will be destroyed after a period of no less than five years.

Benefits of Participation
There may not be direct benefits to your child as a participant in this study. However, your child will complete assessments/evaluations that can lead to additional early intervention services. Early intervention services can lead to remediation of developmental delays and lessen the likelihood that a child will need additional special education services when he or she reaches school age.

Risks of Participation
There are risks involved in all research studies. This study may include only minimal risks. This study may include only minimal risks including minimal discomfort and/or stress in response to the observation, being videotaped, and/or the play based standardized assessment.

Participant Initials ______

Approved by the UNLV IRB. Protocol #1110-3930
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012
TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

Cost /Compensation
There will not be financial cost to you to participate in this study. The study will take 1-2 hours of your child’s time. Your child will/will not be compensated for their time.

Contact Information
If you or your child have any questions or concerns about the study, you may contact Nancy Sileo or Vanessa Fessenden at 702-895-4851. For questions regarding the rights of research subjects, any complaints or comments regarding the manner in which the study is being conducted you may contact the UNLV Office of Research Integrity – Human Subjects at 702-895-2794, toll free at 877-895-2794, or via email at IRB@unlv.edu.

Voluntary Participation
Your child’s participation in this study is voluntary. Your child may refuse to participate in this study or any part of this study. Your child may withdraw at any time without prejudice to your relations with the university. You or your child is encouraged to ask questions about this study at the beginning or any time during the research study.

The assessments and evaluations your child receives from ISS, will not be negatively impacted if you choose not to participate, in this study as ISS is not conducting the study. Regardless of whether your child participates in this study or not, if your child is found to have Autism Spectrum Disorder any other developmental delay, you child will receive the appropriate services based on the diagnosis.

Confidentiality
All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link your child to this study. All records will be stored in a locked facility at UNLV for three years after completion of the study. After the storage time the information gathered will be destroyed/deleted.

Participant Initials ______

Approved by the UNLV IRB. Protocol #1110-3910
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012

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TITLE OF STUDY: Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers.

Parent / Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Parent ____________________________
Child’s Name (Please print) _______________________

Parent Name (Please Print) _______________________
Date _______________________

Parent / Participant Consent for Videotaping:
I have read the above information and agree to give my consent for my child to be videotaped as part of this study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Parent ____________________________
Child’s Name (Please print) _______________________

Parent Name (Please Print) _______________________
Date _______________________

Participant Initials _______________________

Approved by the UNLV IRB, Protocol #1110-3930
Received: 10-17-11 Approved: 11-14-11 Expiration: 11-13-2012
APPENDIX C

ADOS ADMINISTRATION SCRIPT
ADOS ADMINISTRATION SCRIPT

Activity #1 - Free Play

Set-up: Toys on Table - pop up toy, board book, toy telephone, four pieces of yarn, and textured block

Toys on Floor - Jack-in-box, dump truck, baby doll, letter blocks, medium-size ball, two identical cars, two pairs of small identical balls, two pairs of small utensils, four small plates.

Instructions:

• Allow child to explore room without interference from adults.

• If the child has been playing comfortably during warm up period allow him to continue for 3 minutes, and then ask the parent to initiate play with the child.

• If the child is crying and clinging or aimless and unable to look at toys after 2 minutes, ask the parent, "Can you see if you can get him interested in some of these toys?"

• If the child is not playing comfortably, remove the materials and proceed with other activities. Later during assessment return to free play. Let child know there is a break in activities and say "time to look at new toys". If child still does not play independently with toys, show him a toy. After playing comfortably for several minutes lead him to a table.

Activity #2 - Response to Name (Can be completed during Free Play)
Set-up: Use any of the toys from this module

Instructions:

• With toys out from free play say “it’s time to play now."

• When he/she is involved with a toy, make sure you are positioned so he has to turn his head to look at you. From a distance of 3 to 5 feet, call the child's name once or twice and pause.

• If he does not respond by looking at you, try 4 more attempts.

• If he still does not respond, have the parent call child's name in an attempt to get his attention without physical contact.

• If the child still does not respond, encourage the parent to use any method to get a response including touching the child

Activity #3 - Response to Joint Attention (Can be completed during free play)
Set-up: Bunny on table, Car on floor

Instructions:

Give the child a book or quiet toy to play with, child should be facing the front of the room. Have caregiver sit slightly behind and away from the child. Place the remote control toy 65 degrees to the right of the child and 4 to 5 feet away. You should stand left of the child. Call the child's name and/or touch him to get his attention. Say "Look Christian" Look towards the toy and back to the child. If he looks, skip to activation part.

If he does not orient to the toy say "Look Christian, look at that!" (Look at toy, but do not say the name of it) -- try for 5 attempts. If he does not orient to it, point to the toy making sure your hand is in his visual (you can touch his arm or leg) and say "Christian, look at that"

If he does not look at you or the toy, use the switch to activate the toy from your position. Watch to see if the child orients toward the toy, points or reaches, looks toward the parent/caregiver or toward the examiner or vocalizes. Turn the toy off and pause for 5 seconds. Watch to see if the child requests the toy or resumption of its movements by reaching, looking, and or vocalizing.

If there is no response place the toy in front of the child and observe whether he hands the toy to request activation. If there is still no response, turn it on for 5 seconds, then turn it off and wait for the child's next action.

Activity #4: Bubble Play

Set-up: Bubble gun and bubble liquid
Instructions:

• After putting away the remote toy, have child stay close to table or floor with a book or quiet toy. Get bubble gun and move to a spot 5 feet in front of the child and slightly to one side. (Tell parent you want to see if the child with notice the bubbles without having them pointed out to him.)

• Watch to see if the child notices them. Continue blowing bubbles for at least 5 seconds after the child sees them so that he does not need to request more (Note whether the child vocalizes, gestures, and or looks at the examiner's face or turns to parent or caregiver. For full credit the child must act while the bubbles are present. Partial credit is given for turning to the parent/caregiver (not the examiner), if the child acts immediately after the bubbles disappear. Note initiation of joint attention according to the child's reaction within the first 5 seconds of noticing the bubbles.)

• Give the child an opportunity to request more bubbles. Wait for him to initiate a request either physically or vocally.

• If he does not do so, put the bubble gun in an accessible location to allow him to hand it to you as a request or give him the bubble gun, but keep bubble fluid so he needs to request access to it from you. If necessary show the child how it works.

Activity #5: Anticipation of a Routine with Objects

Set-up: A Balloon or a cause-and-effect toy

Balloon Instructions:
If the child seems afraid of the balloon, it may be helpful to have him sit in parents lap while you carry out the routine at the other end of the room making sure the balloon does not fly near him. Blow up a large balloon slowly, exaggerating your behavior as you do so. Pinch the neck of the balloon so that you won't deflate it and hold it directly in front of the child, letting him touch it. Alerting him before you do so "Ready, set, go!" and let go of it so that air will fly out of it and then retrieve the balloon.

Blow it up again and hold it over your head so when you let go of it, it will fly around the room. After the balloon lands, wait for the child to bring it to you to indicate he wants it blown up again. If the child loses interest, get the deflated balloon, show it to him/her, and repeat the procedure in deliberate steps, as follows, pausing after each step to see what he or she will do (1) Hold the balloon in front of your mouth. (2) Say "ready, set, go!", (3) Put the balloon to your mouth, (4) Blow up the balloon, (5) hold it above your head, and (6) release the balloon.

Repeat this procedure two more times, waiting each time for the child to initiate the routine with the balloon.

Activity #6: Responsive Social Smile (May take place anytime during the session)

Set-up: Any materials from the module

Instructions:
• After getting the child's attention by calling his name or using a toy or noise, try to elicit a smile by smiling and making a positive statement (e.g., “Look at that tummy!” Or "Who likes bubbles?") or by making a silly face or funny noise, any visual or vocal means - no touching the child.

• If he does not respond, say to the parent or caregiver, can you show me how you can get him to smile without touching him?

• If this is unsuccessful, encourage the parent to touch the child in order to elicit a smile. In order for this to be coded, the examiner must initiate when the child is not already smiling, there must be a clear change in facial expression, and must smile, not laughter.

Activity # 7: Anticipation of a Social Routine

Set-up: Baby blanket

Instructions:

Select either Peekaboo, tickling game, or swinging. If child does not respond to the one
selected try at least one other. If does not respond to examiner; have the caregiver do one of the routines. If still does not respond have the caregiver demonstrate a social routine to which the child responds.

Peekaboo: Have the child either sitting on the floor, in the parent’s lap, or at the table. Hold the blanket between your face and the child about a foot away. Repeat once, and then hesitate to see if the child pulls it down. If he/she pulls it down, repeat the routine, then stop and see if the child puts the blanket on your face or her face, or looks at you in a way that suggests that he/she is waiting for you to do it again. If not try the sequence once more.

Tickling: From about 2 feet away hold your hands up in front of the child and move to them in a tickling motion saying "here comes the tickling bug." Tickle from leg to stomach, repeat and hold your hands on child's leg without saying anything. Pause to see if child looks at hands. Wait for the child to vocalize, touch or move your hands, and put his hands or body in a ready position. Once more carry out the routine and pause. If the child does not respond, ask parent to do same thing.

Swinging: Approach the child with arms reaching out and jump him up and down a few times, counting 1, 2, 3 out loud and then swinging him around when you say 3. Put the child down and approach him again and repeat the routine. After the second time approach him with arms extended and wait for him to show anticipation or pull arms down.

Activity #8: Functional and symbolic imagination

Set-up: Toy car, toy frog that squeaks, toy cup, toy airplane, toy flower, cylindrical block

Instructions:

Instruction: Seat the child at the table or lap of the caregivers. Ask caregivers to not give instructions. Materials should be accessible to examiner but not visible to the child. Use
the frog or car as example. Put car on table; say "Look at the car." Move the car across
the table saying VrooomVrooom. Give the car to the child and say “you do it”. If the
child imitates this action, clap and cheer. Remove the car and begin the actual trials using
the other objects. If child does not imitate, physically help him to do so. Then take the car
back and repeat. A total of three attempts may be used to teach imitation (physical
assistance offered only once).

If child does not learn to imitate the action, independently, discontinue this item and
proceed to other task.

Trials: For additional items, Pick it up and say "its a __ " and demonstrate an appropriate
action and sound effect for that object. After demonstrating, give to child and say "you do
it."

Placeholder Trials: For the trials with a cylindrical block, use it to represent another
object. Say "now this is a cup" and then demonstrate the same actions you used with cup.
Next use a block to demonstrate a different action not used earlier. If the child does not
demonstrate any of these actions go back to using a real object to regain his interest and
proceed through the same sequence. Once the child imitates using the placeholder the
task is complete.

If he does not imitate with any of the real objects, discontinue the activity.

Activity #9: Birthday Party

Set-up: Baby doll, plate, fork, knife, cup, napkin, play-dough, four candles, blanket.

Instructions:

With child at table or in lap, put the doll on the table or in second chair and say: "Look,
here's the baby." Provide an opportunity for the child to speak, touch, or hug doll if he
wants too. With animation say "It's the baby's birthday!! Lets have a Birthday Party for
the Baby!"

Make a cake out of playdough and pat it "Here is the birthday cake" Give the child a chance to pat it if appropriate.

Put one candle in the cake and say: "here are the candles" and give the second candle to the child and leave the third and fourth on the table in easy reach. If he does not do so independently, help him add the other candles to the cake. Pretend to light the candles with a match and shake out the match saying "HOT" and then say "what should we do now?"

If the child does not respond, say: "Let's sing Happy Birthday" and do so. At the end of the song, clap and cheer. If the child does not spontaneously blowout the candles or help the doll to do so, say Let's blowout the candles and follow these four steps

Say: "what's next?" and demonstrate blowing out candles; before each step pause and look at the child. When the candles are blown out, clap and cheer.

Then give the fork to the child and say the baby is hungry. If the child does not begin to feed the doll, say, “the baby wants some birthday cake" If the child begins to feed the baby make appropriate "yum" sounds. If the child does not feed the doll, demonstrate doing so saying "Lets feed the baby." Give the fork to the child. The cup should also be available in case the child wants to give the doll a drink. Suggest this and if child does not do it, pretend pour and give baby drink.

After placing the napkin on the table, accidently knock the cup over and say "oh no, I spilled the juice! What a mess! What should we do?" If the child does not respond, ask him, can you help clean up? If there is still no response, hand him the napkin. Then say "Ok, the party is over, now what will the baby do?"

Lay the doll down and put the blanket on the table within the child's reach without indicating it. If the child does not respond by putting the doll to bed, say "The baby is tired, time for the baby to sleep" Pause and then give the blanket to the child. If he does not respond, you should cover the doll with the blanket, and say "night night, baby." Give the doll to the child and allow him to put it to bed or give it a kiss.
Activity 10: Snack

Set-up: Small cup, water or juice in a clear container, paper plate, and two kinds of small cookies or crackers in clear containers with lids difficult to open.

Instructions:

• Child should be securely at the table and say "It's time for snack" and place a plate on the table in easy reach of the child.

• Put one of each type of cookie or cracker on the plate and say "we have cookies and crackers"
• After the child has eaten the food, hold up each food container in a different hand, well out of the child's reach and ask "what do you want?" Wait for response. Watch for the child to point, reach, offer his plate, make eye contact, and/or vocalize. If he makes no response, hold one container out and say "crackers" and hold other out and say "cookies". Finally hold both containers out and say "what do you want?"

• If he requests by any means give him one. If he is frustrated or can't indicate a choice, give him a container to see if he will request help in opening it by handing it to you. After he has had one cookie or cracker, start over by holding the containers up and saying "what do you want?" If necessary go through the steps. Continue the snack giving cookies or crackers until you think he has had enough.

• Give child a drink if he is thirsty, you may follow the same procedure to illicit a response for drink if not interested in food.
APPENDIX D

ADOS ADMINISTRATION PROCEDURAL FIDELITY CHECKLIST
<table>
<thead>
<tr>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity #1 – Free Play</td>
<td>Toys arranged correctly</td>
</tr>
<tr>
<td></td>
<td>Child allowed to explore toys for a minimum of three minutes</td>
</tr>
<tr>
<td>Activity #2 – Response to Name</td>
<td>Child is engaged in a quiet toy prior to calling name</td>
</tr>
<tr>
<td></td>
<td>Examiner called child’s name for four attempts if required (discontinued if child responded to any of the four attempts)</td>
</tr>
<tr>
<td></td>
<td>If child did not respond to name, examiner had parent call child’s name without physical contact</td>
</tr>
<tr>
<td></td>
<td>If the child does not respond to parent calling name, examiner had parent model how to get child’s attention including touching the child</td>
</tr>
<tr>
<td>Activity #3 – Response to Joint Attention</td>
<td>Child is engaged in a quiet toy prior to starting activity</td>
</tr>
<tr>
<td></td>
<td>Attempt to get child to orient to toy by gaze alone for five attempts if required (discontinued if orients at any point)</td>
</tr>
<tr>
<td></td>
<td>If child does not orient to toy, examiner trials with a point</td>
</tr>
<tr>
<td></td>
<td>If child does not orient to toy, examiner activates the toy</td>
</tr>
</tbody>
</table>
If child does not orient to toy, examiner places toy in front of child and waits for response

**Activity #4 – Bubble Play**

Child is engaged in a quiet toy prior to starting activity

Examiner is at least 5 feet away from child and blows bubbles without a verbal prompt to look

Examiner provided pauses and opportunity for child to request more bubbles.

If child does not request bubbles, examiner gave bubble gun to child and provided opportunity to request bubbles.

**Activity #5 – Anticipation of a Routine with Objects**

Examiner blows up balloon exaggerating behavior and says “Ready, set, go” before releasing balloon first time

Examiner blows up the balloon a second time and pauses and allows opportunity of anticipation of routine and verbal requesting.

Examiner waits for child to hand balloon back without prompt

If child does not initiate routine, examiner repeated the procedure at least two more attempts giving an opportunity for child to initiate routine by handing balloon or verbal request

**Activity #6 – Response to Social Smile**

Examiner attempts to elicit a smile by smiling and making a positive statement (no physical touching)

If child does not respond, examiner has parent demonstrate how to elicit a social smile (no
If child does not respond to parent, examiner has parent demonstrate how to elicit a social smile with physical touching

**Activity #7 – Anticipation of a Social Routine**

If child does not respond to one of the three activities (peek-a-boo, tickling, or swinging), examiner attempts at least one more activity

If the child does not respond to two of the activities, have parents demonstrate a social routine in which the child responds.

**Activity #8 – Functional and Symbolic Imagination**

Examiner provides instruction for imitation using the car

Examiner completes trials with additional items. If child is successful with any of the trials, examiner moves on to placeholder.

If child is not successful with real items activity is discontinued

Examiner completes trials with placeholder if child was successful with real items

**Activity #9 – Birthday Party**

Examiner introduces child to baby and to party – “It’s baby’s birthday, let’s have a party”

Examiner provides opportunity for child to participate in making a cake

Examiner completes candle lighting routine allowing child to participate “What do we do
now?”

| Examiner sings Happy Birthday and allows child an opportunity to blow out candles spontaneously. |
| If child does not blow out candles, examiner models the action. |
| Examiner gives child fork and says “baby is hungry” – does not provide direct instruction |
| If child does not respond, give direct instruction: “Baby wants some birthday cake” |
| If child does not respond, examiner models action of feeding the baby |
| Examiner gives child cup and says “baby is thirsty” – does not provide direct instruction |
| If child does not respond, give direct instruction: “baby wants a drink” |
| If child does not respond, examiner models giving baby a drink |
| After drink, examiner places napkin on table pretends to knock over drink, provides opportunity for child to pretend to clean up the drink – say “oh no I spilled the drink! What should I do?” |
| If child does not respond, examiner says “can you help clean up?” |
| If child does not respond, examiner hands the child a napkin. |
| Examiner wraps up party by saying “Ok party is over, now what will baby do?” (have blanket available) |
| If child does not respond by putting the baby to bed, examiner says “the baby is tired, time for the baby to sleep” and pauses to give child opportunity |
to cover the baby

If child does not respond, the examiner covers the baby and says “night night baby” and gives the child the baby and allows opportunity for child to put baby to bed.

**Activity #10 – Snack**

Child is at table

Examiner says “It’s time for snack”

One of each snack is on plate for child

After child has had a chance to eat the snacks, examiner offers choice of snack in hard to open containers.

If the child requests by any means the child should be given a snack.

If the child does not request, the examiner labeled the two choices and asks “what do you want?” (continues for at least two more attempts)

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<tbody>
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</tbody>
</table>

Total: _________ / _________________ (NA should not be included in the total)

Percentage of steps administered correctly: _______________
Letter of Authorization to Conduct Research at Facility

Office of Research Integrity – Human Subjects
University of Nevada Las Vegas
4505 Maryland Parkway Box 451047
Las Vegas, NV 89154-1047

Subject: Letter of Authorization to Conduct Research at Southwest Autism & Behavioral Solutions.

Dear Office of Research Integrity – Human Subjects:

This letter will serve as authorization for the University of Nevada, Las Vegas ("UNLV") researcher/research team, Nancy Sileo and Vanessa Fessenden to conduct the research project entitled Which is a Better Predictor of Autism in Toddlers? The Pervasive Developmental Disorders Screening Test II or the Modified Checklist for Autism in Toddlers at the offices of Southwest Autism & Behavioral Solutions.

The Facility acknowledges that it has reviewed the protocol presented by the researcher, as well as the associated risks to the Facility. The Facility accepts the protocol and the associated risks to the Facility, and authorizes the research project to proceed. The research project may be implemented at the Facility upon approval from the UNLV Institutional Review Board.

If we have any concerns or require additional information, we will contact the researcher and/or the UNLV Office of Research Integrity – Human Subjects.

Sincerely,

[Signature]
Facility's Authorized Signatory

[Printed Name and Title of Authorized Signatory]

Facility Authorization 7-2010
MODIFIED CHECKLIST FOR AUTISM IN TODDLERS
INSTRUCTIONS:

Please fill out the following about how your child usually is. Please try to answer every question. If the behavior is rare (e.g., you've seen it once or twice), please answer as if the child does not do it.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Does your child enjoy being swung, bounced on your knee, etc.?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Does your child take an interest in other children?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Does your child like climbing on things, such as up stairs?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Does your child enjoy playing peek-a-boo/hide-and-seek?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Does your child ever pretend, for example, to talk on the phone or take care of a doll or pretend other things?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Does your child ever use his or her index finger to point, to ask for something?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Does your child ever use his/her index finger to point, to indicate interest in something?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Can your child play properly with toys (e.g., cars or bricks) without just mouthing, fiddling or dropping them?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Does your child ever bring objects over to you (parent) to show you something?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Does your child look you in the eye for more than a second or two?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Does your child ever seem oversensitive to noise (e.g., plugging ears)?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Does your child smile in response to your face or your smile?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Does your child imitate you (e.g., you make a face – will your child imitate it)?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Does your child respond to his/her name when you call?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>If you point at a toy across the room, does your child look at it?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Does your child walk?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Does your child look at things you are looking at?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Does your child make unusual finger movements near his/her face?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Does your child try to attract your attention to his/her own activity?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Have you ever wondered if your child is deaf?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Does your child understand what people say?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Does your child sometimes stare at nothing or wander with no purpose?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Does your child look at your face to check your reaction when faced with something unfamiliar?</td>
<td>YES</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

Have you ever filled out this form for this child before? | YES | NO |
Direction: For each item listed check **Yes, Usually True** or **No, Usually Not True** to indicate the response that best describes the child's behavior. Try to recall your child's behavior during that age range. The age ranges are only guidelines. Check **Yes, Usually True** if you experienced this difficulty with your child at *any* age. Use your experience with other children, the child's siblings, or what you expected this child to be like as a basis for comparison when responding to the items.

<table>
<thead>
<tr>
<th>Yes, Usually True</th>
<th>No, Usually Not True</th>
</tr>
</thead>
</table>

### 12 to 18 Months

1. Did your baby not begin to show what he/she wanted, either by using words or pointing?

2. Did your baby either ignore toys most of the time, or play almost all of the time with one or two things?

3. Did your baby ever seem bored or uninterested in conversation going on around him/her?

4. Did you ever notice that your baby could be very alert to some sounds, but ignored other sounds that were just as loud?

5. Did anyone express concern that your baby might have a hearing loss?

6. Did your baby seem unusually interested in feeling different textures, such as bumpy carpets or silky things?

7. Did your baby stare at his/her fingers while turning them or use his/her fingers to stare at patterns of light?

8. Did you ever think that your baby's development was slow because he/she didn't want to do something, like walking, until he/she could do it just right?

9. Did your baby ever do one thing over and over for so long that you were surprised a baby that age could concentrate so well?
### PDDST-II Stage 1 - Primary Care Screener (PCS) continued

18 to 24 Months

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes, Usually True</th>
<th>No, Usually Not True</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Did your toddler usually enjoy tickling and chasing, but not pat-a-cake or peek-a-boo?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Did you think, at times, that your toddler didn’t care if you were there or not?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Did your toddler cry when you left, but not seem to notice much when you returned?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. When you were trying to get your toddler’s attention, did it sometimes seem that he/she avoided looking at you?</td>
<td></td>
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</tr>
<tr>
<td>14. Did your toddler seem uninterested in playing with dolls or stuffed animals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Did your toddler seem to actively avoid or dislike dolls or stuffed animals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Did your toddler have a hard time getting used to playing with new toys, even though he/she eventually enjoyed them when he/she got used to them?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Did your toddler seem uninterested in learning how to talk?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Did your toddler walk on his/her toes, especially when he/she was excited?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Did your toddler seem particularly fascinated by motion (flipping pages of books, sifting sand, spinning things, or watching water)?</td>
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<td></td>
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<tr>
<td>20. Did your toddler ever stop using words he/she once used?</td>
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<tr>
<td>21. Did your toddler ever go through a stage where he/she became less, rather than more, interested in toys?</td>
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<tr>
<td>22. Did your toddler ever stop using gestures he/she had mastered, like waving bye-bye, blowing a kiss, or shaking his/her head no?</td>
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</tbody>
</table>

**Total Raw Score (Total Yes)** [ ]

**Stage 1 Cut Score** [ ]
APPENDIX H

PDDST-II STAGE TWO
Directions: For each item listed check Yes, Usually True or No, Usually Not True to indicate the response that best describes the child’s behavior. Try to recall your child’s behavior during that age range. The age ranges are only guidelines. Check Yes, Usually True if you experienced this difficulty with your child at any age. Use your experience with other children, the child’s siblings, or what you expected this child to be like as a basis for comparison when responding to the items.

Birth to 6 Months

1. If you talked to your baby in baby talk, was it hard to get him/her to “talk” back to you (cooing, etc.)? Yes, Usually True No, Usually Not True

6 to 12 Months

2. Did you sometimes think your baby avoided looking at you or looked right through you during feeding? Yes, Usually True No, Usually Not True

12 to 18 Months

3. Did your baby not begin to show what he/she wanted, either by using words or pointing? Yes, Usually True No, Usually Not True

4. Did your baby ever seem bored or uninterested in conversation going on around him/her? Yes, Usually True No, Usually Not True

5. Did your baby seem unusually interested in feeling different textures, such as bumpy carpets or silky things? Yes, Usually True No, Usually Not True

6. Did your baby stare at his/her fingers while turning them or use his/her fingers to stare at patterns of light? Yes, Usually True No, Usually Not True

7. Did you ever think that your baby’s development was slow because he/she didn’t want to do something, like walking, until he/she could do it just right? Yes, Usually True No, Usually Not True

Continued on back
PDDST-II Stage 2: Developmental Clinic Screener (DCS) continued

<table>
<thead>
<tr>
<th>18 to 24 Months</th>
<th>Yes, Usually True</th>
<th>No, Usually Not True</th>
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<tbody>
<tr>
<td>8. Did your toddler usually enjoy tickling and chasing, but not pat-a-cake or peek-a-boo?</td>
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<td>9. Did you sometimes think that your toddler didn’t care if you were there or not?</td>
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<td>10. Did your toddler cry when you left, but not seem to notice much when you returned?</td>
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<td>11. Did your toddler have a hard time getting used to playing with new toys, even though he/she eventually enjoyed them when he/she got used to them?</td>
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<td>12. Did your toddler walk on his/her toes, especially when he/she was excited?</td>
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<tr>
<td>13. Did your toddler ever go through a stage where he/she became less, rather than more, interested in toys?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Did your toddler ever stop using gestures he/she had mastered, like waving bye-bye, blowing a kiss, or shaking his/her head no?</td>
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</tr>
</tbody>
</table>

**Total Raw Score (Total Yes)**

**Stage 2 Cut Score** 5

REFERENCES

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Vanessa Marie Fessenden

Curriculum Vitae

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Las Vegas, NV 89120
(702) 270-3219
vfessenden@southwestbehavior.com

EDUCATIONAL BACKGROUND

B.A. Pennsylvania State University, University Park, PA, 2001
Major: Psychology

M.Ed. Indiana University of Pennsylvania, Indiana, PA, 2002
Major: Educational Psychology

BCBA University of Nevada, Las Vegas, 2010.

Honors
Awarded a fellowship upon admittance to the School Psychology Program, Indiana University of Pennsylvania (2001)
Elected to Psi Chi, honorary organization for academic excellence in psychology (1999)

PROFESSIONAL EXPERIENCE

2009-Current Behavior Consultant -- Southwest Autism & Behavioral Solutions, Las Vegas, NV
☐ Provides consultation for autism and Behavior Disorders
☐ Develop and implement behavior plans

2008-2010 Itinerant Specialist – Low Incidence Department, Clark County School District
☐ Support classroom teachers in the autism Program.
☐ Provide trainings to CCSD employees on Applied Behavior Analysis, Discrete Trial Training, Functional Behavior Assessments, and Reinforcement.

2007-2008 Part-time Instructor, University of Nevada, Las Vegas
☐ Developed curriculum including lectures, power point slides, small group activities and assessments of student learning.
☐ Provided instruction to undergraduate and graduate students pursuing teacher licensure.

2007-2008 Classroom Teacher-Autism Program, Clark County School District, Las Vegas
☐ Develop daily lesson plans.
☐ Implement behavioral interventions to increase student learning.
☐ Assess learning through data collect, formal and informal assessments.
☐ Develop and implement individualized education plans.

2006-2007 Psychological Developmental Counselor, Nevada Early Intervention Services, Las Vegas
☐ Evaluate children with suspected developmental delays using standardized and curriculum based assessments to determine eligibility for services.
☐ Provide intervention to families and children in the home and community setting.
☐ Coordinate services for children and families with disabilities.
☐ Develop and implement Individualized Family Service Plans.
Serve on a specialized team working with children that have multiple disabilities.
Provide behavioral support for children with autism.
Attended to administrative duties.

2004-2006 Academic Advisor/Instructor, Art Institute of Las Vegas, Henderson, NV

- Advise students of curriculum and aid with the scheduling process.
- Provide interventions with students that are on probation and coordinate intervention plans with instructors to be implemented in the classroom.
- Develop remediation plans including working with students on study skills and time management skills.
- Aided in the coordination of services and schedules for students with disabilities.
- Taught multiple courses this included: Introduction to Psychology, Introduction to Statistics, and Research Writing.

2002-2004 Mobile Therapist/Behavioral Specialist Consultant/Outpatient Therapist, Family Psychological Consultants, Kittanning, PA

- Provided therapy to children/adolescents and families in both the home, school and outpatient settings.
- Worked with students with disabilities in kindergarten through twelfth grade and college freshman, including the development of IEP and 504 plans.
- Developed treatment and behavior modification plans to address client’s mental health, behavioral, and learning needs.
- Supervised the Therapeutic Staff Support for each child.
- Attended to administrative duties.

2001-2003 Graduate Assistant/Clinician
Indiana University of Pennsylvania

- Conducted educational and developmental assessments with children with learning and developmental disabilities.
- Wrote educational reports, including recommendations for the home and school
- Assisted with on-going research projects.

1999-2001 Research Assistant, Pennsylvania State University, University Park, PA

- Aided in the construction of surveys using Teleform.
- Coded, scanned, and evaluated returned surveys.
- Evaluated data in SPSS.

Committee Service

2006-2008 Curriculum Based Assessment Committee – Co-lead on a committee that is piloting a study to collect data on four separate curriculum based assessments to be used at Nevada Early Intervention Services.
**Practicum Experience**

**2001**
Practicum in Social and Personal Competence in Early Adolescence, Pennsylvania State University, University Park, PA
- Wrote and conducted social skills lessons for sixth, seventh, and eighth graders.
- Worked closely with seventh and eight grade peer mediators, instructing them on better communication skills.
- Assisted in the planning of an all-day anti-bullying retreat for seventh and eighth graders and lead activities at the retreat.

**1999**
Teaching Assistant, Human Development and Family Studies, Pennsylvania State University, University Park, PA
- Held office hours in order to provide individual instruction.
- Led small group discussions and conducted small group activities.

**GRANT ACTIVITY**

**2002**
Second Author, Indiana University Graduate School of Research, Differences in Rural, Suburban, and Urban School Psychology: Implications for Training and Recruitment ($350.00), Awarded

**PROFESSIONAL PRESENTATIONS**

**2009**
“Strategies to Support Family Centered Approaches during Transition from Early Intervention Services,” (with Christina Pagett. Division of Early Childhood, National Convocation, Albuquerque, New Mexico.

**2003**