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The Effect of Balance Training on Disruptive Behaviors in Children with Autism Spectrum Disorders

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THE EFFECT OF BALANCE TRAINING ON DISRUPTIVE BEHAVIORS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS

by

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Abstract

Objective

The purpose of this study is to evaluate the effect of balance training on disruptive behaviors in children with Autism Spectrum Disorders (ASD).

Methods

Fourteen parents of children with ASD participated in this study. Data was collected using the Aberrant Behavior Checklist (ABC) distributed to various therapy centers around the Hattiesburg and Jackson areas. A secondary survey was included that collected demographic data and basic data on what therapies the children have been involved in. The ABC provided a measure of the incidence of disruptive behaviors exhibited by the children with ASD as evaluated by their parents. Three of the five subscales of the ABC were used including the irritability, stereotypy and hyperactivity subscales all of which were treated as separate dependent variables. The demographic data and list of therapies was used to investigate relationships between the therapies and disruptive behaviors and to split the participants into the experimental and control groups. The experimental group included those whose children had participated in balance training for more than a year and the control group included those whose children participated in balance training for less than a year. The data was analyzed using Hotelling's Trace and Independent Samples t-scores.

Results

When all three dependent variables were analyzed collectively there was no statistically significant difference between the incidence of disruptive behaviors in the control and experimental groups $p>0.05$. On a one-tailed independent samples t-test of the individual variables none achieved significance between the groups $p>0.05$. When the data was grouped based on number of interventions disregarding type, the score on the irritability subscale just failed to reach significance with $p=0.07$.

Conclusion

None of the data was statistically significant even when analyzed for the effects of ABA and drug treatments which does not reflect the findings of past research. Limitations to this study include a small sample size, a quasi-experimental design, a lack of baseline measures, a lack of representation of patients without access to high quality therapeutic care, and a compromised control group which had to include individuals with less than a year of balance training. Future research with a larger sample and a stronger methodology is necessary to determine the effect of balance training on disruptive behavior in children with ASD. Further research may also need to investigate the link between number of therapies and disruptive behaviors.

Key words: Autism Spectrum Disorders, balance training, Aberrant Behavior Checklist, disruptive behavior

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List of Abbreviations

ASD	Autism Spectrum Disorders
ABA	Applied Behavior Analysis
PDD-NOS	Pervasive Developmental Disorder Not Otherwise Specified
ABC	Aberrant Behavior Checklist
DSM-IV-TR	*Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*
RUPPAN	Research Units on Pediatric Psychopharmacology Autism Network
AIT	Auditory Integration Training
MR	Mental Retardation
EPS	Extrapyramidal Symptoms
IQ	Intelligence Quotient
IRB	Institutional Review Board
SPSS	Statistical Package for the Social Sciences
USM	University of Southern Mississippi

Chapter 1: The Problem

Autism spectrum disorders (ASD) are a group of pervasive neurological disorders described by the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR) as having three core features: impaired social functioning, delayed or abnormal communication skills, and stereotyped behaviors (American Psychiatric Association, 2013). While the core symptoms of ASD are clearly defined, other related symptoms and developmental abnormalities have been shown to be pervasive among the population of individuals with ASD. Such symptoms can include disruptive and maladaptive behaviors (Matson & Nebel-Schwalm, 2007), sensory integration difficulties (Dawson & Watling, 2000), impaired fine and gross motor skills (Baranek, 2002), and impaired balance (Fournier, Amano, Radonovich, Bleser, & Hass, 2014; Memari, Ghanouni, Gharibzadeh, Eghlidi, Ziaee, & Moshayedi, 2013; Fournier, Kimberg, Randovich, Tillman, Chow, Lewis, Bodfish, & Hass, 2010; Romero-Munguía, 2008; Minshew, Sung, Jones, & Furman, 2007; Schmid, Conforto, Lopez, & D'Alessio, 2007; Gowen, & Miall, 2005; Molloy, Dietrich, & Bhattacharya, 2003). The disruptive behaviors commonly exhibited by children with ASD include, but are not limited to, self-injurious behavior, stereotypies, noncompliance, and aggression (Matson & Nebel-Schwalm, 2007). While disruptive behaviors are not considered part of the core symptoms of ASD, the incidence of these behaviors is significant among this population and should not be ignored in the body of research developing around the characteristics and treatment of ASD (Matson & Nebel-Schwalm, 2007).

Disruptive behaviors prevent children with ASD from participating in educational and community activities (Machalicek, O'Reilly, Beretvas, Sigafoos, & Lancioni, 2007). Elliot, Dobbin, Rose, and Soper (1994) suggest that maladaptive behaviors, such as aggression and self-injury, prevent integration into the community and can prompt the decision to place the individual into a restrictive residential center while also prolonging their stay in such facilities. It is also important to note that stereotypical behaviors prevent individuals with ASD from learning and completing tasks in vocational settings even in the absence of aggression or self-injury (Elliot et al., 1994). These findings suggest that children with ASD who exhibit these disruptive behaviors are more likely to be excluded from inclusive learning environments preventing them from learning and practicing valuable social and communication skills.

Currently the only research-based treatments for the symptoms commonly associated with ASD are applied behavior analysis (ABA) and second generation, sometimes called "atypical," anti-psychotic medications. The only research which has consistently investigated the effect treatment has on disruptive behaviors exhibited by children with ASD pertains to psychopharmacological interventions (Matson & Nebel-Schwalm, 2007).

Some of the earliest research concerning strategies for overcoming the unique behavioral challenges presented by children with ASD was conducted by Ivar Lovaas in 1973 (Lovaas, Koegel, Simmons, & Long, 1973). Based on the results of this small scale 1973 study, Lovaas conducted a larger scale experiment in 1987. In the original 1973 experiment Lovaas used the principles of ABA, a revolutionary treatment at the time, to teach language to children with Autistic Disorder who exhibited behavioral problems

serious enough to impede learning (Lovaas et al., 1973). He found that he was able to increase the receptiveness of the children to learning through using the technique (Lovaas et al., 1973). In the 1987 experiment, Lovaas put a group of children with Autistic Disorder through an intensive behavioral modification program and tracked the improvements in their educational and intellectual functioning over an extended period of time (Lovaas, 1987). Lovaas observed some reduction in the incidence of disruptive behaviors in the children studied, however the majority of subsequent studies conducted into ABA since Lovaas' original study do not target disruptive behaviors as the target variable for improvement through behavioral intervention (Matson & Nebel-Schwalm, 2007). A critique of Lovaas' 1987 study by Schopler, Short, and Mesibov in 1989 suggested that the results of Lovaas' study could not be determined due to failures in his research procedure, namely poor choices of outcome measures, biased subject selection criteria, and an inappropriate method for assigning control groups. The authors state that since Lovaas had no quantifiable way to measure the gains made by the children in his intervention it was impossible to tell if the children actually improved (Schopler et al., 1989). Despite the doubts raised about Lovaas' original methods research into ABA continued eventually resulting in ABA becoming the preferred treatment method for children with ASD.

The more recent research into ABA has focused primarily on addressing deficits in intellectual functioning, language development, daily living skills, and social functioning among children with ASD (Virues-Ortega, 2010). A number of studies have shown improvement in these areas associated with the application of long-term intensive ABA treatment, with improvements in language found to be the most dramatic (Virues-

Ortega, 2010). A common element of ABA research is a focus on children with autistic disorder as opposed to a focus on ASD as a whole. Within the studies reviewed by Virues-Ortega (2010) it was found that fifteen of the twenty two studies included focused solely on children diagnosed with autistic disorder and seven also included children with pervasive developmental disorder not otherwise specified (PDD-NOS). None of the studies included children diagnosed with Asperger's syndrome or Rett's syndrome (Virues-Ortega, 2010). This is a failure of the literature because all of the children on the autism spectrum exhibit similar challenges and deficits and as such they should all be researched equally to determine the efficacy of interventions rather than researching one specific diagnostic group and generalizing to the others.

Some research has been conducted into interventions that are based on ABA principles but do not precisely follow the methodology of ABA. A review of these interventions used to decrease disruptive behaviors in a school setting found positive results (Machalicek et al., 2007). The authors found that in the various studies reviewed specific interventions were used to target individual disruptive behaviors (i.e. stereotypy, aggression, non-compliance, and self-injury) as opposed to using one generalized intervention designed to reduce all stated problem behaviors at once (Machalicek et al., 2007). The authors do not see this approach as a problem, however from a practical standpoint it is not feasible in a normal school setting to conduct a separate intensive intervention for each challenging behavior a child with ASD presents.

While ABA research has rarely targeted disruptive behaviors, research into the use of atypical anti-psychotic medications has targeted these behaviors nearly exclusively. Currently the only medications in the class that are approved for use in

children with ASD are risperidone and aripiprazole (Pringsheim, Lam, Ching, & Patten, 2011). The use of atypical anti-psychotic medication to reduce disruptive behaviors in autistic children has increased greatly over the past few decades (Posey, Stigler, Erickson, & McDougle, 2008). The majority of studies conducted concerning the use of atypical anti-psychotics have focused on the use of risperidone for children with ASD (Posey et al., 2008).

In multiple placebo-controlled, double blind studies risperidone has been found to be effective in treating a class of behaviors termed "irritability." (Sharma & Shaw, 2011; Scott & Dhillon, 2007; Jesner, Aref-Adib, & Coren, 2007; West & Waldrop, 2006; Shea et al., 2004; McCracken et al., 2002). This "irritability" is a blanket term for the disruptive behaviors commonly exhibited in children with ASD. Most studies show improvements in irritability over short-term treatment with risperidone, however not many long-term studies have been conducted (Troost et al., 2005). It is important for the long-term effects of risperidone to be established because a growing number of children are being prescribed risperidone as a permanent treatment option despite the lack of research concerning the safety of its use over a long period of time (Troost et al., 2005). A study conducted on the "long-term" effects of risperidone ran a trial for only six months and found improvements in irritability and minimal side effects (predominantly weight gain) (Troost et al., 2005). From an outside perspective, six months does not seem to be a sufficient amount of time to determine the long-term effects this drug class has on children with ASD. The findings on aripiprazole are similar; however less research has been conducted into the use of this drug with this population (Marcus et al., 2009).

This class of medications is known to have serious side-effects. The most common side-effect discussed is weight gain; however, others exist (Pringsheim et al., 2011). Risperidone and aripiprazole were both found to have negative metabolic and neurological effects in children with the neurological effects being the more serious of the two (Pringsheim et al., 2011). The authors suggest that while these medications have been shown to decrease disruptive behaviors in children, their use should be closely monitored and discontinued if serious side effects begin to arise (Pringsheim et al., 2011).

While there is a large body of research into ABA and psychopharmacological interventions, there is little investigation into the more unconventional treatment methods including sensory integration therapy, auditory integration training (AIT), sensorimotor handling techniques, and antecedent physical exercise (Baranek, 2002; Dawson & Watling, 2000). The research that does exist using these methods is predominantly inconclusive (Dawson & Watling, 2000) with the most consistent positive gains seen through the incorporation of antecedent aerobic exercise into the intervention strategy (Baranek, 2002). Since these interventions have been proven neither ineffective nor effective further research into these and other alternate strategies for behavioral intervention in ASD is imperative (Baranek, 2002).

From the available body of research it is clear that alternative intervention methods for reducing disruptive behaviors are necessary. Disruptive behaviors are rarely addressed as a therapeutic goal in ABA, psychopharmacological treatments can be dangerous and are not a permanent solution, and the less common treatment methods have not been appropriately researched and have inconclusive findings (Pringsheim et al., 2011; Matson & Nebel-Schwalm, 2007; Baranek, 2002; Dawson & Watling, 2000).

None of these intervention methods attempt to address the core symptoms of autism as a unit, they all try to reduce specific behaviors. It makes sense that since these symptoms are nearly universal among children with ASD that they are all related and an improvement in one area will trigger positive gains in others, however no research has been found to support that theory.

One of the most common symptoms found in individuals across the range of disorders included in the autism spectrum is a lack of balance (Fournier, et al., 2014). The postural control mechanism in children with ASD neither develops properly nor at the same rate as that of typically developing children (Minshew et al., 2007). These developmental deficits lead to reduced postural stability even in adulthood (Gowen & Miall, 2005). Notably, research shows that deficits in postural control are not related to the presence of co-morbid mental retardation (MR), as postural control problems were found with equal frequency and severity among children with ASD with and without co-morbid MR (Fournier et al., 2010). Two studies have been conducted into the effect of cognitive tasks on balance in children with ASD, and they both found that postural stability decreased with the inclusion of a concurrent cognitive task (Romero-Munguía, 2008; Schmid et al., 2007). From these findings it can be inferred that poor balance interferes with the execution of complex cognitive tasks just the same way that these cognitive tasks have been found to affect balance. This is an important finding because it suggests that improving the balance of children with ASD has the possibility of improving their ability to focus on, and carry out complex cognitive tasks such as learning, speaking, and controlling their own disruptive behaviors. No research has been

conducted on the effect balance training has for children with ASD despite the clear evidence that this population has serious deficits in balance and postural control.

It is not readily apparent what causes children with ASD to exhibit disruptive behaviors; however, it is clear that certain situations and demands placed on the child for learning, or even a specific type of conduct (sitting still, being quiet, complex motor and cognitive tasks), have the potential to aggravate the underlying causes of disruptive behaviors in these children resulting in increased incidence of these behaviors (Matson & Nebel-Schwalm, 2007). It is important that safe and effective treatment methods aimed at reducing these behaviors be developed. According to a survey conducted by the United States Centers for Disease Control in 2014, the incidence of ASD in the population is increasing. The prevalence rates of ASD have increased from one in eighty eight children in the 2012 survey to one in sixty eight children in 2014 (US Centers for Disease Control, 2014; Baio J., 2012). This increase in prevalence makes it imperative that strategies are developed both for how to teach children with ASD to interact appropriately with society as well as how to manage their particular reactions to environmental and activity-based stimuli.

Balance training could provide an effective alternative treatment option for children with ASD; however, this particular subject has never been researched before. This conspicuous lack of research makes it imperative for investigation into this topic to be conducted. This study addresses the question: what is the effect of balance training on disruptive behaviors in children with ASD?

Chapter 2: Literature Review

The purpose of this study is to investigate the effect of balance training on disruptive behaviors in children with ASD. According to the DSM-IV-TR, ASD are a group of developmental disorders including autistic disorder, childhood disintegrative disorder, Asperger's syndrome, Rett's disorder, and PDD-NOS which are all characterized by three core symptoms: communication impairment, social impairment, and stereotypical behaviors (American Psychiatric Association, 2000). A great deal of research has been conducted pertaining to the best methods for managing the disruptive behaviors commonly exhibited by children with these disorders because disruptive behaviors can limit individuals with ASD from participating in community activities both as children and adults (Matson, Sipes, Fodstad, & Fitzgerald, 2011). Some of the most commonly investigated disruptive behaviors include aggression, non-compliance, stereotypical behaviors, and self injurious behavior. Through the currently available research, a few popular and evidence-based methods for managing these disruptive behaviors have emerged including ABA, psychopharmacological interventions, and a poorly researched group of "other" interventions.

Applied Behavior Analysis

Myers and Johnson (2007) discuss the use of ABA interventions and their relative efficacy in a review of ABA literature. They define ABA as "applying interventions that are based on the principles of learning derived from experimental psychology research to systematically change behavior and to demonstrate that the interventions used are responsible for the observable improvement in behavior (Myers & Johnson, 2007)." The

authors discuss that ABA has been found effective in improving Intelligence Quotient (IQ), language, academic performance, and adaptive behavior for the children who participate in ABA programs (Myers & Johnson, 2007). Significantly, consistent positive outcomes cited for ABA treatment do not include a considerable decrease in disruptive behaviors, only gains in the functional areas previously discussed. The authors did find that psychopharmacology has been reported to be a useful intervention to reduce disruptive behaviors, with risperidone being the best supported agent, while other interventions such as sensory and motor therapies were found to be poorly researched with inconclusive results at best (Myers & Johnson, 2007).

Matson and Nebel-Schwalm's 2007 study supports the concept that the literature on ABA neglects to report improvements, if any occurred, in disruptive behaviors. They found that the presence of disruptive behaviors is rarely assessed or included as an outcome measure in studies of the use of ABA with autism despite considerable attention to disruptive behaviors in studies involving children with Intellectual Disabilities (Matson & Nebel-Schwalm, 2007). Conversely, the research into psychopharmacological interventions for children with ASD has focused almost entirely on the reduction of disruptive behaviors using as the primary behavioral marker "irritability," which is defined as aggression, self-injury or tantrums (Matson & Nebel-Schwalm, 2007; Matson et al., 2011). This is an interesting dichotomy present in the research because it suggests that these two major areas of study have begun to diverge from each other in terms of what problems they chose to target with therapeutic intervention.

One of the primary concerns for the management of these disruptive behaviors is how to best address them in the context of a school setting. Children with ASD must

attend school, but the disruptive behaviors exhibited by these children can seriously impede the learning process for not only them but also their peers. Machalicek, O'Reilly, Beretvas, Sigafoos, and Lancioni (2007) reviewed the most commonly used strategies for managing these behaviors in school settings. None of the strategies reported are directly ABA based, but rather include intervention strategies termed "eclectic" by the ABA literature. These included antecedent manipulations, change in instructional context, differential reinforcements, and self-management. Despite not being ABA based, almost all of the studies reviewed had positive results (Machalicek et al., 2007). Upon further investigation into these results, however, it was found that the effectiveness of the interventions may have been overestimated by the strategies used by the original researchers to report the results (Machalicek et al., 2007). The body of ABA research suggests that positive effects from eclectic interventions are either non-existent or negligible in comparison with ABA itself thus indicating that ABA may be a better intervention for use in a school setting to improve learning. In a meta-analysis conducted by Virues-Ortega in 2010 ABA was found to be effective in greatly improving language related measures such as IQ, receptive and expressive language, and communication as well as demonstrating lesser gains in non-verbal IQ, social functioning, and daily living skills. It was also found that the amount of improvement seen on these measures was directly related to the hours of intervention provided to the child with greater hours corresponding to greater gains and vice versa (Virues-Ortega, 2010).

The use of ABA for children with ASD was pioneered by Ivar Lovaas in 1973. In his initial study, Lovaas used ABA to teach language skills to children with autism who exhibited behavioral problems serious enough to impede learning, and he found that he

was able to increase the receptiveness of the children to learning through using the technique (Lovaas et al., 1973). Based on the results of this study, Lovaas conducted a larger study in 1987. In this study thirty-eight children, who Lovaas claimed to have average or below-average functionality, were placed into two groups; an intensive treatment group who received a minimum of forty hours per week of intensive intervention, and a control group who received only ten hours per week of treatment (Lovaas, 1987). Lovaas claimed that by the end of the two year treatment period, forty-seven percent of the children in the experimental group achieved "normal" functioning and were considered "recovered" (Lovaas, 1987). Lovaas supported these claims through the gain in IQ post treatment and the placement of these children into mainstream first grade classrooms without an individual aid (Lovaas, 1987).

The intervention procedure employed by Lovaas has become the gold standard as well as the basis for ABA programs throughout the world despite the presence of some clear deficits in his study. Some of these deficits were investigated by Schopler, Short, and Mesibov in 1989. The most serious problems with Lovaas' research include inappropriate, or absent, outcome measures, subject selection bias, and an inadequate control group (Schopler et al., 1989). In Lovaas' study no empirical measures of functioning were taken. Level of functioning was measured instead using the classroom placement of the children; a measure that has more to do with advocacy and educational politics than with the children involved (Schopler et al., 1989). The only empirical measure used was the improvement of scores on the IQ test which could suggest improvement in compliance and test taking skills rather than a positive effect of the intervention (Schopler et al., 1989). The authors also found that the subjects selected for

the study were of relatively high functioning and had good prognosis despite Lovaas' claims to the contrary (Schopler et al., 1989). Thus, it can be concluded that the results of Lovaas' study cannot be determined due to serious methodological problems; this is a particularly disturbing revelation considering that all of the research that has been conducted since then has been based on Lovaas' study.

In an attempt to combat these criticisms, a study was conducted on the long-term effects of Lovaas' intervention by conducting a six-year follow-up with the children who were included in the original experiment. This study, conducted by McEachin, Smith and Lovaas in 1993 used a number of empirical tests to assess functioning, an element that was lacking in the original study. They found that the children in the experimental group overall had maintained their classroom placement as well as IQ gains over the control group; they also had comparatively higher rates of adaptive behaviors and lower incidences of maladaptive behaviors as assessed by a "Clinical Rating Scale" developed specifically for the study (McEachin et al., 1993). Ironically, this study was also challenged in 2005 by Victoria Shea. Shea discusses that the results on the empirical tests are not reported accurately as many measures are missing for some of the children and only one of the "best outcome" subjects scored in the normal range on all of the tests despite claims by McEachin and Lovaas that all of the children achieved normal functioning (Shea, 2005). Shea also suggests that the much cited forty-seven percent success rate of this intervention should not be taken too seriously due to the methodological limitations of the original 1987 study and the inability for any subsequent research to replicate this finding (Shea, 2005). Another element to consider when evaluating the effectiveness of Lovaas' treatment is that while these studies show the

functioning of children who underwent the intervention to improve, they still remained significantly impaired post-treatment (Shea, 2005). Of the available research into ABA, only one study was found which approximates the level of success of Lovaas' 1987 experiment. This study, conducted by Sallows and Graupner in 2005 found that of the twenty-four children involved in the study, forty-eight percent were placed in regular education classrooms and had average post-treatment scores. Success in this study was predicted by high pre-treatment scores for IQ, imitation, language and social responsiveness (Sallows & Graupner, 2005). This finding suggests that children with ASD who are high-functioning may benefit more from ABA treatment than the majority of the population of children with ASD.

Two other studies also found that rates of success in ABA programs are directly linked to the pre-treatment level of intellectual functioning and autism severity of the children involved (Weiss, 1999; Ben-Itzchak & Zachor, 2007). This finding is significant because it indicates that ABA may not be as effective for the low-functioning population of children with ASD despite what is implied by most of the other literature.

Some other problems with ABA discussed in the literature include: the necessity of starting intervention programs before the age of four in order to have a significant positive effect, concerns about long-term efficacy, and a concern over the different levels of efficacy of clinic based, community based, and home based interventions, as well as the expense of these programs in general (Schoen, 2003). Eikeseth, Smith, Jahr, and Eldevik in 2002 addressed the first problem. Their study was conducted on children who started intervention in a school setting between four and seven years old and the authors found that the children who underwent the behavior intervention improved more than a

control group receiving “eclectic” therapies on measures of IQ, language, and adaptive behaviors, thus indicating that these therapies are effective on older children (Eikeseth et al., 2002). A follow-up study conducted a year after the cessation of treatment by the same authors found that the gains made during the intervention program for the behavioral group were maintained after the cessation of treatment (Eikeseth, Smith, Jahr, & Eldevik, 2007).

Similarly, a study conducted on a group of twenty-three children who were placed into an ABA program and twenty-one children receiving treatment as usual discovered that the children in the ABA group improved more on measures of IQ, language, daily living skills, and social behavior than did the control group (Remington et al., 2007). In contrast to the outcome study conducted by Eikeseth et al. (2007), a two year follow-up study conducted by Kovshoff, Hastings, and Remington in 2011, found that the gains in all of the major outcome measures were lost two years after the cessation of treatment in the group that participated in the ABA program. The authors were not able to account for what caused their findings due to the presence of too many conflicting variables some of which may have contributed to their results (Kovshoff et al., 2011). These inconclusive findings on the long-term efficacy of ABA treatment prevent a decisive answer as to whether or not the gains made during treatment are permanent in the children who undergo these programs.

Much research has been conducted to investigate the efficacy of community and parent-managed programs as compared to clinic based programs. Two studies conducted with children in mainstream pre-school and kindergarten settings found that community based programs are effective in improving adaptive behaviors, maladaptive behaviors,

IQ, and autism symptoms in participating children (Eikeseth, Kintwall, Jahr, & Karlsson, 2012; Eldevik, Hastings, Jahr & Hughes, 2012). A study conducted on the long-term effects of ABA based on if an individualized intervention was conducted in a home-based setting or a generalized treatment program was conducted in a nursery based setting, found that the home-based individualized ABA treatment did not have significantly better outcomes than the general nursery-based treatment either at the conclusion of treatment or during the follow-up evaluation (Magiati, Charman, and Howlin, 2007). This is a significant finding because it is the only study that indicates that the ABA treatment may not be consistently effective for all populations. The study supports the notion that no intervention that is "universally superior" to other interventions in the treatment of ASD (Magiati et al., 2007). These findings however only reflect a single study and could have been influenced by any number of unexpected factors.

Multiple studies have proven clinic based ABA treatment is equivalent to parent managed treatment and that both are superior to the "eclectic" treatment method. In one such study, intensive ABA treatment was compared to "eclectic" treatment, and the intensive ABA treatment was seen to have greater gains in language and communication; however, the number of hours dedicated to the eclectic treatment was not equal to that of the ABA treatment which prevents ruling-out attention as a factor in the improvements achieved (Zachor, Ben-Itzchak, Rabinovich & Lahat, 2007). Another study conducted much the same way found intensive ABA treatment to produce gains in IQ, adaptive behavior, and communication greater than those found in an equally intense eclectic treatment group (Howard, Sparkman, Cohen, Green & Stanislaw, 2005). This finding indicates that ABA treatment has the possibility to be more effective than eclectic

treatment even with equal amounts of time devoted to each intervention (Howard et al., 2005). The only problem with this study is that there was no way for the researchers to monitor the quality of the eclectic treatment as compared to the quality of the ABA based treatment which could have affected the results.

Two studies investigated the efficacy of clinic-based treatment as compared to parent-managed treatment and found that both were equally effective across all outcome measures (Luiselli, Cannon, Ellis & Sisson, 2000; Hayward, Eikeseth, Gale & Morgan, 2009). These discoveries show that ABA treatment can be effectively carried out in an environment other than a clinic which makes it much more accessible; however, the implementation of these interventions in the home comes with its own problems. Grindle, Kovshoff, Hastings, and Remington (2009) investigated parent experiences of these home-based programs; they found that while most parents had positive things to say about the programs there were still considerable negative effects experienced by the families. The most common negative statements about these home-based ABA programs include lack of privacy associated with having a therapist in the home full time, high therapist turnover rates, siblings feeling left out or less time available for the parents to care for them, significant financial stresses involved in paying for the program, and deteriorating marital conditions (Grindle et al., 2009). These problems are significant and should be considered by families before an intensive ABA program is implemented in the home.

From the available literature a number of limitations inherent in both the research and implementation of ABA are clear. First, the original studies conducted on the use of ABA with children with ASD had significant methodological errors as well as faulty and

misleading reporting of outcomes. Secondly, it has been proven in multiple studies that the children most likely to benefit from ABA interventions are those who have the highest IQ's and the lowest level of autism severity. This limitation is significant because the majority of children with ASD are not high functioning, implying that these interventions are not as helpful for the majority of the population as the research would imply. A third problem is that the data is inconclusive at best concerning the long-term efficacy of these interventions. If the gains acquired through these programs are not maintained long-term, then the parents who sacrifice a great deal of time and money to enroll their children in ABA interventions are wasting these sacrifices and ending up right back where they started. Fourth, ABA treatment is exceptionally expensive which puts a great deal of strain on families who attempt to use this intervention to help their children. Finally, the largest problem with ABA is that the research is not focused on reducing disruptive behaviors, but rather using operant conditioning to teach trained responses to certain stimuli. Research into alternative methods for reducing disruptive behaviors is necessary.

Psychopharmacology

The second main research focus on therapeutic interventions for children with ASD is psychopharmacology, and while ABA research has rarely targeted disruptive behaviors, research into the use of atypical anti-psychotic medications has consistently and nearly exclusively attempted to reduce these behaviors. Currently, the only medications in the class that are approved for use in children with ASD are risperidone and aripiprazole (Pringsheim et al., 2011). All of the research conducted into these medications focuses on reducing a set of behaviors referred to as "irritability." This term

can be misleading since it is rarely formally defined in the literature. Generally speaking, when researchers use the term "irritability" it describes the behaviors of aggression, self-injury, and/or tantrums (Matson et al., 2011).

Based on some hypothesized causes of ASD, the literature has suggested that antipsychotic medications may be beneficial in the treatment of disruptive behaviors. It is suspected that some of the behaviors associated with ASD are linked to abnormalities in some of the specific dopamine and serotonin synapses within the brain (Posey, Stigler, Erickson, & McDougle, 2008). These specific synapses are targeted by antipsychotic medications such as risperidone and aripiprazole which sparked the interest in using these drugs for the treatment of ASD (Posey et al., 2008). A great number of reviews have been conducted into the overall efficacy and amount of research available pertaining to the major antipsychotic medications considered for use in children with ASD (Benvenuio, Battan, Porfirio, & Curatolo, 2013; Robb, 2010; Malone & Waheed, 2009; Malone, Gratz, Delaney & Hyman, 2005). The most commonly researched medications are risperidone, aripiprazole, and haloperidol (a first generation anti-psychotic.) Multiple studies have concluded that these medications are safe and effective, with risperidone and aripiprazole preferred to haloperidol due to the lower risk of extra-pyramidal symptoms (EPS) associated with their use (Benvenuio et al., 2013;Robb, 2010; Malone & Waheed, 2009; Malone et al., 2005). Only one study has been conducted that directly compares the efficacy of risperidone and haloperidol; it found that risperidone was more effective, and had less EPS than haloperidol, but had a higher chance of clinically significant weight gain (Miral, Gencer, Inal-Emiroglu, B. Baykara, A, Baykara, & Dirik, 2008). A limitation of the available research into these medications, however, is that the available

body of literature does not examine all of the possible side effects or their relative incidences in the population of children taking these medications. All of the above studies suggest the use of atypical-antipsychotic medications, and only one of the four studies (Malone & Waheed, 2009) suggests that monitoring the side effects of these drugs is necessary.

Risperidone is one of only two drugs approved by the FDA for use in reducing irritability in children with ASD, this approval was acquired after two large-scale randomized double-blind placebo controlled drug trials conducted by the Research Units on Pediatric Psychopharmacology Autism Network (RUPPAN) (Malone & Waheed, 2009). The first was an eight-week trial composed of 101 participants diagnosed with ASD which compared the effects of risperidone to placebo using the aberrant behavior checklist (ABC) as the predominant outcome measure (McCracken et al., 2002). This study found risperidone to be superior to placebo in reducing irritability in children with ASD (McCracken et al., 2002). The second was a four month open-label treatment with a two-month double-blind placebo controlled discontinuation phase using the same outcome measure (McCracken et al., 2002). In this trial risperidone was found to continue to be effective in maintaining behavioral gains during the discontinuation phase; it was concluded that the use of risperidone in children with ASD was safe and effective (McCracken et al., 2002). In a separate study which used the same participants and collected data simultaneously, it was found that risperidone was responsible for effecting gains other than the reduction of irritability including the reduction of maladaptive behaviors, stereotypical behaviors, and an increase in daily living skills but was not able

to affect changes in either of the other two core symptom domains of ASD (Communication deficiency, and impaired social skills) (McDougle et al., 2005).

These studies, however, are not the only ones that have investigated the efficacy of risperidone. Both double-blind and open-label studies have been conducted and all of these studies have found risperidone to be effective in reducing irritability with a claim of few to no adverse effects (Pandina, Bossie, Youssef, Zhu, & Dunbar, 2007; Shea et al., 2004; Nicolson, Awad, and Sloman, 1998). Risperidone has even been researched in conjunction with other medications and therapy techniques in an attempt to prove its effectiveness. Two studies conducted in Iran investigated the efficacy of the simultaneous use of other medications with risperidone. The first investigated the combination of risperidone with topiramate (an anticonvulsant) in a double-blind trial and found risperidone and topiramate together to be more effective in reducing irritability than placebo and risperidone in isolation (Rezzaei et al., 2010). A study with a similar design and outcomes also compared the use of risperidone with pentoxifylline (a blood thinner) and found in favor of using them together (Akhondzadeh et al., 2010). A major limitation of these studies is that they do not fully address the adverse effects associated with these medications. They suggest the use of the drugs without any real indications of research into the negative effects that are possible.

One of the biggest problems with the use of these drugs is that they have a number of unpleasant and uncontrollable side-effects that could cause life-altering damage to the child taking them. Another problem is that continuing to take the medication is required to maintain the behavioral benefits associated with it, meaning that children end up taking the drugs for considerably longer time periods than the available

research has investigated. Only two studies to date have investigated what they call the "long-term" effects of these medications, a period of only six months (RUPPAN, 2005; Troost et al., 2005). Both studies found risperidone to have continuing effectiveness over time without the development of tolerance and that its continued use was necessary to prevent relapse. Despite these findings, the authors suggest that drug therapies are not a permanent solution and other treatment options are necessary to ensure the child maintains their behavioral gains as the medication is tapered off (RUPPAN, 2005; Troost et al., 2005). This is significant because these studies are the only randomized double-blind controlled trials found to suggest that risperidone may not be the best solution to the problem of disruptive behaviors. Both studies found significant weight gain among all of the subjects, a problem that could lead to metabolic disorders at the time of treatment or later in a child's life (RUPPAN, 2005; Troost et al., 2005).

Aripiprazole is the second FDA approved antipsychotic medication used to reduce irritability in children with ASD. It has been found in multiple studies, both open-label and double blind, to be effective in reducing disruptive behaviors among children with ASD (Marcus et al., 2009; Owen et al., 2009; Stigler et al., 2009). The most common side effects reported from these studies included weight gain, EPS, decrease in prolactin levels, and increases in aggression. The increase in aggression was also noted by Rugino and Janvier (2005) when they investigated the prevalence of use as well as common side-effects among all children prescribed aripiprazole. They found that increased aggression was a common side effect only among children with ASD and was present in thirty-five percent of the children with ASD included in the study (Rugino & Janvier, 2005). They also found that aripiprazole was only effective in reducing pre-treatment aggression

levels in twenty-five percent of the autistic subjects (Rugino & Janvier, 2005). This is significant because many of the children who are placed on these medications are prescribed them because of serious problems with aggression that could not be resolved through other therapeutic measures. If aripiprazole is not effective in reducing aggression and is capable of making aggression worse, then it is not a good choice for use in this population. The findings from this article are in direct conflict with the findings of a double-blind study comparing the efficacy of aripiprazole and risperidone. According to the study aripiprazole and risperidone had similar efficacy in reducing irritability and similar levels of side-effects (Ghanizadeh, Sahraeizadeh, & Berk, 2013). This conflict points out an important limitation in the research into the efficacy of antipsychotic medications in this population. Since the research focuses on reducing the blanket set of behaviors termed "irritability," it is difficult to isolate the relative efficacy of these drugs on the specific symptoms included under that name (i.e. aggression, tantrums and/or self-injurious behaviors). All of the studies on aripiprazole down play the symptoms associated with this medication in a manner very similar to the risperidone literature. This can skew the interpretation of the results as far as safety and tolerability of these medications is concerned.

The only studies that truly investigate the prevalence of adverse effects associated with these medications are conducted by separate authors and review the side-effects as reported, or acquired through communication with the authors of the original projects. All of these studies found that there are serious neurological, metabolic, and endocrine adverse effects caused by these medications which are masked in the literature through faulty reporting or misleading outcome measures used to evaluate the side-effects. Of

particular note is the prevalence of EPS in children who take risperidone and aripiprazole, particularly since these medications became popular for use in this population due to being supposedly free of neurological complications (Mckinney, & Renk, 2011; Pringsheim et al., 2011; Vitiello, Correll, Zwieten-Boot, Zuddas, Parellada, & Arango, 2009). Risperidone and aripiprazole have both been shown to cause weight gain, with risperidone causing more significant weight gain than aripiprazole, and both medications have been shown to affect prolactin levels (risperidone raises it, aripiprazole lowers it) but the consequences of these effects have not been fully explored in this population (De Hert, Dobbelaere, Sheridan, Cohen, & Correll, 2011; McKinney & Renk, 2011; Pringsheim et al., 2011; Vitiello et al., 2009). All of these studies agree that the risks of these medications are too great to be ignored and psychopharmacological treatment should be used only as a last resort if it is used at all.

Another interesting omission in the literature surrounding the treatment of disruptive behaviors in children with ASD is research into the combination and/or comparison of ABA and risperidone as methods to reduce disruptive behaviors (Weeden Ehrhardt, & Poling, 2009). These two treatment options are viewed as being mutually exclusive in the literature when in reality as the two main schools of thought for treating ASD they ought to be working together. One suggestion for why they are not used together is that the two research strategies have fundamentally different methodologies that are difficult to combine into a valid and coherent experiment (Weeden et al., 2009). The only study discovered which remotely attempts to rectify this omission was conducted in 2012 by RUPPAN into the efficacy of combining risperidone treatment with parent training to reduce maladaptive behaviors in children with ASD. It was found that

children whose parents underwent the training for how to manage disruptive behaviors in their children had a significantly lower incidence of these maladaptive behaviors by the end of the treatment than did children taking risperidone alone (Scahill et al., 2012). This is important because the inclusion of parent training with a prescription of risperidone may allow the child to end treatment faster and keep more of their gains after the cessation of drug treatment. This has not been proven, however and a study to test this concept would be difficult to implement.

Overall, while the research shows atypical anti-psychotic medications such as risperidone and aripiprazole to be effective in reducing disruptive behaviors in children with ASD, they have many draw-backs. The most serious of these is the large number of adverse side-effects that are possible, the long-term effects of which have not been fully investigated. Another issue is that no research has been appropriately conducted into the long-term effects of these medications especially since they are generally prescribed for very long periods of time. A final problem is that risperidone and other drugs like it are not a permanent solution to the problem of disruptive behaviors, a child cannot be expected to live the rest of their lives on a medication to control their behaviors.

Other Interventions

While there is much research into ABA and psychopharmacological interventions, there is little research into the more unconventional treatment methods including sensory integration therapy, auditory integration training (AIT), sensorimotor handling techniques, and physical exercise (Baranek, 2002; Dawson & Watling, 2000). The research that does exist involving these methods is predominantly inconclusive (Dawson & Watling, 2000) with the most consistent positive gains seen through the incorporation

of antecedent aerobic exercise into the intervention strategy (Baranek, 2002). In a population of adults, vigorous antecedent aerobic exercise was found to reduce disruptive behaviors and allow them to carry out jobs both in group homes and in the community (Elliot et al., 1994). Auditory integration training was found to have the most negative evidence and mostly inconclusive results in the studies available suggesting that this intervention may not be effective, however due to the low quality of the data, it is difficult to tell (Dawson & Watling, 2000). Sensory integration therapy has more positive results but the limitations inherent in the study design prevent generalization of the findings (Baranek, 2002). It is difficult to ascertain the effectiveness of these interventions because there are serious limitations in the experimental design including small population size, no control groups, presence of confounding variables, and a lack of consistent outcome measures. Since these interventions have neither been proven ineffective nor effective further research into these and other alternate strategies for behavioral intervention in ASD is imperative (Baranek, 2002).

Balance Deficits in ASD

A lack of postural stability and balance is epidemic among individuals with ASD, though it is rarely addressed in the literature. Improving postural stability is also included infrequently in the interventions commonly used for children with ASD. A number of studies have proven that there is a measurable deficit in balance among both children and adults with ASD that persists throughout the lifetime (Fournier et al., 2014; Memari et al., 2013; Fournier et al., 2010; Romero-Munguía, 2008; Minshew et al., 2007; Shmid et al., 2006; Gowen, & Miall, 2005; Molloy et al., 2003). There is much controversy as to what exactly causes these balance problems in children with ASD. One

author suggests that the balance problems are due to poor sensory integration and an over-reliance on visual cues to maintain balance (Molloy et al., 2003). Another was not able to suggest any specific neurological complications, only a correlation between autism severity and degree of instability (Memari et al., 2013). A study by Minshew et al., (2007) supports the correlation between autism severity and degree of postural control because they found that balance difficulties were not related to mental retardation, but rather completely dependent on the presence of ASD. They also found that development of postural control was significantly delayed and never reached appropriate adult levels suggesting that this deficiency is persistent throughout the lifetime (Minshew et al., 2007). Finally, it is suggested by the authors that their data disproves the assumption that these postural control issues are due to a problem with the cerebellum as has been reported by other authors (Gowen & Miall, 2005), but rather may be due to a dysfunction of the basal ganglia, supplementary motor, and anterior cingulate regions of the brain (Minshew et al., 2007).

A pair of studies conducted by Fournier et al. has important implications for the application of balance training to children with ASD. The studies found that children with ASD have decreased static and dynamic postural control and that these deficits could be linked neurologically to the expression of stereotypical behaviors (Fournier et al., 2014; Fournier et al., 2010). The authors recommend balance training as an important treatment for children with ASD as it combats the natural deficits in this important mechanism (Fournier et al., 2014; Fournier et al., 2010). The link between stereotypical behaviors and reduced postural control in children with ASD is particularly important because it demonstrates that there may be a neurological basis to suppose that

improving balance in children with ASD through balance training may reduce disruptive behaviors (such as stereotypies).

An easy assumption to make is that children who have poor balance are more likely to have difficulty carrying out complex cognitive tasks. If these children have to spend all of their time focusing on keeping themselves from falling, then this increased difficulty in performing basic tasks may cause children to act out in an effort to escape from the demanding situation. This assumption is supported by a study conducted into the association between concurrent cognitive tasks and balance. In this study, it was found that children who were asked to complete a complex cognitive task while attempting to stand still had significantly lower levels of postural control than when they had no concurrent cognitive task (Schmid et al., 2007). It is not difficult to turn this finding around. Though more difficult to prove, it would make sense that the greater amount of mental energy needed to maintain balance (the level of postural instability), the more difficult it would be for a child to carry out complex cognitive tasks. This supposition is supported by a cognitive theory developed by Romero-Munguía called Mnesic imbalance. It suggests that the problems associated with ASD particularly balance deficiency can all be explained by a disruption in procedural memory (Romero-Munguía, 2008). He suggests that this deficiency in procedural learning requires children with ASD to use their conscious thought to avoid falling since they are not able to move information from declarative to procedural memory and therefore transfer the motor skills to unconscious control (Romero-Munguía, 2008). This may be related to disruptive behaviors because children who must consciously prevent themselves from falling do not have enough mental energy left over to control their own behaviors.

No research has been conducted as of yet on what the benefits of balance training on children with ASD are and certainly none has been conducted into its effect on disruptive behaviors. It seems clear from the evidence that there must be a connection between these two sets of symptoms. Overall, there are many limitations to the current lines of research into the reduction of disruptive behaviors and it is important to individuals with ASD and the community as a whole that sustainable, safe, practical, and effective intervention strategies for reducing these behaviors be researched. Balance training has the capability to provide an intervention that meets all of these criteria and it has not been previously researched thus calling for investigation into balance training as an intervention to reduce disruptive behaviors in children with ASD. This research hopes to answer the question what is the effect of balance training on disruptive behaviors in children with ASD?

Chapter 3: Methods

Since the current literature has suggested that it is possible for balance training to positively affect behavior, this study investigated that possibility. This study was approved by the Institutional Review Board (IRB) at the University of Southern Mississippi (USM).

Sample

The sample for this study consisted of fourteen parents of children with ASD aged between two and eighteen years old. This age range was selected in an effort to maximize sample size due to the low availability of study participants. This sample was acquired through contacting various therapy centers in the Hattiesburg and Jackson areas and the Dubard School on USM's campus. The sample was broken down into two groups one composed of parents of children who have been engaged in therapy programs that include a balance training component for more than one year and another of parents of children who were engaged in therapy programs that did not include a balance training component or have participated for less than a year. This allowed for comparison between groups of children who had differing exposure to balance training in an attempt to detect an effect on disruptive behaviors. The control group contained six participants and consisted of individuals whose children had less than a year of balance training or none at all. The experimental group contained eight participants and consisted of participants whose children had more than a year of balance training.

Variables

The dependent variable was the level of disruptive behaviors exhibited by the children while the independent variable was the incorporation of balance training into these children's therapy programs. Disruptive behaviors were defined as aggression, stereotypies, and non-compliance. The children must have exhibited these behaviors on a semi-regular basis (i.e. at least once a week) to qualify as having disruptive behavior problems. In general, balance training programs are incorporated into physical therapy, occupational therapy, and therapeutic riding programs. Balance training programs from these various therapies are identified as such by the therapist who prescribed them thus allowing parents to know their child is engaged in balance training.

Instrumentation

The norm-referenced Aberrant Behavior Checklist (ABC) was the primary outcome measure used to determine the severity of disruptive behaviors. Three of the five subscales were used as follows: irritability, stereotypic behaviors, and hyperactivity/noncompliance. These subscales were chosen because they measure the main disruptive behavior markers that this study was concerned with investigating. A separate survey written by the author was used to establish baseline demographic data such as current age, age when intervention was begun, gender, specific ASD diagnosis, type of intervention/therapy program, the presence or absence of balance training in said program and length of time involved in the intervention. All of these materials are contained in Appendix A: Survey Packet.

Procedure

Physical therapy clinics, the Jackson Autism Center, the Dubard School and therapeutic riding centers were contacted to acquire permission to leave survey packets for the therapists to disseminate to the parents of autistic children who attend those centers. The therapists in charge of treatment at each center signed two brief verification forms which established both if the therapist does or does not engage in balance training in their programs and that the participants they recruited do have children with autism. After reading the information letter and signing the consent form, one parent from each family filled out the demographic information questionnaire as well as the ABC. The questionnaires were collected by the researcher two weeks from the first day that they were sent to each therapy center. In cases with an insufficient response, the clinics were contacted again and the therapists requested to ask their parents again to complete the surveys. In most cases the therapy center did not respond to the second attempt at contact so the sample size was limited both by available subject recruitment pools and by low participation rates.

Data Analysis

The raw data obtained from the three subscales of the ABC was analyzed using IBM's Statistical Package for the Social Sciences (SPSS) version twenty-two. In all tests, $p<0.05$ was used to indicate significance. To determine if there was an overall difference between the control and experimental groups, the data was analyzed using Multivariate Analysis of Variance techniques (specifically the Hotelling's Trace test) in order to determine if there was a significant difference between the groups overall when all three dependent variables were taken into account. Due to the small sample size, the individual variables were also analyzed for significance independent of each other using

an Independent Sample T-test that was corrected for differences in sample size and unequal variance as appropriate. For this analysis, the data was split not only into the control and experimental group, but also other groupings based on the available information on other therapeutic interventions provided by the participants. Due to the lack of sufficient survey response, the sample size was smaller than optimal which limited the power of the statistical analyses to detect differences and limited generalization.

Chapter 4: Results

Participants

A total of fourteen participants were recruited for this study of these, twelve were male and two were female. There were no differences between groups on which parent (mother or father) filled out the survey, but both of the female participants were in the control group. On average, compared to the experimental group, the participants in the control group tended to be younger ($\bar{x}$= 7.4 yrs vs. $\bar{x}$= 11.1 yrs), have a lower severity of Autism (based on self-reported diagnosis), participated in therapy programs for a lower total number of years ($\bar{x}$= 3.4 yrs vs. $\bar{x}$= 8 yrs), were more likely to participate in ABA interventions (83.3% vs. 25%), and were less likely to use psychopharmacologic interventions (16.67% vs. 66.67%). The sample was also grouped by presence of ABA interventions and the presence of drug interventions in the therapy program as part of the follow-up analyses. All of these demographic measures are summarized in Table I: Demographic Measures below.

Table I: Demographic Measures

Grouping Variable		Age (years)	Autism Severity	Years in Therapy	Balance training	ABA	Drug Intervention	N
Balance	Yes	11.1	High	8	100%	25%	16.67%	8
Yes	No	7.4	Low	3.4	0%	83%	66.67%	6
No								
ABA Yes	Yes	8.9	Medium	6.2	42.8%	100%	42.8%	7
No	No	10.1	Medium	5.7	71.4%	0%	28.5%	7
Drug Therapy	Yes	11.2	High	9.2	40%	80%	100%	5
No	No	8.6	Low	4.3	44%	33%	0%	9

Efficacy

There was not a statistically significant difference in incidence of disruptive behaviors based on the presence of balance training in the therapy program when all three dependent variables were taken into account simultaneously, $F(3,10)= 2.278$ $p>0.05$; Hotelling's Trace= 0.683 (see Table II: Multivariate Analysis). This lack of significance is likely attributable to small sample size. When analyzed individually using a one tailed t-test (p=0.05) the results on irritability, stereotypy, and hyperactivity also all failed to reach significance with $p= 0.207$, $p= 0.98$, and $p= 0.614$ respectively. Similar results were found when the data was broken up into groups based on ABA and Drug intervention strategies wherein none of the variables reached significance on a two tailed t-test (p=0.05). Notably, when the sample was grouped based on total number of therapeutic interventions (>5 vs. <5) the irritability variable just failed to reach significance with $p= 0.073$. This data is summarized in Table III: Univariate Analysis on the next page.

Table II: Multivariate Analysis

Effect	Value	F	Hypothesis df	Error df	Significance*
Pillai's Trace	0.406	2.278	3.000	10.000	0.142
Wilks' Lambda	0.594	2.278	3.000	10.000	0.142
Hotelling's Trace	**0.683**	**2.278**	**3.000**	**10.000**	**0.142**
Roy's Largest Root	0.683	2.278	3.000	10.000	0.142

*significant at $p< 0.05$ level

Table III: Univariate Analysis						
Group			N	Mean	Std. Dev.	Sig.
Balance	Yes	Irritability	8	6.875	4.969	0.207
		Stereotypy	8	6.750	3.807	0.980
		Hyperactivity	8	16.875	14.095	0.614
	No	Irritability	6	9.333	5.921	-
		Stereotypy	6	2.833	1.834	-
		Hyperactivity	6	15.000	7.071	-
ABA	Yes	Irritability	7	7.285	4.820	0.670*
		Stereotypy	7	5.714	4.347	0.529*
		Hyperactivity	7	18.857	14.346	0.376*
	No	Irritability	7	8.571	6.106	-
		Stereotypy	7	4.428	2.935	-
		Hyperactivity	7	13.285	7.181	-
Drug Intervention	Yes	Irritability	5	8.000	8.455	0.979*
		Stereotypy	5	4.000	3.082	0.432*
		Hyperactivity	5	15.600	15.962	0.913*
	No	Irritability	9	7.888	3.218	-
		Stereotypy	9	5.666	3.937	-
		Hyperactivity	9	16.333	8.888	-
Number of Therapies	≥5	Irritability	6	10.666	6.623	0.073
		Stereotypy	6	5.833	4.875	0.259
		Hyperactivity	6	21.666	15.174	0.091
	<5	Irritability	8	5.875	3.181	-
		Stereotypy	8	4.500	2.563	-
		Hyperactivity	8	11.875	4.696	-

*indicates 2-tailed test

Chapter 5: Discussion

Findings

This study presents data on fourteen children, eight of whom were engaged in balance training for more than a year and six of whom were engaged in balance training for less than a year or not at all. There were no statistically significant differences in overall incidence of disruptive behavior between the control and experimental groups. There were also no statistically significant differences in irritability, stereotypy, or hyperactivity between the groups when these variables were analyzed individually. The small sample size likely caused the difficulty in detecting significant differences between the groups. This conclusion is supported by the follow-up analyses conducted by splitting the sample into two further groupings, one based on participation in ABA interventions and the other based on participation in drug interventions. Neither of these groupings was capable of detecting a significant difference in any of the disruptive behaviors measured despite the fact that both interventions have been shown by other researchers to have statistically significant effects (Ben-Itzchak & Zachor, 2007; Malone & Waheed, 2009). Notably, when the sample was grouped based solely on the number of interventions used (less than five or greater than five) it was found that the scores on the irritability subscale of the ABC just failed to reach significance with $p = 0.07$. This suggests that having a more diverse set of therapies may be more beneficial than having only one, an observation which was not made in the ABA or pharmacologic research reviewed.

Another possible reason that the data failed to reach significance is due to the differences between the study groups. The two groups had very different make ups over all, and these differences were amplified during analysis by the small sample size. On average, the participants in the experimental group tended to be older and have a much higher severity of Autism (based on self-reporting by the parents of the child's diagnosis) compared to the control group. This difference in Autism severity may have led to a masking of the treatment effect since, according to the DSM-IV-TR; higher degrees of Autism severity tend to lead to increased rates of disruptive behaviors (American Psychiatric Association, 2000). This possible increase in disruptive behaviors with autism severity would easily have masked any treatment effects in the small sample especially due to the inability to collect pre-treatment measures of disruptive behavior.

Limitations

There were a number of methodological issues with this study that may have affected the interpretation of the findings; the largest of which was the method of subject recruitment and assignment to groups. The sample was a convenient one, taken from various therapy centers whose directors were willing to participate in the research. There was no way to recruit the subjects from diverse locations or to ensure an even distribution of secondary characteristics such as age, gender, autism severity, ethnicity, or socioeconomic status, this increases the risk of confounding variables in the research and reduces the generalizability of the findings. The study also used a Quasi-Experimental design wherein the participants were not randomly assigned to the treatment states; rather, the participants were sorted into groups based on what therapies they have chosen to do. This method resulted in the experimental group having a higher level of Autism

Severity than the control group which likely masked any treatment effect that could have been detected at this small sample size.

Another methodological issue with this study is that the data was taken through parent completed surveys. Survey based studies are difficult to interpret due to the number of uncontrolled variables inherent in this data collection method. Although as many variables were controlled as possible, the researcher had no way of confirming if the information listed in the demographic questionnaire or the ABC was true.

Another problem with this study was the small sample size. After spending nearly seven months contacting therapy centers to get their permission to distribute surveys to their locations, only five centers consented to participate and only three of those returned completed surveys. Of the fifty surveys distributed only fourteen were returned completed and only one center returned the blank ones with the completed ones. The small sample size also forced compromises to be made in the control and experimental groupings. Because only two surveys were returned that indicated the children participated in no balance training at all, the groups had to be split based on length of time in the balance program which severely weakened the integrity of the research.

Recommendations for Future Research

With all of the research indicating that all individuals with ASD have some sort of balance deficit, it is important to determine exactly what effect improving the balance of children with ASD has not only on their behaviors but on their general quality of life. Future research into this topic should be paramount among Autism researchers. Due to the inconclusive nature of the results of this study, it is important to repeat the study with

a larger participant base and in a way that minimizes the methodological problems experienced in this first attempt. Further research into this topic should also include longitudinal research that follows children from their first entrance into a balance program all the way until they are discharged from therapy services. It will be important to discover which type of balance (static or dynamic or both) improvements are the most beneficial for these children because this knowledge will allow more focused therapeutic programs to be created for these individuals.

Due to the finding that the number of therapies (regardless of type) that the children participated in had a nearly significant effect on reducing irritability, another interesting avenue of research would be to determine if the number of therapies a child is involved in increases their functionality. So much of the research into treatments for Autism, this study included, has focused on finding the one most effective treatment to reduce the difficulties associated with Autism. A study into if the quantity of therapeutic interventions applied is more advantageous than the type of individual interventions would be an interesting addition to the literature.

Conclusions

Overall, it is crucial that the effect of balance training on children with ASD be determined because until there is sufficient research backing the intervention, it will be difficult for parents to get appropriate treatment for their children. Despite the methodological problems with this study and the inconclusive results it is still paramount to discover what effect balance training has on these individuals. Despite all of the individual variation in children with ASD all of them have some form of balance deficit a unilateral similarity that is not true of any other element of the disorder. It is important to

determine how improvements in balance can help the whole of this population. The biggest benefit to balance training is that it has no dangerous side effects (like the drug therapies), it does not require thousands of dollars and hours of work (like ABA), and it has the potential to improve the lives of every child with ASD not only the few that have the specific problems targeted by other interventions. This study has shown that future research into this topic is paramount to discovering further treatments that can help this ever increasing population.

References

Akhondzadeh, S., Fallah, J., Mohammadi, M., Imani, R., Mohammadi, M., Salehi, B., et al. (2010). Double-blind placebo-controlled trial of pentoxifylline added to risperidone: Effects on aberrant behavior in children with autism. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 34*, 32-36.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders, 4th edition, Text Revision (DSM-IV-TR)*. Washington, DC: American Psychiatric Publishing.

Baio, J. (2012). *Prevalence of autism spectrum disorders.* Retrieved January, 28, 2014, from http://www.cdc.gov/mmwr/preview/mmwrhtml/ss6103a1.htm?s_cid=ss6103a1_w

Baranek, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of Autism and Developmental Disorders, 32*(5), 397-422.

Ben-Itzchak, E., & Zachor, D. A. (2007). The effects of intellectual functioning and autism severity on outcome of early behavioral intervention for children with autism. *Research in Developmental Disabilities, 28*, 287-303.

Benvenuio, A., Battan, B., Porfirio, C., & Curatolo, P. (2013). Pharmacotherapy of autism spectrum disorders. *Brain and Development, 35*, 119-127.

Dawson, G., & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: A review of the evidence. *Journal of Autism and Developmental Disorders, 30*(5)

De Hert, M., Dobbelaere, M., Sheridan, E. M., Cohen, D., & Correll, C. U. (2011). Metabolic and endocrine adverse effects of second-generation antipsychotics in children and adolescents: A systematic review of randomized, placebo controlled trials and guidelines for clinical practice. *European Psychiatry, 26*, 144-158.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2002). Intensive behavioral treatment at school for 4- to 7-year-old children with autism: A 1-year comparison controlled study. *Behavior Modification, 26*(1), 49-68.

Eikeseth, S., Smith, T., Jahr, E., & Eldevik, S. (2007). Outcome for children with autism who began intensive behavioral treatment between ages 4 and 7: A comparison controlled study. *Behavior Modification, 31*, 264.

Eikeseth, S., Kintwall, L., Jahr, E., & Karlsson, P. (2012). Outcome for children with autism receiving early and intensive behavioral intervention in mainstream preschool and kindergarten settings. *Research in Autism Spectrum Disorders, 6*, 829-835.

Eldevik, S., Hastings, R. P., Jahr, E., & Hughes, C. (2012). Outcomes of behavioral intervention for children with autism in mainstream pre-school settings. *Journal of Autism and Developmental Disorders, 42*, 210-220.

Elliott, R., J., Dobbin, A. R., Rose, G. D., & Soper, H. V. (1994). Vigorous, aerobic exercise versus general motor training activities: Effects on maladaptive and stereotypic behaviors of adults with both autism and mental retardation. *Journal of Autism & Developmental Disorders, 24*(5), 565-576. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=2009847445&site=ehost-live

Fournier, K. A., Kimberg, C. I., Randovich, K. J., Tillman, M. D., Chow, J. W., Lewis, M. H., et al. (2010). Decreased static and dynamic postural control in children with autism spectrum disorders. *Gait and Posture, 32*, 6-9.

Fournier, K. A., Amano, S., Randovich, K. J., Bleser, T. M., & Hass, C. J. (2014). Decreased dynamical complexity during quiet stance in children with autism spectrum disorders. *Gait and Posture, 39*, 420-423.

Ghanizadeh, A., Sahraeizadeh, A., & Berk, M. (2013). A head-to-head comparison of aripiprazole and risperidone for safety and treating autistic disorders, a randomized double blind clinical trial. *Child Psychiatry and Human Development,*

Gowen, E., & Miall, R. C. (2005). Behavioral aspects of cerebellar function in adults with asperger syndrome. *The Cerebellum, 4*, 279-289.

Grindle, C. F., Kovshoff, H., Hastings, R. P., & Remington, B. (2009). Age and IQ at intake as predictors of placement for young children with autism: A four- to six-year follow-up. *Journal of Autism and Developmental Disorders, 39*, 42-56.

Hayward, D., Eikeseth, S., Gale, C., & Morgan, S. (2009). Assessing progress during treatment for young children with autism receiving intensive behavioral interventions. *Autism, 13*(6), 613-633. doi:10.1177/1362361309340029

Howard, J. S., Sparkman, C. R., Cohen, H. G., Green, G., & Stanislaw, H. (2005). A comparison of intensive behavior analytic and eclectic treatments for young children with autism. *Research in Developmental Disabilities, 26*, 359-383.

Jesner, O. S., Aref-Adib, M., & Coren, E. (2007). Risperidone for autism spectrum disorder. *Cochrane Database of Systematic Reviews, 1*

Kovshoff, H., Hastings, R. P., & Remington, B. (2011). Two-year outcomes for children with autism after the cessation of early intensive behavioral intervention. *Behavior Modification, 35*(5), 427-450. doi:10.1177/0145445511405513

Lovaas, O. I. (1987). Behavioral treatment and normal education and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology, 55*(1), 3-9.

Lovaas, O. I., Koegel, R. L., Simmons, J. Q., & Long, J. (1973). Some generalization and follow-up measures on autistic children in behavior therapy. *Journal of Applied Behavior Analysis, 6*, 131-166.

Luiselli, J. K., Cannon, B. O., Ellis, J. T., & Sisson, R. W. (2000). Home-based behavioral intervention for young children with autism/pervasive developmental disorder: A preliminary evaluation of outcome in relation to child age and intensity of service delivery. *Autism, 4*, 426.

Machalicek, W., O'Reilly, M. F., Beretvas, N., Sigafoos, J., & Lancioni, G. E. (2007). A review of interventions to reduce challenging behavior in school settings for students with autism spectrum disorders. *Research in Autism Spectrum Disorders, 1,* 229-246.

Magiati, I., Charman, T., & Howlin, P. (2007). A two-year prospective follow-up study of community-based early intensive behavioral intervention and specialist nursery provision for children with autism spectrum disorders. *Journal of Child Psychology and Psychiatry, 48*(8), 803-812. doi:10.1111/j.1469-7610.2007.01756.x

Malone, R. P., Gratz, S. S., Delaney, A. M., & Hyman, S. B. (2005). Advances in drug treatments for children and adolescents with autism and other pervasive developmental disorders. *CNS Drugs, 19*(11), 923-934. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=s3h&AN=19190733&site=ehost-live

Malone, R. P., & Waheed, A. (2009). The role of antipsychotics in the management of behavioral symptoms in children and adolescents with autism. *Drugs, 69*(5), 535-548.

Marcus, R. N., Owen, R., Kamen, L., Manos, G., McQuade, R. D., Carson, W. H., et al. (2009). A placebo-controlled, fixed-dose study of aripiprazole in children and adolescents with irritability associated with autistic disorder. *Journal of the American Academy of Child & Adolescent Psychiatry,*

Matson, J. L., & Nebel-Schwalm, M. (2007). Assessing challenging behaviors in children with autism spectrum disorders: A review. *Research in Developmental Disabilities, 28*, 567-579.

Matson, J. L., Sipes, M., Fodstad, J. C., & Fitzgerald, M. E. (2011). Issues in the management of challenging behaviors of adults with autism spectrum disorder. *CNS Drugs, 25*(7), 597-606. doi:10.2165/11591700-000000000-00000

McCracken, J. T., McGough, J., J., Shah, B., Cronin, P., Hong, D., Aman, M. G., et al. (2002). Risperidone in children with autism and serious behavioral problems. *New England Journal of Medicine, 347*(5), 314.

McDougle, C. J., Scahill, L., Aman, M. G., McCracken, J. T., Tierney, E., Davies, M., et al. (2005). Risperidone for the core symptom domains of autism: Results from the study by the autism network of the research units on pediatric psychopharmacology. *American Journal of Psychiatry, 162*, 1142-1148.

McDougle, C. J., Stigler, K. A., Erickson, C. A., & Posey, D. (2006). Pharmacology of autism. *Clinical Neuroscience Research, 6*, 179-188.

McEachin, J. J., Smith, T., & Lovaas, O. I. (1993). Long-term outcome for children with autism who received early intensive behavioral treatment. *American Journal on Mental Retardation, 97*(4), 359-372.

McKinney, C., & Renk, K. (2011). Atypical antipsychotic medications in the management of disruptive behaviors in children: Safety guidelines and recommendations. *Clinical Psychology Review, 31*, 465-471.

Memari, A. H., Ghanouni, P., Gharibzadeh, S., Eghlidi, J., Ziaee, V., & Moshayedi, P. (2013). Postural sway patterns in children with autism spectrum disorder compared with typically developing children. *Research in Autism Spectrum Disorders, 7*, 325-332.

Minshew, N. J., Sung, K., Jones, B. L., & Furman, J. M. (2007). Underdevelopment of the postural control system in autism. *Neurology, 2004*(63), 2056-2061.

Miral, S., Gencer, O., Inal-Emiroglu, F. N., Baykara, B., Baykara, A., & Dirik, E. (2008). Risperidone versus haloperidol in children and adolescents with AD. *European Child and Adolescent Psychiatry, 17*, 1-8.

Molloy, C. A., Dietrich, K. N., & Bhattacharya, A. (2003). Postural stability in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 33*, 643-652.

Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. *Pediatrics,* 1162-1187.

Nicolson, R., Awad, G., & Sloman, L. (1998). An open trial of risperidone in young autistic children. *Journal of the American Academy of Child & Adolescent Psychiatry, 37*(4)

Owen, R., Sikich, L., Marcus, R. N., Corey-Lisel, P., Manos, G., McQuade, R. D., et al. (2009). Aripiprazole in the treatment of irritability in children and adolescents with autistic disorder. *Pediatrics.*

Pandina, G., Bossie, C., Youssef, E., Zhu, Y., & Dunbar, F. (2007). *Journal of Autism and Developmental Disorders, 37*, 367-373.

Posey, D., Stigler, K., Erickson, C., & McDougle, C. (2008). Antipsychotics in the treatment of autism. *The Journal of Clinical Investigation, 118*(1), 6-14.

Pringsheim, T., Lam, D., Ching, H., & Patten, S. (2011). Metabolic and neurological complications of second-generation antipsychotic use in children a systematic review and meta-analysis of randomized controlled trials. *Drug Safety, 34*(8), 651-668.

Remington, B., Hastings, R. P., Kovshoff, H., Espinosa, F., Jahr, E., Brown, T., et al. (2007). Early intensive behavioral intervention: Outcomes for children with autism and their parents after two years. *American Journal on Mental Retardation, 112*(6), 418-438. doi:10.1352/0895-8017(2007)112[418:EIBIOF]2.0.CO;2

Rezzaei, V., Mohammadi, M., Ghanizadeh, A., Sahraian, A., Tabrizi, M., Rezazadeh, S., et al. (2010). Double-blind, placebo-controlled trial of risperidone plus topiramate in children with autistic disorder. *Progress in Neuro-Psychopharmacology and Biological Psychiatry, 34*, 1269-1272.

Research Units on Pediatric Psychopharmacology Autism Network (RUPPAN) (2005). Risperidone treatment of autistic disorder: Longer-term benefits and blinded discontinuation after 6 months. *American Journal of Psychiatry, 162*(7), 1361-1369.

Robb, A. S. (2010). Managing irritability and aggression in autism spectrum disorders in children and adolescents. *Developmental Disabilities Research Reviews, 16*(3), 258-264. doi:10.1002/ddrr.118

Romero-Munguía, M. Á. (2008). Mnesic imbalance: A cognitive theory about autism spectrum disorders. *Annals of General Psychiatry, 7*(20)

Rugino, T. A., & Janvier, Y. M. (2005). Aripiprazole in children and adolescents: Clinical experience. *Journal of Child Neurology, 20*, 603.

Sallows, G. O., & Graupner, T. D. (2005). Intensive behavioral treatment for children with autism: Four-year outcome and predictors. *American Journal on Mental Retardation, 110*(6), 417-438.

Scahill, L., McDougle, C. J., Aman, M. G., Johnson, C., Handen, B., Bearss, K., et al. (2012). Effects of risperidone and parent training on adaptive functioning in children with pervasive developmental disorders and serious behavioral problems. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(2), 136-146. doi: http://dx.doi.org/10.1016/j.jaac.2011.11.010

Schmid, M., Conforto, S., Lopez, L., & D'Alessio, T. (2007). Cognitive load affects postural control in children. *Experimental Brain Research, 179*, 375-385.

Schoen, A. A. (2003). What potential does the applied behavior analysis approach have for the treatment of children and youth with autism? *Journal of Instructional Psychology, 30*(2), 125. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=pbh&AN=10164747&site=ehost-live

Schopler, E., Short, A., & Mesibov, G. (1989). Relation of behavioral treatment to 'normal functioning': Comment on Lovaas. *Journal of Consulting and Clinical Psychology, 57*(1), 162-164. doi:10.1037/0022-006X.57.1.162

Scott, L., & Dhillon, S. (2007). Risperidone A review of its use in the treatment of irritability associated with autistic disorder in children and adolescents. *Pediatric Drugs, 9*(5), 343-354.

Sharma, A., & Shaw, S. R. (2011). Efficacy of risperidone in managing maladaptive behaviors for children with autistic spectrum disorder: A meta-analysis. *National Association of Pediatric Nurse Practitioners,* 291.

Shea, S., Turgay, A., Carroll, A., Schulz, M., Orlik, H., Smith, I., et al. (2004). Risperidone in the treatment of disruptive behavioral symptoms in children with autistic and other pervasive developmental disorders. *Pediatrics, 114*(5)

Shea, V. (2005). A perspective on the research literature related to early intensive behavioral intervention (Lovaas) for young children with autism. *Communication Disorders Quarterly, 26*(2), 102-111. doi:10.1177/15257401050260020101

Stigler, K. A., Diener, J. T., Kohn, A. E., Li, L., Erickson, C., Posey, D., et al. (2009). Aripiprazole in pervasive developmental disorder not otherwise specified and Asperger's disorder: A 14-week, prospective, open-label study. *Journal of Child and Adolescent Psychopharmacology, 19,* 265-274.

Troost, P., Lahuis, B., Steenhuis, M., Ketelaars, C., Buitellar, J., Van Engeland, H., et al. (2005). Long-term effects of risperidone in children with autism spectrum disorders: A placebo discontinuation study. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*, 11.

U.S. Department of Health and Human Services. (2014). *CDC estimates 1 in 68 children has been identified with autism spectrum disorder.* Retrieved April 23, 2014, from http://www.cdc.gov/media/releases/2014/p0327-autism-spectrum-disorder.html

Virués-Ortega, J. (2010). Applied behavior analytic intervention for autism in early childhood: Meta-analysis, meta-regression and dose–response meta-analysis of multiple outcomes. *Clinical Psychology Review, 30*, 387-399.

Vitiello, B., Correll, C., van Zwieten-Boot, B., Zuddas, A., Parellada, M., & Arango, C. (2009). Antipsychotics in children and adolescents: Increasing use, evidence for efficacy and safety concerns. *European Neuropsychopharmacology, 19*, 629-635.

Weeden, M., Ehrhardt, K., & Poling, A. (2009). Conspicuous by their absence: Studies comparing and combining risperidone and applied behavior analysis to reduce challenging behavior in children with autism. *Research in Autism Spectrum Disorders, 3*, 905-912.

Weiss, M. J. (1999). Differential rates of skill acquisition and outcomes of early intensive behavioral intervention for autism. *Behavioral Interventions, 14*(1), 3-22. doi:10.1002/(SICI)1099-078X(199901/03)14:1<3::AID-BIN25>3.0.CO;2-F

West, L., & Waldrop, J. (2006). Risperidone use in the treatment of behavioral symptoms in children with autism. *Pediatric Nursing, 32*(6), 545.

Zachor, D. A., Ben-Itzchak, E., Rabinovich, A & Lahat. (2007). Change in autism core symptoms with intervention. *Research in Autism Spectrum Disorders, 1*, 304-317.

Appendix A: Survey Packet

Introduction

Please read this letter before completing the included surveys.

To Whom it may concern:

My name is Claire Scates and I am a senior honor's student at the University of Southern Mississippi. As part of my degree, I have to complete an original research project for my honor's thesis.

The purpose of my project is to investigate the effect (if any) of balance training on disruptive behaviors in children with Autism Spectrum Disorders. I hope to accomplish this through the data collected in these surveys. You will complete a brief demographic questionnaire and a longer survey. Based on your answer to the question on the next page that asks "what therapies your child has been involved in or is currently involved in" your results will be sorted into two groups. The first group will include only those children who are involved in some sort of balance therapy and the second will include only those children who do not have any balance improving therapies.

Balance is defined as the ability to control the body's center of gravity within a given base of support. Simply put balance is your ability to keep control of your body so you do not fall. Common methods employed in therapy settings to improve a child's balance include but are not limited to the following: BOSU ball exercises, standing on balance boards(sometimes called wobble boards) strengthening the core (abdominal) muscles, and therapeutic riding. Testing of balance is commonly conducted through the Romberg test where the child will stand on both feet with the eyes closed and their ability to maintain that position is monitored.

The survey you are about to complete is called the Aberrant Behavior Checklist (ABC) and is a norm-referenced scale used to assess the frequency and severity of disruptive behaviors among children, teens, and adults. The ABC is designed to be completed by parents based on their observations of their child's recent behavior. The results from this checklist will be used to calculate the relative amounts of disruptive behaviors exhibited by the two sample groups in the study (one whose therapies include balance training and one whose do not).

Thank you so very much for helping me with this. Your answers to this survey will be kept completely confidential and will never be associated with yours or your child's name. Ignore the blanks on the entire first page of the Aberrant Behavior Checklist (pink survey) that ask for name, educational status, ethnicity, specific medications, etc. as it is not necessary for you to provide that information.

Thank you,

Claire Scates

Demographic Information

1. Parent filling out survey Mother Father

2. Age of Child- _____

3. Gender of Child M F

4. Specific Autism Diagnosis- _____

4. Total years involved in therapy programs- _____

5. Please check all therapies your child is currently involved in as well as any they have ever been involved in, then indicate approximately how many years they participated in each therapy.

✓	Therapy	Years of Participation
	Physical Therapy -does this include a balance component Yes No	
	Occupational Therapy -does this include a balance component Yes No	
	Speech Therapy	
	Therapeutic Riding	
	Applied Behavior Analysis	
	Psychopharmacologic Interventions (ex: Risperdal, Abilify, etc.)	
	TEACCH	
	Sensory Integration Therapy	
	Auditory Integration Therapy	
	Other (Please List): _____ _____	

ABERRANT BEHAVIOR CHECKLIST – COMMUNITY

Do NOT fill out this page

Proceed to next page

_____

ıcck):

Date of Birth ____/____/____
Month Day Year

- ❑ Teacher
- ❑ Trainer/Supervisor
- ❑ Other (please specify)

_____

Today's Date ____/____/____
Month Day Year

Where Was the Client Observed?

- ❑ Home
- ❑ School
- ❑ Residential Unit
- ❑ Workshop
- ❑ Other (please specify)

_____

If in School, Type of Class (check one): ❑ Developmentally Handicapped ❑ Multihandicapped ❑ Severe Behavior Handicap ❑ Other _____

Ethnic Group (check):

❑ Caucasian ❑ Hispanic
❑ African-American ❑ Other (please specify) _____

CLIENT'S MEDICAL STATUS (Please circle)

a. Deafness?	No	Yes	? (Don't Know)
b. Blindness?	No	Yes	?
c. Epilepsy?	No	Yes	?
d. Cerebral Palsy?	No	Yes	?

e. Other _____

CURRENT MEDICATIONS (Please list any medication and dosage schedule)

1. _____
2. _____
3. _____
4. _____
5. _____

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INSTRUCTIONS

The ABC–Community rating scale is designed to be used with clients living in the community. Please note that the term *client* is used throughout to refer to the person being rated. This may be a child of school age, an adolescent, or an adult.

Please rate this client's behavior for the last four weeks. For each item, decide whether the behavior is a problem and circle the appropriate number:

0 = not at all a problem
1 = the behavior is a problem but slight in degree
2 = the problem is moderately serious
3 = the problem is severe in degree

When judging this client's behavior, please keep the following points in mind:

(a) Take relative *frequency* into account for each behavior specified. For example if the client averages more temper outbursts than most other clients you know or most others in his/her class, it is probably moderately serious (2) or severe (3) even if these occur only once or twice a week. Other behaviors, such as noncompliance, would probably have to occur more frequently to merit an extreme rating.

(b) If you have access to this information, consider the experiences of other care providers with this client. If the client has problems with others but not with you, try to take the whole picture into account.

(c) Try to consider whether a given behavior interferes with his/her *development, functioning*, or *relationships*. For example, body rocking or social withdrawal may not disrupt other children or adults, but it almost certainly hinders individual development or functioning.

Do not spend too much time on each item— your first reaction is usually the right one.

1. Excessively active at home, school, work, or elsewhere	0	1	2	3
2. Injures self on purpose	0	1	2	3
3. Listless, sluggish, inactive	0	1	2	3
4. Aggressive to other children or adults (verbally or physically)	0	1	2	3
5. Seeks isolation from others	0	1	2	3
6. Meaningless, recurring body movements	0	1	2	3
7. Boisterous (inappropriately noisy and rough)	0	1	2	3
8. Screams inappropriately	0	1	2	3
9. Talks excessively	0	1	2	3
10. Temper tantrums/outbursts	0	1	2	3
11. Stereotyped behavior; abnormal, repetitive movements	0	1	2	3
12. Preoccupied; stares into space	0	1	2	3
13. Impulsive (acts without thinking)	0	1	2	3
14. Irritable and whiny	0	1	2	3
15. Restless, unable to sit still	0	1	2	3
16. Withdrawn; prefers solitary activities	0	1	2	3
17. Odd, bizarre in behavior	0	1	2	3
18. Disobedient; difficult to control	0	1	2	3
19. Yells at inappropriate times	0	1	2	3
20. Fixed facial expression; lacks emotional responsiveness	0	1	2	3

21. Disturbs others	0	1	2	3
22. Repetitive speech	0	1	2	3
23. Does nothing but sit and watch others	0	1	2	3
24. Uncooperative	0	1	2	3
25. Depressed mood	0	1	2	3
26. Resists any form of physical contact	0	1	2	3
27. Moves or rolls head back and forth repetitively	0	1	2	3
28. Does not pay attention to instructions	0	1	2	3
29. Demands must be met immediately	0	1	2	3
30. Isolates himself/herself from other children or adults	0	1	2	3
31. Disrupts group activities	0	1	2	3
32. Sits or stands in one position for a long time	0	1	2	3
33. Talks to self loudly	0	1	2	3
34. Cries over minor annoyances and hurts	0	1	2	3
35. Repetitive hand, body, or head movements	0	1	2	3
36. Mood changes quickly	0	1	2	3
37. Unresponsive to structured activities (does not react)	0	1	2	3
38. Does not stay in seat (e.g., during lesson or training periods, meals, etc.)	0	1	2	3
39. Will not sit still for any length of time	0	1	2	3
40. Is difficult to reach, contact, or get through to	0	1	2	3
41. Cries and screams inappropriately	0	1	2	3
42. Prefers to be alone	0	1	2	3
43. Does not try to communicate by words or gestures	0	1	2	3
44. Easily distractible	0	1	2	3
45. Waves or shakes the extremities repeatedly	0	1	2	3
46. Repeats a word or phrase over and over	0	1	2	3
47. Stamps feet or bangs objects or slams doors	0	1	2	3
48. Constantly runs or jumps around the room	0	1	2	3
49. Rocks body back and forth repeatedly	0	1	2	3
50. Deliberately hurts himself/herself	0	1	2	3
51. Pays no attention when spoken to	0	1	2	3
52. Does physical violence to self	0	1	2	3
53. Inactive, never moves spontaneously	0	1	2	3
54. Tends to be excessively active	0	1	2	3
55. Responds negatively to affection	0	1	2	3
56. Deliberately ignores directions	0	1	2	3
57. Has temper outbursts or tantrums when he/she does not get own way	0	1	2	3
58. Shows few social reactions to others	0	1	2	3

Appendix B: IRB Approval

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
118 College Drive #5147 | Hattiesburg, MS 39406-0001
Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 14100104
PROJECT TITLE: The Effect of Balance Training on Disruptive Behaviors in Children with Autism Spectrum Disorders
PROJECT TYPE: New Project
RESEARCHER(S): Claire Scates
COLLEGE/DIVISION: College of Health
DEPARTMENT: Human Performance and Recreation
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Exempt Review Approval
PERIOD OF APPROVAL: 10/17/2014 to 10/16/2015
Lawrence A. Hosman, Ph.D.
Institutional Review Board

Appendix C: Consent Form

ORI | Office of Research Integrity

INSTITUTIONAL REVIEW BOARD
SHORT FORM CONSENT

SHORT FORM CONSENT PROCEDURES

This document must be completed and signed by each potential research participant before consent is obtained.

- All potential research participants must be presented with the information detailed in the Oral Procedures before being signing the short form consent.
- The Project Information section should be completed by the Principal Investigator before submitting this form for IRB approval.
- Copies of the signed short form consent should be provided to all participants.
- The witness to consent must be someone other than the Principal Investigator or anyone else on the research team.

Last Edited July 22nd, 2014

Today's date:		
PROJECT INFORMATION		
Project Title: The effect of balance training on disruptive behaviors in children with ASD		
Principal Investigator: Claire Scates	Phone: 769-233-4034	Email: claire.scates@eagles.usm.ed
College: Health	Department: HPR	

CONSENT TO PARTICIPATE IN RESEARCH

Participant's Name: _____

Consent is hereby given to participate in this research project. All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected.

The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All personal information is strictly confidential, and no names will be disclosed. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project.

Questions concerning the research, at any time during or after the project, should be directed to the Principal Investigator using the contact information provided above. This project and this consent form have been reviewed by the Institutional Review Board, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to the Chair of the Institutional Review Board, The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-5997.

_____ _____

Research Participant **Witness to Consent**

_____ _____