2015

The Effects of Complementary Hippotherapy for Children with Austism Spectrum Disorder

Jamie Hicks
University of Central Florida

THE EFFECTS OF COMPLEMENTARY HIPPOTHERAPY FOR CHILDREN WITH AUSTISM SPECTRUM DISORDER

by

JAMIE HICKS

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Nursing
in the College of Nursing
and in the Burnett Honors College
at the University of Central Florida
Orlando, FL

Spring Term 2015

Thesis Chair: Dr. Krisann Draves

Abstract

Autism Spectrum Disorder (ASD) is an intricate and complex disorder that continues to grow in its prevalence year after year. The disorder is based on decreased social communication with prevalent stereotypical behaviors and problems in sensory processing. Due to the disorder diagnosis based on a spectrum, each child is different in their severity, and thus requires individualized forms of therapies and treatments. The cause of ASD is unknown, which makes the treatment difficult to standardize. Desperate to find a regimen that benefits their child's ability to function more successfully, more and more parents are utilizing complementary alternative medicine (CAM). The problem with CAM is lack of evidence that supports using CAM practice. One example of CAM is hippotherapy, which is a type of intervention used by physical, occupational and speech therapists which uses the movements of a horse to address a patient's impairments physically, emotionally and neurologically. Hippotherapy has been used since the 1960s for a number of disorders. This systematic literature review examines the effects of hippotherapy for children with ASD in regards to increasing social communication and decreasing stereotypical behaviors. The conclusion of the review resulted in conflicting evidence regarding the efficacy of hippotherapy for children with ASD. This inconclusive lack of evidence is generally due to the lack of standardized measurement scales or treatment plans used during each session and small sample sizes.

Dedication

This idea of this review would never have been created if it wasn't for the models of perseverance, hard work and excellence by the wonderful people in my life.

To my parents, mom and dad (Dr. Hicks), thank you for your constant encouragement, support and belief in me. I am grateful everyday to have you two has my parents.

To my siblings, you have always put the bar of achievement high for me because of your hard work and I thank you.

To my best friends, sisters in Christ, and roomies for life, Ambber, Delaney and Mollie, you all will accomplish great things in life and in the nursing profession. I thank you for showing me true friendship, love and loyalty.

To my grandparents, thank you for your financial and spiritual support. I am here because of you all.

To my Nana, Alice Marie Hicks, I fulfilled your dream.

Acknowledgement

Dr. Draves, thank you for your guidance through this journey, your dedication, and your willingness to help and teach.

Dr. Burr, thank you for providing your expertise and knowledge. It was an honor working with you.

Dr. Schwartz, thank you for your constant encouragement throughout this learning process. You pointed me in the right direction and allowed me to grow academically and as a person. My only regret in college is not having you as my professor.

Miss Dever, you have been there from the beginning of my nursing journey. Thank you for teaching and exemplifying what it means to be a great nurse. Your patience and kindness astounds me. I hope to one day gain these same virtues.

Dr. Loerzel, thank you for your dedication and support. I would not be here if it wasn't for your advocacy and inspiration to persevere. I am beyond grateful!

Table of Contents

List of Figures

Introduction

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is defined as a neurodevelopment disorder, which decreases social interaction and communication and produces stereotypical behaviors, such as head banging, hand flapping, and echolalia (the repetition of vocalized words) (American Psychiatric Association [APA], 2013). The current diagnosis of autism occurs in one of every 68 children, with no known cause for this disorder (Centers for Disease Control and Prevention [CDC], 2014). The diagnosis of autism, as well as any other mental disorder, is based on the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*). The most recent *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013) focuses on the spectrum of autism and categorizes the level of function per diagnosis rather than differentiating into separate disorders, such as Aspergers.

As of May 2013, the diagnostic criteria for ASD are divided into five categories. Category "A" focuses on persistent deficit in social communication and interaction manifested by at least one of the following: deficits in social reciprocity and failure to approach back-and-forth conversation, poorly integrated nonverbal and verbal communication ranging from poor eye contact to lack of facial expression, and poor progress in developing and maintaining relationships (APA, 2013). Category "B" focuses on repetitive and restricted behaviors, activities, and interests manifested by at least two of the following signs currently or historically:

hyper or hyposensitivity to sensory input (e.g., sounds, temperature, lights or textures), inflexible adherence to change in routine, stereotyped behaviors (e.g., lining up toys or flipping objects), and highly restricted or fixated interests on objects (APA, 2013). According to category "C" and "D," the symptoms of ASD must be present in early development and cause clinically significant impairment in occupational, social, and other areas of functioning (APA, 2013). Category "E" states the present symptoms of ASD must not be explained by intellectual disability (APA, 2013).

It is important to differentiate the *DSM-5* from the *Diagnostic and Statistical Manual of Mental Disorders* fourth edition text revision (4th ed., text rev.; *DSM-IV-TR*; APA, 2000*)*. As mentioned before, Asperger's Disorder (AD) is no longer a diagnosis based on the new diagnostic criteria in the *DSM-5*. Asperger's Disorder (AD) was known as a higher functioning form of autism, but was differentiated as its own disorder. Now, those previously diagnosed with AD or pervasive developmental disorder not otherwise specified will be given the diagnosis of ASD (APA, 2013).

Because ASD presents a deficiency in socialization and communication, these terms must be specified and defined. Communication is the act of sending information from one entity to another (National Communication Association [NCA], 2014). The process of communication can be sent through various channels, such as verbal, nonverbal, electronic or handwritten. In order for communication to occur, three elements must be present: a sender, a channel and a receiver. The receiver must have proper understanding and comprehension of the message and actively respond (NCA, 2014). This process is known as the Transactional Model of Communication (NCA, 2014).

Socialization is the "preparation of newcomers to become members of an existing group and to think, feel, and act in ways the group considers appropriate" (Persell, 1990 p. 98).

The level of deficiency in socialization and communication for ASD are determined by the presenting signs and symptoms of the child and are outlined in the *DSM-5*. This may include, lack of social reciprocity, reduced shared interests, failure of normal back-and-forth conversation, and failure to initiate social interaction with children of same age and/or older adults (APA, 2013). When there is a decrease in socialization, the child is at risk for becoming a non-participant in society, resulting in loss of identity and function. There is a direct relationship between socialization and communication; hence children diagnosed with ASD will have a deficiency in both (Hattier & Matson, 2012). In addition, children with ASD can also depict stereotypical behaviors, such as hand flapping and repetition of words, (which may be due to sensory processing disorder) resulting in inability for the child to socialize with other children (Caminha & Lampreia 2012).

Complementary Alternative Medicine

Types. Complementary therapy is used in conjunction with conventional medicine, whereas alternative medicine is used in place of conventional medicine (National Center for Complementary and Alternative Medicine [NCCAM], 2012). Complementary Alternative Medicine (CAM), also or complementary and integration health (CIH), is divided into five domains: mind and body medicine, biologically based practices, manipulative and body-based practices, energy medicine and whole medical systems (NCCAM, 2012). Manipulative and body based

practices are massage, spine manipulation by chiropractors, and any kind of movement therapy with a goal to correct the balance of the body (Barnett, et al., 2014). Parents of children with ASD use more complementary interventions when existing gastrointestinal symptoms, seizure disorders and behavioral problems arise (Perrin et al., 2012; Whitehouse, 2012). Perrin et al. (2012) determined that out of a sample of 3,413 children with ASD, 28% reported use of some form of CAM, despite uncertainty regarding efficacy. With considerable time and financial support for a treatment that has not been supported to be valuable or effective, and may in some cases dangerous, such as chelation and over use of vitamins, it is essential for health care providers to provide information and guidance to the families (Whitehouse, 2012).

Animal Assisted Therapies. One type of CAM therapy that results in minimal risks is the use of animal assisted therapy (AAT). Animal assisted therapy is the integration of animal interaction into a client's therapy with activities planned by a licensed physical, occupational or speech therapist to achieve the treatment goals (Sori & Hughes, 2014). Goals can include socialization, participation, physical, and/or emotional improvements (Sori & Hughes, 2014). Animal assisted activities (AAA) differs from AAT due to the fact that AAA can be delivered by volunteers and paraprofessionals and is geared towards opportunities for motivational, recreational and educational benefits (Marino, 2012).

According to O'Haire (2010), interacting with animals can support psychosocial well being. A recent study that supports this conclusion was conducted by O'Haire, McKenzie, Beck, and Slaughter (2013). The study tested the effects of animal assisted

therapy for individuals with ASD and supports evidence that guinea pigs can enhance social interaction, such as talking, looking at faces, making tactile contact, and decrease negative effects of crying, frowning, and whining (O'Haire et al., 2013). This study supports the use of animals as a catalyst in increasing socialization for those who lack the skills and/or find it difficult, such as children with ASD. Animals are social soothers that allow children with ASD to use them as channels to aid in decreasing their anxiety related to social communication and be used as a vehicle to transport their ideas, wishes and words (O'Haire et al., 2013).

Hippotherapy

Hippotherapy is a type of intervention used by physical, occupational and speech therapists which uses the movements of a horse to address a patient's impairments physically, emotionally and neurologically (Professional Association of Therapeutic Horsemanship International [PATH Intl.], 2014). Equine-assisted therapy is similar to hippotherapy, but is provided by someone certified under the Professional Association of Therapeutic Horsemanship International, not a licensed professional.

Hippotherapy was first used as an official adjunct therapy in Germany, Switzerland and Austria in the 1960s for clients with physical and mental disorders and came to America in 1969 (American Hippotherapy Association [AHA], 2000b). The client can be positioned on the horse lying on his/her side, facing forwards or backwards, supine or prone, depending on the activity, until the ultimate goal is reached (AHA, 2000a). For hippotherapy, the most common position is facing forward in the saddle. The movements of the horse leads to efficient postural alignment muscle tone, flexibility and

strength (AHA, 2000a). According to the American Hippotherapy Association (2000a), increased physical core strength often precedes increased cognitive and sensory processing, adaptation, and speech/language production, which are related to the impairments of children with ASD.

According to Edwards (2012) it is the increased anxiety and sensory processing disorder that makes therapy for children with autism too difficult to plan, assign, and implement. However, she states that the horse may be ideal for children with ASD due to the non-judgmental expectations of horses and the relaxed environment they create. This relaxed environment may allow interventions to be more effective and achieve the planned outcomes for the child, such as decrease anxiety, increase social communication, and decrease stereotypical behaviors (Edwards, 2012).

Problem

Currently, many parents are now in search of complementary treatments for ASD due to treat co-morbidities of ASD, such as disruptive sleeping habits, gastrointestinal complications and the lack of communication and interaction with their own child (Valicenti-McDermott et al., 2013). Parents desire other forms of treatment, such as hippotherapy, but there is scant and poorly designed research that results in unaccepted usage by the medical community or coverage through insurance companies (National Research Council, 2001; Pauw, 2000)

Purpose

The purpose of this paper is to provide a systematic review of the present literature related to the use of hippotherapy and its effect on social communication and stereotypical behaviors for children diagnosed with ASD.

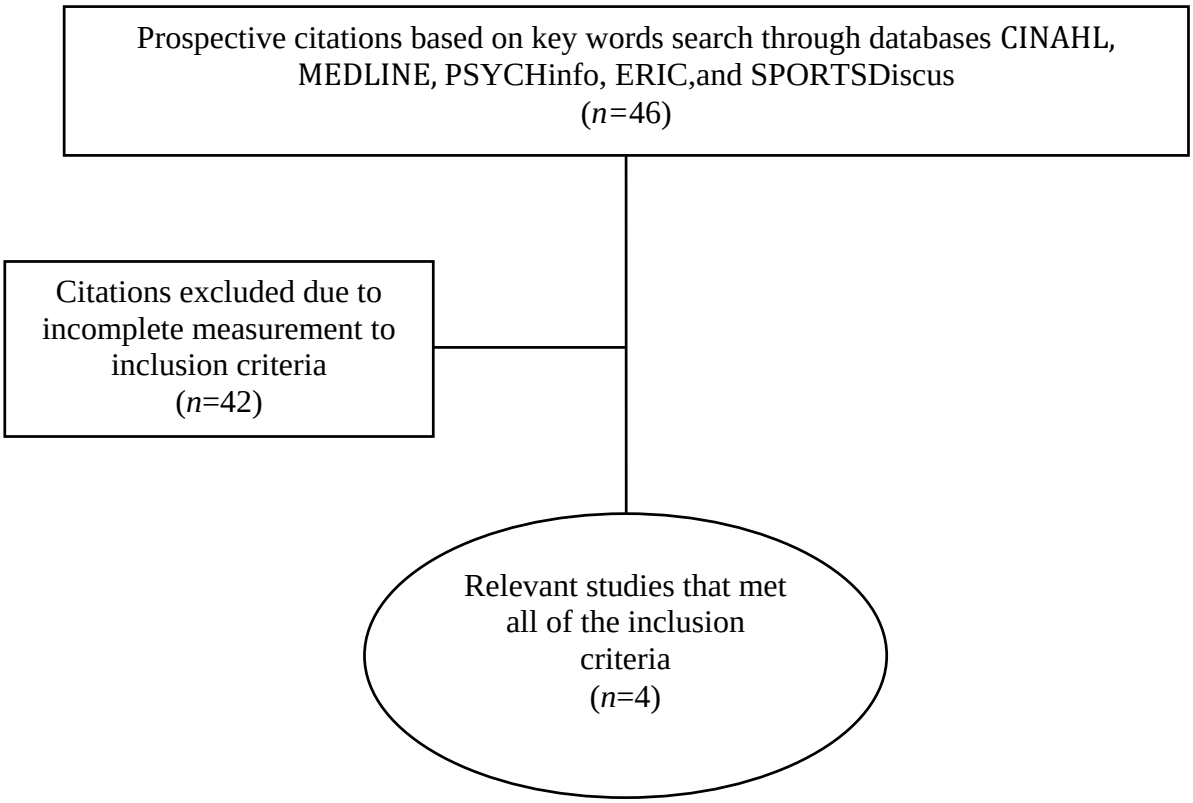
Method

The focus of this systematic review of literature was to examine original research on the complementary use of hippotherapy and its effective outcomes related to social interaction, stereotypical behaviors, and motivation for children with ASD. The key words "autis* or ASD" combined with "horseback riding, or hippotherapy or equine therapy" or "hors* and therap*" were used. The terms hippotherapy, equine-assisted therapy and horseback riding were used interchangeably. The search was limited to only journal articles that were peer reviewed. The time frame between the years from 2009 to 2014 was used to refine the search. Utilizing the search criteria, 46 articles were found. The inclusion criteria for this review consists of research involving children, male or female, with the diagnosis of ASD based on the *DSM IV TR* or *DSM-5*, effects of hippotherapy, therapeutic riding or equine assisted therapy specific outcomes of social interaction and/or communication and stereotypical behaviors. Studies were excluded if they involved children older than 21-years-old, diagnosis of disorders other than ASD and previous experience with hippotherapy. After eliminating those that did not meet the inclusion criteria, only four studies remained in the review (Please see Figure 1).

Figure 1.Flow Diagram of Study Selection Process

Key Search Terms = autis* or ASD" combined with horseback riding, or hippotherapy or equine therapy or hors* and therap*.

Limiters = Journal articles peer reviewed, between the year 2009 to 2014.



Findings

A total of four studies met inclusion criteria. Select studies measured socialization, communication and/or stereotypical behaviors (Kern et al., 2011; Jenkins & Reed, 2013; Ajzenman, Standeven, & Shurtleff, 2013; Bass, Duchowny, & Llabre, 2009). Another measurement was parents' satisfaction with hippotherapy (Kern et al, 2011; Jenkins & Reed, 2013). Several dimensions of behavior will be specified and discussed in the review of the study by Jenkins and Reed (2013).

Ajzenman et al. (2013) conducted a pilot study using a pre and post test, single group (n=6) designto determine whether hippotherapy increased function and participation in children with ASD. The ages ranged from five to 12 years old and did not specify which was male or female. The study did state that the participants received school-based therapies during hippotherapy intervention, but did not specify what kinds of therapy nor which specific participants received them. They hypothesized hippotherapy would improve motor control, which in turn might increase flexible behaviors and daily participation. The treatment lasted for 12 weeks, with one 45 minute session per week. The participants continued to receive routine school-based therapies throughout the 12 weeks of hippotherapy intervention. During the hippotherapy intervention various mounting positions were utilized including forward sitting, prone, supine, backward astride, side sit, kneeling and standing. Various riding figures included straight lines and weaving through cones in order to challenge postural stability. Change in speed and intermittent stops further challenged trunk stability and attention. Functional

activities during the hippotherapy treatment included: changes in positions, obstacle courses, and games completed in groups and individually while on the horse.

Several surveys were used in this study. The Vineland Adaptive Behavior Scale II (VABS-II), a 297-item parental report form, was used to measure communication, daily living skills, socialization and motor skills. The Child Activity Card Sort (CASC), a semi-structured parent interview, was used to examine participation in typical age-appropriate activities and identify individualized goals for the therapy treatment. Motor control was also evaluated using force plates and motion capture VMC system to analyze postural sway of each individual in the designated time of 20 seconds while standing on the force plates (Ajzenman et al., 2013).

The VABS-II's four domains are divided into sub-domains. Communication divides into receptive communication, expressive communication and written communication. Daily living skills is sectioned into personal daily living skills and domestic daily living skills. Socialization branched into interpersonal relationships, play/leisure time and coping skills. Motor skills included fine and gross motor skills. The only domains that showed significant change was socialization of coping with an effect size of $d = 0.350$ and receptive communication with an effect size of $d = 1.618$. No other significant differences were noted (Ajzenman et al., 2013).

The CASC presented to the parents/guardians with activities displayed on picture cards to determine child participation. The categories included: self care, low- demand leisure, social interaction, community mobility, high-demand leisure, domestic and education. The results showed significant change in only self care ($d= 0.624$), low demand leisure ($d = 0.889$) and social interaction ($d = 0.911$) (Ajzenman et al. 2013).

The VCM system determined significant change in the variability of sway, sway path length, normalized sway and velocity of sway ($p < .05$). The VCM system was originally used to find a connection between postural stability and the deficits of communication and socialization in ASD. The force plates found an increase all three variables. The authors concluded that hippotherapy can increase receptive communication, impact socialized coping, increase self care and daily functions and improve postural stability.

Bass et al. (2009) used a pre and post test design to evaluate the effects of hippotherapy on social function in children with ASD. Participants were randomized into a treatment group (n=19) and control group (n=15). The treatment group included two girls and seventeen boys ranging from five to ten years old. The treatment group was categorized based on severity diagnosis and types of outside therapies that the participants received during the hippotherapy study trial. Types of therapies included occupational therapy (OT), physical therapy (PT) and speech therapy (ST). The intervention lasted a total of 12 weeks, with one hour session per week. The hour was divided into four different sections: mounting/dismounting, exercises, riding skills and mounted games. The mounting processes "was aimed at stimulating verbal communication, proprioception and vestibular processing" (p. 1264). Exercises were utilized in order to stretch using trunk twists and arm circles before riding. Riding skills focused on stimulating sensory seeking and fine/gross motor domains and included: walking, trotting and halting. The riders had to participate in giving commands to the horse verbally or physically through touch of hand to horse. Mounted games focused on

group and individualized games to improve social communication. Games included "Simon says", red light/green light and catch and throw.

The Social Responsiveness Scale (SRS), a parent questionnaire, measures the severity of ASD and differentiates socialization using four different categories: awareness, cognition, communication and motivation. The subcategories showed no significant change individually; however, the treatment group ($p < .017$) did show significant change in the overall score of the SRS when compared to the control group ($p < .916$). These results suggest hippotherapy can produce some effect on social interaction and improve socialization when compared to not having treatment.

The Sensory Profile (SP) was another form of measurement used by Bass et al. (2009). The SP is a 125-questionnaire that is completed by parents or teachers to address overall social functioning and the severity in the problems in sensory processing, modulation and behavioral/emotional responses. The SP originally contained nine subcategories, but Bass et al. (2009) chose to only use five: fine motor/perception, sensory seeking, attention/distractibility, sensory sensitivity and sedentary. There were significant differences between groups in four subcategories ($p < .001$) except for fine motor/perception ($p > .05$) (Bass et al., 2009).

Kern et al (2011) used a single group (n= 24 during baseline date and n=20 for the completion of the study), longitudinal, pre and post test design was used. There initially was six girls and eighteen boys, two Blacks, one Hispanic and 21 White. The average age was 7.8 years (standard deviation = 2.9 years). The study was conducted over a nine month period with four different intervals of data collection. The treatment was delivered once a week with each session lasting one hour. Baseline data was

collected for three months prior to starting the treatment sessions. Follow-up data was measured at the beginning of the therapy, three months into the treatment and after the completion of the final session at the sixth month period.

At the start of the lesson, the child was assigned and introduced to a horse or pony. The child was then expected to groom and saddle the horse at every session. The parents were the "side walkers" for their children, which is unusual when compared to the other studies that have used volunteers or experienced professional association of therapeutic horsemanship (PATH) international instructors.

The Childhood Autism Rating Scale (CARS) tested the severity and quality of autism. A score of 15 to 29.5 is considered non-autistic, 30 to 36.5 is mild to moderate autistic and 37 to 60 is moderate to severely autistic. There was an overall significant decrease ($p< .04$) in CARS scores after the six months of riding treatment. There was no significant change during the three months prior to starting the hippotherapy sessions, but findings did show significant change between beginning the sessions and three months into the treatment ($p < .02$). There was an even greater decrease between the times of three months after starting the therapy to the final session in the sixth month of treatment ($p < .005$). This study supported the hypothesis that hippotherapy can aid in decreasing the severity state of autism (Kern et al. 2011).

Kern et al. (2011) also used the Timberlawn Parent Child Interaction Scale to examine expressiveness, responsiveness, positive regard, negative regard, mood/tone and empathy between the parent and child through observation on a 5-point Likert scale. In all subscales the higher the score equated to increased interaction and socialization between the child and parent. However, lower scores indicate less negative regard which

is defined as a positive outcome. There was reduction in negative regard over the six month treatment ($p < .07$). Also, there was significant improvement in mood and tone over the first three months of treatment ($p < .005$) and over six months of treatment ($p < .02$).

Kern et al. (2011) used the SP instrument as well to measure social effect and problems with sensory processing, modulation and behavioral/emotional responses. However, they divided the instrument into 14 sections. The SP sections tested included: auditory processing, visual processing, vestibular processing, touch processing, multisensory processing, oral sensory processing, sensory processing related to endurance/tone, modulation related to body position and movement, modulation of movement affected activity level, modulation of sensory input affecting emotional response, modulation of visual input affecting emotional responses and activity level, emotional/social response, behavioral outcomes of sensory processing, and items indicating threshold for response. The only significant difference between groups was in auditory processing. The experimental group ($p < .002$) improved compared to the control group. The authors concluded hippotherapy had no effect on interaction, communication or socialization between the parent and the child with ASD (Kern et al., 2011)

Finally, the Quality of Life and Enjoyment and Satisfaction Questionnaire (QLES-Q) is a parent survey that was designed to investigate and measure the degree of enjoyment and satisfaction experienced by people in all domains of life, and in this case, having children with ASD. Only 10 items from this survey were used. There was an overall increase in parent-rated quality of life ($p <.02$). However, the only significant

change observed was seen three months prior to the start of riding and three months into the treatment concluding that "this possible effect is may be due to enrollment and not specific effects of" hippotherapy (Kern et al., 2011, p. 18).

In the final study, Jenkins and Reed (2013) used a randomized pre and post test design to compare a treatment group (n=4) and control group (n=3). Each child was categorized based on age, diagnosis and skills. Treatment was given for nine weeks, one session per week, with each session lasting one hour. The data collection was performed once a week. Direct observation was used to evaluate several dependent variables. Four activities total, each lasting 10 minutes. These various dependent variables were chosen based on past study research and parent anecdotal comments about behavior changes in their children after participating in hippotherapy. The dependent variables included the following: affect of happiness and unhappiness, spontaneous initiations, responses to imitations, off- tasks behaviors, compliance problem behaviors, commands to direct the horse and posture. Reed and Jenkins (2013) defined appropriate posture as sitting upright with the back parallel to the wall and buttocks in the saddle during hippotherapy. Any deviations larger than 45% and lasting longer than 10 seconds were considered inappropriate. There was no significant change except for posture in three out of the four participants in the treatment group (M = 94.25%, 64.5%, 71.86%)

Posture was measured using force plates and motion capture VMC system before and after hippotherapy (Ajzenman et al., 2013) and through direct observation (Jenkins & Reed, 2013). The two studies concluded an increase in appropriate posture and decrease in body swaying. Involvement with hippotherapy thus has potential to improve autonomic postural mechanisms for children with ASD.

The Child Behavior Check List (CBCL) was also used by Jenkins and Reed (2013). The CBCL measured externalizing problems, such as aggressiveness, hyperactivity, and noncompliance, and internalizing problems, such as anxiety and depressive mood, and total problems. None of stated problems changed in any significant way.

Two studies focused on the parents' satisfaction of the hippotherapy treatment for their children with ASD. Kern et al. (2011) used the Treatment Satisfaction Survey, a five point scale with four domains: satisfaction with treatment, perceived treatment benefit, willingness to continue treatment and willingness to recommend treatment, with a high score indicating overall satisfaction with the treatment. All domains received an average of four and higher from the parents. Jenkins and Reed (2013) used an original survey to examine the parents' satisfaction with the treatment and possible continuation. No significant change was seen in the measured variables indicating no satisfaction of the parents. The parents viewed hippotherapy as a "fun activity" for their child to experience and a leisure activity, but they did not deem hippotherapy as a treatment for ASD or necessary (Jenkins & Reed, 2013).

These findings are helpful in determining the effectiveness for children with ASD that have not been previously been exposed. By comparing the procedures, methods and measurements of each study, limitations, gaps and hypothesis support can be acknowledged.

Discussion

Four studies were found that examined the use of hippotherapy in children with ASD; however, the results were largely inconsistent between studies. Two studies measured the severity of ASD through two different measurement tools (Kern et al, 2011; Bass et al. 2009). In both studies, an overall decrease in autistic severity did result. However, there was no change in the subcategories of social awareness, social cognition, communication or motivation (Bass et al., 2009).

The same two studies used the sensory profile (SP) tool to measure sensory processing and social effect. The SP tool is best used to measure sensory processing disorder (SPD), which is found to be common in children with ASD (Matsushima & Kato, 2013; Baranek, 2002). Bass et al. (2009) found improvement in each category (sensory seeking, attention/distractibility, sensory sensitivity and sedentary) when compared to the control group. Sensory processing refers to the process of the brain receiving input by the nervous system and then sending out responses to what is received (Sensory Processing Disorder Foundation, 2014). Dr. Jean Ayres developed the term SPD which is any atypical social, emotional, motor, and functional patterns of behavior that are related to poor processing of sensory stimuli (Sensory Processing Foundation, 2014). According to Ayres, there are three ways a child with ASD may respond due to SPD: sensory seeking-behavior, sensory under-responsitivity and sensory overload (Robson, 2013). When a child exhibits sensory seeking behavior, the child "seeks an activity to exhilarate the senses" so as to contain control of the stimulation and to release it in order to sustain a sense of stability (Robson, 2013 p. 132-133). Sensory overload, or

hypersensitivity, is encountered when the child is over-stimulated by what is occurring, such as smells, contrasting colors, fluorescent lighting, or loud noises (Robson, 2013). Bass et al. (2009) has support to show hippotherapy can have some effect in improving sensory processing in children with ASD. However, Kern et al. (2011) had conflicting results with only the auditory processing category having significant improvement. This inconsistent outcome may be due to the use of different categories in the SP by the two studies, showing that consistent terms and tools with the same definitions and characteristics need to be used in future research for generalized results to occur.

Ajzenman et al. (2013) found improvement in receptive communication, social interaction, self care and low demand leisure from the CACS. There was, however, no improvement in motor skills based on the VABS-II or expressive communication by the CACS, but did have improvement in postural stability from the VCM system. This supports the findings of Stone et al., (1997), who found that failure in motor imitation skills leads to poor expressive language. A previous study that supported the findings of Ajzenman et al. (2013) was conducted by Dziuk et al. (2007) that showed "motor signs can also serve as markers for deficits in parallel brain systems which are most important for control of social and communication skills" (p. 734), which are key impairments in autism.

Posture was measured using force plates and motion capture VMC system before and after hippotherapy by Ajzenman et al. (2013) and through direct observation by Jenkins and Reed (2013). The two studies concluded there was an increase in appropriate posture and decrease in body swaying. Involvement with hippotherapy thus has potential to improve autonomic postural mechanisms for children with ASD. Poor motor control is

theorized to account for the social, communication and behavioral characteristics seen in ASD (Dziuk et al., 2007). Based on this conception, two studies involved improved posture and postural movement as an outcome for hippotherapy treatment (Ajzenman et al., 2013; Jenkins & Reed, 2013). To correlate socialization and motor skills, Ajzenman et al. (2013) measured both and did have progression in social improvements as evidenced in the CACS scale and receptive communication in the VABS-II scale, supporting the connection of social interaction improvement due to improved motor control. This further supports the connection that increased motor abilities allows for the child to have increased opportunities to engage in more independent activities, such as dressing and tying shoes, and leads to activities for social interaction (i.e. cutting papper and coloring) with other children (Hilton, Zhang, Whilte, Klohr, & Constantino, 2012). This was not the same discovery for Jenkins and Reed (2013) due to no significant differences in the Child Behavior Checklist in external and internal behavior problems.

Limitations

There were several limitations that prevented a decisive conclusion in the efficacy of including hippotherapy in the treatment regimen for children with ASD. First, there was limited research regarding the use of hippotherapy as a treatment for ASD. Hippotherapy is not a new form of treatment for physical or mental disorders, but using it as a means to help ASD is recently becoming a subject of interest. Not only were there limited studies that focused on hippotherapy and ASD, but the number of studies with children who were never exposed to hippotherapy were limited to four. Significantly more studies must be completed to support the efficacy of the treatment.

Second, each study used multiple and varied measurement tools and times for date collection. For measuring socialization, three studies used four different scales, CACS, SP, VABS-II and SRS. Two studies (Bass et al., 2009; Kerns et al., 2011), used the SP scale, however, each study used different subscales with different defining terms. This inconsistency makes comparing results across studies difficult and results regarding hippotherapy treatment hard to generalize.

Third, several outcomes were based on parent observation. The use of parent questionnaires is not blinded and may obscure the data due to biased opinion and the parents' desire to believe that their child is improving, when they may not be. This is supported by researchers Jenkins and Reed (2013), who used direct observation to test improvements in several variables. There was no significant improvement in communication, off task behaviors, affect, compliance, problem behavior (stereotypical behaviors) as rated as researchers even though past studies have shown improvement

based on parent questionnaires. Conflicting results in this study show differences between blinded, direct observation and parent questionnaires. It is difficult to pinpoint which form of data collection is superior due to limited number of blinded, direct observation research trials studying hippotherapy and children with ASD.

Fourth, each study offered different treatment periods. The dosage for two studies was one session per week for 12 weeks (Bass et al., 2009; Ajzenman et al., 2013), one study with one session per week for nine weeks (Jenkins & Reed, 2013), and another study with one session per week for six months (Kern et al., 2011). This difference makes it hard to determine a standard time period children with ASD should participate in hippotherapy in order to reach predetermined goal outcomes.

Fifth, Bass et al. (2009) and Ajzenman et al. (2013) used pre and post test examination before the start of the session in week one and then again after the last session in week 12, respectfully. Jenkins and Reed (2013) performed the tests every week during the sessions. Kern et al. (2011) performed the outcome tests three months prior to starting the sessions, immediately before starting the sessions, three months into the sessions and then again after the completion of six months of treatment. The times of testing the outcomes were not uniform in either study, which made it difficult to compare the results.

Sixth, the sample sizes varied across each study and were extremely small, ranging from six to 20. Without larger sample sizes, the results cannot be generalized.

Only two studies included a randomized control and treatment group (Bass et al., 2009; Jenkins & Reed, 2013). The limited number of randomized control and treatment groups makes it more difficult to conclude whether hippotherapy produces significant

differences for children with ASD who are involved in the treatment than those who are not receiving treatment.

There were varied treatment plans for each study. One treatment plan included changes in positions, obstacle courses, and games completed in groups and individually while on the horse (Ajzeman et al., 2013), while another divided the session into mounting/dismounting, exercises, riding skills and mounted games (Bass et al.). Kern et al. (2011) started each session by having the children groom the horse and the parents were utilized as "side walkers." There is no universal, standard treatment plan detailing which activities should be utilized, allowing room for confounding factors to impair the results.

Implications for Nursing

Research

More research is needed in order to determine the effectiveness of hippotherapy in increasing socialization and communication and reducing stereotypical behaviors in children with ASD. These studies should consider using consistent instruments to measure outcomes. Larger sample sizes are also needed. In order to improve study validity, researchers should consider utilizing randomized control trials with comparative groups in order to produce more definitive results regarding the effectiveness of hippotherapy.

Further research is also needed to determine optimal dosing or exposure to hippotherapy in this population. In addition, a universal intervention plan needs to be developed with defined tasks, such as grooming the horse, games played, individualized or group sessions, in order to have a consistent structured system that can maximize outcomes.

Research also needs to take into account the level of severity of ASD can vary from child to child. With this concept in mind, it is important for future studies to have one group of children with the same level of severity and each group having a different level of severity. By testing children with the same level of function/severity, an intervention plan can be more focused to fit their level of needs.

Education

There needs to be an increase in the knowledge of signs in the diagnosis for ASD for nurses both at the bedside and in the schools so interventions can be implemented as

soon as possible. Once the diagnosis is suspected and then finalized, it is the nurses' role to educate the parents on the types of complementary and alternative therapies and interventions that can be utilized for their child. Hippotherapy has not been found to improve social communication or stereotypical behaviors, showing the treatment has little to no effects. Even with inconsistency from one study to another, there was overall decreased severity in autistic symptoms presented by two different studies. Thus, hippotherapy may have an effect in decreasing the severity of state for some children with autism.

Nursing Practice

One of the nurses' roles is being the advocate for the patient, which includes providing education to the patient and the family on resources, treatments, and care. Educating parents on the types of treatments available based on scientific evidence for ASD may provide an opportunity for miraculous breakthroughs and success for their child.

Appendix Research of Hippotherapy for Children with ASD

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Ajzenman, Standeven, & Shurtleff, 2013,USA	Pilot study, single group pre and post test design (n= 6) -ages: 5-12 years -received school-based therapies during hippotherapy intervention	Therapy session: - Once per week - 12 weeks - Each session lasting 45 minutes	Vineland Adaptive Behavior Scale-II (VABS-II): Measures: • Communication • Daily living skills • Socialization • Motor skills Internal consistency = 0.96-0.97 Subdomain reliability: = 0.71-0.81 Child Activity Card Sort (CACS) Retest reliability: = 0.93 . Force Plates and Motion Capture VMC system: Calculated the center of pressure (COP) and the center of mass (COM). Both were used to analyze postural sway if each individual in the allotted time of 20 seconds while standing on the force plates.	VABS-II: Effect size (d) of 0.2 indicates small change; effect size of 0.5 indicates a moderate change; effect size .0.8 indicates clinical change. Communication: d= 0.473 • Receptive: d=1.618 • Expressive: no significant change • Written: no significant change Daily living skills: no significant change Socialization: d=0.364 • Interpersonal: no significant change • Play and leisure: no significant change • Coping: d= 0.350 Motor skills: no significant change CACS: • Self Care: d= 0.624 • Low-demand leisure: d = 0.889 • Social interaction: d = 0.911 • Community mobility: no significant change	Hippotherapy can increase receptive communication, socialized coping, self care and low demand leisure. Can improve postural stability.

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Ajzenman, Standeven, & Shurtleff, 2013,USA				• High-demand leisure: no significant change • Domestic: no significant change • Education: no significant change Force plates and VCM system: • variability of sway for COP: *p* = 0.028, d = 0.1999 • COM mean anteriorposterior velocity: *p* = 0.46 d = 0.845 • COM normalized area of sway: *p* = 0.046 d = 0.702 • Sway path length: *p* = 0.028 d = 0.499 • COP normalized area of sway: *p* = 0.046 d = 0.99 • Sway path length: *p* = 0.28 d = 1.259	

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Bass, Duchowny, & Lilbre, 2009, USA	Random treatment and control group, pre post test design. Treatment: (n= 2 girls) (n=17 boys) -Ages 5-10 years Severity Verbal: 9 Non verbal: 10 Diagnosis Aperger's: 1 Mild: 6 Moderate:10 Severe: 2 Therapy None: 8 OT: 6 ST: 2 OT/ST/PT: 0 OT/PT: 2 ST: 1 Control: (n= 3 girls) (n=12 boys) -Ages 4-10 years Severity Verbal: 6 Nonverbal:9 Diagnosis	Therapy session: -One session per week - 12 weeks -one hour per session	Social Responsiveness Scale (SRS): measures the severity of the ASD symptoms. -Internal consistency = 0.97 -Retest temporal stability in males and females r= 0.85 and r = 0.77) Sensory Profile (SP): Internal consistency for the SP ranges from 0.47- 0.91.	ANOVA was used in the analysis of the results. SRS: Overall score: 4.92, (p = 0.038) Treatment group: (p = 0.017) (d = 0.66) Control group: (p = 0.916) (d = 0.02) Two paired sample t-tests of change from pre-post test: Treatment group: Significant change t = 3.93, (p < 0.003) Control group: No significant change t= 0.284, (p = 0.782) SP: Treatment group • Sensory seeking t= 4.85, (p < 0.001) • Attention and distractibility t = 5.19, (p <0.001) • Sensory sensitivity t = 6.20, (p <0 .001 • Sedentary t= 4.93, (p < 0.001) • Fine motor/perceptual:	Hippotherapy can improve sensory seeking and attention/ distraction, sensory sensitivity and sedentary.

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Bass, Duchowny, & Lilbre, 2009, USA	Aperger's: 1 Mild: 5 Moderate: 6 Severe: 3 Therapy None: 3 OT: 5 OT/ST: 0 OT/ST/PT: 1 OT/PT: 5 ST: 1			no significant change Control group • Sensory seeking t= 1.00, (p = 0 .337) • Attention and distractibility t = 0.001 (p = 1.00) • Sensory sensitivity t = 1.47, (p = .165) • Sedentary t = 1.00, (p = .336) • Fine motor/perceptual: no significant change	
Kern et al., 2011, USA	Single group, pre and post test design (n= 24 for the wait list period) (n=20 after six months of treatment) -6 girls -18 boys -2 black -1 Hispanic -21 white Average age: 7.8 (SD = 2.9) years	Therapy session: -One session per week -six months -one hour per session	Childhood Autism Rating Scale (CARS): -Internal consistency reliability: = 0.94, -Inter-rater reliability: = 0 .71 -Test-retest: = 0.8 Timberlawn Parent-Child Interaction Scale: Sensory Profile: see previous description Quality of Life Enjoyment and Satisfaction Questionnare -only 10 of the 14 - internal consistency : = 0.90 - test-retest reliability : =0.74)	To test overall effect of treatment, analysis was conducted using a multivariate analysis of variance (MANOVA) for each primary outcome. T1: three months before treatment T2: just before starting the riding treatment T3: three months after starting the riding period. T4: six months after starting the riding treatment. CARS: Overall decrease in CARS score after riding treatment: = 4.30 (p < 0.04)	Hippotherapy can decrease the severity of autism significantly after six months of treatment, can decrease negative regard and increase mood and tone in parent and child interaction. Auditory threshold can be decreased with treatment. Parents were overall satisfied with treatment.

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Kern et al., 2011, USA				• T1-T2: = 1.57= no significance • T2-T3: = 2.73 ($p < 0.02$) • T3-T4: = 3.33 ($p < 0.005$) Timberlawn Parent-Child Interaction: No overall changes were significant in any of the six subscales. Did show differences between individual time periods in marginal improvements: • Negative Regard T2-T4: = 1.82 ($p < 0.07$) • Mood and Tone T2-T3: = -3.19 ($p < 0.005$) • Mood and Tone T3-T4: =-2.62 ($p < 0.02$) SP: none of the overall MONOVA s indicated significant changes for the eight subscales. Did show significant improvement in marginal improvement in one subscale over a period of time: • Auditory High Threshold : T2-T3= -2.52 ($p < 0.02$) T2-T4:= -2.47 ($p < 0.03$) **was not blinded QLES-Q:	

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Kern et al., 2011, USA				Overall increase: ($p < 0.02$). However, changes were seen three months prior o the start of riding. Treatment Satisfaction Survey: Was completed by the parents at the end of the riding program, with only 18 parents out of the original 20 completing the survey. • Average Satisfaction: M= 4.5 • Average perceived benefit of treatment: M= 4.1 • Average willingness to continue: M= 4.6 • Average Willingness to recommend: M= 4.4	

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Jenkins and Reed, 2013, USA	Random pre and post test design. Treatment: (n=4) Seth: -Age: 6 years -Diagnosis: ASD -Skills: • Vocal communication • Tact colors/shapes • Read sight words • Count to 100 Selina: -Age: 13years -Diagnosis: ASD. Verbal and motor apraxia -Skills: • Vocal communication • Tact colors/shapes and alphabet • Read sight words Frank: -Age: 6 -Diagnosis: ASD -Skills: • Non-vocal • Match stimuli	Therapy session: -Once session per week -9 weeks -One hour per session	Measurement was performed once a week while at home and during center-based activities. There were four activities total, each measured for 10 minutes. • Affect: -Happiness -Unhappiness • Spontaneous initiations • Responses to initiations • Off-task behavior • Compliance • Problem behavior • Command to direct the horse • Posture Child Behavior Checklist (CBCL): -measured by parents and teachers. Was measured before initial treatment began and after treatment. Focused on: Externalizing problems (aggressiveness, hyperactivity, noncompliance)internalizing problems (anxiety and depressive mood)and total problems -Internal consistency: = 0.78–0.97 for problem scales Survey for parents:	Affect: -No significant change • Spontaneous initiation: -No significant change • Reponses to initiations: -No significant change • Off-task Behaviors: -No significant change • Compliance: -No significant change • Problem Behavior: -No significant change • Command to direct horse: -No significant change • Posture: -Change in three of the four participants in treatment CBCL: • *T*-scores above 63 indicate clinical ranges • *T*-scores between 60 and 63 indicate borderline • *T*-scores below 60 are considered to be within normal ranges -no significant improvement in problems in treatment group. Survey for parents:	Hippotherapy was beneficial only in the area of posture improvement. Parents and teachers did not rate significant change in child's behavior. Parents did not rate therapy as necessary, but only a fun activity.

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Jenkins and Reed, 2013, USA	• Receptively identify numbers/letters/shapes and colors Milo: -Age: 14 years -Diagnosis: Tuberous sclerosis, ASD -Skills: • Non-vocal • Match stimuli • Requires assistance with writing • Receptively identify some colors Control: (n=3) Ivan: -Age:14 years -Diagnosis: Tuberous Sclerosis, ASD -Skills: • Non-vocal • Match identical stimuli • Requires hand-over-hand assistance when writing Denis: -Age: 6 years -Diagnosis: ASD -Skills: • Vocal communication		Measuring their satisfaction with the treatment and possible continuation.	Highest score for "was a fun activity for my child to experience."	

Author, Pub. Year, Country	Study Design and characteristics	Interventions	Outcome Measures	Findings	Conclusion
Jenkins and Reed, 2013, USA	• Expressively identify some colors/shapes/letters • Count to 50 Edmund: -Age: 8 years -Diagnosis: ASD -Skills: • Vocal communication • Tact colors • Add and subtract numbers • Read				

References

Ajazenman, H.F., Standeven, J.W., & Shurtleff, T.L. (2013). Effect of hippotherapy on motor control, adaptive behaviors, and participation in children with autism spectrum disorder: A pilot study. *American Journal of Occupational Therapy*, *67*(6), 653-663. doi: 10.5014/ajot.2013.008383

American Hippotherapy Association. (2000a). Introduction to hippotherapy. Retrieved from http://tinyurl.com/m2rk5cu

American Hippotherapy Association. (2000b). Present use of hippotherapy. Retrieved from http://tinyurl.com/mtnesoa

American Psychiatric Association. (2013*). Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.) Washington, DC: Author.

Baraneck, G. T. (2002). Efficacy of sensory and motor interventions for children with autism. *Journal of Autism and Developmental Disorders, 32*(5), (397-421).

Barnett, J. E., Shale, A. J., Elkins, G., & Fisher, W. (2014). Foundations of complementary and alternative medicine*. Complementary and Alternative Medicine for Psychologists: An Essential Resource* (pp. 15-20). Washington DC: American Psychological Association.

Bass, M. M., Duchowny, C.A., & Llabre, M.M. (2009). The effect of therapeutic

horseback riding on social functioning in children with autism. *Journal of Autism and Developmental Disorders*, *39*(9), 1261-1267. doi: 10.1007/s10803-009-0734-3

Burgon, H. L. (2014). Background to equine-assisted therapy and learning. *Equine-Assisted therapy and learning with at-risk young people* (pp. 17). New York, NY: Palgrave Macmillan.

Caminha, R.C., & Lampreia, C. (2012). Findings on sensory deficits in autism: Implications for understanding the disorder. *Psychology & Neuroscience, 5*(2), 231-237. doi: 10.3922/j.psns.2012.2.14

Centers for Disease Control and Prevention. (2014). Facts about ASD. Autism Spectrum Disorder. Retrieved June 17, 2014 from http://tinyurl.com/yg7otz5

Dziuk, M. A., Gidley Latson, J.C., Apostu, A., Mahone, E.M., Denckla, M.B., & Mostofsky, S.H. (2007). Dyspraxia in autism: Association with motor, social and communicative deficits. *Developmental Medicine and Child Neurology, 49*, 734-739. doi: 10.1111/j/1469-8749.2007.00734.x

Edwards, S. D. (2012).Treatment of autism and attachment with interpersonal equine therapy. In K. Trotter (Eds.), *Harnessing the power of equine assisted counseling: Adding animal assisted therapy to your practice.* (pp.134-149). New York, NY: Routledge Taylor & Francis Group.

Hattier, M.A., Matson, J.L. (2012). An examination of the relationship between communication and socialization deficits in children with autism and PDD-NOS. *Research in Autism Spectrum Disorders*, *6*(2), 871-880. doi: 10.1016/j.rasd.2011.12.001

Hitlton, C.L., Zhang, Y., Whilte, M.R., Klohr, C.L., & Constantino, J. (2012). Motor impairment in sibling pairs concordant and discordant for autism spectrum disorders. *Autism, 16*, 430-441. doi: 10.1177/1362361311423018.

Jenkins, S.R., & Reed, D.D. (2013). An experimental analysis of the effects of therapeutic horseback riding on the behavior of children with autism. *Research in Autism Spectrum Disorder*, *7*(6), 721-740. doi:10.1016/j.rasd.2013.02.008

Kern, J.K., Fletcher, C.L., Garver, C.R., Mehta, J.A., Grannemann, Knox, C.R., Richardson, T.A., & Trivedi, M.H. (2011). Prospective trial of equine-assisted activities in autism spectrum disorder. *Alternative Therapies in Health and Medicine*, *17*(3), 14-20.

Marino, L. (2012). Construct validity of animal assisted therapy and activities: How important is the animal in AAT? *Anthrozoos: A Multidisciplinary Journal of the Interactions of People & Animals , 25*(1), 139-151. doi: 10.2752/175303712X13353430377219

Marino, L. & Lilienfeld, S.O. (2007). Dolphin-assisted therapy: More flawed data and more flawed conclusions. *Anthrozoos: A Multidisciplinary Journal of The Interactions of People & Animals, 20*(3), 239-249. doi.org/10.2752/089279307X224782

Matsushima, K., & Kato, T. (2013). Social interaction and atypical sensory processing in children with Autism Spectrum Disorder. *Hong Kong Journal of Occupational Therapy*, *23*, 89-96. doi: 10.1016/j.hkjot.2013.11.003

McDonald, M.E., Pace, D., Blue, E., & Schwartz, D. Critical issues in causation and

treatment of autism: Why fads continue to flourish. *Child and Family Behavior Family, 34*(4), 290-304. doi: 10.1080/07317107.2012.732849

National Center for Complementary and Alternative Medicine. (2012). CAM Basics. Retrieved from http://nccam.nih.gov/sites/nccam.nih.gov/files/D347_05-25-2012.pdf

National Research Council. (2001). *Educating Children with Autism*. Washington, D.C.: National Academy of Sciences Press.

O'Haire, M. E. (2010). Companion animals and human health: Benefits, challenges, and the road ahead. *Journal of Veterinary Behavior: Clinical Applications and Research, 5*(5), 226–234. doi: 10.1016/j.jveb.2010.02.002

O'Haire, M.E, McKenzie, S.J., Beck, A.M.,Slaughter, V. (2013). Social behaviors increase in children with autism in the presence of animals compared to toys. Plos One, 8(2), 1-10. doi: doi:10.1371/journal.pone.0057010

Journal of Autism Developmental Disorders, 43(7), 1606–1622. doi:10.1007/s10803-012-1707-5

Pauw, J. (2000). Therapeutic horseback riding studies: Problems experienced by researchers. *Physiotherapy, 86*(10), 523-527.

Perrin, J. M., Coury, D. L., Hyman, S. L., Cole, L., Reynolds, A. M., Clemons, T. (2012). *Pediatrics, 130* (S77). doi: 10.1542/peds.2012-0900E

Persell,C. H. (1990). Becoming a member of society through socialization. *Understanding Society: An Introduction to Sociology* (3rd ed., pp. 98-107). New York, NY: Harper & Row, Publishers, Inc.

Robson, B. (2013). Autism spectrum disorder: A review of the current understanding of pathophysiology and complementary therapies for children. *Australian Journal of Herbal Medicine, 25*(3) 128-137.

Sensory Processing Disorder Foundation. (2014*). About SPD*. Retrieved from http://spdfoundation.net/about-sensory-processing-disorder.html

Sori, C.F., Hughes, J.C. (2014). Animal-assisted play therapy: An interview with Rise VanFleet. *The Family Journal: Counseling and Therapy for Couples and Families, 22*(3), 350-356. doi: 10.1177/1066480714534394

Valicenti-McDermott, M., Burrows, B., Bernstein, L., Hottinger, K., Lawson, K,, Seijo, R., Schechtman, M., Shulman, L., & Shinnar, S. (2013). Use of complementary and alternative medicine in children with autism and other developmental disabilities: Associations with ethnicity, child comorbid symptoms, and parental stress. *Journal of Child Neurology, 29*(3), 360-367. doi: 10.1177/0883073812474489

Whitehouse, A. J. (2012). Complementary and alternative medicine for autism spectrum disorders: Rationale, safety and efficacy. *Journal of Pediatrics and Child Health, 49*, 438-442. doi: 10.11/jpc.12242