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Autism Spectrum Disorder (ASD) and Equine Assisted Therapy: An Integrative Review of the Literature

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AUTISM SPECTRUM DISORDER (ASD) AND EQUINE ASSISTED THERAPY: AN INTEGRATIVE REVIEW OF THE LITERATURE

by

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ABSTRACT

The purpose of this integrative review of the literature is to examine the effectiveness of equine assisted therapy with individuals diagnosed with Autism Spectrum Disorder (ASD). An extensive review of the literature was conducted regarding children diagnosed with ASD who received equine therapy, equine psychotherapy, therapeutic horseback riding, or horse therapy. Inclusion criteria include articles written in the English language, articles that were peer-reviewed, and had a publication date from 2006 to present. Fourteen articles were analyzed regarding children with ASD who participated in different types of equine therapy. The majority of the studies found individuals with ASD who participated in equine therapy had improvements in behavior, social interactions, and communication with decreased stereotypical ASD behaviors. Only one article found no changes in behavior. Most of the articles had very small sample sizes that limited the generalizability of the findings. There were many different ways that the research was conducted and therefore the screening measures were completely different for all studies. Many studies did not take gender of participants into account, whether the participants were verbal or nonverbal, and other treatments the participants were receiving. Although the literature analyzed had different methodologies, the overall research suggests equine assisted therapy can be a beneficial therapy for individuals with ASD and therefore could be considered a viable treatment option. The outcomes of this integrative review supports the need for larger, randomized, controlled trials with larger samples to effectively evaluate the effects of equine therapy.

DEDICATION

This paper is dedicated to my mother who has supported and encouraged me through everything that I have ever done. Thank you for being a source of motivation and an amazing mother and nurse.

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a group of developmental disorders, classified as neurodevelopmental disorders (NIH, 2016). ASD is often characterized by learning problems, difficulty communicating and interacting with others, notable repetitive behaviors, along with other symptoms that impact an individual's ability to function in different areas of life. In the United States, ASD has had a 10-fold increase in prevalence in the last 40 years. Statistics from the Centers for Disease Control and Prevention (CDC) identified that 1 in 68 American children are diagnosed with ASD (2016). Until recently, Asperger's syndrome and Autistic Disorder were considered a subtype of "Pervasive Developmental disorders." According to the latest edition manual from the American Psychiatric Disorders (DSM - 5) individuals whose symptoms were previously diagnosed as Asperger's syndrome or Autistic Disorder are now considered to be part of the Autism Spectrum Disorder (ASD).

Because ASD exists on a "spectrum" no single treatment is recommended or preferred. There are many treatment options ranging from medications to behavioral therapy depending on the type and severity of the symptoms. Medications used in treating ASD can sometimes help to manage the symptoms of ASD, such as an inability to focus or depression. There are also complementary therapies used for ASD including behavior therapy, communication therapy, dietary approaches, medications, and alternative medicine (CDC, 2016). In particular one alternative therapy for children with ASD is animal therapy. According to the Autism Spectrum Disorder Foundation (ASDF) those with ASD may benefit from animal therapy associated with benefits in motor, emotional, and sensory sensations (Autism Spectrum Disorder Foundation, 2017).

BACKGROUND

Overview of ASD

The exact cause of ASD is unknown, but experts theorize that ASD is caused by multiple factors involving the environment, and the physiological function of the brain (Autism Treatment Center of America, 2017). It is believed that genetics play a role in the development of ASD. For example, studies have shown that if one identical twin has a diagnosis of ASD, there is up to a 40% chance that the other twin will also develop ASD (Autism Treatment Center of America, 2017). No specific single gene has been associated with ASD, but rather it is believed that multiple genes are involved. Several studies found a link to maternal exposure to certain viruses and chemicals during pregnancy; however, these studies have a very small population size (Autism Treatment Center of America, 2017). While the exact cause for ASD is unknown, there are several risk factors have been identified. For example, the factor of gender, as boys are more likely to be diagnosed with ASD than girls. Another risk factor for developing ASD includes having a sibling with ASD; parents who were older when becoming pregnant and at birth; and, having another genetic condition such as Fragile X syndrome. Fragile X syndrome is a genetic disorder caused by a change in the FMRI gene which causes developmental delays and learning disabilities (CDC, 2016). Another risk factor for developing ASD is a genetic condition known as Tuberous Sclerosis; that is, a genetic disorder caused by a change in the TSC1 and TSC2 genes which affects many organs and can cause brain tumors (CDC, 2016).

Signs and Symptoms of ASD

Signs and symptoms of ASD vary among individuals but often include repeating certain behaviors, becoming highly upset by even a slight change in routine, making little or inconsistent eye contact, difficulty relating to others, not having any interest in other people, and difficulties

expressing needs using repetition of words or motions (NIH, 2016). Social issues, the most common problem in individuals with ASD, include avoiding eye-contact, preferring to play alone, having a flat or inappropriate facial expression, avoiding physical contact, and difficulties understanding other people's feelings and body language (CDC, 2016).

There are often issues with communication in a child with ASD. Approximately 40% of children with ASD are considered nonverbal while 25-30% of children with ASD have some communication using words that are appropriate at 12-18 months of age. It is not unusual for those who do use words to eventually lose their verbal abilities as they mature (CDC, 2016). It is not uncommon for communication skills to develop much later in childhood. Other unusual behaviors include obsessive interests, such as vacuum cleaners, electronics, or certain toys, following very specific routines, flaying hands in a repetitive motion or head banging.

Signs and symptoms of ASD vary greatly. It is possible that one individual with ASD may exhibit only a few signs and symptoms while another individual with ASD will exhibit multiple signs and symptoms. Individuals with ASD tend to experience a high rate of stress, anxiety, and depression along with sensory problems, impaired intellectual function, and sleep disturbances (Gabriels et al., 2015). Often it is a teacher who will first identify ASD-like behaviors in a child that differ from peers and, in turn, recommend that parents seek further psychological and physical evaluations.

Due to the complexity of the signs and symptoms of ASD there is no one diagnostic test and diagnosis is based upon a child's behavior and emotional development (CDC, 2016). Diagnosing ASD is generally two fold; developmental screening along with comprehensive physical and mental evaluation. Children are generally screened for developmental delays and disabilities during physician visits at 9 months, 18 months, and 24-30 months (CDC, 2016). The

procedure includes asking the parents questions about the child's behavior and observing the child at play to assess behavioral interactions. When there are symptoms, a more comprehensive evaluation is recommended. With the comprehensive evaluation, the child's behavior and development is assessed through interviewing the parents, along with hearing and vision screenings, and genetic and neurological testing. When appropriate, a primary care provider should refer the child to a specialist for a more comprehensive assessment for accurate diagnosis.

Complementary Treatment of ASD

An extensive array of complementary and alternative therapies are used to treat ASD including dietary alterations, medications, and behavioral therapy. Often, multiple therapies are used for children to manage the symptoms associated with ASD that focus on behavior and communication modification. Applied behavior analysis (ABA) is a therapy where positive behaviors are reinforced and negative behaviors are discouraged (CDC, 2016). Other subtypes of ABA focus on verbal skills and motivational strategies for the child at specific age levels. For example, Developmental Individual-difference Relationship-based model (DIR) or "floortime" focuses on emotional development which involves having children engage in games that gradually increase levels of interactions with others to increase emotional thinking and communication. Treatment and Education of Autistic and Related Communication-Handicapped Children (TEACCH) focuses on teaching visual clues to help children gain flexibility and independence (CDC, 2016). Occupational therapy may focus on activities of daily living (ADLs) to improve an individual's independence and speech therapy to improve communication. Picture Exchange Communication System (PECS) is another intervention that uses symbols to help teach children how to communicate thoughts, needs, or anything that can be symbolized on a card (CDC, 2016).

Various dietary approaches are used to treat individuals with ASD including vitamin supplements, probiotics, and herbal remedies. It has been theorized that ASD may be related to casein or gluten allergies; however, this has yet to be conclusively proven (Brondino, 2015). Specific vitamin and herbal remedies include supplementation of Omega 3. Experts hypothesiz that Omega 3 is essential for brain development and function, and an insufficient amount of Omega 3 may play a role in the development of ASD (Brondino, 2015). Other vitamin supplements used for individuals with ASD include multivitamin supplements, vitamin C, and Vitamin B12. There are also herbal remedies including probiotics, digestive enzymes, and L-carosine, but there is a lack of evidence on the actual effects on the symptoms. Most of the literature on these included is antidotal in nature.

Medication Treatment of ASD

To reiterate, the symptoms of ASD vary and so does the treatment. Often, a pharmacological approach is taken to reduce the symptoms of ASD. However, there is no medication that will "cure" ASD or manage all of the associated symptoms. It is not uncommon for a child diagnosed with ASD to have co-morbidities such as Attention Deficit Disorder (ADD), Attention Deficit Hyperactivity Disorder (ADHD), and Oppositional Defiant Disorder (ODD). Therefore, medications may be needed to treat symptoms of these comorbities. Antipsychotic drugs are used to treat schizophrenia, bipolar disorder, and depression and may also help to manage symptoms of ASD (Interactive Autism Network, 2016). In addition, antipsychotics treat irritability, aggression, and self-injury behavior. Antipsychotic drugs include risperidone (Risperdal) and apirprazole (Abilify) which have been approved by the US Food and Drug Administration (FDA) to treat ASD in children (Interactive Autism Network, 2016). However, with these medications there are many side effects including sleepiness, weight gain,

movement disorders, blood dyscrasias, and tremors which can reduce the quality of life of a child with ASD as well as the family unit (Interactive Autism Network, 2016).

Antidepressants may be used to treat depression, anxiety, agitation, and obsessive-compulsive behavior (Interactive Autism Network, 2016). Four categories of antidepressants used to treat ASD include monoamine oxidase (MAO) inhibitors, tricyclic antidepressants (TCAs), selective serotonin reuptake inhibitors (SSRIs), and "other agents." (Interactive Autism Network, 2016). Stimulants may be used to treat individuals with ASD who are also diagnosed with ADHD. Methyphenidate (Ritalin) is the most commonly used and most studied stimulant (Interactive Autism Network, 2016). In a double-blind placebo controlled study on pediatric patients about half of the children with ASD responded to Ritalin with reduced hyperactivity and increased attention (Interactive Autism Network, 2016). Mood stabilizers are used to treat the symptoms of aggression, self-injury, and impulsivity; however, these drugs have not been extensively studied in children with ASD (Interactive Autism Network, 2016). Anti-seizure medications are used to treat ASD individuals who suffer from seizures.

Animal Assisted Therapy

Another intervention for individuals with ASD includes animals. Animal assisted therapy is an umbrella term that includes animal assisted therapy and animal assisted activities. Animal assisted therapy aims to improve the physical, social, emotional, and cognitive functioning of the individual (Monarch Center, 2009). There are various types of animals used in this type of therapy, including dogs, cats, elephants, birds, and horses which have been reported to help manage symptoms in an individual with autism. Animal therapy can encourage in the individual nurturing behavior, responsibility, and adherence to a schedule. It may improve motor skills and balance, lower blood pressure and the risk for a stroke or heart attack, and

decrease the incidence of depression (Monarch Center, 2009). For individuals with Autism, animal therapy can improve verbal interactions, increase attention skills, increase self-esteem, and reduce anxiety and loneliness (Monarch Center, 2009). Animal therapy has even shown an improvement in a child's vocabulary, short and long-term memory, and in the understanding of concepts (Monarch Center, 2009). Studies have found that animal therapy can improve verbal interactions, increase attention skills, and reduce anxiety.

While there are numerous therapies available for individuals with ASD; however, it may be difficult, time consuming, and expensive to use different therapies to see which one will help. Animal therapy is an alternative therapy that can be costly but it is an alternative to traditional therapies and medications. Parents and caregivers of an individual with ASD may not be aware of this type of therapy and even if they are aware of it may not be available to them due to financial restrains or geographical location.

Despite the known benefits of animal assisted therapy, there is very limited research on animal assisted therapy and ASD especially equine assisted therapy. Many of the studies on ASD and equine assisted therapy had a small sample size and were conducted at only one location for a limited amount of time. There have been no significant research studies with large sample sizes that show a clear correlation or effect between equine assisted therapy and symptom improvement for individuals with ASD.

Due to the inconclusive results from studies on equine assisted therapy with ASD individuals, it is clear that further research on the topic is necessary. Research that considers the length of the treatment, the different types of animals used, as well as the difference between animals in the home and therapy programs for individuals with ASD is also necessary. Given the potential for positive repercussions for individuals with ASD, more studies are needed to

understand the relationship between animal therapy and ASD. There were also many different studies that examined a relationship between equine assisted therapy and ASD, but, they failed to create a cause and effect relationship as there was no control, only an experimental group. In almost all the studies, there was no standardized way to collect and compare data. With the potential for positive improvement of symptoms in individuals with ASD, there needs for further research on this topic.

Animal therapy has not been fully studied and needs to be thoroughly examined for the potential for improved quality of life for an individual with ASD and the family unit. There has also been no consistency between the time periods of the studies conducted as well as the different animals, used in the therapy.

It is necessary to understand the full benefits of equine assisted therapy to further help individuals who have a diagnosis of ASD. Because there is no one "right" treatment, ASD interventions must be customized to meet an individual's needs, and animal therapy should be further investigated as a potential mainstream treatment choice for individuals with ASD. Research is needed to ascertain conclusive evidence about the connection between ASD symptom improvement and equine assisted therapy. The nurse is likely to encounter children with a diagnosis of ASD. Therefore, there is a need to further investigate the existing research to determine appropriate and effective alternative treatment options that can be customized to an individual's needs.

PURPOSE

The purpose of this integrative review of the literature was to examine the effectiveness of equine assisted therapy on individuals diagnosed with ASD.

METHOD

A comprehensive literature review was performed using research articles available from 2006 to 2015 which studied the use of complementary and alternative therapies for ASD, specifically equine assisted therapies. The focus was on the use of equine therapy as a treatment for individuals with ASD. Databases that were used to search for articles include Ebsco Host, Medline, Pubmed, and ProQuest. Searches used a combination of the following terms: Autism Spectrum Disorder, Autism, ASD, animal assisted therapy, alternative therapies, equine therapy, horse therapy, symptom improvement with animals, and pet therapy. Inclusion criteria consisted of published research in English and equine therapy treatment with individuals with ASD.

Flow Diagram of Study Selection Process

Search terms: animal assisted therapy or animal therapy or animal intervention or animal assisted activity AND autism spectrum disorder or asd or autism AND equine therapy or equine psychotherapy or equine assisted therapy or therapeutic horseback riding or horse

Limiters: English language, peer-reviewed, publication date from 2006 to present

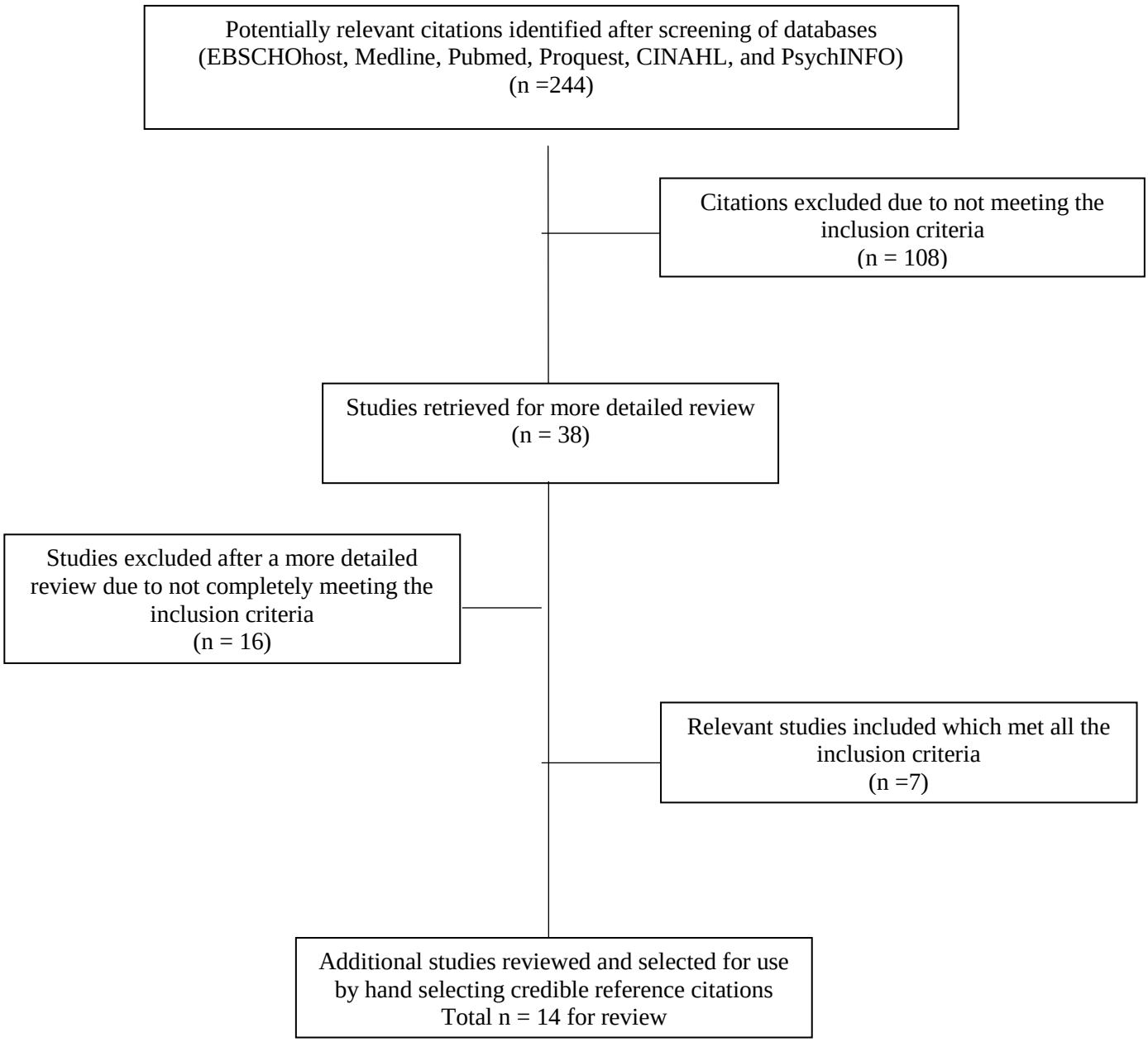


Figure 1: Consort Diagram of Thesis Methodology

The data generated from the articles were arranged into tables that synthesize the relationship between improvement of symptoms in individuals with ASD who participated in animal therapy programs. Information gained on ASD and equine assisted therapy will be arranged according to the design and purpose of each article, the population and sample size, the intervention protocol, screening measures, and the findings and nursing implications. The data will be used to synthesize and evaluate the current literature available on equine assisted therapy and ASD that can be used to develop guidelines for equine assisted therapy as an alternative therapy for individuals with ASD. The data will be synthesized in order to evaluate what the research has shown on equine assisted therapy interventions and individuals with ASD. The included articles will be arranged into themes that are generated from all of the combined articles.

For this review, ASD includes a range of mild to severe symptoms, with varying levels of ability and disability. There is no definitive sign or symptom of ASD and therefore no one "right" treatment. ASD interventions must be individualized and customized to treat an individual's needs. Because of the tenfold increase in the prevalence of ASD, the nurse is likely to encounter children with a diagnosis of ASD. For this reason, there is an increasing need for further research to provide evidence of treatment options that are best suited for individuals with ASD

RESULTS

A total of 14 articles were included in this integrative literature focusing on equine assisted therapy and ASD. Additional articles and websites were used for background research and anecdotal reports of the data presented. During the analysis of the articles, it was evident that there were different approaches to data collection with various questionnaires. In compiling the results, the following major themes became apparent to the reviewer: improved social functioning and interpersonal relationships, increase in communication, decrease in stereotypical behavior, and increase in social skills. Minor themes included improvement in physical condition, increase in self-esteem, and increase in motivation. (See Table 1)

Table 1: Major themes in children who participated in equine assisted therapy diagnosed with ASD

Results Found	Supportive Articles	Total Articles
Improved social functioning/interpersonal relationships	(Bass, Duchowny, Llabre, 2009), (Borgi et al., 2015) (Gabriels et al., 2015), (Garcia-Gomez, Risco, Rubio, Guerrero, Garcia-Pena, 2013), (Harris &Willians, 2017), (Lanning, Baier, Ivey-Hatz, Krenek, Tubbs, 2014), (Tan &Simmonds, 2017), and (Ward, Whalon, Rusnak, Wendell, Paschall, 2013).	8
Increase in communication	(Al-Hmouz & Arabiat, 2015), (Gabriels et al., 2015), (Holm et al, 2013), (Llambias, Magill-Evans, Smith, Warren, 2016), (Tan &Simmonds, 2017), and (Ward, Whalon, Rusnak, Wendell, Paschall, 2013).	6
Decrease in stereotypical behavior	(Al-Hmouz & Arabiat, 2015), (Anderson & Meints, 2016), (Holm et al, 2013), (Tan &Simmonds, 2017)	4
Improved social skills (including interaction, emphasizing, inattention, and hyperactivity/irritability)	(Al-Hmouz & Arabiat, 2015), (Bass, Duchowny, Llabre, 2009),(Borgi et al., 2015), (Gabriels et al., 2015), (Garcia-Gomez, Risco, Rubio, Guerrero, Garcia-Pena, 2013), (Harris &Willians, 2017), (Lanning, Baier, Ivey-Hatz, Krenek, Tubbs, 2014), (Llambias, Magill-Evans, Smith, Warren, 2016),(Tan &Simmonds, 2017), and (Ward, Whalon, Rusnak, Wendell, Paschall, 2013).	10

Table 1: Major themes in children who participated in equine assisted therapy diagnosed with ASD

Improved Social Functioning/Interpersonal Relationships

All of the studies that included social functioning as a dependent variable concluded that there was an improvement in social functioning and interpersonal relationships due to the intervention of equine assisted therapy (see table 1). Bass et al. (2009) found children who were involved in therapeutic horseback riding had greater social motivation, sensory seeking, and sensory sensitivity. The researchers speculated this may have been due to the horseback riding to be a stimulating experience which may have led to higher levels of motivation and social engagement. Borgi et al. (2015) also found an increase in social interaction suggesting that the interaction with horses could help facilitate social interactions between humans.

Gabriels et al. (2015) randomized controlled trial found an increase in subjects' communication. This is an especially significant study because it included the largest, randomized, controlled trial of equine assisted activity in the treatment of ASD. Garcia et al. (2014) found there were increases in communication as evidenced by increased differences in the areas of "interpersonal relations" and "social inclusion" sections. Harris and Willians (2017) found improvements in social functioning occurred after a shorter intervention period with than other equine assisted interventions. Lanning et al. (2014) found children in the equine assisted therapy had the most noted improvements in social functioning, and in overall mental health and behavior. Parents in this study reported an increase in school functioning and that their child participated more in school activities and sports.

Tan and Simmonds (2017) was an interesting study that focused on the parent's perceptions of equine assisted therapies. Overall, the major conclusions that emerged from their study was an increased social benefit for the child. This study found multiple areas of improvement including learning social skills, improved social motivation, and quality of

interactions in children who were involved with equine assisted therapy. Ward et al. (2013) found teacher's ratings indicated participants in equine assisted therapy had increased social interaction. This gain in social interaction, however, was not maintained after two six week breaks from equine assisted therapy; but was recovered once the therapy was reinstated. This study suggests the possible improvements that were gained from equine assisted therapy may positively affect children with ASD and could be transferred into the classroom setting with regular equine assisted interventions.

Increase in Communication

A total of eight articles studied improvements in communication. Of those studies, 75% found an increase in communication. Interestingly, two of the studies that focused on communication found no significant improvements in those who participated in an equine assisted therapy. Al-Hmouz and Arabiat (2015) found increases in communication after a 12-week riding intervention with a control group. This study found that children in the experiment group "increased their vocabularies, expanded their sentence length, and demonstrated sustained level of directed attention." Gabriels et al. (2017) also found increases in social communication. This study considered the total number of words spoken, and new words spoken. Improvements were seen that support an increase in communication due to the equine assisted intervention. This is especially credible because this is the largest sample size included in this review of the literature of 116 participants.

Holm et al. (2013) found, in comparison to the children's baseline, of four children, two showed improvements in spontaneous verbal communication of wants and needs and verbal demands of three or more words. This study was especially notable because it measured number

of "doses" the child received and if an increased number of "doses" of equine assisted therapy would have more positive results. In addition, this study looked at a withdrawal phase and found, even after the withdrawal of equine assisted therapy, the child still maintained an increased in verbalization and improvements in communication. Llambias, Magill-Evans, Smith, and Warren (2016) found in a multiple baseline design that children showed improvements in communication. In this study 71% of the participants parents reported their children were talking more, were initiating conversations, speaking new words, and using longer sentences.

Tan and Simmonds (2017) looked at parent perceptions of equine assisted therapies and found parents reported increases in communication, improved social motivation, and quality of interactions. One parent stated that prior to equine assisted intervention her child didn't care about talking to people; afterwards her child would talk more and even ask more questions. Ward, Whalon, Rusnak, Wendell, and Paschall (2013) found an increase in communication and social interaction occurred in those who were participating in an equine assisted intervention, however, after two six week breaks that gain in behavior was not maintained unless the equine assisted therapy was reinstated.

Interestingly, two studies that looked at communication found no improvements in communication. Anderson and Meints (2016) found improvements in empathizing and a reduction in maladaptive behaviors; but found communication and socialization were not affected by the equine assisted therapy. In addition, Jenkins and Reed (2012) found no improvements in communication, spontaneous initiations, or compliance. This study, however, did find that three of the four participants body posture had improved. It is interesting that in these two studies there were no improvements in communication. This is perhaps due to the

incredibly small sample size in both studies, with the first study having N=15 and the second having N=4.

Decrease in Stereotypical Behavior

Of the four studies that considered stereotypical behavior, all four found a decrease in stereotypical behavior. Al-Hmouz and Arabiat (2015) found a reduction in the amount of stereotypical behaviors after a 12-week intervention of equine assisted therapy, specifically therapeutic horseback riding. Anderson and Meints (2016) found a reduction in maladaptive behaviors including internalized, asocial, and external behaviors. This study proposed the reduction of these behaviors could have a positive effect the day to day life of a child with ASD.

Holm et al. (2013) used a single subject baseline to evaluate the dosing of equine assisted therapy. This study found with equine assisted therapy specific children had a reduction in stereotypical behavior including snapping fingers, pounding on surfaces, pushing in nose, and clapping. This study also found increasing the dosage of weekly therapeutic riding sessions did not impact the number of positive behavior changes, however the intervention did impact the magnitude of those changes, suggests that the more often equine assisted therapy occurs each week the more positive the results. Tan and Simmonds (2017) found through interviewing parents that a decrease in negative behavior was one of the themes found in their research. This theme may be attributed to a reduction in stress and anxiety and greater enjoyment in the activity.

Improved Social Skills

One of the most notable results from this integrative literature review was the increase in social skills in the child with equine assisted therapy. The social skills found to be improved included increased interaction, decreased inattention, and decreased hyperactivity/irritability. Of the ten studies that considered theses three social skills every article found at least one of the social skills improved as a result of equine assisted therapy. Considering that social issues are one of the most common problems among individuals with ASD, an improvement in social skills in this literature review is especially critical (CDC, 2016).

Increased interaction was found in a total of four out of five studies (80%) that had increased interaction after the implementation of equine assisted therapy as a dependent variable. Al-Hmouz and Arabiat (2015) found an increase in social interaction in those who participated in equine assisted interventions. In the experimental group, this study found the children learned social skills such as greeting people, making eye contact, and listening while others were speaking. This finding could be attributed to the stimulating effects on the part of what formulated higher motivation and social engagement in the child. In a randomized direct assessment approach Borgi et al. (2015) (N=28) also found increased interaction. Lanning, Baier, Ivey-Hatz, Krenek, and Tubbs (2014) found that participants in equine assisted therapy had increased social interaction after the implementation of equine assisted intervention. Parents are reported as stating that the children participated more in class and in sports. The study by Llambias, Magill-Evans, Smith, and Warren (2016) (N=7) found those who participated in equine assisted therapy showed increased levels of social interaction that were maintained after the withdrawal of the therapy in comparison to the baseline trends. The only study that considered increased interaction that did not find a positive result was the study completed by

Anderson and Meints (2016) (N=15). This study found that socialization and communication were not affected by equine assisted therapy but there was an increase in emphasizing and reduction of maladaptive behaviors.

Of the four studies that considered inattention, 100% of those studies show improved attention. Bass, Duchowny, and Llabre (2009) (N=34) found an increase in attention after equine assisted intervention. This study found that participants in equine assisted therapy may have had an increase in attention due to the highly structured intervention that required a sustained level of focus. The equine assisted therapy required children to listen to directions, instruct the horse, and actively engage in the activity which may have very well resulted in increased attention. Lanning, Baier, Ivey-Hatz, Krenek, and Tubbs (2014) (N=25) found increased attention when the participants were exposed to equine assisted therapy. This study found the children were able to pay more attention in class and showed higher amounts of attention overall. Tan and Simmonds (2017) (N=6) also found an increase in attention among participants. Parents reported their children were more alert and able to focus better. Ward, Whalon, Rusnak, Wendell, and Paschall (2013) (N=21)found that in a 10-week equine assisted therapy teachers reported amount the sample higher levels of attention, tolerance, and reactions to sensory input in the classroom.

Of the four studies that considered hyperactivity and irritability, all four of those studies (100%) showed a decrease in hyperactivity and irritability. Gabriels et al. (2015) (N=116) in a randomized controlled trial found that those who participated in equine assisted therapy had a significant reduction of irritability and hyperactivity. Garcia-Gomez, Risco, Rubio, Guerrero, and Garcia-Pena (2013) (N=16) found the participants that were involved in equine assisted therapy had lower levels of aggression. They theorized that this lowered level of irritability and

aggression may be due to the structured activity of riding a horse. Harris and Willians (2017) (N=24) found that after the intervention of equine assisted therapy participants had a significantly lower score of hyperactivity when compared to their baseline and the control group. Tan and Simmonds (2017) (N=6) found through interviews with parents their child had less negative behaviors, including a decrease in reactive behaviors after participating in equine assisted therapy. Parents reported that their children learned to regulate internal processes during equine assisted therapy and that this eventually had an impact on other behaviors as well.

Other Results

There were also other improvements that did not fit into a specific category. These include: increased self-esteem, increased motivation, increased emphasizing, and improvements in physical condition. Tan and Simmonds (2017) (N=6) found an improvement in self-esteem in children who participated in equine assisted therapy. They also found that children who were involved in equine assisted therapy had improved self-concept and emotional well-being. Bass, Duchowny, and Llabre (2009) (N=34) found that children who were involved in equine assisted therapy of 12 weeks had increased social motivation. Anderson and Meints (2016) found an increase in emphasizing as a result of an equine assisted therapy through the empathizing and systemizing quotient. A total of two articles also found improvements in the physical wellbeing of those that participated in equine assisted therapy. Lanning, Baier, Ivey-Hatz, Krenek, and Tubbs (2014) (N=25) found improvements in physical functioning in those who participated in equine assisted therapy. Jenkins and Reed (2013) (N=7) found in their study, six participants in equine assisted therapy had no improvements with the exception of posture. The improvements of posture and physical condition is likely related to the physical nature of riding a horse.

Overall, of the 14 studies that were considered for this literature review all had at least one positive effect on those who participated in equine assisted therapy. Those who participated in equine assisted therapy showed the general themes of improved social functioning, increased communication, decreased stereotypical behavior, and an increase in social skills. While it is clear that there are positive results from the studies done on equine assisted therapy more research needs to be conducted in order to evaluate the best positive outcomes.

DISCUSSION

The studies examined for this literature review provide useful findings regarding ASD and equine assisted therapy. This review of the literature serves as preliminary evidence for future research focused on the improvements in symptoms in those who have ASD after equine assisted therapy. The literature suggested, at the very least, children will have improvements in at least one category; and, more likely also show improvements in social functioning, communication, stereotypical behaviors, and social skills. Improvements in these areas are likely to impact other aspects of the child's life. In some of the studies, the parents did report improvement after being involved in equine assisted therapy. Considering the preliminary findings of this review, it is important to look at this type of therapy as a potential option for those who are diagnosed with ASD.

In this literature review, it became evident that a variety of methods were used to conduct the studies, including pretest and post-test, quasi experimental, and longitudinal studies. Of the fourteen studies, the individual therapy sessions ranged from 30 minutes to three hours; the average time per session being slightly over an hour. The amount per week ranged from one to five sessions per week; the average being slightly higher than one. The duration ranged from five to 25 weeks; the average being 12 weeks. Holm et al. (2013) was the only study in this literature review that included different time doses of equine assisted therapy per week. Holm et al. (2013) found that increasing the dosage of weekly dosage of sessions did not impact the number of positive behavior changes; however, it did impact the magnitude of the changes. This study suggests that increasing the amount of equine assisted therapy per week could potentially lead to increased positive cognitive and behavioral results.

Another important factor that needs to be considered is whether these changes in behavior are maintainable after the intervention is stopped. Only one study looked at whether the improvements in behavior could be maintained after a set period of time. Ward, Whalon, Rusnak, Wendell, and Paschall (2013) found there were increases in communication and social interaction but that the improvement in behavior was not maintained after two six-week breaks. The increase in behavior could only be maintained if the equine assisted therapy was reinstated. This study is especially significant because it looked at the long-term effects and whether the overall positive changes in participants could be maintained after a break. More research needs to be conducted to look at longitudinal studies that investigate this matter, including when the improvements occur as well as if they are maintained over time.

In researching at this type of therapy it is interesting to consider what specific part of the therapy promotes the positive results in the participants. The various studies suggested that it may have been the structured lessons, development of new skills, use of props, emotional bond between participant and horse, or even the active engagement in the activity that helps the children focus. More research should be conducted to attempt to isolate what factor or factors led to the improvement in symptoms for participants in this therapy.

IMPLICATIONS

Based on this integrative review of the literature, the next section highlights implications for research, education, and practice.

Research

From the articles included in this review of the literature it is evident that there are numerous possible benefits to children who participate in equine assisted activities. Many of the articles found improvements in at least one area of functioning, if not multiple areas of functioning. The research included in this literature review does have limitations which warrents the need for future research on this topic. Further research is needed evaluate the long-term effectiveness of this therapy in the treatment of ASD. Future research also needs to consider longitudinal research designs to determine the long-term benefit of this type of equine assisted therapy as well as the differing degrees of severity of individuals with ASD. In future research studies, all efforts should be made to reduce confounding variables such as the other types of therapies that the participants were involved in. However, with the research that has been presented in this literature review, it is clear that equine assisted therapy should be considered and recommended option for individuals with ASD as a viable treatment. More research should be conducted to fully evaluate all of the positive and possible negative effects of equine assisted interventions in children with ASD.

Education

The results of this literature review can have implications for nursing education and dealing with families with a child with ASD. As mentioned previously, ASD exists "on a spectrum," therefore there is no one "correct" treatment. Nurses and prospective nurses should be made aware of the types of alternative therapies available to individuals with ASD, including

equine assisted therapy. For those nurses who work with pediatric clients, suggesting different forms of therapy as an adjunct therapy can have benefits to a child with ASD. Because equine assisted intervention is noninvasive and not a pharmacological intervention there are no significant side effects associated with this type of therapy.

Nurses should be made aware of equine assisted therapy in the treatment of ASD so they can educate their clients and family members. Healthcare facilities should help to educate and provide resources for equine assisted therapy in the treatment of ASD as a viable alternative or complementary therapy. Education from healthcare facilities should promote different forms of alternative therapy to families and individuals with ASD. Educating families and individuals about alternative therapies such as equine assisted therapy can lead to greater gains in social functioning, communication, and social skills in those who are diagnosed with ASD.

Practice

Registered nurses, who work in the hospital and those who work in other settings should be made aware of equine assisted therapy as a viable option to those diagnosed with ASD. Nurses should be made aware of the improvements in social function, communication, and social skills as well as deceased stereotypical behavior in order to educate their clients and family members in complementary and alternative therapies. Nurses should advocate for what is in the best interest for their client and consider if equine assisted interventions is something that the child is interested in. Other than cost, currently there are no known associated negative effects of equine assisted therapy, therefore children and parents should be encouraged to try this type of therapy to see if it helps their child. More research needs to be conducted on the potential negative effects of equine assisted therapy to fully educate individuals and family members. Nurses should be aware of local resources that can be offered to family members such as

nonprofit organizations that provide this type of therapy. Because there are no potential side effects from this type of therapy in comparison to pharmacological treatment, it should be considered in the treatment plan of individuals with ASD.

Policy

Further efforts should be made to promote equine assisted therapy as a mainstream treatment for individuals with ASD. Policy changes can include having third party payers and insurance companies reimburse the family for complementary and alternative therapies. In doing so, equine assisted interventions would be available to more individuals with ASD as there would be less of a financial burden on the family. If third party payers and insurance companies were to cover an alternative therapy such as equine assisted therapy, it is possible that more equine facilities would be created, thereby increasing the possibility that individuals with ASD could get this type of alternative treatment. However, additional evidence is needed to demonstrate effective symptom reduction and control of symptoms and behaviors of individuals with ASD.

LIMITATIONS

Of the 14 studies reviewed, all found at least one improvement in those who participated in equine assisted intervention. Many of the studies found numerous benefits to those who participated. However, there are various limitations that can most definitely affect the validity and quality of the results presented in this literature review. Many of the studies used either interviews or structure observations and both of these methods for data collection can have errors. With interviews with parents it is possible that parents may be biased in their opinions of their child or overestimate their improvements. With structured observations it is possible that the children may modify their behavior because they know they are being watched. It is possible that the behavior that is recorded in the observations may not be representative of their behavior the majority of the time.

Another major limitation of this research is the small sample sizes that all of the reviewed studies. The number of participants ranged from three to 116 with an average of 25.6 participants per study. With such a low number of participants in these studies it is possible that the results may not be representative of allows populations diagnosed with ASD. Also, many of the studies did not involve a control group. A control group is necessary to ascertain if the changes in behavior are due to the intervention that is being studied or to something else. In this literature review, only 64% of the studies included a control group.

Another confounding variable that could affect the results would be other therapies that the child was partaking in at the time of the equine assisted therapy. The articles did not included information relating to medications and other therapies that the participants were receiving. Therefore, it is possible that the improvements seen in these studies were a different treatment option that the child was going through at the same time. Another confounding

variable that was not taken into consideration in the majority of the studies was the severity of ASD that the child had. It is possible that children who were verbal versus nonverbal may have reacted differently to this therapy, with different results. This needs further investigation. Taking these limitations into consideration, there is a need for a large scale randomized controlled trial with controlled experiments and multiple data collection points

SUMMARY

This review of the literature found that children with ASD involved in equine assisted therapy had improvements in social functioning, communication, stereotypical behaviors, and social skills. All of the studies analyzed found at least one positive outcome, with many finding multiple positive outcomes. Due to small sample sizes, lack of a control group, and various designs, more research needs to be done to establish the evidence related to the benefits of equine assisted therapy in individuals with ASD. More research needs to be conducted that evaluates the long-term effectiveness of equine assisted therapy in the treatment of ASD. However, as supported by this literature review, equine assisted therapy should be considered for individuals with ASD as a treatment option. There is no definitive sign or symptom of ASD and therefore no one "right" treatment. ASD interventions must be individualized and customized to treat an individual's needs. Because of the tenfold increase in the prevalence of ASD, the nurse is likely to encounter children with a diagnosis of ASD. For this reason, there is an increasing need for further research to provide evidence of treatment options that are best suited for individuals with ASD

APPENDIX A

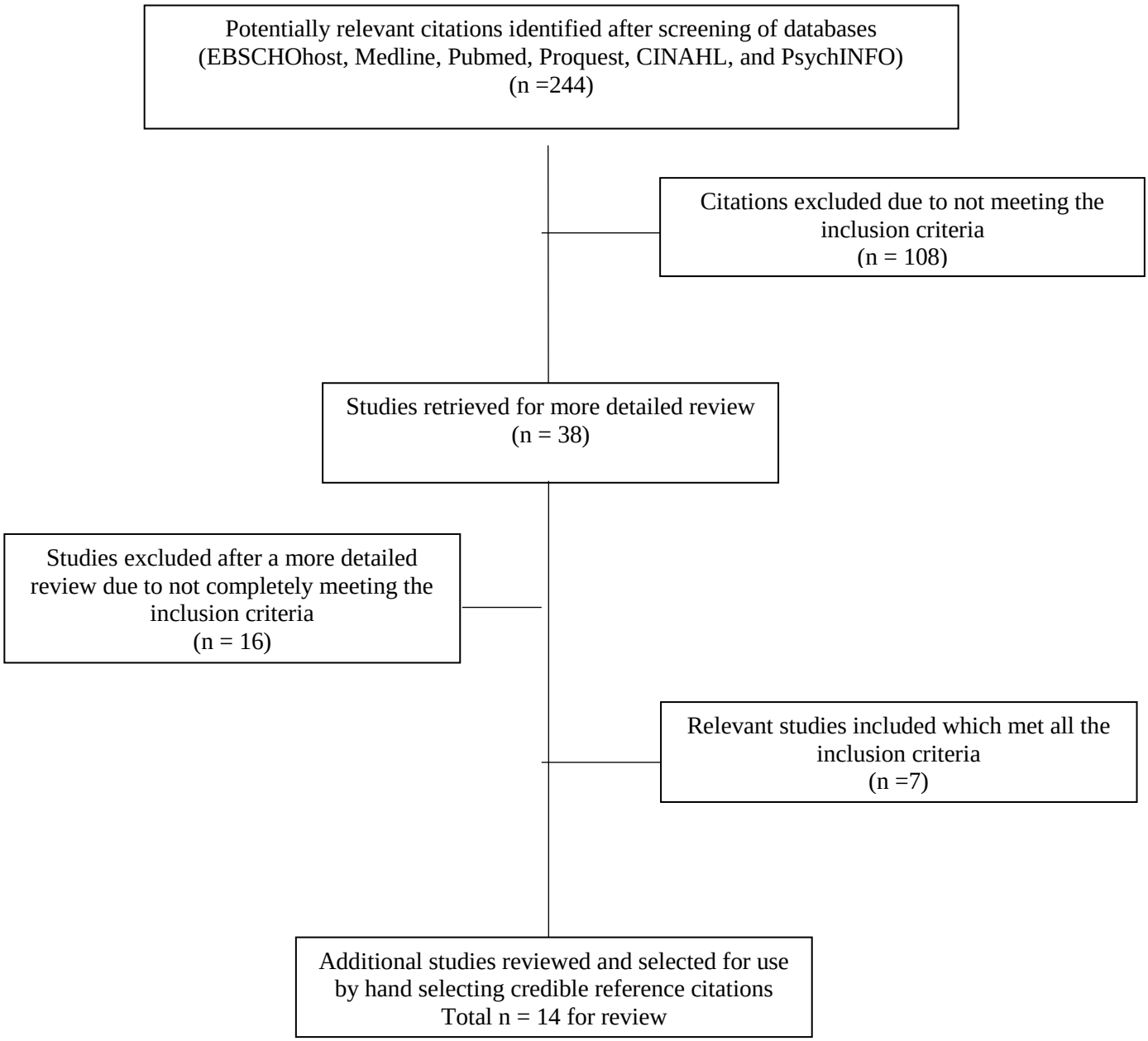
Figure 1: Consort Diagram of Thesis Methodology

APPENDIX A
Figure 1: Consort Diagram of Thesis Methodology

Flow Diagram of Study Selection Process

Search terms: animal assisted therapy or animal therapy or animal intervention or animal assisted activity AND autism spectrum disorder or asd or autism AND equine therapy or equine psychotherapy or equine assisted therapy or therapeutic horseback riding or horse

Limiters: English language, peer-reviewed, publication date from 2006 to present



APPENDIX B:

Table 2: Table of Evidence of Reviewed Literature

Table 2: Table of Evidence of Reviewed Literature

Article	Design and Purpose	Population and Sample Size	Intervention Protocol	Screening Measures	Findings and Nursing Implications
Al-Hmouz, H. h. g. c., & Arabiat, A. (2015). Therapeutic Horseback Riding and Children with Autism Spectrum Disorders. Journal of the International Association of Special Education, 16(1), 42-50.	This study used a pre-test-post-test control group design. The two groups (experimental and control) were generated by random assignment. The purpose of this study was to evaluate the effectiveness of therapeutic horseback riding (THR) in individuals with ASD. This study aimed to see a reduction in autism associated behaviors (stereotypical behaviors, communication difficulties, and social interactions	(n = 45) diagnosed with ASD, ages 10-14 years, verbal and non-verbal. Experimental group (n =23). Control group (n = 22).	Therapeutic horseback riding sessions consisted of an hour session. The participants started with exercises and learned first how to ride a horse. During the next part of the session the child learned how to play games that focused on improving communication skills. The participants also took part in grooming activities. Each child reviewed a therapeutic riding session for one hour per week over the span of 12 weeks.	Gilliam Autism Rating Scale -2 was used to measure the 45 participants before and after the intervention. The GARS-2 is a 42 item, normalized instrument developed to identify individuals with ASD 3-22 years of age.	Children with ASD in the experimental group presented with a reduction of stereotyped behaviors, improvements in communication, and social interaction. This study showed that children diagnosed with ASD can exhibit significant improvement in symptoms after a 12 week THR intervention. Limitations of this study include a small sample size, it was conducted at one location and that only one screening measure was used to evaluate the effectiveness of THR. In future studies, it would be necessary to look at what other treatments the child

	difficulties) at post-intervention.				was partaking in such as medication or other forms of therapy. Other interventions the child is receiving could possibly be confounding variables that would need to be controlled in future studies.
Anderson, S., & Meints, K. (2016). Brief report: The effects of equine-assisted activities on the social functioning in children and adolescents with autism spectrum disorder. Journal of Autism and Developmental Disorders, 46(10), 3344-3352. doi:10.1007 /s10803-016-2869-3	A combination of parent-report questionnaires and semi-structured tests were administered on the first and last day of the intervention. The purpose of this study was to examine the effects of therapeutic riding (TR) and horsemanship skills on social functioning in children and adolescents with ASD.	(n = 15) diagnosed with ASD, ages from 5-16 years. Children were required to have no riding experience with horses and all of the children were verbal.	This was a six-week study with an initial assessment day which was by following five weeks of a three-hour session per week. The initial assessment day consisted of an 8-hour day where an individual assessment for each child was conducted. Each three-hour assessment consisted of activities that addressed physical, psychological, and social skills. The three main activities included in the weekly three-hour sessions were therapeutic riding, horsemanship,	The effectiveness of the program was evaluated using a mix of parent report questionnaires and semi structured tests on the first and last day of TR. The Autism Spectrum Quotient, the Vineland Adaptive Behavior Scale (VABS), and the Empathizing and Systemizing Quotient were all used to assess the effectiveness of TR. The Autism Spectrum Quotient gives an understanding of	This study found that adaptive behaviors such as socialization and communication were not affected by the intervention. However, the study did note that there was an improvement in empathy due to the intervention as determined by examining the empathizing scores. The study found that that there was positive reduction in maladaptive behavior traits but no significant improvement in overall adaptive behaviors. Limitations of this study include the small

			and stable management.	ASD traits in individuals. The VABS was used to measure adaptive and maladaptive behaviors. The Empathizing and Systemizing Quotient was used to measure the underlining skills for empathizing.	sample size and that caregivers completed some of the self-assessment forms and interviews. While this form of measurement offers insight into the child's behaviors while away from the horses, it is possible that the parents may be biased in their opinions of their child.
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 & Developmental Disorders, 39(9), 1261-1267. doi:10.1007/ s10803-009-0734-3	This study used a pre-test-post-test control group design. The purpose of this study was to examine the effectiveness of a 12-week therapeutic horseback riding intervention on social functioning in children with ASD.	(n = 34) diagnosed with ASD, aged 4-10 years. The participants had no prior exposure to equine assisted activities. Experimental condition (n =19) Control (n =15)	Each child in the treatment group received therapeutic riding sessions for one hour per week over the span of 12 weeks. The intervention consisted of the following sections: mounting/dismounting, exercises, riding skills, mounted games, and horsemanship activities.	The Social Responsiveness Scale (SRS) and Sensory Profile (SP) were used to assess social functioning at pre- and post-intervention. The Social Responsiveness Scale is a 65-item questionnaire that measures the severity of ASD symptoms. The Sensory Profile is a 125-item questionnaire that addresses overall	This study found that the experimental group exhibited greater sensory integration and directed attention as compared to the control group. The study also showed that the experimental group had less inattention, distractibility and sedentary behaviors. However, this study did not find any effect on fine motor/perceptual skills, social cognition, or social awareness. This study showed that therapeutic horseback riding can be a possible

				social functioning and the degree to which children exhibit problems in sensory processing, modulation, and behavioral and emotional responses.	option in the treatment of an individual with ASD. Limitations of this study include that other treatments that the children were receiving were not documented, including other therapies and medications. Therefore, there was no way of knowing if the children that improved in the experimental group improved because of the intervention or perhaps from a different treatment option that that child was going through. This study is also limited because nine total participants dropped out of the study due to its rural location. This study would also benefit from a larger sample size and a longer study time.
Borgi, M., Loliva, D., Cerino, S., Chiarotti, F., Venerosi, A.,	This study used a randomized repeated measures design to assess	(n = 28) diagnosed with ASD, all males, ages	Each child attended one session once a week for six months with a total number of	Each child was evaluated at the beginning of the study, 30 days into	This study found that the experimental group had an improvement in social functioning in

Bramini, M., . . . Cirulli, F. (2016). Effectiveness of a Standardized Equine-Assisted Therapy Program for Children with Autism Spectrum Disorder. Journal of Autism & Developmental Disorders, 46(1), 1-9. doi:10.1007/s10803-015-2530-6	changes in both adaptive and executive functioning. The purpose of this study was to examine the effectiveness of an equine assisted therapy (EAT) in improving adaptive and executive functioning in children with ASD.	6-12 years, and all verbal. Inclusion criteria included an IQ >70 on the Wechsler Intelligence Scale for Children III. Experimental condition (n =14) Control group (n=13)	25 sessions for each individual. The sessions were held in small groups of three to four participants and each session lasted about 60-70 minutes and included 10 minutes of hand walking the horse followed by 20-30 minutes of horseback riding and a final phase on the ground. A grooming phase was also included.	the study, and after six months, and within 30 days after the end of the sessions using the Vineland Adaptive Behavior Scale (VABS) and the Tower of London scale (TOL). The VABS assesses communication, daily living skills, socialization and motor skills. This study also used a series of Mixed Model ANOVAs to assess the possible time dependent changes in both adaptive and executive functioning.	comparison to the control group and milder effects on motor abilities. However, this study found that there was no increase in communication. This study was also interesting as it looked at the executive abilities of children by using a problem-solving task. The results show that there was a reduced planning time in the problem-solving task in the experimental group at the end of the study in comparison to the control group. This study was also significant in that it took place at multiple different centers with trained individuals. There are several limitations of this study. The sample size was small and only included verbal males. Therefore, the results are unable to be

					generalized to all individuals with ASD. The other limitation of this study, is that while the participants were randomized, there was a great difference in the baselines of each group. Therefore, more studies which have randomized controlled trials with a larger number of participants, including both boys and girls, are needed to evaluate the effectiveness of this therapy.
Gabriels, R. L., Pan, Z., Dechant, B., Agnew, J. A., Brim, N., & Mesibov, G. (2015). Randomized controlled trial of therapeutic horseback riding in children and adolescents with autism spectrum disorder. Journal of the American Academy of Child & Adolescent	This study used a randomized controlled trial to examine the effectiveness of therapeutic horseback riding on self-regulation, socialization, communication, adaptive, and motor behaviors in children with ASD.	(n = 116) diagnosed with ASD, aged 6-16 years, were stratified by nonverbal IQ standard scores and randomized to 1 of 2 groups, THR or barn activity (BA)	Each child attended a 10-week intervention, that were a minimum of 45 minutes long per session and had two to four participants. The therapeutic horseback riding intervention taught therapeutic riding skills and horsemanship skills. Lessons would start with a warm up activity, skill review, new skill, and cool	Each child was measured at the beginning of the study and at the end of the study by various tools. A speech therapist measured participants receptive vocabulary using the Peabody Picture Vocabulary Test, Fourth Edition as well as	This study found that the children in the THR intervention had increased self-regulation and greater social cognition. The study found that there was not a significant difference between the THR group and the BA group in terms of communication. The study also found that there were no statistically significant

Psychiatry, 54(7), 541-549. doi:10.1016/ j.jaac.2015.04.007		THR group (n = 58) BA group (n = 58)	down activity. In the Barn Activity Control Intervention children were taught horsemanship skills but the participants had no contact with horses, however, a life sized stuffed horse was a part of the teaching session.	the Systematic Analysis of Language Transcripts. An occupational therapist administered the Bruininks-Oseretsky Test of Motor Proficiency and two subscales of the Sensory Integration and Praxis Test. This experiment also used the ABC-C which is a symptom checklist for assessing problem behaviors that were filled out by the caregivers. Caregivers also completed the Social Responsiveness Scale (SRS), a 65-item questionnaire about social communication.	differences between adaptive and motor behaviors. This study was interesting in that it had a barn activity group instead of a control group. This study suggests that even though the children in the BA group learned about horses, without having the interaction with the horses they did not gain the same benefits as did individuals in the THR group. This study has multiple limitations. Some of the tools used to examine the successfulness of the intervention were questionnaires filled out by the caregivers. It would have been helpful if there were more objective observational measures. It would have improved if there had been a control group that both the THR group and BA

					group could be compared to.
García-Gómez, A., Risco, M. L., Rubi, J. C., Guerrero, E., & García-Peña, I. M. (2014). Effects of a program of adapted therapeutic horse-riding in a group of autism spectrum disorder children. Electronic Journal of Research in Educational Psychology, 12(1), 107-128. doi:10.14204 /ejrep.32.13115	This study used a quasi-experimental, test-retest design, with an experimental and control group. The purpose of this study was to understand the social and behavioral effects of a therapeutic horseback riding in a group of children with ASD.	(n =16) diagnosed with ASD, ages 7-14 years, and IQ > 50. Requirements were that the child not have contact with horses two years before the start of the program. Experimental group (n = 8) Control group (n= 8)	Each child attended a three-month intervention that consisted of 45 minute sessions two times a week for a total of 24 sessions in groups of four. Each session consisted of activities includingprior to mounting, mounting and riding, and dismounting, and gathering and putting away equipment.	Each child was measured with the BSC-T and test battery that has five components: self-report on personality, developmental history, an observation system, and two questionnaires - one for parents and one for teachers. This study also used the Quality of Life Model questionnaire which has 77 items relating to emotional wellbeing, relationships, development, self-determination and social inclusion.	This study found that there were significant differences in some of the quality of life and indicates that there were lower levels of aggressiveness in the children that were in the experimental group. There are many limitations to this study. The main limitation of this study is that the study's sample was not selected at random which could have influenced the results. This study also had a very small population size and doesn't come close to be representative or able to being generalized to individuals with ASD. Studies that have a randomized controlled design with more participants are needed to fully evaluate the benefits of THR, as

					well as longitudinal studies to evaluate if the benefits of the therapy is lost or maintained over time.
Harris, A., & Williams, J. M. (2017). The Impact of a Horse Riding Intervention on the Social Functioning of Children with Autism Spectrum Disorder. International Journal Of Environmental Research And Public Health, 14(7). doi:10.3390 /ijerph14070776	This study is a case-control study of a horse riding intervention for children with ASD.	(n = 24) diagnosed with ASD, ages 6-9 years, and the majority of the participants were "mainly nonverbal" meaning that the child can use 5 single words in familiar contexts, but no verbal phrases or sentences. Intervention group (n =10) Control group (n = 14)	This study used a waiting list design where half of the group was scheduled to have horse riding sessions and the other half was not. Participants in both groups received Speech and Language Therapy for at least a half a day a week. The intervention group consisted of two school classes who attended weekly horse riding sessions that lasted approximately 45 minutes. However, the first half of the group received 7 lessons and the second half of the group only received 5 lessons.	Pre-and post-tests were conducted using the Childhood Autism Rating Scale, second edition and the Aberrant Behavior Checklist-Community Edition. The post test was completed after approximately a 7-week time period. Also, an observational measure of compliance and behavior during horse riding sessions was completed for the intervention group.	This study found that there was a significant reduction in the severity of ASD symptoms and hyperactivity after the intervention. No significant changes, were found in participants levels of lethargy, irritability, or inappropriate speech after the intervention period. This study found that the extent of compliance and engagement with riding tasks did not influence the effectiveness of the intervention group. Rather they found that the general experience of riding, such as touching the horse may have helped to reduce ASD symptoms and hyperactivity. Limitations to this

					study include the small sample size and the lack of randomization of the participants, and that all of the participants attended the same school. Another limitation of this study is that without a longitudinal study, there is no way to know if the reduction of symptoms was maintained after the conclusion of the study.
Holm, M. B., Baird, J. M., Kim, Y. J., Rajora, K. B., D'Silva, D., Podolinsky, L., . . . Minshew, N. (2014). Therapeutic horseback riding outcomes of parent-identified goals for children with autism spectrum disorder: An ABA' multiple case design examining dosing and generalization to the home and community. Journal	This study used an ABA single subject design with each phase lasting four weeks and the entire study lasting 12 weeks. The purpose of this study was to ascertain whether different doses of therapeutic riding influenced parent nominated target behaviors in the session, at home, or in the	(n =3) diagnosed with ASD, ages 6-8	In the baseline or control condition, the three participants received their typical one session (30-45 min) of therapeutic riding per week for a total of four weeks. In the intervention phase the participants received either one, three, or five sessions per week. In the withdrawal phase, all participants returned to their usual one session per week routine.	Each child was measured with the Aberrant Behavior Checklist-Community (ABC-C) which consists of a 58 item that measure clusters of behaviors. The Social Responsiveness Scale was also used and ensures the severity of symptoms associated with ASD. This study also used the	Compared to baseline, 70% of the target behaviors were better during the intervention and improvement was retained in 63% of the behaviors during the withdrawal period. The study found that increasing the doses of therapeutic riding was significant for the magnitude of change. However, this study did have limitations. Because there were only three participants the conclusion of the

of Autism and Developmental Disorders, 44(4), 937-947. doi:10.1007/ s10803-013-1949-x	community. This study used a multiple case design, with dosing of one, three, and five times per week.			Sensory Profile-Caregiver Questionnaire (SP-CG) which is a 125-item questionnaire that measures sensory processing, modulation, and behavioral and emotional responses.	results is extremely limited. Also, the parents were informed about the general purpose of the study and as they were one the main data collectors in this study, the data can be misconstrued. All three of the participants had also been riding a horse once a week for approximately one year, and this variable was not taken into consideration.
Jenkins, S. R., & DiGennaro Reed, F. D. (2013). An experimental analysis of the effects of therapeutic horseback riding on the behavior of children with autism. Research in Autism Spectrum Disorders, 7(6), 721-740. doi:10.1016 /j.rasd.2013.02.008	This study used a multiple baseline design for participants to evaluate the effects of THR. The purpose of this study was to evaluate the effects of therapeutic horseback riding in children using a multiple baseline for participants	(n =7) diagnosed with ASD, ages 6-14 years, with no prior history of participating in therapeutic horseback riding. Treatment group (n = 4)	The children in the treatment group attended one hour sessions weekly for a total of nine weeks. During the sessions volunteers would walk alongside the horse and help the child with prompts to deliver commands to the horse.	Data collection occurred once a week for 10 minutes and during home observations. This study did not use any typical screening measures, rather they defined dependent variables that would be measured. The dependent variables that were	This study found that there were no changes in systemic changes in affect, responding to others' initiations, spontaneous initiations, off task behavior, compliance, problem behavior, or performance on two standardized measures. However, three out of the four participants showed improved posture. It is interesting that this

	design and a waitlist control group for comparison.	Waitlist Control group (n =3)		investigated were happiness, unhappiness, spontaneous initiations, responses to initiations, off task behavior, compliance, problem behavior, commands to direct the horse, and posture. All of these dependent variables had a definition as to how to define each term.	study failed to demonstrate any meaningful improvements across participants and perhaps this failure can be due to the design of the experiment rather than the results. For one, it is puzzling that this researchers of this study chose not to use a standardized collection method for data. There also appears to be other problems with the collection of data in which the video cameras used to capture the activities of the participants malfunctioned and at other times classes began late and some classes were missed. While the authors of this paper state that it is unlikely that this loss of data greatly impacted the analysis, I believe that it most certainly could have and these issues question the

					validity of the results. This study is limited by its sample size. With only a total of seven participants, the data collected from this study can hardly be considered conclusive or have the ability to be generalized to individuals with ASD.
Kern, J. K., Fletcher, C. L., Garver, C. R., Mehta, J. A., Grannemann, B. D., Knox, K. R., . . . Trivedi, M. H. (2011). Prospective trial of equine-assisted activities in autism spectrum disorder. Alternative Therapies in Health & Medicine, 17(3), 14-20.	The design of this study was a nonrandomized study that had four assessment points: when placing on the waiting list, before participant riding, at three months after riding, and at six months after the participant began riding. The purpose of this study was to examine the effects of equine assisted activities on overall severity of ASD.	(n = 24) diagnosed with ASD, ages of 3-12 years. Twenty-four of the participants began the riding program, 22 completed three months, and 20 participants completed the entire six months.	The sessions were once per week for about 60 minutes. The lessons include leading, grooming, and tacking responsibilities. The lessons were for a period of six months.	The participants were assessed at the beginning of the waiting list, immediately before the participant began riding, three months after riding, and six months after the participant began riding. This study used the Childhood Autism Rating Scale (CARS) which is a 15-item behavior rating scale that can quantitatively describe the severity of the disorder. This study also used the	This study found that there was a reduction of ASD symptoms with the therapeutic riding treatment. This study also found that there was no change in the CARS scores during the pretreatment baseline but that there was a significant decreased after treatment at three months and six months of riding. The parent rated quality of life measure also showed improvement from the pretreatment baseline. Limitations of this study included the participants were not

				Timberlawn Parent-Child Interaction Scale that measures expressiveness, responsiveness, positive and negative regard, mood and tone, and empathy. This study also included parent rated measures which included a sensory profile and a quality of life enjoyment and satisfaction questionnaire.	randomized into treatment conditions. There was also a large issue with the attrition rate of the participants, which could have affected the results as the sample size was already small to start with.
Lanning, B. A., Baier, M. E. M., Ivey-Hatz, J., Krenek, N., & Tubbs, J. D. (2014). Effects of Equine Assisted Activities on Autism Spectrum Disorder. Journal of Autism and Developmental Disorders, 44(8), 1897-1907.	A repeated measure, quasi-experimental, and longitudinal design was utilized to assess changes in quality of life indicators and behavior of the participants. The purpose of this study was to determine if a 12-week Equine	(n =25) diagnosed with ASD, ages 4-15 years, must not have participated in EAA six months prior to the study EAA experimental	The children in the EAA intervention group participated in weekly therapeutic riding sessions for 12 weeks, with each session lasting approximately one hour in length. The sessions were either individual or with one other child. The weekly lessons consisted of basic	A repeated measures design was used to assess the quality of life indicators and behavior of the participants. Questionnaires were completed at the beginning and at 3, 6, 9, and 12 weeks. Each child was measured with the Pediatric	This study found that the parents noted significant improvements in their child's physical, emotional and social functioning following the first six weeks of EAA. The children also participating in the social circles group showed improvement in behavior, but to a lesser extent in

	Assisted Activities (EAA) positively affected the quality of life of children with ASD.	group (n =13) Comparison group in which children were involved in social circles (n =12)	safety lessons, grooming lessons, and riding activities. the children in the social circles group participated in one social activity session per week for 12 weeks. Activities were planned around social goals, card games were played, and interventions that included sensory input were used.	Quality of Life 4.0 Generic Core Scales (PedsQL) that measures health related quality of life and the Child Health Questionnaire (CHQ) which measures physical and psychosocial concepts.	comparison to the EAA experimental group. This study also had several limitations. In this study, there was no true "control group" to compare both the EAA experimental group, and the social circle group to. Also, due to a clerical error, data was not collected at the 12-week interval so no treatment comparison could be made at that time. This study could also have benefited from having the participants randomized, as well as a larger number of participants in both of the groups. This study also used the parent as the only means of data collection. Including data from observation and from researchers would help to enhance the quality of this study.

Llambias, C., Magill-Evans, J., Smith, V., & Warren, S. (2016). Equine-assisted occupational therapy: Increasing engagement for children with autism spectrum disorder. American Journal of Occupational Therapy, 70(6).	This study had a multiple-baseline design to test the effects of the intervention. The purpose of this study was to investigate the effects of equine assisted occupational therapy on the engagement of young children with ASD.	(n = 7), diagnosed with ASD, ages 4-8 years, and have no riding experiences for three months prior to the study.	All of the sessions (baseline, intervention, and follow-up) were 45-60 minutes long. Children spent 20 minutes in gross motor or physical activities and 20 minutes in fine motor or cognitive activities. The children were evaluated at the beginning and the follow up sessions. The sessions occurred once a week and consisted of horse therapy followed by fine motor activities in a quiet area.	This study used digital video recordings that captured the interactions of the children with the horses and these interactions were then coded by raters. This study also provided reliability checks that occurred during all phases to ensure that the data was calculated correctly.	This study found that engagement of the children increased markedly early in the intervention and then remained at that level throughout. They also found that at follow up the children remained similar to that seen in the intervention. This indicates that the children's general engagement level remained high even when the intervention was removed. There were several limitations of this study most notably, the small sample size. And while the researchers, compared the child's behaviors to their baseline there was no specific control group, but rather the child's baseline appeared to be used as a control. It would also have been interesting to see a follow up study at a later time than one

					month to fully understand if the increases in engagement were kept up over a period of time. This study would have also benefited if there had been a means of having a standardized assessment of the participants in addition to the video recordings that were made.
Tan, V. X.-L., & Simmonds, J. G. (2017). Parent perceptions of psychosocial outcomes of equine-assisted interventions for children with autism spectrum disorder. Journal of Autism and Developmental Disorders. doi:10.1007 /s10803-017-3399-3	This study used semi-structured interviews that were then transcribed and analyzed using Interpretative phenomenological Analysis to provide a qualitative approach. The purpose of this study was to explore parent's perceptions of the psychosocial outcomes of their children's	(n =6), diagnosed with ASD, and those children who received EAI for at least a month on a weekly basis	While this study did not implement an intervention for the child, the child was already involved in an EAI. Five out of six of the children had a EAI program with mixture of both on ground and mounted work with the horses, which depended on the comfort level of the individual. The other child was in an EAI program which was entirely mounted and therefore described as therapeutic riding.	There were no specific screening measures that analyzed the specific improvement in the children. Rather, this study focused on exploring the parent's perceptions of the psychosocial implications of EAI. This study used semi-structured interview questions. The questions were	This study found that there were four overarching themes that emerged: child's improved self-concept and enhanced emotional well-being, child's improved self-regulatory ability, social benefits for the child, and unexpected outcomes. This study found that EAI was perceived by the parents as having several benefits for their children. However, there were limitations to the

	experience of receiving equine assisted interventions (EAI).			designed to explore how EAI provide benefits to their children and if their child had any behavioral or developmental changes since their child received EAI.	research. For one, the sample size is incredibly small and therefore the themes that emerged from the interview may not be generalizable. Also, while this research did not provide statistical data, its qualitative approach provides important themes that reinforce the effectiveness of EAI therapy for individuals with ASD.
Ward, S. C., Whalon, K., Rusnak, K., Wendell, K., & Paschall, N. (2013). The association between therapeutic horseback riding and the social communication and sensory reactions of children with autism. Journal of Autism and Developmental Disorders, 43(9), 2190-2198. doi:10.1007/ s10803-013-1773-3	This study used a 10-week Therapeutic Riding (TR) intervention with an interrupted treatment design that allowed the researchers to investigate the maintenance benefits during a six-week break from riding and an eight-week break from TR intervention.	(n = 21), diagnosed with ASD, ranging from kindergarten to fifth grade. Thirteen of the participants had never participated in TR.	Each of the weekly sessions consisted of four parts which included orientation, mounting and riding, riding skills, and closure. In the orientation, the lesson began with a sensory activity. During the mounting and riding the participants went through a phase of quiet riding time and then directed riding instruction. In the closure part of the	This study used the Cilliam Autism Rating Scale, second edition. This scale includes a 42-item scale which looks at stereotyped behaviors, communication, and social interaction. This study also used the Sensory Profile School Companion which is a 62-item questionnaire that	This study found that the children who participated in TR had improved ratings of social interaction, improved sensory processing, and decreased the severity of symptoms associated with ASD. Unfortunately, this study found that these gains were not maintained consistently after a six-week break from TR, but the gains could be recovered

	The purpose of this study was to evaluate the association between TR and the social communication and sensory processing skill of the individuals.		session, games were used that promoted socialization.	measures sensory processing abilities across five groups: auditory, visual, movement, touch, and behavior.	when TR was resumed. There are limitations to this study, most notable the small sample size and the lack of a control group. Furthermore, all of the TR occurred at a small facility and all of the data collected was by teacher ratings. This study could have been improved if additional data collection methods were used including direct observation, parent questionnaires, and standardized measuring tools.

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